STATE FAUNA SERIES 6

FAUNA OF DELHI

ZOOLOGICAL SURVEY OF INDIA
1997

Explanation of cover photographs (read left to right from top):

Redcrested Pochard, *Netta rufina* (Pallas). Ruddy Shelduck or Brahminy Duck, *Tadorna ferruginea* (Pallas). Pheasant-tailed Jacana, *Hydrophasianus chirurgus* (Scopoli). *Papilio demoleus* Linnaeus. Indian Peafowl, *Pavo cristatus* Linnaeus. Whitebreasted Kingfisher, *Halcyon smyrenensis* (Linnaeus). *Ischnura aurora aurora* (Brauer). Blacknecked Stork, *Xenorhynchus asiaticus* (Latham). Purple Moorhen, *Porphyrio porphyrio* (Linnaeus). Blue Bull or Nilgai, *Boselaphus tragocamelus* (Pallas). Pintail, *Anas acuta* Linnaeus. Rosy or White Pelican, *Pelecanus* onocrotalus Linnaeus.

FAUNA OF DELHI

Published in Commemoration of the 50th Anniversary of India's Independence

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1997

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सत्यमेव जयते

प्रो० सैफुद्दीन सोज़
PROF. SAIFUDDIN SOZ

मंत्री
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MESSAGE

I am happy to note that as part of its general activities, the Zoological Survey of India has very appropriately brought out a volume on the fauna of Delhi to coincide with the 50th Anniversary of India's Independence. The volume indicates that Delhi still has significant faunal diversity of which we should be proud. To the extent such diversity continues to be found, the credit for conservation should go to the residents of Delhi

In consonance with India's ethos of living in harmony with nature, the Constitution of India provides that the State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife in the country. It also lays down that it shall be the duty of every citizen of India to protect and improve the national environment including forests, lakes, rivers and wildlife, and to have compassion for the living creatures.

The people of Delhi need to play a major role in conserving the rich faunal diversity in Delhi including the Delhi Ridge area. The publication on fauna of Delhi should greatly help in creating awareness of the existing diversity of plant and animal life in Delhi, a wealth which needs to be protected and conserved for posterity.

I compliment the Scientists of Zoological Survey of India for having brought out this well documented account on the faunal diversity of Delhi, India's National Capital, during the 50th Anniversary of India's Independence.

SAIFUDDIN SOZ

FAUNA OF DELHI

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T. K. A. NAIR

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FOREWORD

The biological diversity of India is one of the richest in the world, not only in variety but in uniqueness as well. As India is a signatory to the Convention on Biological Diversity (Brazil, June, 1992) it becomes obligatory on our part to protect biological diversity on a point of National Conservation Strategy. Exploration and identification of the existing biodiversity is the first prerequisite to conserve the bio-resources. Therefore, the efforts made by the scientists of the Zoological Survey of India in inventorising the faunal diversity of Delhi are laudable.

Delhi, the metropolis of India, recently declared as *National Capital Territory* has a unique physiographic location between the Thar desert, the Aravalli hills and the Himalayas.

The Ridge in Delhi which is the culminating spur of the Mewat branch of the Aravalli hills, constitutes a major physiographic feature of the region. The significance of the Ridge in the environment of Delhi was earlier perceived as a forest inhabited by some extraordinary plants and fierce animals. The growing human population of Delhi has changed much of it, though we are fortunate to have Yamuna as well as patches of green forest (Ridge) still harbouring a variety of fauna and flora.

The development activities in Delhi, which started almost immediately after the transfer of the capital of India from Calcutta in 1911, have taken great toll and resultantly degradation of the Ridge and the Yamuna had begun. The Ridge, which was once about 53 km of forest, abound with rich wild fauna such as leopard, wolf and antelopes, has now been reduced to merely four small patches of about 7800 ha.

The present document has been prepared with the painstaking efforts of a team of dedicated scientists coordinated by Dr.Arun Kumar under the guidance of Dr.J.R.B.Alfred of the Zoological Survey of India. As it provides the baseline data, it could be used as benchmark for any present or future action plans for the protection and conservation of biodiversity and bio-resources of the metropolis. Several Delhi based Non-governmental Organisations (NGOs) specially, the Kalpavriksh, Srishti and Vatavaran have played a significant role in this direction by creating public awareness and gathering public support to conserve the flora and fauna of Delhi, especially of the Ridge. The present study of the Zoological Survey of India, let me hope, will give further impetus in this direction.

21st September, 1996

(T.K.A. NAIR)

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MINISTRY OF ENVIRONMENT & FORESTS
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PREFACE

The Zoological Survey of India, during its 80 years of existence has surveyed almost every State, Union Territory and Island groups of the country for its fauna. However, both intensive and extensive surveys were undertaken on a time bound schedule during the last eight years, to bring out exclusive faunal inventories for each individual State/Union Territory. The present volume is the sixth in series and deals with the faunal diversity of Delhi.

Delhi has unique geo-political position in the history of India. On one hand the human population is nearing about 10 million, on the other the river Yamuna and the Ridge forest support a rich animal life. Urbanisation of the metropolis has taken a great toll on the biodiversity leading to its rapid depletion. Records indicate that till a few decades back, the river Yamuna supported population of gharial, crocodile and testudines, and in winter thousands of migratory birds, besides many other fauna.

An inventory of the Delhi fauna is, therefore, the need of the hour. The Zoological Survey of India, Northern Regional Station, Dehra Dun, undertook the onerous task of surveying the faunal diversity of Delhi and estimating the present status of fauna in its forest, vegetation and wetland areas. It is a happy coincidence that we are able to publish the volume in the year of 50th Anniversary of India's independence.

The present document reports about 1,800 species belonging to 35 animal groups. It also includes invited articles from some NGOs and Research Institutes of Delhi where naturalists are actively engaged in conservation of the biodioversity of the area.

I would like to record my thanks to Dr. A.K. Ghosh, former Director of the Zoological Survey of India, for motivating the scientists of the department to undertake this study and to Dr. Arun Kumar, Joint Director-in-Charge of Northern Regional Station, Dehra Dun for coordinating the programme. Thanks are also due to all other scientists and staff of Z.S.I. who have participated in the survey and contributed chapters in the volume.

(Dr. J.R.B. Alfred)
Director (Acting)

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It would not be out of place to mention my deep thanks to colleagues at this Regional Station as well as others and at Hqrs. who have very painstakingly completed their studies on various groups and submitted the manuscripts in given time frame, without which the final completion of this document would not have been possible.

It is my pleasant duty to acknowledge my sincere thanks to various environmentalists at Delhi, viz., Drs. Ashish Kothari (Kalpavriksh) and Iqbal Malik (Srishti, Vatavaran) who discussed the subject from time to time and provided information from their respective organisations, which has been freely used by us while preparing this document. I am also thankful to them for having contributed two very useful articles. I am thankful to Shri V.B.Sawarkar and his colleagues from Wildlife Institute of India, Dehra Dun ; Dr. P.S. Roy, and his colleagues from Indian Institute of Remote Sensing, Dehra Dun for having contributed important articles on Asola-Bhatti Wildlife sanctuary. Dr. S.N.Rai, Director, Forest Survey of India, took keen interest in this project and readily provided important information and satellite imageries on forest cover of Delhi. Shri S.K. Mukherjee, Director, Wild life Institute of India, Dehra Dun kindly discussed the draft and gave many useful suggestions, which is gratefully acknowledged. Prof. K.K.Sharma, Wadia Institute of Himalayan Geology, Dehra Dun, contributed on Geological profile of Delhi at a very short notice. Prof. J.S. Bhatti, University of Delhi, besides contributing an important chapter constantly discussed the progress of the project.

I acknowledge my sincere thanks to Dr. R.K.Bhatnagar, Indian Agricultural Research Institute, for constant help throughout the survey programme, field guidance and other activities, to Drs. S.I.Farooqui and S.C. Khanna of Entomology Division for various help extended to field survey parties. Dr. D.K.Singh, Botanical Survey of India, Dehra Dun, provided the necessary

guidance towards the computerisation of data for which my thanks are due to him. Thanks are due to the Director, National Zoological Park, Delhi for allowing the photography and collections within the premises of the park.

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FAUNA OF DELHI : AN OVERVIEW

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The plants and animals have always been an integral part of our environment from the time immemorial. Man has been attracted towards the animals in its surroundings be they large ones like leopard, tiger and deer or small ones like butterflies. The richness of the diversity of the animals and plants alone indicate the health of any ecosystem, terrestrial or aquatic. It is generally known that the biodiversity is less in urban areas when compared to rural or tribal areas. Any loss of bio-diversity due to urbanization would ultimately lead to imbalance in the environment and if corrective measures are not taken for its conservation may eventually result in almost total loss of the bio-resources at some point of time. As a sequel to the bio-diversity conservation the first logical step is biodiversity exploration and inventorisation. Therefore, in keeping with the defined working plan of the Zoological Survey of India and the geo-political importance of Delhi, being both the *National capital territory of India* and a *proposed state*, the scientists of Zoological Survey of India have undertaken the challenge of the onerous task of exploring and inventorising the faunal diversity of Delhi.

In all nine faunistic surveys of the metropolis were undertaken by the task forces of Northern Regional Station, Zoological Survey of India, Dehra Dun, between June, 1993 and December, 1995 (Table-2). Thus covering about 71 localities from various ecosystems available in Delhi (Fig. 3 ; Table 3). The principal objective being to prepare a strong baseline data, which could be used as bench mark study in any present or future action plan for the protection and conservation of faunal diversity and biotic resources of Delhi, which is a typical example of anthropogenic pressure on the urban biodiversity. The population of Delhi has risen from 0.25 million to 10 millions in last half a century.

Delhi, the metropolis, comprises a long narrow strip of territory (1483 km^2area), wedged between the states of Uttar Pradesh, Haryana and Rajasthan, along the western bank of *river Yamuna*. To the south west lies the famous Thar desert, to the north east is the plain area of Indo-gangetic divide, west of which are the plains of India. Immediately to the south, running along north-east to south-west direction is the Aravalli hills, the last tail and extension of which enters Delhi from Gurgaon as the Ridge.

The origin of Delhi dates back to 10th century B.C., when the city of Indraprastha was founded by Pandava's between the now historical Purana Quila and Humayun's tomb. No records are available about Delhi for the following centuries till about 1st century B.C. when Raja Dillu of the Mauryan Dynasty founded a city near about the site where Qutub Minar stands today. The said city was named after him and the name corrupted to Delhi, Dehli and Dilli.

The growth of Delhi started around 11th century A.D., when the Rajput dynasty kings founded new capital cities in the vicinity of this ancient site, and named these after themselves. The ruins of at least eight capitals remain scattered over an area of about 181 km^2 provide adequate evidence of the significance of this region in the political geography of India. It has been suggested

that barring Rome and Istanbul, no other city in the world has such long sustained significance.

The ridge, which is a culminating spur of the Mewat branch of Aravalli, constitutes the most significant physiographic feature of Delhi state. It enters Delhi from the south and extends like a *`lean but wiry finger straight to Yamuna'* in a north-easterly direction. Skirting the city on the north-west and west, the ridge appears like the rampart of a huge fort provided by nature to defend the heart of India (Figs. 1 & 2).

Since historical times the ridge has been perceived as impenetrable area inhabited by extra ordinary plants and fierce animals. The people of Delhi were fortunate to have both, a river as well as a lush green forest, co-existing with a large number of beings from wolves to leopards, to minute insects living in a perfect harmony.

With the transfer of the capital of India from Calcutta to Delhi during British times (1911), the development activities started in Delhi and as a result simultaneous degradation of ridge and the river Yamuna also began, loosing its natural state. The situation worsened further when the developmental activity also started across these two natural boundaries, viz., the ridge and the river.

The exhaustive development in Delhi has reduced the ridge to merely four small patches, one near Delhi University, a large one near Dhaulakuan and two in south Delhi. Sanjay Van is the ancient most part of the ridge forest. The total ridge area now remains is merely 7782 ha (Figs. 1 & 2).

Consequent upon the developmental activities and the reduction of the forest areas the endemic species of the flora and fauna have been lost to the artificial gardens and recreation parks like Budha Jayanti Park, Mahabir Jayanti Park, Lodhi Garden, etc., to name a few. The complete balance and harmony has already been almost disturbed. The undergrowth which sustained many live forms is totally grazed.

However, amazingly despite urbanisation, deforestation, industrialisation, pollution, mining and what not, the ridge forest has still survived in small patches and still sustains variegated forms of life from protozoa to mammals (Table, 1). Similarly the river Yamuna which too has been reduced to a mere drain and is an escape for the city's waste, despite being fully polluted, attracts a good population of water fowls at Wazirabad, Okhla and Najafagarh impoundments. Today, as capital of one of the largest democracies in the world, it is a mushrooming, land scarce city of over ten millions population which struggle to survive in a largely degraded environment.

Does it mean that we have destroyed our natural heritage, the ridge and the river, and leaving behind nothing for the future generations?

But in reality the picture may not be so bad, perhaps Delhi is the only capital city in the world which can boast of a wildlife protected area, within its boundaries, namely - Asola - Bhatti Wildlife sanctuary near Chattarpur. The Asola-Bhatti WLS has the distinction of being the first man-made sanctuary and supports a rich wildlife, besides being the only protected area (PA) in Aravalli hills (Fig. 2). Sawarkar (1996) along with associates has carried out detailed studies on the

management of this sanctuary under the auspices of Wildlife Institute of India, Dehra Dun.

The awareness to conserve and protect the environment of Delhi has been there since the time immemorial. In 14th century, the ridge forest which was having very little tree cover was afforested by emperor Firoz Tughlaq. The British started massive plantation programme and records show 3000 Neem and Babool trees were planted between 1878-79. In 1913 part of N. & C. Ridge was declared as Reserve Forest under Indian Forest Act, 1878, additional 150.46 ha. of north Ridge was declared as Reserve Forest in 1942. Further, in 1948 the southern and central Ridge was also declared as Reserve Forest. In 1980 twenty sites in northern, central and southern Ridge were declared as Protected Forest under the Indian Forest Act, 1927. On October 9, 1986 the Lt. Governor, Delhi declared 1880 ha. in the southern Ridge as *Asola Wildlife Sanctuary* and further in 1989 declared Mehrauli Complex as *protected heritage zone*. Another 840 ha. of *Bhatti mines* was brought under Asola sanctuary in April, 1991. The Ridge management committee (also known as Lovraj Kumar Committee) was appointed in April, 1993. It submitted its report for management of Delhi Ridge in October, 1993. In November, 1993, the Ministry of Environment and Forest, New Delhi directed Delhi Administration to implement the above report fully. In May, 1994, the Lt. Governor of Delhi declared the whole Ridge, on the basis of present day boundaries, as *Reserve Forest* under section 4 of Indian Forest Act, 1927. This was in accordance with the Lovraj Kumar Committee report on the Ridge.

The Delhi based Non Governmental Organizations (NGOs) have played a significant role in the conservation of the flora and fauna of Delhi, especially of the Ridge. Since the protection and conservation of the Delhi Ridge has been a challenging and enormous task, these NGOs formed a joint forum, comprising 18 members, to save the Delhi Ridge. The most important being *Conservation Society of Delhi* (CSD), *Conservation Action Group India* (WWF-India) and *Srishti, Vatavaran and Kalpavriksh*. The Kalpavriksh keeps a regular data on birds of Delhi Ridge and brought out a well documented list of Delhi ridge fauna (1991). Similarly Srishti (1994) in their document entitled *"Saving the Delhi Ridge, one year of conservation action"* has dealt with the biotic communities of the ridge. It deals in detail with various steps taken to protect the ridge. Recently *Vatavaran* has been actively canvassing to protect the environment and biodiversity of Delhi.

These NGOs have played a significant role in creating public awareness and forming public support to conserve the biodiversity of Delhi. A very heartening feature has been the active role of school children of Delhi in saving the ridge, and the Delhi bird counts like *Ridge woodpeckers'* records (Nature Club of the Army Public School, New Delhi). Singh & Basu (1990) have given a lucid account of seasonal changes in the urban biodiversity of Delhi.

At first sight the forested and vegetated areas of Delhi may appear devoid of any kind of animal life, but they really support a myriad of fauna and flora, not immediately visible to the casual observer. The present surveys indicate that Delhi does have wide animal diversity, About 1800 species of fauna have been recorded in the present document (Table, 1).

The Gazetteer of Delhi (1883-84), in a note on the fauna of Delhi, records that the pigs (boars), foxes, hares were plentiful in the eastern bank of river Yamuna. Black buck were found

almost everywhere while the Chinkara abound the hills, specially in Bhunsi, Sinali and part of the Ridge. Wolves were not plentiful but usually found near the old cantonment. The Nilgai or the blue bull were constantly seen near the villages of Borari and Khadipur. Leopard were seen in Tughlaqabad and the outlying villages, while Para (Hog deer) were plentiful near Borari and Yamuna. It further records the presence of Mugger and the Gharial predominantly in river Yamuna, but the snub-nosed man-eater Crocodile was plentiful and could be seen abundantly sun-basking on the bank of river Yamuna near the present rifle range. It further gives an account of the interesting facts about the fauna of Delhi when it documents that within the past five years rewards to the amount of Rs. 8900/- have been given for the destruction of ten leopards, 367 wolves and 1127 snakes.

The Gazetteer of 1912 documents the reward of Rs. 143/- for killing leopard @ Rs. 5/-; male and female wolf @ of Rs. 5/- and Rs. 3/- respectively. It further chronicles the comprehensive list of resident and migratory birds, including teal, duck specially perching around Najafgarh, Bhalsawa Juar, Dobaita, etc.

The Gazetteer of 1976 records major animals like hyaena, wolf, fox, jackal and leopard, and describes them as rare and seen around starry ravines of the Kohi tract. Three genera of the antelopes were found to occur in Delhi along with wild boar which were once common in South Delhi, Narella and Shahadara. The black buck in small herds in the Najafgarh tract and in large herds of over a hundred could be seen in the vicinity of Mehrauli. The Indian gazelle and nilgai co-existed in small numbers. It also gives a list of 32 spp. of Mammals, roughly 200 spp. of Birds, 19 spp. of Reptiles, two spp. of Amphibia, 28 spp. of Protozoa, two spp. of Coelenterates, one sp. of Porifera, 20 spp. of Helminthes, two spp. of Annelida, one sp. of Isopoda, two spp. of Myriapoda, four spp. of Arachnida, besides three spp. of Mollusca from Delhi. Donahue (1966, 1967) and Ashton (1972) have recorded about 70 species of butterflies from Delhi, while Ghorpade (1991) has listed 84 species of Lepidoptera from Delhi. Recently Sawarkar *et al.* (1996) have listed birds and mammals of Asola-Bhatti wildlife sanctuary.

In December 1995 the author came across a small herd of nilgai (12-15) in Asola Bhatti Wildlife sanctuary (estimated population 38, vide Sawarkar *et al.*, 1996) and has been given to understand that the species still occurs in handsome numbers in adjoining Sanjay Van as well.

The sighting of two pairs of leopard cat in Delhi Ridge forest by Ridge-wood peckers in 1987 has been a very exciting news for wildlife lovers and conservationists. The reported prowl of hyena in Okhla area during April, 1996 is noteworthy and confirms its occurrence in ridge forest. Sawarkar *et al.* (1996) have added the Ruddy mongoose (*Herspestes smithi*) to the mammalian fauna of Asola-Bhatti WLS, while confirming the occurrence of Jackal (*Canis aureus*), small Indian civet (*Vivvericula indica*) (both near Neemwala Johar), Rufous tailed Hare (*Lepus nigricollis*) and Jungle cat (*Felis chaus*). They also found indirect records of the presence of Spinytailed lizard (*Uromastix hardwickii*) and Porcupine (*Hystrix indica*) in the above sanctuary.

Ganguli (1970), under the auspices of Delhi Bird Watching Society, listed 403 species of birds from Delhi and environs, which are almost one third of the total number of species found in India. Of these, she recorded 150 spp. as migratory, 200 as resident and 50 with an unknown

status. Subsequently, Kalpavriksh (1991) updated this to 444, and listed about 200 species of birds from the Ridge alone which attracts both migrant and resident species (Srishti, 1994). The wetlands of Delhi like Yamuna, Najafgarh, Ramghat and Okhla attract a large population of water fowls, viz, teal, mallard, pintail, shoveller. a variety of gees, storks and cranes which descend on the swamps and jheels of Delhi during winters. The Delhi Gazetteer (1912) records that in winter teal and duck were found wherever there was any suitable water in which they could pitch.

Recently Urfi (1993a, 1993b, 1995) while studying bird life of the wetlands of Delhi region lists Okhla and Najafgarh drain as very important water fowl habitats in Delhi. The Okhla barrage in particular attract as many as 160 species of birds, the winter population of which may touch the peak of quarter million individuals. These may include (beside the common species like coot, pochards (both white eyed and red crested), pintail, common teal, mallard, gadwall, purple moor hen), rare species like black necked stork, lesser adjutant stork, great crested grebe, rosy pelican and the flamingo. It is heartening that the Okhla barrage and its environs in U.P. state have been declared as a bird sanctuary. But changing its legal status alone is not enough, effective steps must be ensured to protect and manage this wetland of ornithological significance. Besides the clandestine poaching and movement of motorboats and yachts near ODS selling club, the pollution of Yamuna is the single most threatening factor to disturb the balance of the Okhla barrage which is still among the few surviving patches of wilderness in Delhi. Gaur (1994) listed about 200 bird species around Najafgarh drain including a flock of about 20 flamingos.

Urfi (1995) has further dwelt upon the importance of the conservation of Heronries in Delhi and specially the one in National Zoological Park. The canopy of *Prosposis juliflora* growing on various islands, specially adjoining to the Old Fort, have been the regular nesting site of globally threatened species like Painted stork. Sri Satya (1993) in her studies on the impact of urbanisation on the Avi fauna of Delhi records that rosy pelican, which was common upto 1970 in various wetlands of Delhi, is now restricted to National Zoological Park alone.

The studies of Sri Satya (l.c.) gives an insight on the impact of urbanisation on the avifauna of Delhi. The author records that both adverse and beneficial impact has been there. She further reports that 48 species of birds have been adversely affected by habitat loss, loss of food and loss of nesting sites and materials. Overall 20 species have been affected due to human disturbances and 8 species due to competition with other birds. Of the beneficiaries, 13 have benefited either due to introduction of new habitats or their original habitats have been improved upon due to urban process. She further summarizes her studies by concluding that urbanisation of Delhi, specially after 1950, has a definite impact on the overall floral and faunal profile of the metropolis. By the fifties the `green belt' of Delhi with large avenue plantations and parks had developed and provided suitable shelter for garden birds to settle down and flourish besides inviting additional species. Simultaneously, disappearance of scrubland and rocky open patches, and shrinking wetlands had adversely affected the fauna. Additionally changes in the neighbourhood of Delhi also have their impact on the biodiversity of the metropolis. Like the dry spells in Bharatpur and Sultanpur lakes invariably lead to greater influx of migratory water fowls to the wetland in National Zoological Park, where the water level is artificially maintained and food is provided for such birds. Similarly a good monsoon in the neighbouring wetlands results in the dispersal of bird population of Delhi specially those of Najafgarh drain. Urgent attention must be paid to save these wetlands, since

besides Ridge, they are the major source to sustain the biodiversity of the metropolis. It is interesting to note that Sawarkar *et al.* (1996) have highlighted that the distribution pattern of ungulates in Asola - Bhatti WLS is to a large extent influenced by the location and spread of water sources.

Malik (1994), while studying the impact of urbanization on rhesus monkeys in Delhi estimates that 55 percent share human population, while only 45 percent live in forests.

The Wildlife Institute of India, Dehra Dun has recently estimated a population of 38 nilgai individuals in Asola-Bhatti WLS (19.05 Km^2). Using the same grid, relative abundance of domestic livestock was also estimated, which gave a figure of 8077 goats and 2209 cattles, besides the occasional migratory herds of sheep, camel and asses owned by local mining labour community. There is also a sizable population of feral cattle. Based on these, the relative abundance ratios indicate, 1 nilgai : 212 goats and 1 nilgai : 58 cattles (Sawarkar *et al.* 1996).

Thus it may be summarised that while the wetland and scrubland fauna has suffered the woodland fauna has sustained itself. According to Sri Satya (l.c.) the city can be divided into the following composition

1. Thickly populated areas with multistoried buildings interspersed with small pockets of horticultural gardens and parks. These gardens with large lawns and flower beds provide very negligible shelter and food to the fauna; while the wooded parks form very small islands, unconnected with each other thus little faunal diversity exist there again;

2. Small dwelling units surrounded by fruit plants and canopy trees. These can be collectively called as Woodlands and sustain floral and faunal diversity more effectively.

3. Old city, where there is no scope for open area, is devoid of biodiversity in general. In these commercial areas with intense human activities only die hard species like crow, myna, pigeon and sparrow survive.

4. We are fortunate to still have the Ridge woodland, though it too is succumbing under the demographic pressure. The flora of the Ridge is not what it was in last century or so. The exotic plant species have mostly over taken the native ones. We must get rid of the exotic flora and try to replace it with the native one, thus giving Ridge a chance to survive, though like an island in sea of humanity. Simultaneously the patches of the indigenous plant species must be interlinked with each other to provide green belts, where the faunal diversity can sustain.

The present document not only inventorises the faunal diversity of Delhi (Table, 1), but also provides an up to date information and diagnostic taxonomic characters for each species along with a key to their identification. Efforts have also been made to put together relevant information

on the management and conservation aspects of the fauna, namely the GIS and management strategies for Asola-Bhatti WLS in particular and Delhi in general. The leading NGOs of Delhi were consulted from time to time and have accepted our request to give their inputs on biodiversity conservation in Delhi.

At last but not the least it is hoped that the present publication will effectively cater to the need of conservationists and managers.

REFERENCES

Agarwal, R. & Iqbal Malik, 1994. Walk on the wild side. *Srishti*, 1 (4) : 12-19.

Anonymous, 1883-84. *Gazetteer of Delhi District*. Compiled and published, Punjab Govt.

Anonymous, 1912. *Gazetteer of Delhi District*, Part A. Compiled and published, Delhi Admn.

Anonymous, 1976. *Gazetteer of Delhi*. Compiled and published, Delhi Admn.

Ashton, R. 1972. Butterflies of New Delhi. *J. Bombay nat. Hist. soc.*, 69(3) : 502-507.

Donahue, J.P.1966. An annotated list of butterflies of Delhi, India. *J. Bombay nat. Hist. Soc.* 63(2) : 235-260.

Donahue, J.P. 1967. An annotated list of butterflies of Delhi, India. *J. Bombay nat. Hist. Soc.*64(1) : 22-48.

Ganguli, Usha, 1975. *A guide to the Birds of Delhi area*. Indian Council of Agricultural Research, New Delhi.

Gaur, S. 1995. Bird Haven (in drain). *Srishti*, 2(1) : 34-40.

Kalpavriksh, 1991. The Delhi Ridge Forest : Decline and Conservation. pp. 1-49.

Lal, R. 1994. The neighbourhood watch. *Srishti*, 1(5) : 33-36.

Lovraj Kumar Committee Report, 1993. To recommend the pattern of Management of Delhi Ridge.

Maheshwari, J.K. 1988. *The Flora of Delhi*. CSIR, New Delhi.

Malik, I. 1994. Troops at the Fort. *Srishti*, 1(3) : 38-34.

Sawarkar, V.B. et al. 1996. *Management Planning for Asola-Bhatti Wildlife sanctuary*. Study report, Wildlife Institute of India, Dehra Dun : 1-130.

Singh, Khushwant & S. Basu, 1990. *Nature Watch.* Tien Wah Press, Singapore.

Srishti, 1994. *Saving the Delhi Ridge : One year of Conservation Action.* A Srishti Report.

Sri Satya, C. 1993. *Effects of Urbanization on Avifaunal Diversity in Delhi.* M.Sc. thesis, Deptt. of Environmental Biology, University of Delhi (Unpublished), pp 1-85.

Urfi, J. 1993a. The Bird life of Okhla. *Sanctuary*, **23**(5) : 50-53.

Urfi, J. 1993b. Heroneris in the Delhi region of India. *OBC Bulletin*, **17** : 19-21.

Urfi, J. 1995. Wetland of Ornithological significance in the Delhi region. *OBC Bulletin*, **22** : 38-41.

Table - 1. Summary of the Fauna of Delhi :

GROUP	SPECIES
I. **INVERTEBRATA**	
PROTOZOA	44
PORIFERA	01
COELENTERATA	02
HELMINTHES	20
NEMATODA	57
MOLLUSCA	23
ANNELIDA	09
CRUSTACEA	03
INSECTA	
Thysanura	01
Odonata	47
Orthoptera	99
Blattariae & Mantodea	09
Dermaptera	04
Isoptera	14
Hemiptera	152
Thysanoptera	91
Coleoptera	97
Diptera	79
Lepidoptera	101
Hymenoptera	178
DIPLOPODA	04
CHILOPODA	10
ARANEA	11
ACARI	145
Total	**1202**
II. **VERTEBRATA**	
PISCES	87
AMPHIBIA	7
REPTILIA	25
AVES	434
MAMMALIA	32
Total	**585**
III. **Grand Total (I + II)**	**1787**

Table - 2. Schedule of Faunistic Surveys undertaken in Delhi by Zoological Survey of India, Dehra Dun :

Sl. No.	Period	Days	Party
1.	June, 1993	10	Vinod Khanna & party
2.	October, 1993	11	N.K. Sinha & party
3.	May, 1994	10	A. Husain & party
4.	September, 1994	10	J.P. Sati & party
5.	December, 1994	10	A. Husain & party
6.	February, 1995	12	J.P. Sati & party
7.	May, 1995	06	P.C. Tak & party
8.	July, 1995	09	J.P.Sati & party
9.	December, 1995	07	Arun Kumar & party

Table - 3. Alphabetical list of collection localities in Delhi :

S.no.	Locality
1.	Asiad village
2.	A.N. Jha Deer Park, Hauz Khas
3.	Asola-Bhatti Wildlife sanctuary
4.	Bhalsawa Water Sports complex, Ring Road
5.	Budha Jayanti Park
6.	Bawana
7.	Chhawala village
8.	Chhatarpur
9.	Chhawala lake
10.	Dhaulakuan ridge
11.	Dhaulakuan lake garden
12.	Dhaulakuan cantonment area
13.	Delhi-U.P.border
14.	Delhi Zoological Park (National Zoological Park)

S.no.	Locality
15.	Delhi University campus
16.	Delhi University campus (south)
17.	Horse-shoe Lake, Jahangirpuri
18.	Humayun's tomb
19.	Hauz Khas Park
20.	IARI campus
21.	Indira Gandhi Indoor stadium
22.	India Gate boat club
23.	Jahanpanah private forest, Chirag Dilli
24.	Jheel Park, Rani Bagh
25.	Kakraula nursery, Najafgarh road
26.	Kedia nursery, Karnal road
27.	Kamala Nehru Ridge
28.	Lal Bagh Model town
29.	Lodhi garden
30.	Lodhi tomb complex
31.	Lake Garden, Dhaulakuan
32.	Lado Sarai, Mehrauli
33.	Lake Garden, Shakur Basti
34.	Masoodpur near Vasant Kunj
35.	Masudabad, Najafgarh road
36.	Majnu-ka-tila, Najafgarh drain near Wazirabad
37.	Mangal Mahadev near IGI Airport
38.	Najafgarh village
39.	Najafgarh drain
40.	Naraina
41.	Nizamuddin
42.	Nangli
43.	Okhla
44.	Old Fort near NZP
45.	Okhla dam
46.	Okhla barrage
47.	Okhla barrage, Shaheen Park
48.	Okhla barrage, Kalindi Kunj
49.	Okhla reservoir
50.	Punjabi Bagh Municipality nursery
51.	Piggery Farm, Ring road
52.	Palam
53.	Patparganj
54.	Priya Park, Munirka
55.	Qutubuddin Idgah
56.	Qutub Minar complex

S.no.	Locality
57.	Rohini
58.	Ridge - Dhaulakuan
59.	- Kamala Nehru
60.	south
61.	south central
62.	River Yamuna ITO
63.	Salimgarh Bridge
64.	Seelampur
65.	Ramghat
66.	- Yudhishter bridge
67.	- Wazirabad
68.	Saraswati Vihar, Rohini, outer Ring road
69.	Safdarjung Tomb Complex
70.	Sanjay Vana
71.	Tughlaqabad Park
72.	Wazirabad Ramghat
73.	Yamuna barrage
74.	Sabhyapur
75.	Gopalpur nala
76.	Gurzar ghat
77.	Yamuna canal Rohtak road

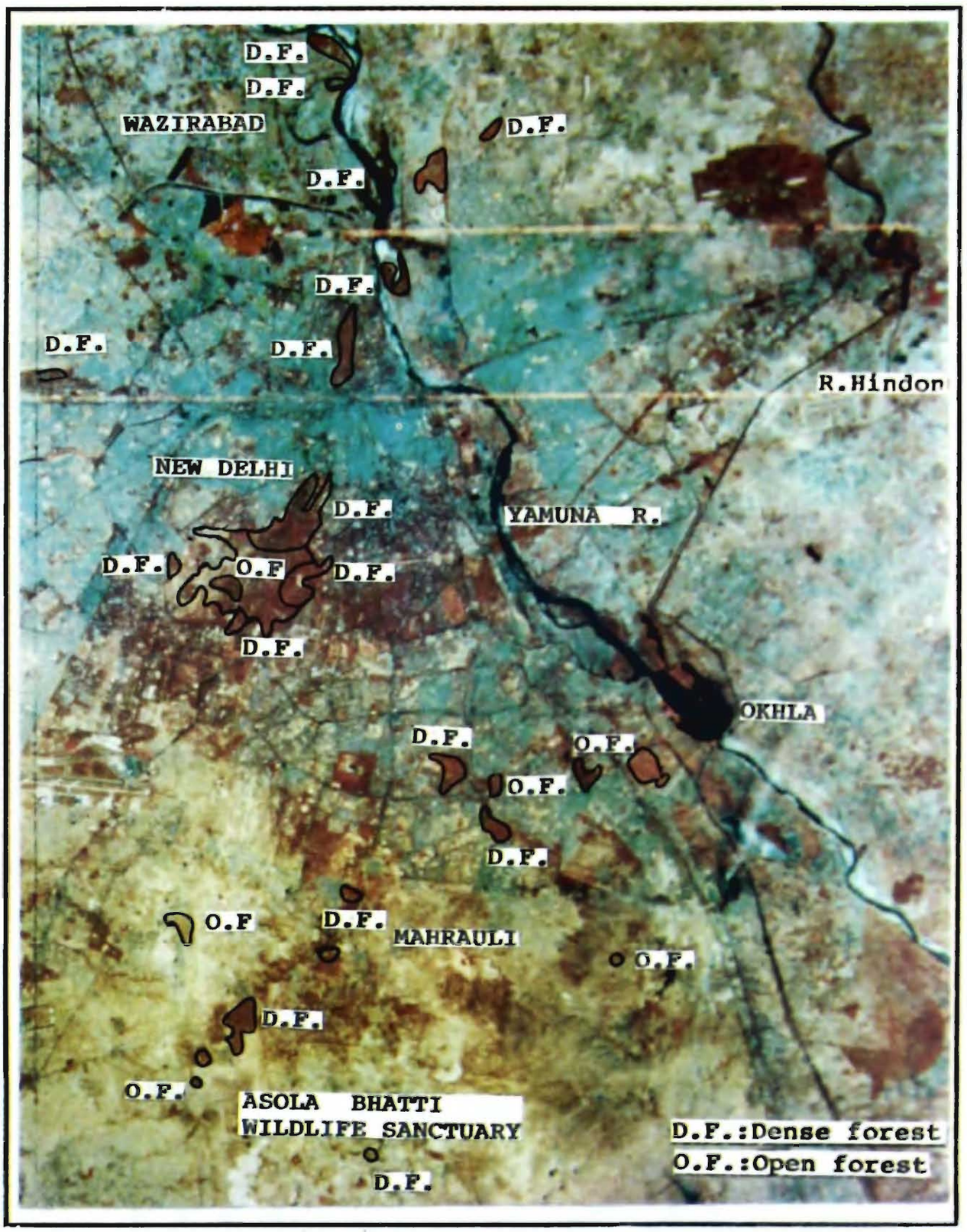

Fig. 1 Satellite Imagery (IRS/1B) of Delhi showing forest cover and wetlands (Source : Director, Forest Survey of India, Dehra Dun)

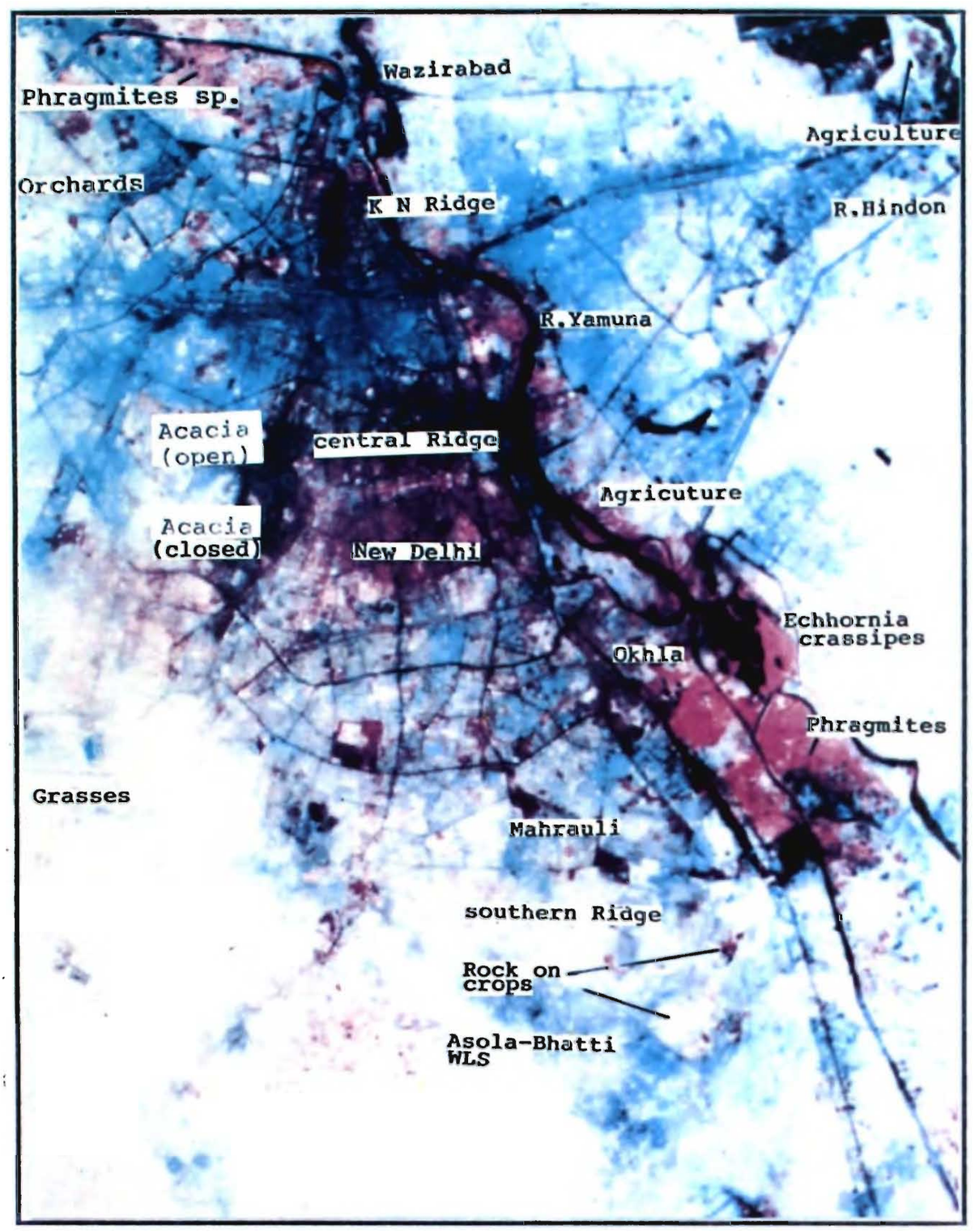

Fig. 2 SPOT-2 Imagery of false composite of Delhi showing land Cover/Vegetation (Source : IIRS, Dehra Dun)

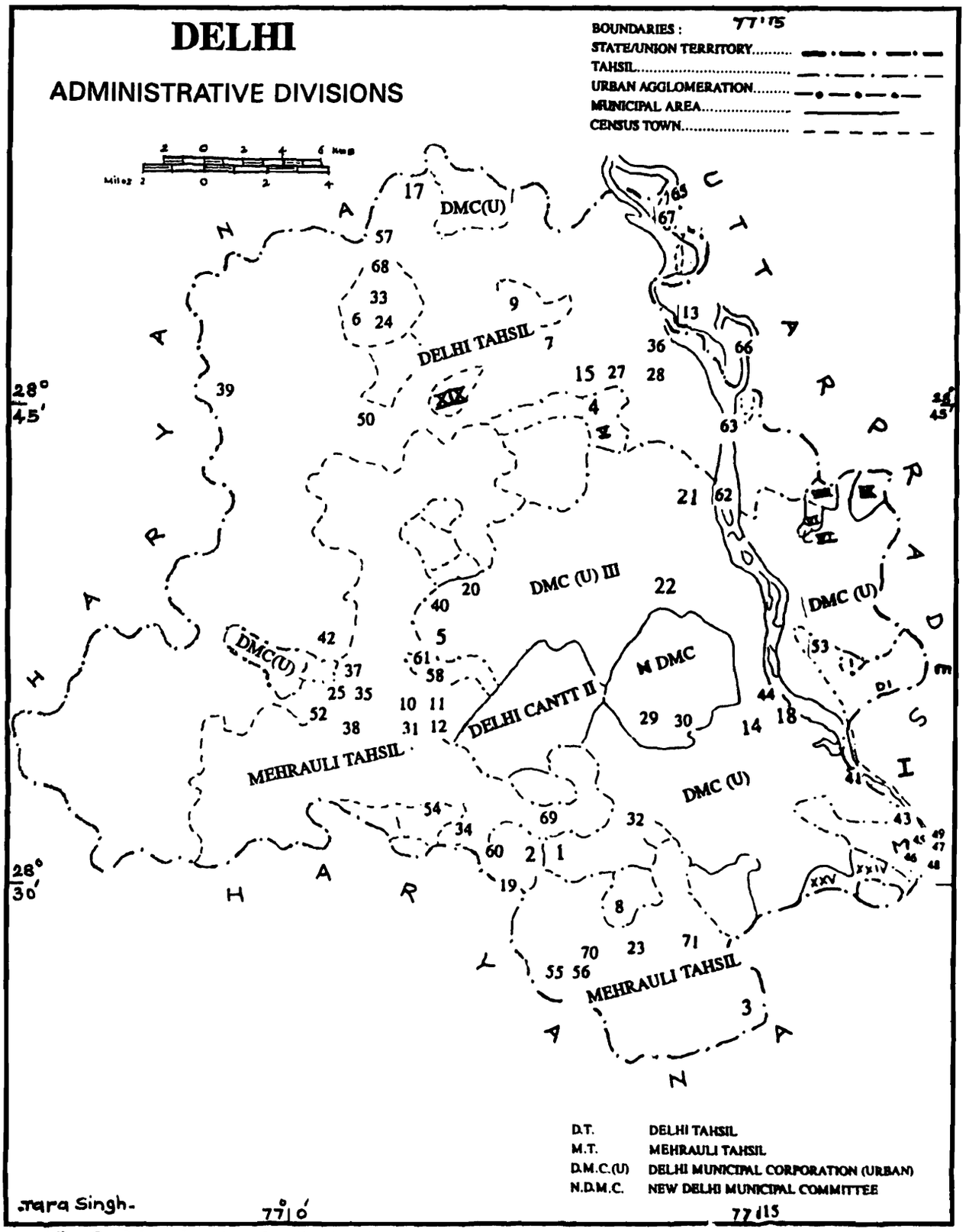

Fig. 3 Map showing the distribution of collection localities in Delhi.

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BIOGEOGRAPHY OF DELHI

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INTRODUCTION

Delhi, the national capital territory of India, is situated at an average altitude of 216 m above MSL, lies between 28° 24' and 28° 53' N latitudes and 76° 50' and 77° 20' E longitudes. It covers a geographical area of 1483 sq. kms.

It occupies a strategic position on the Indian subcontinent being situated on the watershed dividing the two mighty river systems the Ganga draining into the bay of Bengal and the Indus falling in the Arabian sea. The geographical area of Delhi is like a broad alluvial neck, bounded by Thar desert on the south, by mighty Himalaya on the north, Indo-gangetic plains on the north-east, the fertile Gangetic plains on the east and by Aravalli hills on the south.

Delhi, which was so far (since 1913, when its population was 0.25 million) having a status of a single large district/Union Territory, has today crossed the population of over 10 millions and has been recently assigned the status of National Capital Territory, occupying an area of 1483 sq. kms. Its greatest length and width being 51.90 kms and 48.48 kms respectively. It comprises on date, following nine administrative districts (Fig. 4) :

1. North District,
2. North-West District,
3. North-East District,
4. South District,
5. South-West District,
6. East District,
7. West District,
8. Central District,
9. New Delhi District.

TOPOGRAPHY

The topography of Delhi has two important physical features, the Ridge and the river Yamuna. Though atleast ruins of eight capitals are scattered in Delhi yet, these two natural boundaries were never infringed. The ridge was incorrectly perceived as impenetrable area, while the river Yamuna provided a perennial source of water. The people of Delhi have been lucky to

have the river as well as the lush green forest.

The Ridge, situated in the heart of Delhi, with an estimated length of 53km, is an extension of the oldest chain of mountains in India the Aravalli's, and constitute the most important physiographic feature of the region. It enters Delhi from south and extends like a "lean but wiry finger" straight to Yamuna in the north easterly direction. Encircling the city on the north west and west, the ridge appears like the rampart of a huge fort provided by the nature to defend the heart of India. A branch of ridge separates itself from the main trunk near Bhatti and extends in north easterly direction upto Arangpur where it turns to the north west till it joins again the main ridge in a sweeping curve. In addition to this branch a number of flanking spurs join the complex topography of the ridge. Also present are many seasonal rivulets and nullahs. Due to inadequacy of water and rocky nature of the terrain, the vegetation in the ridge is generally poor and can be called as thorny scrub. The most common native tree species are the Babul, Kikar, Karil and thorny bushes of Ber. There are traces of thin layers of mica over the surface shining brightly in the sunlight. The water table is low and traditional irrigation is impracticable. The quarrying in the ridge has been done on a fairly large scale and a number of abandoned quarries have become water bodies, which attract animals and birds. The ridge achieves the maximum elevation of 316 m near Bhatti, relatively this point is about 100 m higher than Yamuna Railway bridge. The two branches of the ridge enclose a plateau, which is sandy in nature. The ridge forms about 6% of the total land area of Delhi (Fig. 6).

The ridge consists of four relatively small pockets of forests (Fig. 5). The total area now actually available in the ridge is approximately 7782 ha, which is not a continuous stretch but divided into four zones (Fig.14), namely :

1. **The northern Ridge or the old Delhi Ridge** : About 87 ha in area, it is the smallest section bounded by Delhi University in the north, Kamla Nagar in the south, Rajpur Road in the east and Malka Ganj in the west. It is also known as Kamla Nehru ridge.

2. **The central or the New Delhi Ridge** : More popularly known as **Dhaulakuan Ridge** (869 ha), is bordered in the north, south, east and west by Link Road, Dhaulakuan, Mandir Marg and Naraina Industrial area respectively.

3. **The south central Ridge (Vasant Kunj)** : It is about 626 ha in area and is flanked by Mehrauli Institutional area, Mahipalpur, Sri Aurobindo Marg and Jawahar Lal Nehru University road, in north, south, east and west respectively.

4. **The southern Ridge** : About 6200 ha in area, where a substantial tree cover is found in the Sanjay Vana or Kishangarh forests and the Jahanpanah city forest. The remainder of the southern ridge is mostly the Asola-Bhatti wildlife sanctuary which is protected but is largely

degraded owing to mining and grazing activities. It is estimated that about 72% of the ridge area has been encroached leaving only 28% as green area.

The ridge is vital to the city's well being since it :

1. Serves as a sort of a giant central air conditioning plant where on entering a noticeable drop in temperature can be experienced,
2. Provides the increasingly polluted capital with oxygen, as well as absorption of pollutants,
3. Blocks the dust and tames the hot dusty *`Loo'* that sweeps the capital during summers,
4. Acts as a massive sound insulator absorbing the hubbubs of the city,
5. Gives the jaded city dwellers a taste of nature where one can jog, walk and exercise, and finally,
6. Is a potential source of habitat for many species of large and small animals and variety of flora, which too otherwise would have faced the onslaught of development, ever growing urbanisation and industrialisation.

In May, 1994, the Lt. Governor of Delhi notified the entire ridge, on the basis of present day boundaries, as Reserve Forest under Section 4 of Indian Forest Act, 1927, in accordance with recommendations of the Luv Raj Kumar committee.

River system and drainage : The R. Yamuna, one of the ancient water courses of northern India, forms the chief drainage channel of the state. The river has almost a north-south course in Delhi and extends about 51 kms forming almost the eastern boundary of Delhi with the state of Uttar Pradesh. During south west monsoon the river expands considerably in width at places to several kilometers. The course of Yamuna from its entry point in north (village Palla) to its exit in south (Jaitpur) is quite tortuous. It runs due south upto Wazirabad, from where it takes sharp easterly turn passing close to the Red Fort and flows south-eastwards to Okhla, where Agra Canal head works is located.

The course of Yamuna through centuries has formed a deep impression on the physiography of the plains in the region. The 227 m contour may be considered as the western boundary of plains, demarcating it from the ridge. With an average altitude of 200 m, the Delhi plain areas are considerably wider, more fertile and populous in the north but almost lose themselves in the most of rocky undulations of Siri and Tughlaqabad. Further south, the terrain becomes flatter and more open (Fig. 6).

In addition, a well defined drain system exists in Delhi comprising the western Yamuna canal, Mangolpur drain, Nangloi drain and Najafgarh drain, outside Yamuna, it is most important

drain in Delhi. Originally it was created in the year 1838 from Najafgarh Jheel to provide a passage to excess water from Jheel to River Yamuna. The drain is about 49.9 kms long and together with tributaries serves as a catchment area of 1315.7 sq kms.

Lakes and reservoirs : The largest natural depression in Delhi is the *Najafgarh Jheel*, in extreme south lying along Delhi - Haryana border. It is located adjacent to Najafgarh village about 32.2 kms south-west of Delhi. It has a catchment area spreading over about 906.5 sq. kms lying both in Delhi and Haryana. The normal tankful level of the jheel is about 210 m, with the submergence area of about 7500 acres, it has an outlet- the Najafgarh drain. The *Horse-shoe Lake*, probably the remnant of old westerly Yamuna course, is located north of Bhaleswa-Jahangirpur along GT Road in its Delhi-Karnal stretch. North of Najafgarh Jheel there are other important perennial water pools namely Shamspur Khalsa, Pindwala Kalan and minor lakes in Khera in the west, and Gadipur in the south.

Okhla barrage : Okhla barrage is located at a point where river Yamuna leaves the territory of Delhi and enters Uttar Pradesh. It lies approximately 3 km off stream from Okhla Defence Services Sailing Club, sandwiched between Jamia Millia University campus on the west and NOIDA on the east. The portion of reservoir falling in U.P. has been declared as a *bird sanctuary* by the Govt. of Uttar Pradesh. The avian diversity is strongly influenced by the sporadic water level. More than 160 species of birds have been recorded from the wetland (Urfi, 1995). The various seepage ponds on the sides of barrage are good birding spots. It is, therefore, an incredible bird heaven.

Wazirabad barrage : Wazirabad is yet another man made wetland on the northwest bank of river Yamuna stretching almost a distance of 6-8 kms. This wetland too attracts a large number of bird species. A number of fish species have also been collected from the wetland besides aquatic invertebrates, etc. The river Yamuna enters Delhi at Wazirabad and leaves at Okhla.

Heronries : Four heronries are known from Delhi region, the largest and the most consistent one is at National Zoological Park.

Climate : The climate of Delhi is generally influenced by its remote inland location, the major contributing factor being the Delhi Ridge and the river Yamuna. Due to its geographical location between Indo-gangetic plains (in the east), the Thar Desert (in the west), the Aravalli (in the south) and Himalaya (in the north), the Delhi state has a unique character of semi - arid climate with extremes of summer alternating with extremes of winter and moderate rainfall. Therefore, it is not favorable for the growth of luxuriant vegetation.

The cool oceanic air is able to penetrate the area only during the month of July, August and September, i.e., during south west monsoon, which has a major impact as 80% of the precipitation

is received during this period and effects both the fauna and flora of the area.

The main important climatic features of Delhi are :

1. Relative humidity, 2. Temperature, 3. Rainfall, 4. Wind, 5. Thunderstorms, squalls, dust storms, etc., and, 6. Hail storms and fog, etc.

1. **Relative Humidity** - is highest during monsoon from July - August (75-87%) and minimum April-May (32- 34%).

2. **Temperature** - Extremely hot summers with temperature exceeding as high as 46-47°C during day time in the month of June and as low as 26-28°C during night. The summer lasts for almost a period of four months from the end of March to the end of July or beginning of August. The cold weather lasts for 3-4 months from December to February with temperature ranging from 6-8°C during night and 20-22°C during day time (Fig. 7).

3. **Rainfall** - The south - west monsoon season lasts for about 3 months from mid July to the beginning of September. The number of rainy days are however, 40 or so with an average rainfall of 725 mm, of which August alone has 370 mm or so, while about 75% occurs during monsoon months. There is practically no rainfall from mid September to January (Fig. 8).

4. **Wind** - The normal wind speed is 10-12 m/h during June-July; 3/4 m/h during November-January. Thunder storms, squalls, dust storms are also occasionally witnessed in Delhi during summer.

PHYSIOGRAPHY

The soil of Delhi is most remarkable and important factor in contributing to the environment of Delhi ridge vegetation. Geologically, the soil consists of ferrugineous and lime quartzites, grits and schistose rocks, intruded by large bodies of granite and amphibodies. The Delhi quartzite possesses a vitreous luster. The schistose rocks consists of biotite, schists, phyllites and impure biotic lime stones. The reddish or brown red appearance of the hilly tracks may be due to the dehydrated form of iron oxide, turgite or haematite (Fig. 9).

The sources of Delhi soils are : 1. Local Quartzite, 2. River borne alluvium, 3. Alluvium of Acolian origin.

The territory of Delhi has been divided into four physiographic regions on the basis of its soil quality :

1. **Khadar or Riverine zone or new Alluvium :** Along river Yamuna - silt to sandy loam in texture, with pH ranging from 8- 8.8 and the soil is more alkaline with the depth generally fertile and suitable for crops.

2. **Bangar or the old Alluvium :** Ridge tract near GT Road - large areas are inundated due to the poor state of drainage. Saline alkali soils with high pH value and .045% nitrogen contents are very fertile soil. Variety of crops can be cultivated in the Bangar.

3. **Dabar or Soils of low lying areas :** Najafgarh Area - the low lying areas are flooded during monsoon; improper drainage results in water logging and formation of saline alkali sandy loam soils with .032% nitrogen contents.

4. **Kohi or Pahari (Hill side) or soils of rocky areas :** Near Mehrauli and Tughlaqabad - the soil comprises sand stone rocks of Delhi Ridge, the texture varies from sandy loam to clay loam. Due to uneven topography the soil erosion and formation of gullies is common. The pH varies from 7-8. The nitrogen content is .035% with poor to medium fertility. Due to the low water level the irrigation is difficult. It has sparse vegetation grown over it.

The three physiographic divisions, namely the **Khadar, Dabar** and **Bangar** are the part of the plains of the region and are now the centre of various human activities, including housing and agriculture.

The distribution of Delhi soils is more dependent on its topography. In low lying areas, i.e., Dabar, both salinity and alkalinity develop in profile, otherwise the soils are well supplied in plant nutrients except nitrogen. The saline and alkaline soils known locally as **Kollar** or **Usar** are absent in **Kohi** areas but frequent in **Khadar, Bangar** and **Dabar** areas. Their formation is favoured by semi - arid climate, impervious sub-soil and temporary abundance of humidity in soils with alternate dry spells.

The chief salts are usually Chlorides, Sulphates and Carbonates of Sodium, in varying proportions. Apart from direct injurious effects of salts on the plant life, the salts also make the soil impervious to water, as a result, in the year of good rainfall the patches of Kollar are water logged. (Mahto & Bhanotar, 1977).

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FOREST

Delhi has an estimated forest area of about 42 sq. kms, which is about 2.8% of the total geographical area. However, according to 1991 State of Forest report prepared by the Forest Survey of India, Dehra Dun, the actual forest area is only 22 sq. kms (which covers about 1.5%) with the following details :

Dense Forest (Crown density above 40%)	-	*12 sq. kms.*
Open Forest (Crown density 40%)	-	*10 sq. kms.*
Scrubs	-	*3 sq. kms.*

The overall forest cover of Delhi is divisible into two general types, **Dry Forest** (Natural) and **Mixed Forest** (Plantation). The natural forests generally include *Acacia* (Babool) and also thorny bushes. Forests under aforestation schemes include temperate, tropical and deciduous trees which are grouped under mixed forests (Figs. 10, 11 & 12).

The major natural forests in Delhi are generally restricted to the ridge, while there are 19 mixed forest plantations in state, of which seven were planted between 1971-1981, namely Shahpur, Bawana, Garhi Mandu, Zindpur, Setberi, Shakurpur and Yahya Nagar.

Sanjay Van : This beautiful protected area lies next to CRPF Camp between Lalkot and Qutub Institutional Area. Sanjay Van still represents the original ridge forest having native species like Kadam and Siras trees. It has a good population of native fauna and is recorded that Nilgai is more common here than any other part of the ridge. The diversity of bird species is also extensive. The nearby population of residents use the area for exploration of fodder and medicinal plants.

Protected areas : *Asola-Bhatti Wildlife sanctuary* : On October 9th, 1986, the Lt. Governor of Delhi declared 1880 ha of land in the southern ridge as Asola Wildlife sanctuary. Further to this, in April, 1991, the adjoining 840 ha of Bhatti-mines were also brought under Asola Wildlife sanctuary. Thus the two erstwhile sanctuaries of Delhi, viz., the Asola and the Mehrauli were merged and renamed as Asola-Bhatti Wildlife sanctuary (approx. 6200 ha). As per the Srishti report (1994) it is also called as Indira Priyadarshini WLS (Fig.14).

It is located near Chhatarpur, Tughlaqbad - Bhatti mines in Mehrauli block and forms a part of the southern ridge, with an overall area of 6200 ha. The sanctuary stretches 22 kms across its length and is developed tree by tree. It has eight feet high boundary wall stretching over 48 kms. This wall serves to demarcate the sanctuary. The land is generally degraded and devoid of trees other than Kikar. The water is a scarce commodity in the sanctuary and the water table is ca. 180 m below the ground level.

It supports a good population (80-110) of nilgai, besides occasional fox and jackal. A large number of bird species can be sighted in the vegetation and according to the forest officials migratory species have made the sanctuary a stopover point en route their migration. Recently Wildlife Institute of India (1995) undertook a study on the problems and prospects in conserving Asola-Bhatti WLS (Sawarkar & Hussain, 1996).

Asola has a nursery in which saplings are raised and a total of 25 lakhs have already been planted. Experts feel that once completed this sanctuary will work as an alternate lung of Delhi.

Okhla Water Bird sanctuary : Recently the part of reservoir at the border of U.P. has been declared as a bird sanctuary by the Govt. of Uttar Pradesh, primarily to protect the waterfowl visiting this reservoir. Urfi (1995) records as many 160 species of resident and migrant birds from this wetland.

National Zoological Park : The Government of India has setup this park in Delhi in the year 1959 on the recommendations of the Indian Board of Wildlife. Presently, it is administered by the Ministry of Environment and Forests, New Delhi, under Central Zoo Authority. It was created for conservation and breeding of the rare fauna and to educate and provide recreation to the people. It is estimated that 16 to 17 lakh people visit the park annually.

The park has an area of about 214 acres, with rolling green lawns, groves of trees, etc., which gives it an appearance of a natural wood land. The park is located adjacent to the old fort and the river Yamuna (Fig. 15). The scrubs of the park form a contiguous vegetation with old fort, which provide an ideal habitat for a large variety of birds like *Painted stork.*

It has wetland in the form of a central lake and ponds, which attract a large number of resident and migratory water fowl. Roughly, there are about 400 Painted storks which are attracted for breeding and roosting on *Prosopis juliflora* trees. Also a flock of 40-50 *Rosy Pelicans* visit the NZP, during winters though at one time they were visiting other wetlands of Delhi in large numbers. Otherwise as well the park abounds in the avifauna as more than a hundred species of birds have made their homes in tress, bushes, shrubs and lakes. Urfi (1995) records the wetland of NZP as the most consistent Heronry of Delhi.

National Zoological Park, formerly known as Delhi Zoological Park, displays 1264 animals in captivity, comprising 54 spp. of mammals, 85 spp. of birds and 16 spp. of reptiles (Fig. 16). It contributes to the conservation of rare and endangered animal species by successful captive breeding of brow antlered deer, swamp deer, himalayan black bear, hippopotamus and white tiger.

There are four large water ponds spread on the body of this park. The pinioned stock of storks and cranes can be seen hopping or running on the islands around and pelicans sailing on the

placid pond waters. Upon the tree canopies, except for a brief period, hordes of migratory and local birds can be seen in their nesting and breeding activities all through the year. Come August and painted storks in different flights descend down on the canopies of trees near the two largest ponds and within a few days they colonise the whole area. For starting their nesting activities in the right earnest, if need be they de-throne the breeding white ibises, pond herons and egrets from their nests. The little and large cormorants who had migrated during April can also be seen raising chicks in small colonies. During August painted stork, white ibis, pond heron, egret and cormorant can be seen together breeding in serried colonies. The painted storks, by their size and magnificance provide a grand spectacle to the onlookers. Their cruising on their daily chores and raising chicks in close proximity to bystanders puts the celebrated Keoladeo Ghana Bird National Park in paler light in its comparison. In one of the two big ponds, a large group of rosy pelicans surfing and sailing on the pond water and another large-group, zoo-bred chicks, soaring on the zoo şky area are a treat to watch.

Some of the non-captive avian species migrating to this park, colonise the area around water ponds. Besides the said painted storks there are white ibis, pond heron, cormorant and egret, many species of ducks like Pintail, Shoveller, Spotbilled duck, common teal, Pochard, Gadwal, etc. While a significantly large population of peafowl is spread all through the length and breadth of the zoo, different species of birds can be seen, some of them breeding as well, here at different parts of the year. These birds are white necked vulture, Pariah kite, grey hornbill, hawk cuckoo, koel, golden oriole, large green barbet, common barbet, crow pheasant, grey partridge, robin, babbler, wagtail, baya, lapwing, mynah, parakeet, warbler and many other species. Besides the many species of birds, reptiles like cobra, krait, water snake, rat snake, python, etc. and mammals like porcupine, common palm civet and mongoose are a common sight as non-captive stock inside the park. These make this zoo as a veritable sanctuary and draw the nature lovers and cameramen of all hues.

Gardens and Parks : The main horticulture gardens in Delhi are Roshanarah Park, Qudisia bagh and Kamala Nehru Park in north Delhi and the Lodhi Garden, Budha Jayanti Park, Nehru Park and Deer Park in south Delhi. Horticulturally these are the green areas of Delhi. Mention must be made of the Moghul Garden which is considered one of the finest in Asia. These habitats are common nesting places for the native birds and other fauna. Though the flora is not natural representative vegetation, many exotic species of plants have been introduced. Most of these parks have been landscaped after clearing the natural shrubs and undergrowth resulting in the loss of habitat for both invertebrates and avifauna as well. It is expected that the birds like Prinia, White Throated munia, Yellow Eyed babbler, Grey partridge, peafowl and quail are fast depleting due to this reason.

The roads and avenues, specially in south Delhi are lined with several flowering trees, the Neem being the common species, the others are *Amaltas, Gulmohar, Semul and Kachnar* (Singh &

Basu, 1990).

Budha Jayanti Park : Located in Central Ridge near Kushak view, cradled between rocky out crops, emerald green lawns gently slopes away carpeting every curve of natural contour. Trees and shrubs, associated with the life of Lord Budha have been planted in large numbers. A winding channel with its picturesque falls meanders through blending hormoniously with rural surroundings.

Lodhi Garden : Situated near Lodhi road, the Lodhi garden contain four buildings of historical importance. Recently the garden has been further developed and beautified with provision of an air-conditioned glass house, which is used as nursery for rare and imported plants. A 1000 ft serpentine lake varying from 7-10 ft. in depth traverses through the middle of the garden and provides ideal habitat site for avifauna and aquatic insects.

Mughal Garden : The Mughal garden of Rashtrapati Bhawan mainly designed by W.R. Mustoe, the coadjutor of Sir Edwin Lutyens is a pleasant blend of different styles of horticulture. The lush green turf, lovely flower beds made in intricate geometrical patterns, the climbing vines over bowers, and spouting fountains, invest this garden with an aura of glory. At the base of several tiers of terraced flower beds is a circular pond. The garden is thrown open to public for about a month during winters. It is the *crowning glory* of the floral and faunal paradise. A fish pond at the northern entrance has been a special feature of this garden which contains some exotic fresh water fish presented by the then Chinese Premier Mr. Chou-En-Lai to Pandit Jawahar Lal Nehru (*Delhi Gazetteer*, 1976). The beautiful garden with well maintained lawns attracts, besides birds, a variety of colourful butterflies and dragonflies. The fauna and flora of the garden has the natural as well as the legal protection.

Smriti Van : The memorial sites of the great national leaders (along the bank of river Yamuna around Indraprashta state) have natural as well as planted vegetation and forest. These sites enjoy the status of protected areas, thus providing a boon for conservation of biodiversity. A mention may be made of the groves present in IARI campus as well, which support rich biodiversity and the sight of flocks of Peafowl are very encouraging.

Monuments : There are a number of abandoned monuments in Delhi like Tughlaqabad Fort, Old Fort the tombs of Humayun and Nizamuddin. These monuments are ideal nesting sites for a large number of birds species like parakeet, hoopooe, blue rock pigeon, Indian robin, swallow and swift which are likely to find crevices, walls and hedges convenient to roost and feed. The Red wattled lapwing lay eggs very often on the roof tops of these deserted monuments. Large troupes of macaque inhabit the Tughlaqabad fort (Malik, 1994).

Purana Quila (Old fort) : Situated on Delhi - Mathura Road about 3 km south of Delhi Gate

and adjoining to the National Zoological Park, the Purana Quila was constructed on the historical site of Indraprastha by Sher Shah and Humayun. The citadel has a circuit of about a mile. It attracts a very good population of migratory as well resident birds, the most prominent the flocks of painted stork.

Qutub Minar : Towering high above the countryside, the Qutub Minar is a noble monument of the Muslim rule in India. The single majesty of this minar, so grandly conceived, beautifully proportioned, chastely embellished and exquisitely finished, that it fills the mind of the spectators with emotions of wonder and delight. It is 238'1" high with a base diameter of 47' 3" The shaft is divided into five storeys, of which the lowest is 94' 11", while the fifth storey is 22' 4", in descending proportions from below upwards.

Tughlaqabad : Ghiyas-ud-din in 1320 selected Tughlaqabad as the site for his capital on the edge of rocky out crops, five miles from Qutub Minar. It is one of the most striking ruins of Delhi, shaded by trees on both sides and almost adjoining the Asola-Bhatti WLS.

Across the road and facing the fort is the mausoleum of Ghiyas-ud-din, which is fortress like in structure. Around this monument a number of species of various animal groups have been collected, and the troupes of macaque are a very common sight (Malik, 1994).

VEGETATION

Flora : The forest of Delhi ridge has been described as semi-arid and open scrub and has a characteristic similarity with the plants of deserts. These species occur in clumps and do not cover the ground densely leaving ample space between them. Maheshwari (1988) has given an exhaustive account of the flora of Delhi. Both Kalpavriksh (1991) and Srishti (1994) in their report on Delhi ridge have dealt in details on the Delhi flora.

Trees : Among the most common native species is Babool (*Acacia nilotica*). Three other species of the genus also found in Delhi are Phulahi (*A. modesta*), Katha (*A. catechu*) and *A. senegal*; the prettiest native species in bloom is the flame of the forest, *Butea monosperma*, also known as Dhak or Palas, at time confused with Gulmohar (*Delarix regia*), because this species also has bright orange flame coloured flowers. Other common species of trees in Delhi are Rong (*Acacia leucophloea*) in hilly tracts, Dhok (*Anogeissus pendula*), Pilu (*Salvadora persica*), Lisauna (*Cordia dichotoma*), Desi Papri (*Ehretia laevis*), Ber (*Zizyphus mauritians*), Hirigot (*Belanites aegyptica*), Amaltash (*Cassia fistula*) and Shishum (*Dalbergia sissoo*). Singh & Basu (1990) have given fascinating account of flowering calender of Delhi trees.

Shrubs : The most common and dominant shrubs in Delhi are Bansa (*Adhotoda vasica*) and Heens (*Capparis sepiaria*), both evergreen, the former being abundant in north Delhi ridge. It is commonly used as a medicinal plant as cough expectorant. Jungli Karaunda (*Carissa spinarum*) is often found in the ridge, Khatai (*Flacortia indica*) and Kakera (*Mayternus senegalensis*) are other common shrubs.

Exotic vegetation : In addition to the native flora Delhi also has a number of introduced species of plants which, in due course of time, have become naturalised. The most common species is Kabuli or Vilayati Keeker (*Prosopis juliflora*) belonging to the arid regions of Mexico and central America. It reached India via England in 1877. The other dominant species are Neem (*Azadirachta indica*), Perkinsonia (*Perkinsonia aculeta*), Kaitha (*Feronia limonia*),. Kadamba (*Mitragyna parvifolia*) and Papri (*Haploptela integrifolia*).

Seasonal vegetation : During south west monsoon a large number of animal and plants sprout up in the forest floor of the ridge and adjoining areas and are in co-existence till winters. The most common plant species are Kasni (*Pupalia lappaccea*), Missi (*Peristrophe bicalyculata*), Sui Ka Ped (*Bidens bitternata*), Santhi (*Boerhavia diffusa*) and Til (*Seasamum indicum*). India's most common orchid *Zeuine strateumatica* has also been recorded from Delhi.

Agriculture: On the basis of the census carried out in the year 1991, the population of Delhi is touching nearly ten millions and the total geographical area is just 1483 sq. km., of which the cultivated area is diminishing fast owing to the increasing urbanisation of the rural areas. As a result the net area sown, which was 81,000 ha in 1971 has decreased to 48,350 ha in 1991. Similarly the total cropped area, which was 1,17,000 ha in 1971, has decreased to 76,230 ha in 1991. Wheat, Bazra, Jawar and Maize are the main crops. Emphasis has now shifted from agricultural crops to vegetables and fruit crops, floriculture, dairying, poultry farming, etc., as these are more remunerative than the food crops in the territory, thereby greatly effecting the faunal component as well.

Crops : Delhi produces mainly for the local consumption some cereals, pulses, vegetables and fruits crops. *Pennissetum tryphoides* (Bajra), *Sorghum vulgare* (Jawar) , and *Cajanus cajan* (Arhar) are the Kharif (Rainy season) crops. Wheat, sugarcane, sarson (rape) and lentil are the chief crops of the winter season. The vegetable crops out number the cereals and pulses. In summer and pre-monsoon months several gourds, melons and squashes flood the market, the winter vegetables abound in radish, cabbage, cauliflower, knol-kohl, carrot, capsicum, pea, beans, and the greens. The chief fruit crops are *Syzigium cumini* (Jamun), jujuba and papaya. The production of none of these crops meet the demand of ever increasing population of the metropolis. Nevertheless, increasing urbanisation is further endangering vegetable and fruit growing activities.

Land reclamation and land utilisation : Out of a total land area of Delhi, the two rivers, the Yamuna and the Hindon, cover about 12000 ha of the metropolitan area. The Hindon cut, the Agra canal and the western Yamuna canal take up additional 240 ha. The total land under the rivers and the canal, therefore, is over 12000 ha or roughly 5.8% of the total metropolitan area.

More than 2/3rd of the total land area is used for agricultural purposes. The northern parts of the area, north of Rohtak road, Grand Trunk road and Ghaziabad road are irrigated by the distributaries of eastern Yamuna and western Yamuna canals are thus very fertile. Productivity in these areas is relatively higher than that in the west and south-west around Nangloi and Najafgarh areas, or in the south around Mehrauli and Chhatarpur villages.

According to the land utilisation pattern the geographical area of Delhi has remained constant at around 148 thousand hactares over the last twenty years or so (Delhi Gazetteer, 1976). The net sown area has, however, declined from 90.9 thousand ha during 1950-51 to 80 thousand hactare during 1970-71 and 45,350 ha in 1994, owing to the increased urbanisation. Another peculiar feature of land utilisation pattern is that the forests constitute approximately 1.5% of the geographical area (Fig. 16).

A characteristic feature of land tenure in the rural areas is the reservation of wood producing land in the Shamilat-deh (common land) as enclosure from where no fuel or wood is to be cut.

REFERENCES

Anonymous, 1883-84. *Gazetteer of Delhi District*. Compiled and published, Punjab Govt.

Anonymous, 1912, *Gazetteer of Delhi District*, Part A. Compiled and published, Delhi Admn.

Anonymous, 1976. *Gazetteer of Delhi*. Compiled and published, Delhi Admn.

Bhalla, V.K., 1981. Census of India 1981- *Census Atlas, Series* 28, pt. 12, Director, Census Operations, Delhi. pp. 1-127.

Kalpavrakish, 1991. The Delhi Ridge Forest : Decline and Conservation. pp. 1-49.

Lovraj Kumar Committee Report, 1993. To recommend the pattern of Management of Delhi Ridge.

Mahto, Y. and Bhanotar, R.K. 1977. Bio-ecological studies of Acridids of Delhi Region II. Geographic distribution of genera and species. *Bull. Ent.*, **18** : 25-45.

Maheshwari, J.K. 1988. The Flora of Delhi, CSIR, New Delhi.

Malik, I. 1994. Troops at the Fort. *Srishti*, 1(3) : 38-34.

Malik, I. and Ivan Amenita, 1994. *Saving the Delhi Ridge - One year of conservation action.* Srishti report, pp. 1-81.

Anonymous, 1996. Newsletter of the Indian Zoo Director's Association & Central Zoo Authority of India, 4 (1 & 2) : 5-8.

Sawarkar, V.B., and Hussain, S.A., 1996. Problems and prospects in conserving Asola-Bhatti Wildlife Sanctuary : some management strategies. *State Fauna Series 6 : Fauna of Delhi, Zool. Surv. India.* (mss., 1-17 pp).

Singh, K. & S. Basu, 1990. *Nature Watch.* Tien Wah Press, Singapore.

Urfi, A.J., 1995. Wetlands of Ornithological significance in the Delhi Region. *OBC Bulletin,* 22 : 38-41.

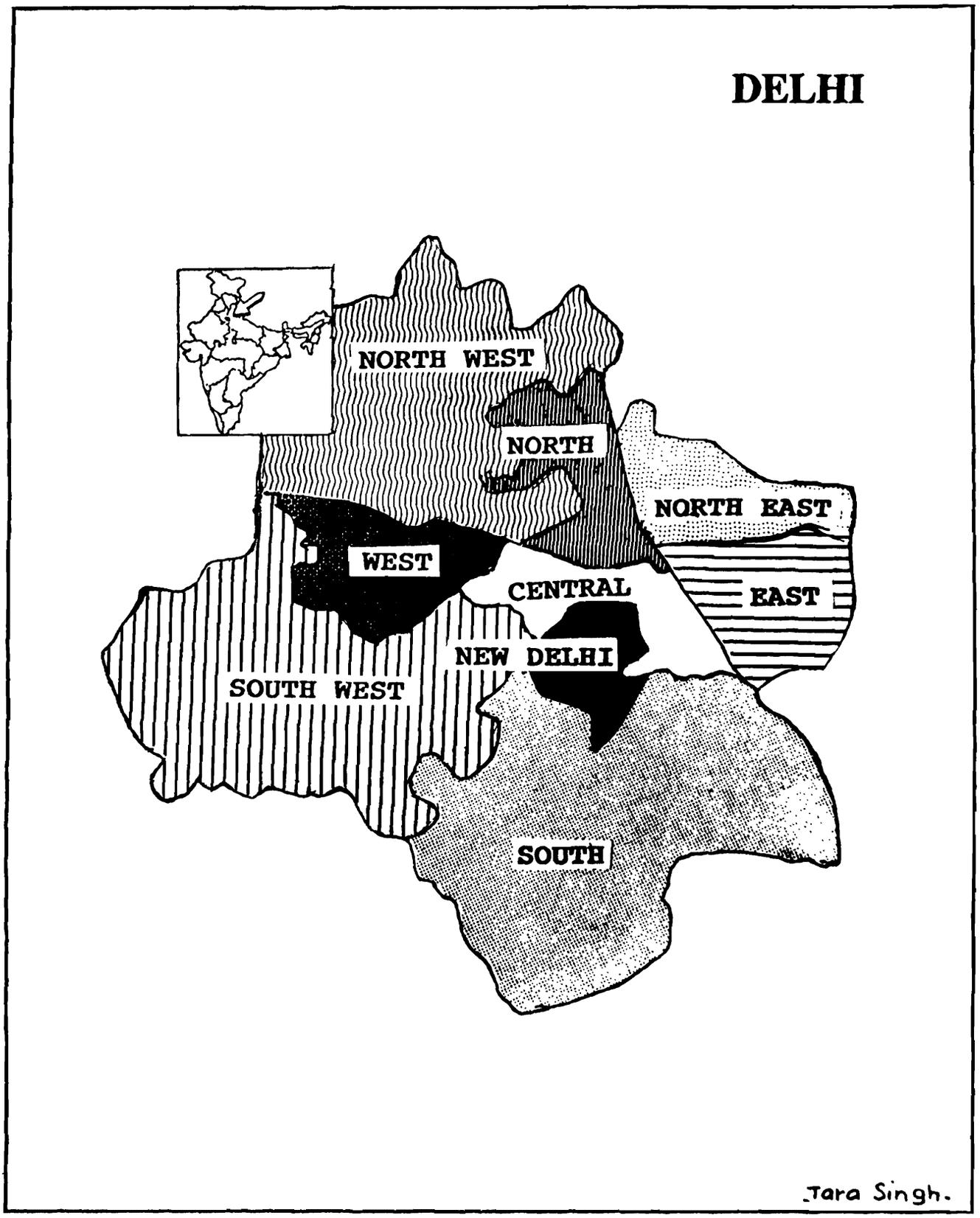

Fig. 4 Map showing the Administrative districts of Delhi.

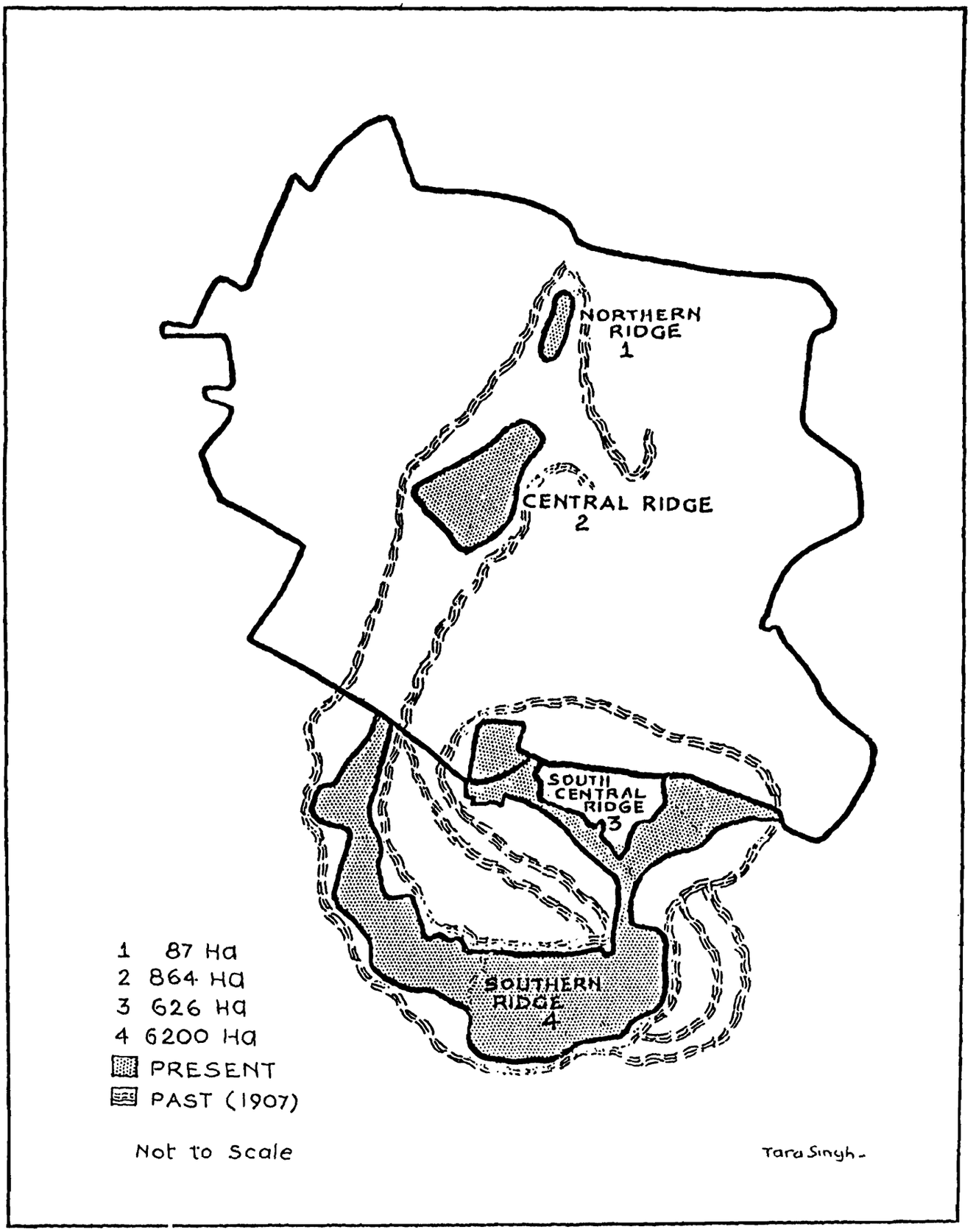

Fig. 5 Map showing the status of Ridge in Delhi in past (1907) and present (1994) (Source : Srishti, 1994)

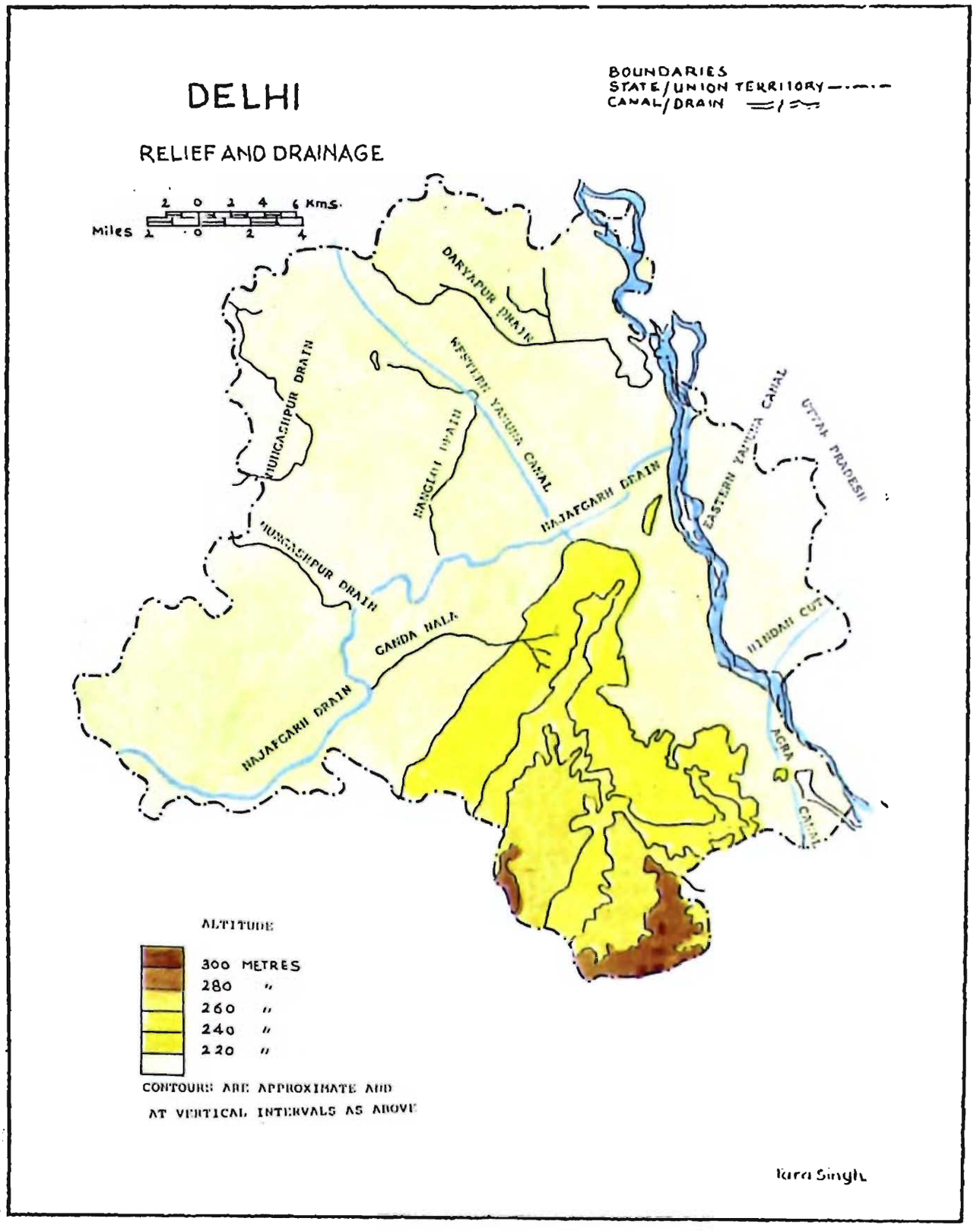

Fig. 6 Map showing Relief and drainage in Delhi
(Source : Census Atlas ; Census of India, 1981)

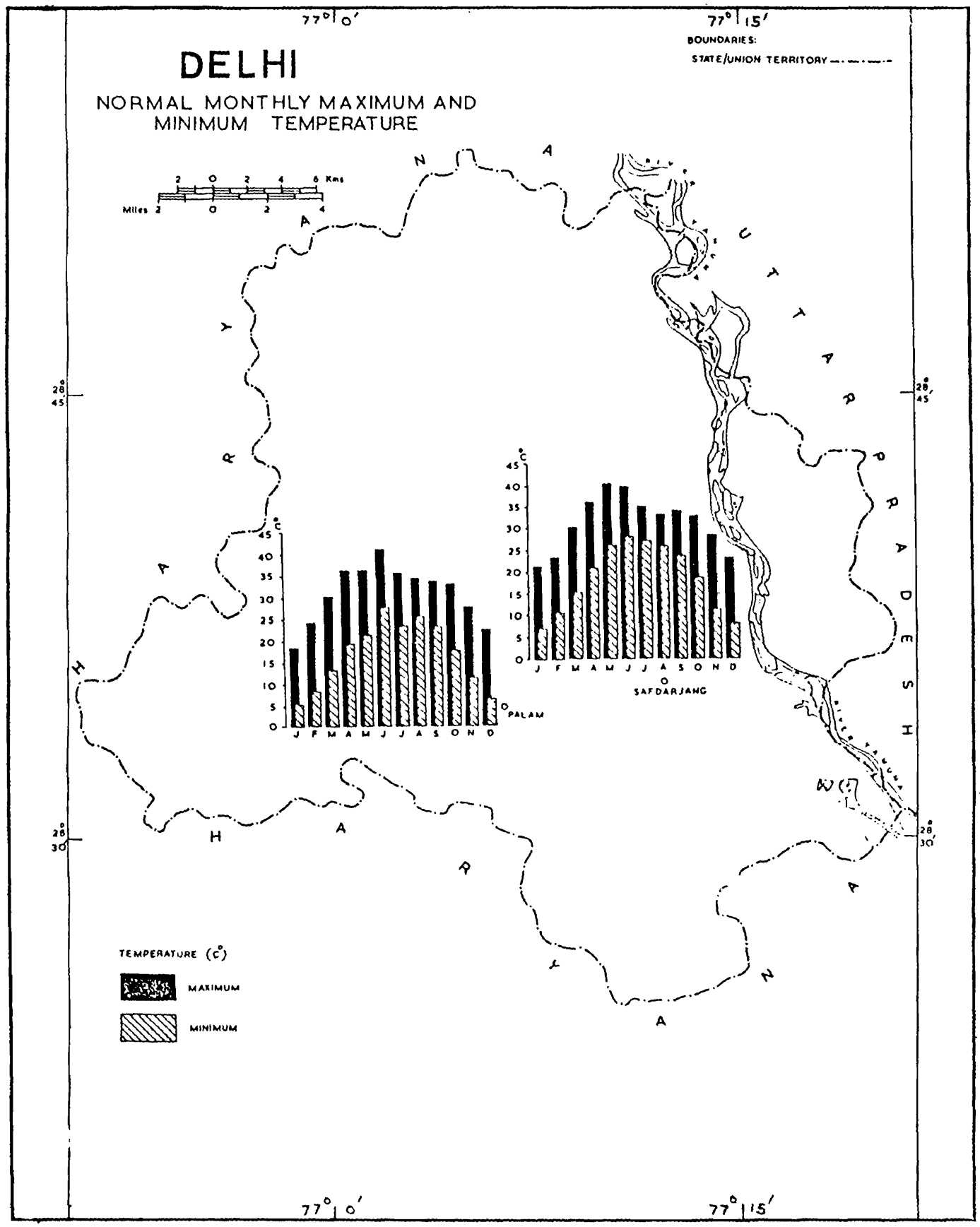

Fig. 7 Map showing normal monthly maximum and minimum temperature in Delhi (Source : Census Atlas, Census of India, 1981)

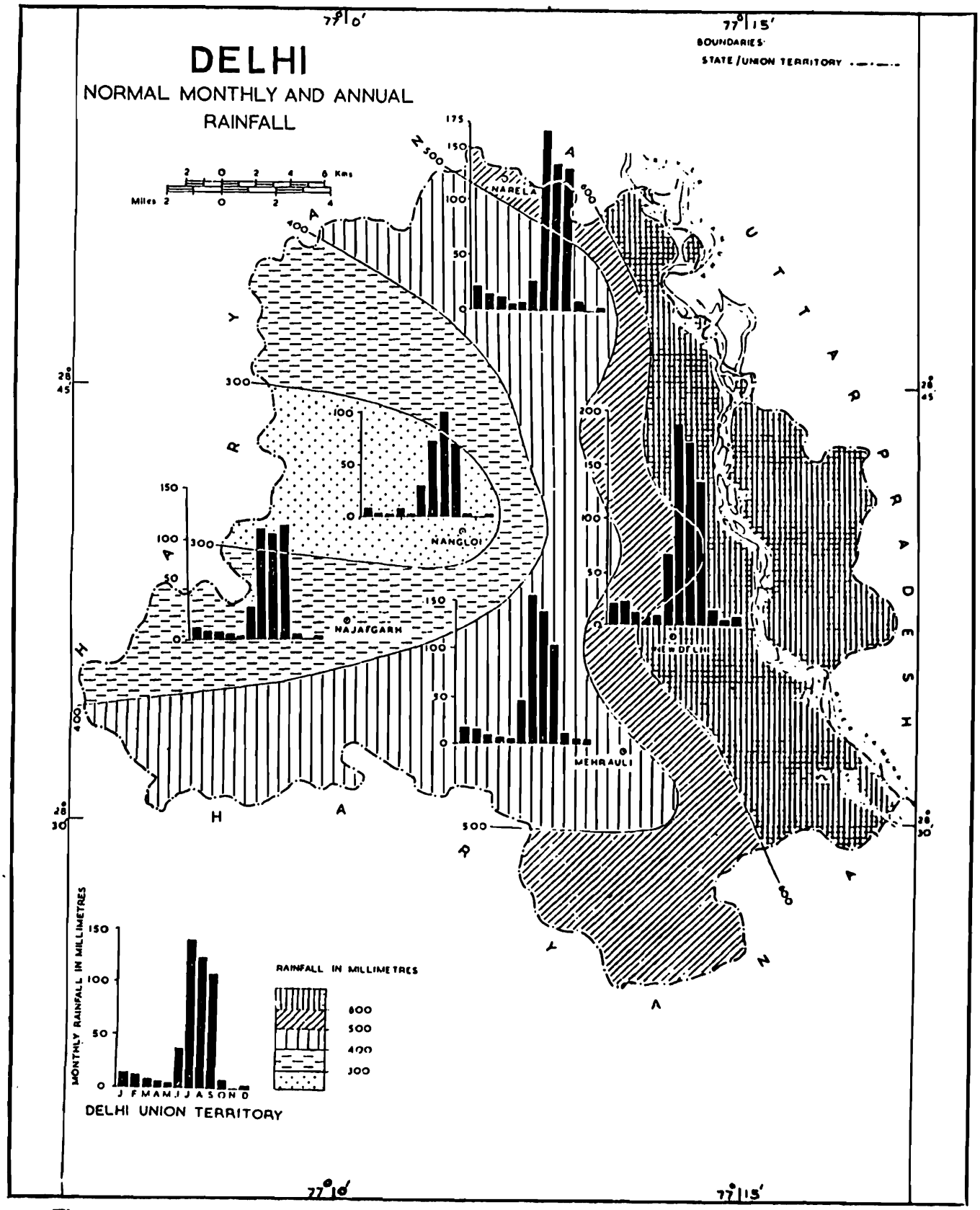

Fig. 8 Map showing normal monthly and annual rainfall in Delhi
(Source : Census Atlas, Census of India, 1981)

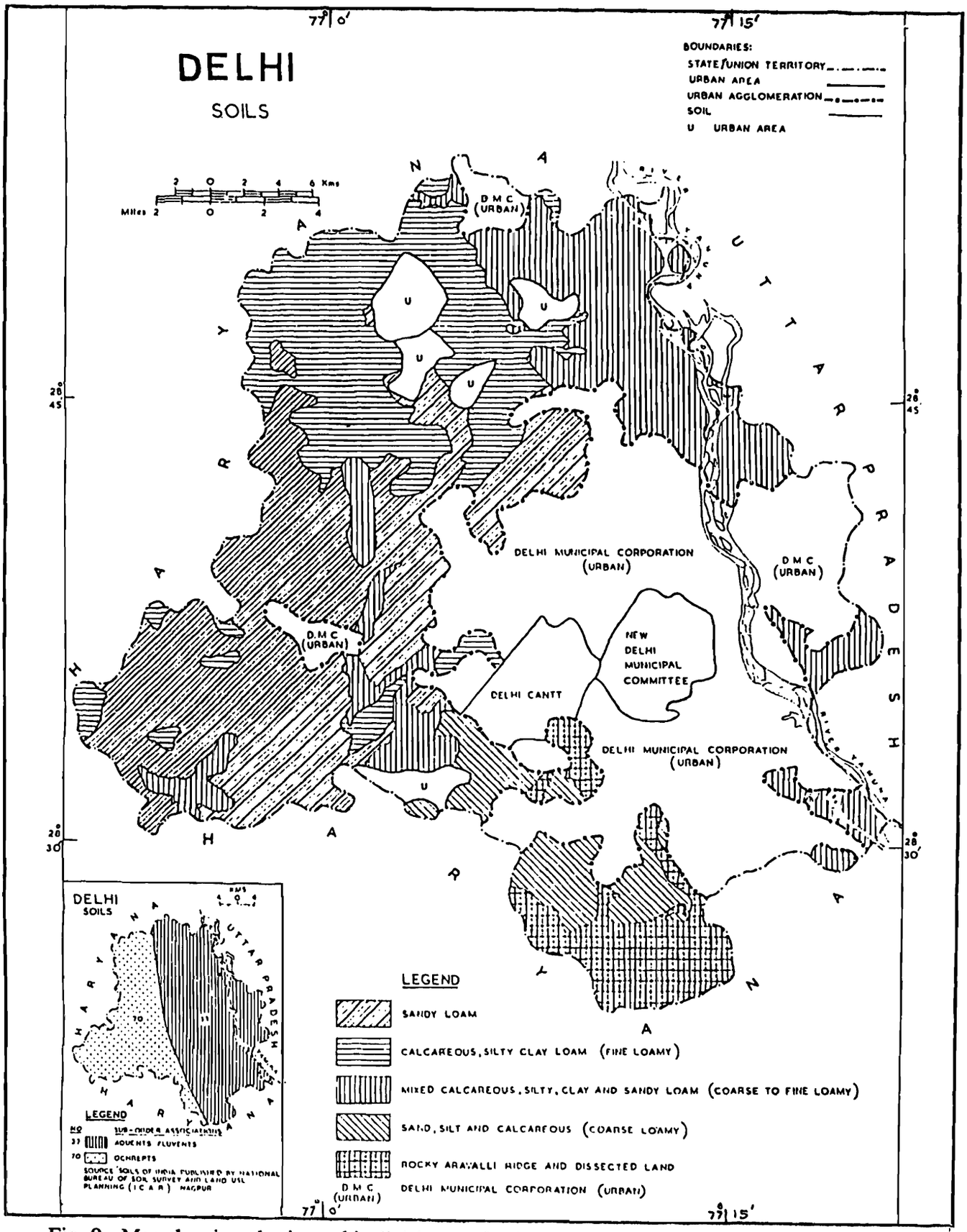

Fig. 9 Map showing physiographic divisions and soils of Delhi
(Source : Census Atlas, Census of India, 1981)

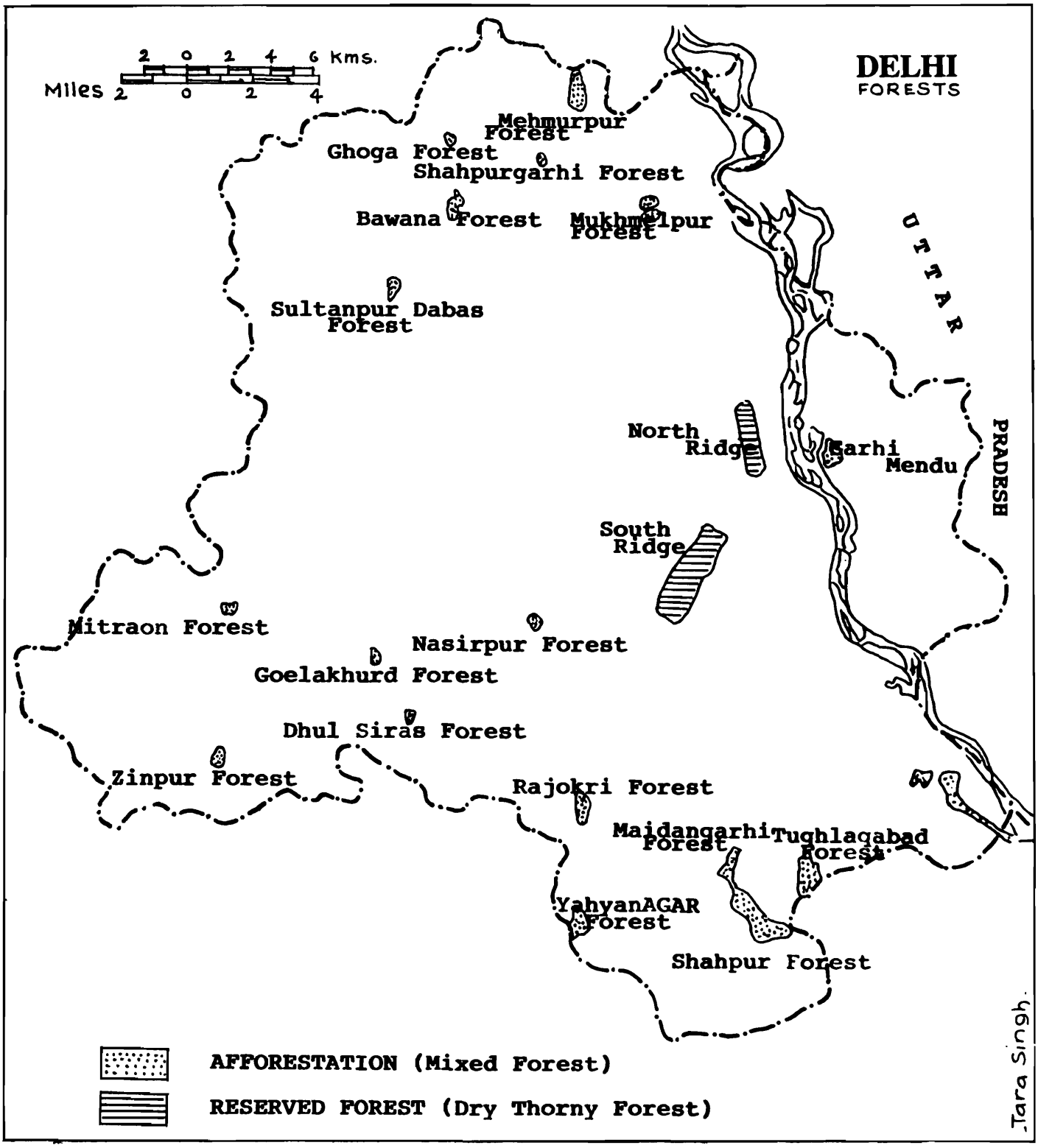

Fig. 10 Map showing the distribution of natural and cultured forest in Delhi
(Source : Census Atlas, Census of India, 1981)

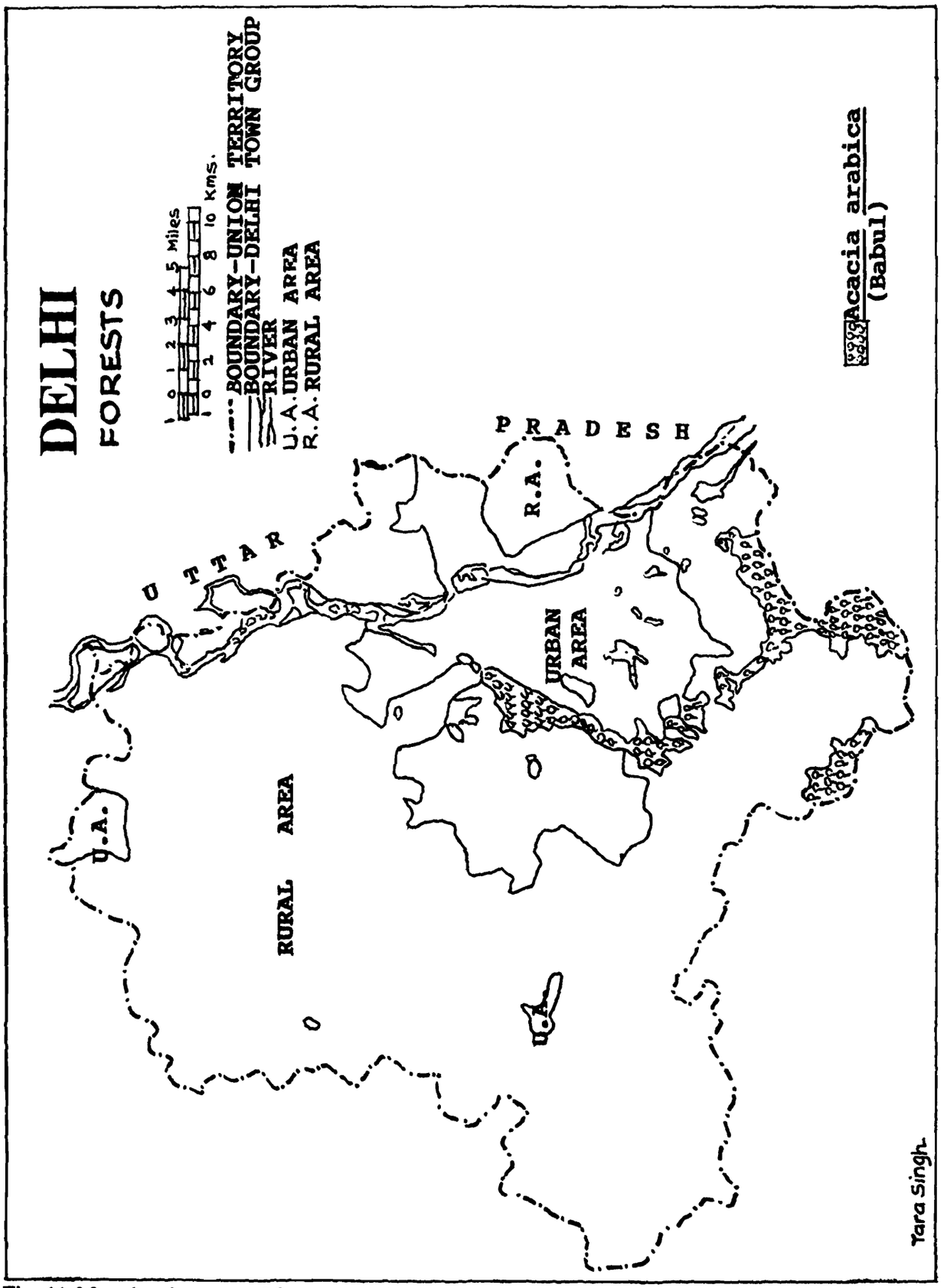

Fig. 11 Map showing state of forest cover in Delhi in the year 1961
(Source : Thesis, C. Srisatya, 1993, Delhi Univ.)

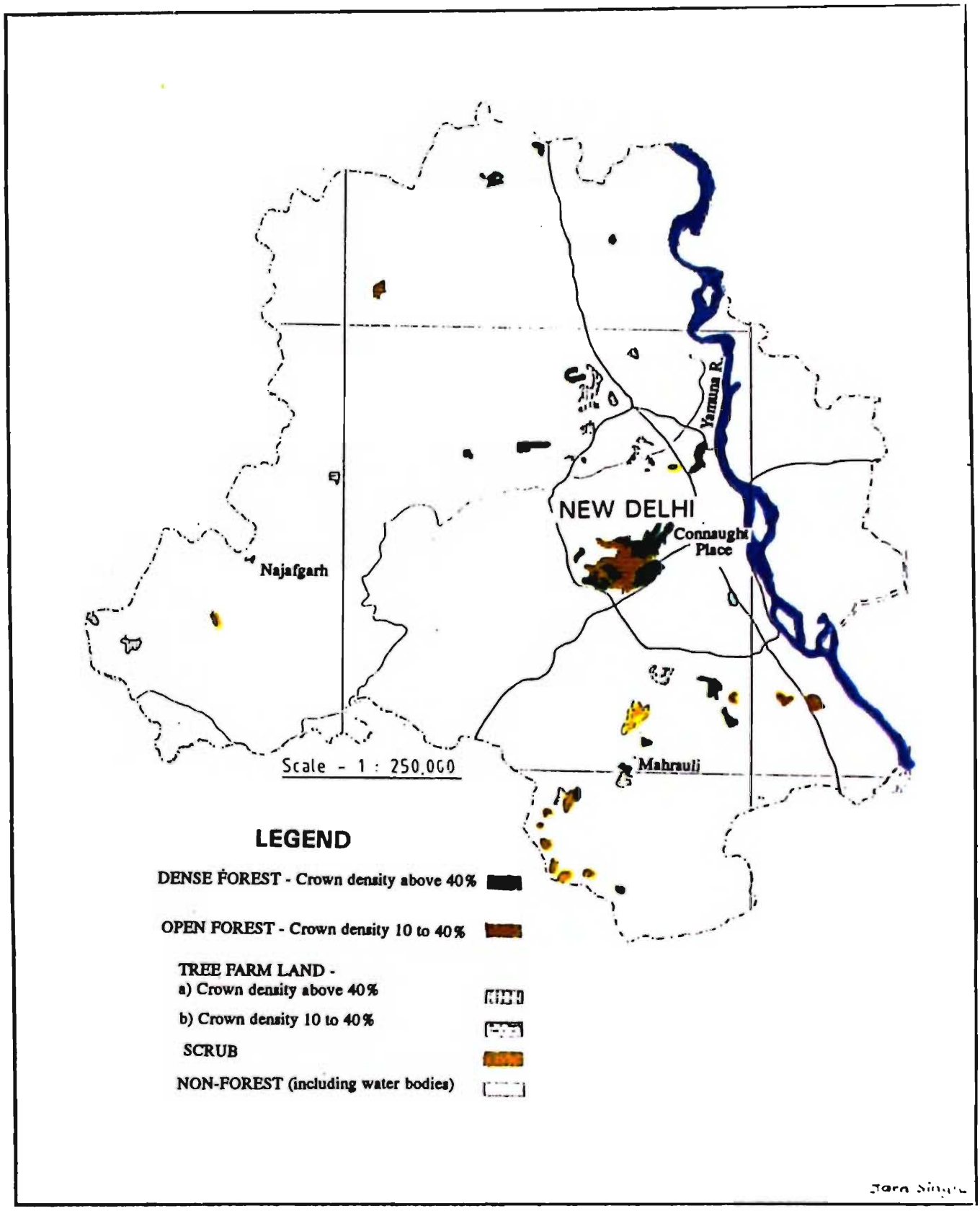

Fig. 12 Forest Vegetation map of Delhi (Based on Visual interpretation of Landsat imagery, 1991) (Source : Forest Survey of India, Dehra Dun)

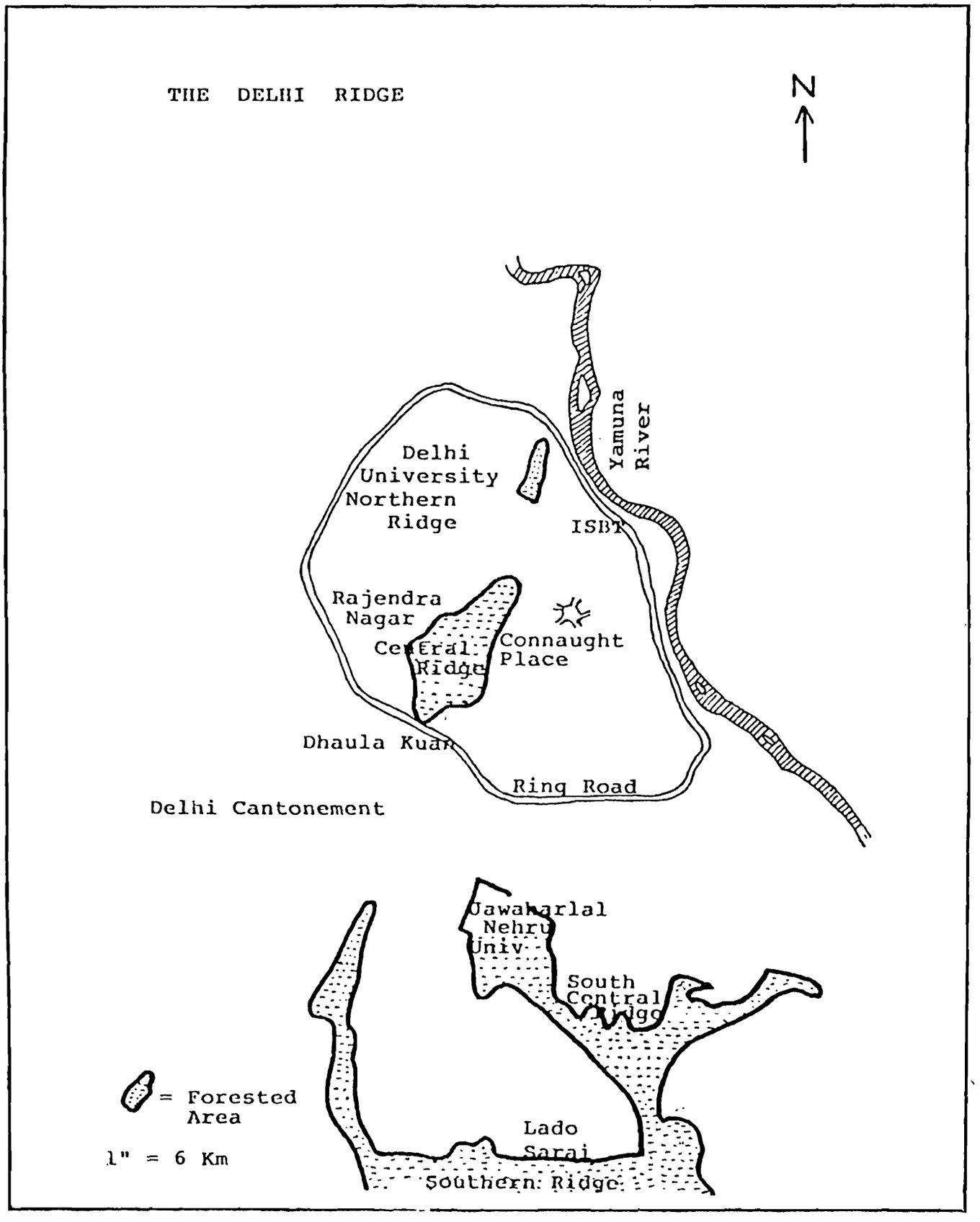

Fig. 13 Map showing present status of Delhi Ridge,
(Source : Delhi Environment status Report, WWF (India), 1988)

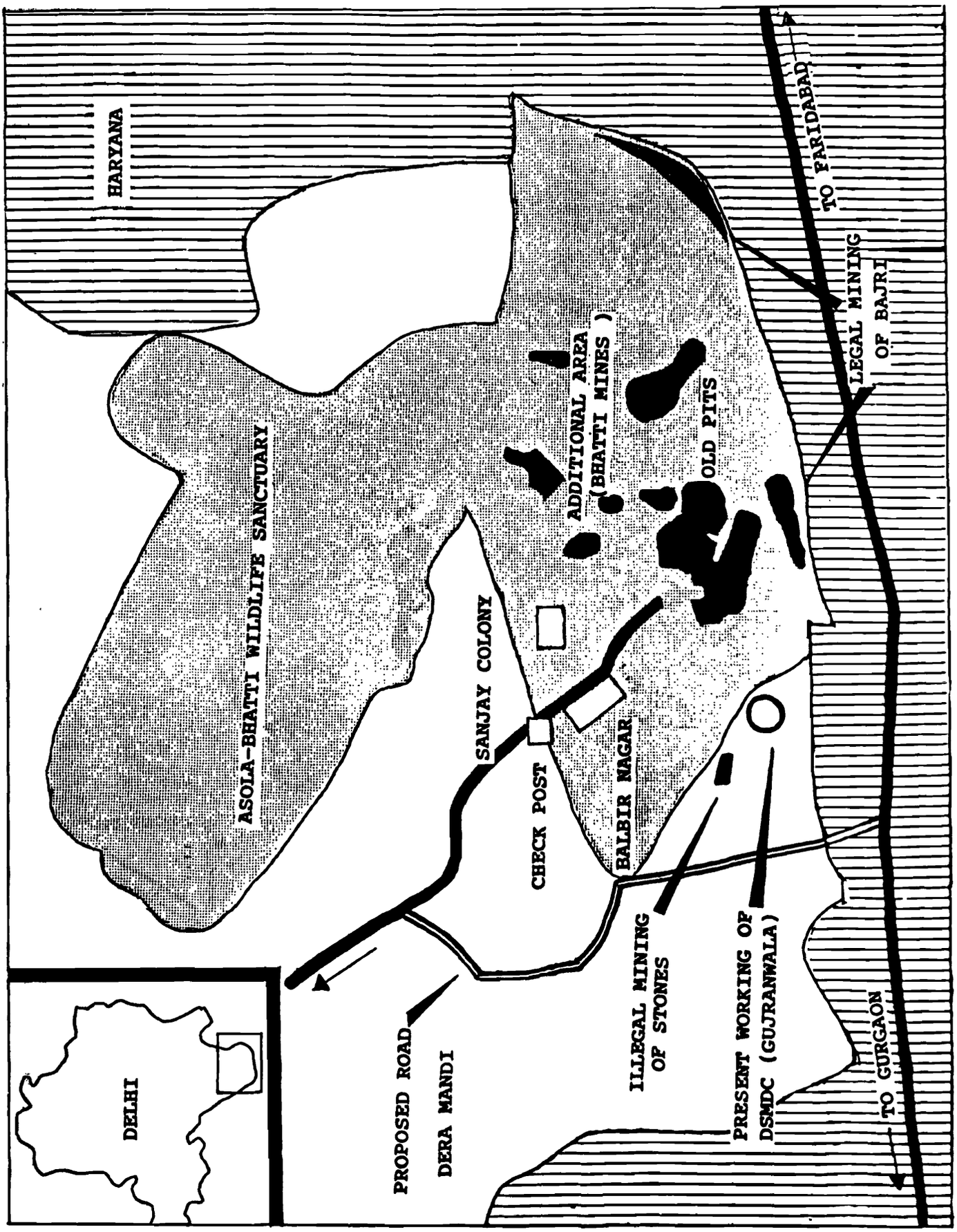

Fig. 14 Map of Asola-Bhatti Wildlife Sanctuary
(Source : Srishti, 1994)

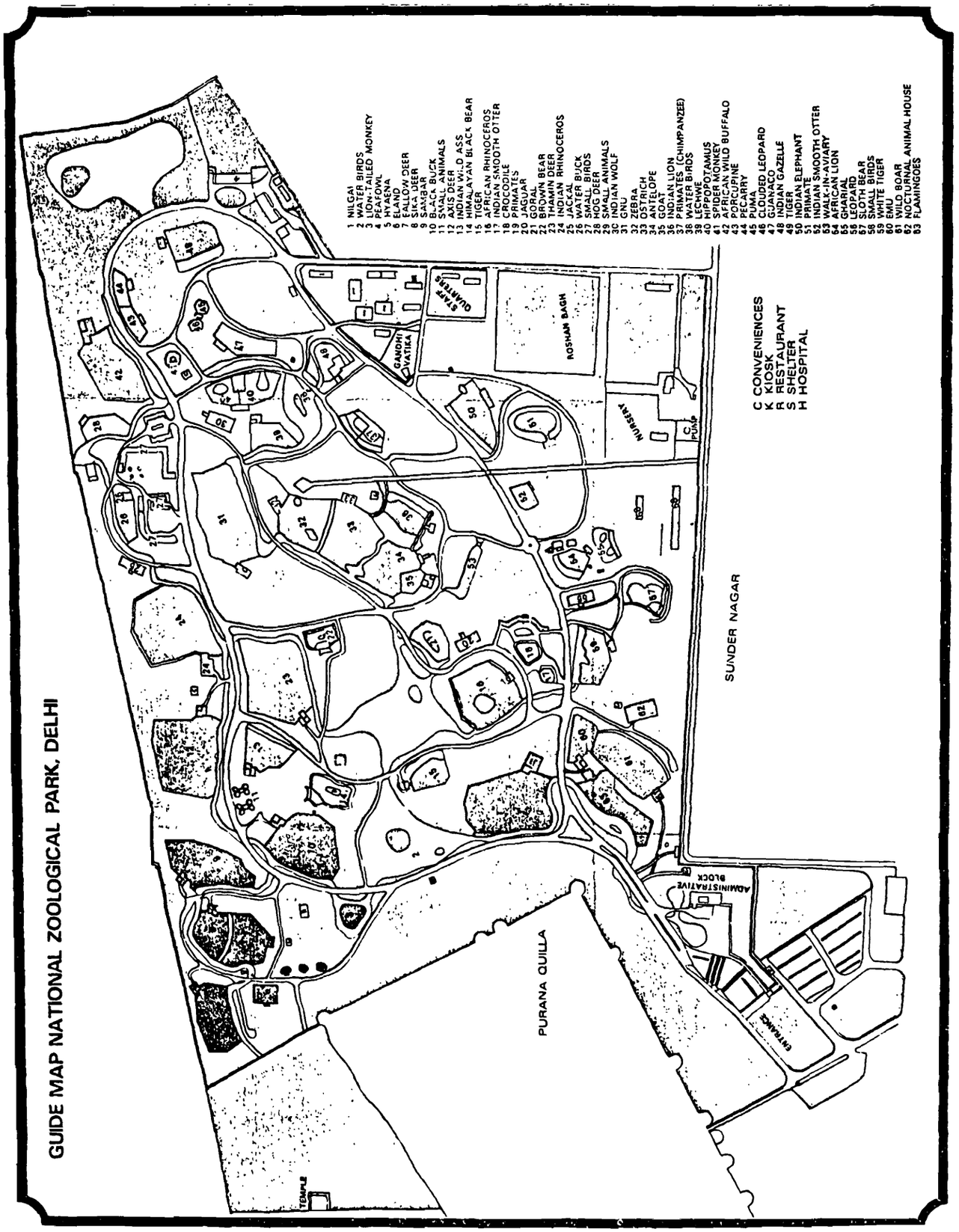

Fig. 15 Map of National Zoological Park, Delhi enlisting incaptivated fauna and wetlands
(Source : National Zoological Park, Delhi, DAVP, 1982)

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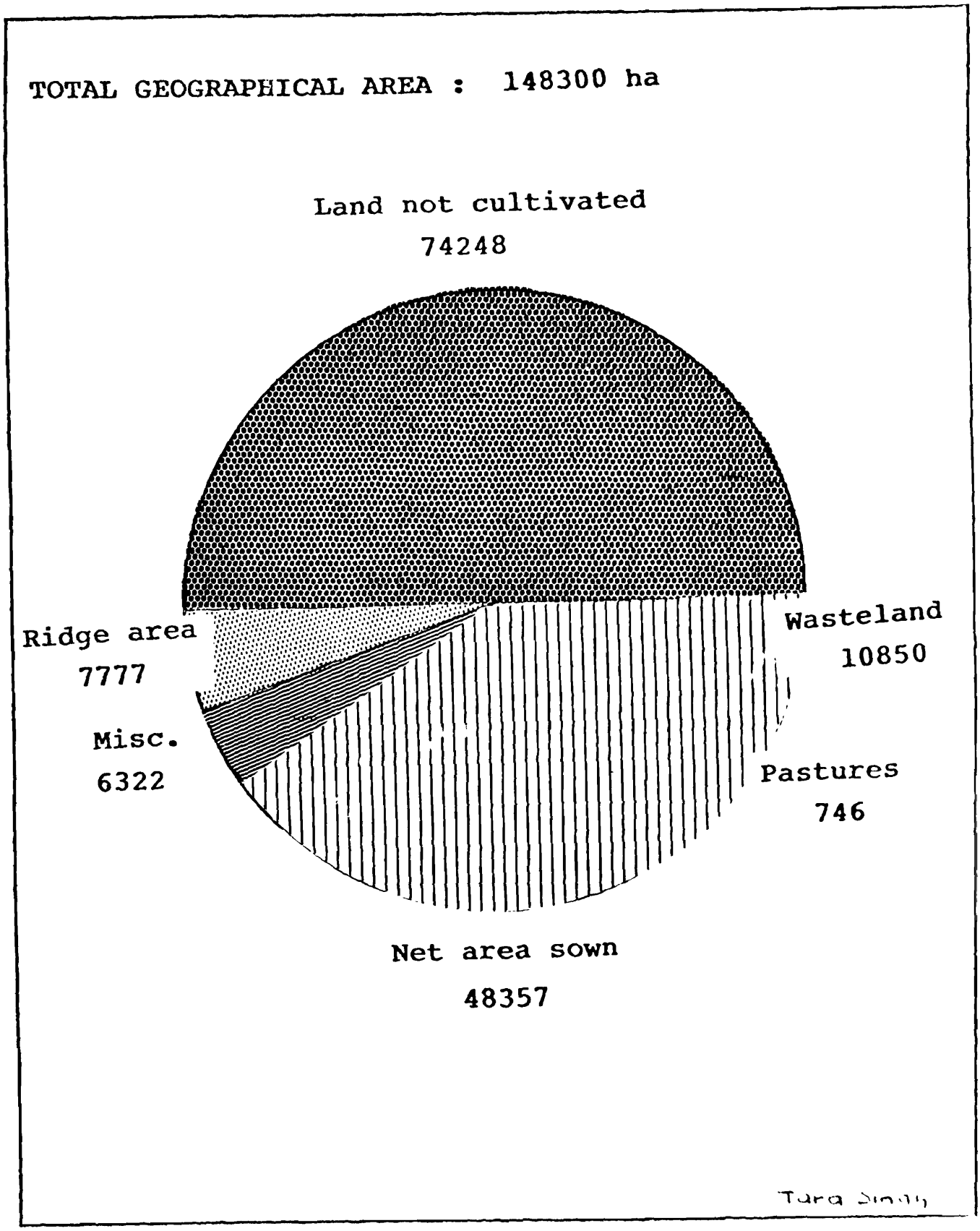

Fig. 16 Diagram showing land use pattern of Delhi
(Source : Srishti, 1994)

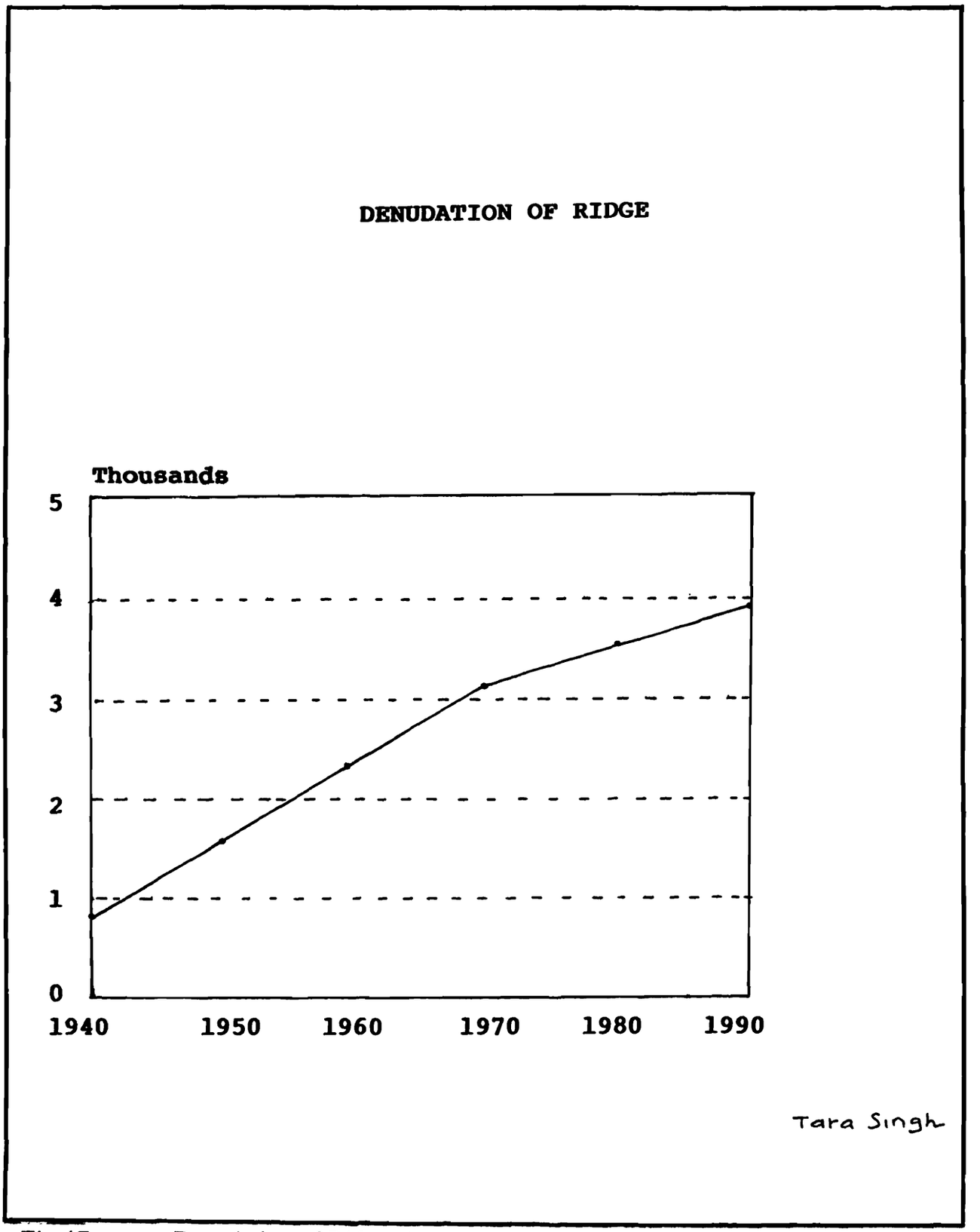

Fig.17 Denudation of Ridge since 1940's (Area in Ha)
(Source : Srishti, 1994)

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STATE OF FOREST COVER

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HISTORY AND GEOGRAPHY

Delhi finds prominent reference in pre historic times right from the epic *Mahabharat*. Later, Delhi went on passing from one kingdom to another beginning with the *Mauryas, Gupta's, Palas of Central India* and finally to the *Chauhans* in the 12th century. After them, it was the Afghan and the Muslim invaders for about four centuries and finally to the Mughals in the 16th century. In 1911 it was made the Capital of the British India. In the freedom struggle too, it was the Centre of all activities. After 1947 it became capital of India. Lying in the northern part of the country, it has a geographic area of 1483 sq.km. Delhi is surrounded by Haryana on all sides except east where Uttar Pradesh touches it.

CLIMATE

The climate of Delhi is influenced by its inland position with the desert of Rajasthan to the west and south west and Gangetic plains of U.P to the east. Extreme dryness with an intensibly hot summer and cold winter are the characteristics of the climate. The year can broadly be divided in to four seasons. The cold season starts in late November and extends to about the beginning of March. This is followed by the hot season which last till about the end of June. When the monsoon arrives, it continues in the last week of September. The two post monsoon months, October and November constitute a transition period from monsoon to winter season. The average annual rainfall ranges between (40-60 cm.). The average annual temperature ranges between 22-45°C.

AGRO ECOLOGICAL ZONE

Delhi falls under agro-ecological zone 4 (northern plain and central high lands including Aravalli's hot semi-arid ecoregion with alluvium derived soils and growing period 90-150 days.)

FOREST

Important species of Delhi : *Prosopis* spp., *Eucalyptus* spp.,*Azadirachta indica, Acacia* spp., etc.

Actual forest cover by density classes

Dense Forest (Crown density above 40%)	-	12 sq.km
Open Forest (Crown density 10-40%)		10 sq.km
Total Forest covered area	-	22 sq.km
Recorded Forest area	-	42 sq.km

Geographic area and actual forest cover

Geographic area	-	1483 sq.km
Actual Forest Cover	-	22 sq.km
The Actual Forest cover as % of geographic area		1.5

DISTRICT-WISE FOREST COVER OF DELHI

Delhi has very little area under forests. Important patches of natural forest cover are located at Budha Jayanti Park, Kamala Nehru ridge, Rijokri and plantations located near Wazirabad, along Yamuna river and Aya Nagar.

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TERRITORY OF DELHI: A GEOLOGICAL PERSPECTIVE

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INTRODUCTION

The surface geology of any region is the manifestation of the geodynamic processes active deep within the earth. They consequently cause uplift and subsidence of large areas and in due course influence the surrounding environment and carve out the geomorphological features. The birth of the mighty Himalayan mountain from the cradle of the Tethys sea is a glaring example where the forces within the earth have caused considerable movement of large continental blocks, their subsequent collision and exhumation of the rocks, once deposited on the bottom of the sea and later buried deep within the earth, to the summit of the Everest. In the process not only the mighty mountain chain with deep cut river valleys were formed but also brought about changes in the topography and the climatic conditions resulting in accumulation of large masses of valley glaciers and also providing the suitable habitat for the growth and dispersal of flora and fauna.

The man is a biological creature and a social animal descended from older non-human primates (apes) and coexisted in ecological hormony with the flora and the fauna for more than two million years (Ma). The transition from apes to man through various evolutionary stages is still a matter of curiousity and debate but it is now certain that the early man (*Australo- pithecine*) is known for the past 5 Ma. The well preserved footprints of three hominid individuals on soft volcanic ash at Laetoli, Tanzania which errupted in the area 3.6 Ma ago is a convincing evidence supported by the oldest known hominid skeleton called Lucy from South Africa thought to be 3 Ma old (Janes et al., 1992). The reconstruction of the subsequent story of human activity from an early stone age nomadic man through a well settled cultural creature, extinct human societies to modern cosmopolitan life style of cities like Delhi is reconstructed from the occupational remains like stone tools, cave dwellings, fireplaces, early settlements and historical monuments.

The influence of the geologically induced environmental changes of the recent past is well reflected in the floral and faunal species which have great adaptability to changing habitats. The neotectonic activity which causes earthquakes, geomorphic reorganization, landslides and floods, changes in river courses and hence the supply of water resource (necessary for all living beings) strongly influence all animal and plant life including man. An anomalous behaviour change in animals and insects before a major earthquake has been well documented from China during Haicheng Earthquake of 4th February, 1975 and a strong possibility of their use as precursor to forecast a major earthquake has been suggested (Deng et al., 1981).

In view of the impact the geological events exercise on the flora and fauna of the region,

some general aspects of geology of Delhi and its surrounding regions are considered necessary for a book dealing with Delhi fauna.

SOME ASPECTS OF GEOLOGY OF THE DELHI REGION

Location of Delhi in geologic setting: The Territory of Delhi has a unique geological and geomorphic location in the Indian subcontinent. It is situated on the southern edge of the Indo-Gangetic (Indus-Ganga) Plain a fore-deep in front of the young active mountain ranges of the Himalaya in the north and the low lying Aravalli ranges (relicts of an old mountain chain) in the south (Fig. 1).

The Himalayan Mountain Belt: The still active Himalayan mountain chain is a consequence of about 5,000 km northward movement of the Indian landmass, caused by the opening of the Indian Ocean, and its final collision with the Asia nearly 40 million years ago. The continued northward movement of India at the rate of 5 cm per year is still keeping this mountain active with devastating earthquakes occurring now and then.

The Indo-gangetic Plains: The fast flowing mighty rivers from the Himalaya bring with them large quantities of sediment which have filled the Indo-gangetic depression in front of the rising mountain and also the ever spreading deltic fronts of the Indus (Indus Fan) and the Ganga-Brahmaputra (Bengal Fan) rivers plunging deep into the Arabian sea and the Bay of Bengal, respectively.

Around Delhi the Aravalli ranges plunge into the vast alluvial expanse of Indo-gangetic Plain of late Quaternary-Recent sediments. These Quaternary alluvial sediments overlie older Tertiary sediments and together they gradually increase in thickness (up to 4.5 km) from south to north where they abut against the Siwalik rocks of the Himalayan foreland belt.

The Aravalli Mountain Belt: The Aravalli ranges to the south of Delhi represent relict core of one of the oldest mountains of the Indian shield. These ranges rising up to 1200-1500 m height represent Proterozoic fold belt peneplained in Pre-Cretaceous times (> 60 Ma) and reactivated during late Tertiary-Quaternary period, i.e., the last 20 million years (Ma) or so. The Aravalli mountain belt comprises metasediments once deposited in the Aravalli (2500-2000 Ma) and Delhi (1500-1500 Ma) oceanic basins developed on the Archaean (3500-2500 Ma) crust. The rocks of these basins were subsequently deformed and folded into the Aravalli and Delhi fold belts. A 10 km thick rock sequence of the Delhi basin called the Delhi supergroup includes 3-4 km thick pile of quartzites, grit, conglomerate and contemporary volcanics in the lower part called the Alwar group and 6-7 km thick sequence of slates, phyllites, quartzites and impure limestone in the upper part called the Ajabgarh group. The rocks of the Delhi basin were affected by multiple folding and polyphase metamorphism and magmatism culminating in the Delhi Orogenic Cycle around 1450

Ma ago. The last phase of the post-Delhi orogenesis, magmatism and volcanism observed in the southern and western part of the Aravalli mountain is 900-750 Ma old.

Figure 2 shows distribution of various rock types of the Aravalli mountains. The territory of Delhi exposes four prominent ridges known as (i) The northern Ridge or the Old Delhi Ridge; (ii) the central Ridge or New Delhi Ridge; (iii) south central Ridge or Vasant Kunj Ridge and (iv) the southern Ridge or the south Delhi Ridge. These ridges expose quartzites, grits and schistose rocks, often ferruginous, belonging to the Alwar group (the lower part of Delhi basin rocks) and marking the northernmost prolongation of Aravalli range before plunging into the Ganga plain. Further north the Aravalli range continues subsurface under the Ganga alluvium as Delhi-Haridwar and Delhi-Moradabad ridges bounded by faults (Fig.1). The low topography adjoining the Delhi ridges comprises a vast alluvial and sandy plains. The extensive open mines and pits in the south Delhi Ridge on the quartzites of the Alwar group of the Delhi supergroup and the pegmatite veins which intrudes into it provide the various raw materials like China clay for the potteries and terra cota for the cottage industries of Delhi and crushed quartzite and Badarpur sand for the enormous road and building construction works in and around Delhi. The Bhatti mines (located on the southern ridge) with huge pits created by open cast mining provided building stones and sand before the area was declared as the Wildlife sanctuary in 1991.

Southwestward the widely isolated strike ridges of Delhi rocks represent local remnants of the Aravalli mountain chain rising above the plains filled with various thicknesses of sand and alluvium extending into the Thar (Rajasthan) desert.

FOSSIL FLORA AND FAUNA IN ROCKS AROUND DELHI

Fully preserved early microscopic fossils of unicellular (elongated and spherical) organisms are reported from various parts of the earth and date back to 3100 Ma. Further, between 2500-1700 Ma, they evolved into unicellular or cell fibers, divided or undivided, micro-organisms belonging chiefly to blue-green algae families. They were oxygen producing organism capable of photosynthesis. Subsequently, the life further evolved through blue-green, green and red algae, fibrous bacteria and Ediacarian fauna to visible life with hard parts since Cambrian (570 Ma ago).

The rocks of the Aravalli and Delhi supergroups are Precambrian and hence no visible life with hard parts is possible, as it evolved only after Cambrian. Only some Proterozoic algal stromatolites in these rocks have been reported. The possibilty of some early micro-organisms preserved in these Proterozoic rocks can not be ruled out. On the other hand the rocks of Himalaya have yielded fossils of various ages providing evolution record of more than 1000 Ma. The well preserved Phanerozoic marine fossils are known from the Tethyan rocks. Rich fossil horizons containing Tertiary mammalian fauna are known from the Siwalik rocks. The late Quarternary-Holocene fauna must have been preserved in the Indo-gangetic alluvium but their reports may be

few as the rocks are still buried deep in the foredeep basin. They need to be studied where ever such rocks are being dug for construction works.

WHY DELHI SHAKES NOW AND THEN ?

In terms of the regional geomorphic features the Delhi lies on the uplifted water divide between west-flowing Indus river system and the east-flowing Ganga river system. Large number of Harappan cultural settlements are confined to the dry beds of Ghaghar-Hakra river, the course of which now lies almost entirely through the sandy desert. Obviously the drying up of the Ghaghar-Hakra river was a major factor in the decline of the Harrapan culture attributed to reduced rainfall and the desertification of the area. The 'Rigveda' made a vivid description of a mighty Sarasvati river which in the Ramayana and Mahabharata epics is reported to have dried up and gone underground. Many historians believe that the Sarasvati river could only be located in the present day course of the Ghaghar-Hakra river which is situated between the Satluj and Yamuna rivers. However, the complete absence of the Harappan culture sites along the present day course of the Satluj and the Yamuna rivers and presence of succeeding painted grey ware culture suggest that the Satluj and the Yamuna rivers were not flowing in their present courses. Instead they possibly occupied the course of the present day Ghaghar-Hakra which was then known as the Sarasvati (Misra, 1996).

Changes in the river courses are caused by the neotectonic activity and the presence of Delhi-Haridwar and Delhi-Sargodha ridges and their marginal faults in the present day water divide between the Satluj and the Yamuna rivers could be attributed to the uplift of these subsurface structures. The reported earthquakes which rocked Delhi and its surrounding area now and then (Khatri, 1987) indicate stress release along tectonically weak zones and suggest neotectonic activity attributed to uplift of these ridges forcing rivers to change their courses and thus necessitate the shifting of the sites of human settlements. The subsurface ridges of the contiguous Indian shield beneath the Indo-gangetic plain and possibly extending into the Lesser Himalaya have been investigated using the magnetovariational and magnetotelluric methods (Arora et al., 1995). The magnetotelluric (MT) studies suggest presence of a conductive layer and an asthenospheric ridge, some 45 km wide with its top at the depth of 15 km more or less coinciding with the Delhi-Haridwar ridge (Arora and Mahashabde, 1987). Similar views regarding the subsurface structure DSF, a 20 km wide zone, have been expressed by Khatri (1987).

HAVE ANCIENT SETTLEMENTS OF DELHI SHIFTED FREQUENTLY ?

The Eicher City Map of Delhi (1996) reproduces a map of Ancient Cities of Delhi (source not indicated, possibly Survey of India) showing different historic sites: (i) **Indraprastha** - 1450 BC to 350 AD; (ii)**Lal Kot** 1024 AD; (iii) **Qila Rai Pithora** 1170 AD; (iv)**Siri**, 1302 AD; (v) **Tughlakabad** 1320 AD, (vi) **Jahanpanah** 1320 AD; (vii) **Firuzabad** -1351 AD; (viii)

Dinpanah (Purana Qila 1530 AD and (ix)**Dilli** 1542 AD; (x)**Shahajanbad** 1648 AD (Fig.2). With the addition of British built **New Delhi** and shifting of their capital from Calcutta in 1931, there has been a phenomenal growth of capital city, particularly since independence, thus making it difficult to identify and delineate the ancient city sites. Qureshi and Chansarkar (1989) made one such attempt and suggest that a comparative study of Thematic Mapper and Spot data reveals that the former (TM) has good interpretation value for identification of settlement patterns, its limits, major monuments and those in ruines.

It is evident from Fig. 3 that except the oldest city of Indraprastha most of the early settlements (from 1024 AD to 1334 AD) have been strategically located just to the east of the ridge around a number of small rivulets flowing into the Yamuna. These rivulets had to be perennial in order to support these settlements which just could not have been possible without a thick vegetation cover on these ridges. This natural habitat must have been destroyed somehow forcing the new settlements (from 1351 AD to 1648 AD) to be located close to the Yamuna flood plains for their growing need of the water resources. The possible eastward shift of the Yamuna due to the neotectonic activity can not be ruled out particularly when the signs of its eastward shift of about 1 km exist during the past 300 years, i.e., from the eastern limits of the Red Fort when it was built (Fig.4) to the present day course of the Yamuna.

CONCLUSION

It is evident from the foregoing discussion that the environmental changes on the surface of the earth are controlled by the geological processes which in turn strongly influence the natural habitat and hence the evolution and the distribution of the flora and fauna. Delhi and its surrounding regions have witnessed neotectonic activity causing shift in river courses thus affecting the availability of the water resources and forcing human settlements to shift their sites in historic and pre-historic times. The present day fauna of Delhi discussed in detail in this book obviously must have also been influenced by the changing habitat induced by the neotectonic activities. Their distribution pattern can be well appreciated if we could somehow investigate the systematic changes in the fauna of the past to that of the present. It may be difficult but certainly not impossible to work out provided, a systematic search is organised to dig out the remains of fauna of the past preserved in the alluvium surrounding the ridges of Delhi.

ACKNOWLEDGEMENTS

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REFERENCES

Arora, B.R. and Mahashabde, M.V., 1987. A transverse conductive structure in the northwest Himalaya. *Physics of the Earth Planetary Interior,* **45** : 119-127.

Arora, B.R., Mahashabde, M.V. and Reddy, C.D., 1995. Geomagnetic and geoelectric investigations in the study of seismicity and seismotectonics of the Himalayan region. *DST Project Completion report*, IIG, Bombay, 1-120.

Deng, Q. Jiang, Pu, Jones L.M., and Molnar. P., 1981. A preliminary analysis of reported changes in ground water and anomalous animal behaviour before the 4 February 1975 Haicheng Earthquake. In: Earthquake prediction: an international review (Eds. Simpson, D & Richards, P.) *M. Ewing Series Amer. Geophys. Union*, Washington D.C. V.4, 543-565.

Eicher City Map of Delhi, 1996. Eicher Goodearth Limited, New Delhi, pp. 274.

Janes, S. Martin, R. and Pilbeam, D. (Eds) 1992. *The Cambridge Encyclopedia of Human Evolution*. Cambridge University Press, pp.506.

Khatri K.N. 1987. Great earthquakes, seismicity gaps and potential for earthquake disaster along the Himalayan plate boundary. *Tectonophysics,* **138** : 79-92.

Misra, V.N. 1996. Aspects of geoarchaeology. 27th Foundation Day Lecture of the Wadia Institute of Himalayan Geology, Dehra Dun, 29th June 1996.

Thussu, J.L. 1995. Quaternary straitigraphy and sedimentatioin of the Indo-Gangetic Plains, Haryana. *Jour. Geol. Society of India,* **46** : 533-543.

Qureshi M.N. and Chansarkar, A. 1989. Analysis of Historic major settlements from Remote sensing data. *28th International Geological Congress*, Washington D.C. Abstract, *2*, 652.

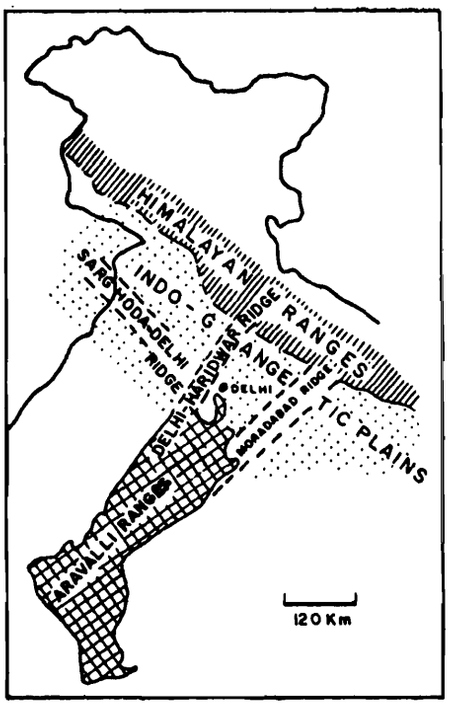

Fig.1. Map showing location of Delhi vis-a-vis the geological setting

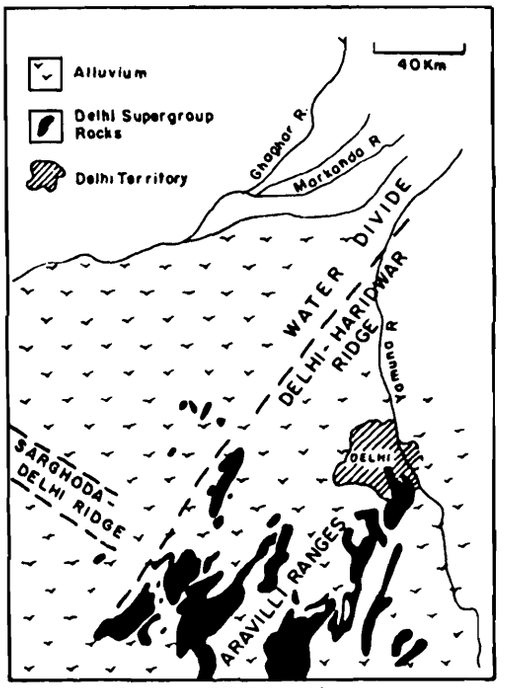

Fig.2. Geology of Delhi and its surrounding regions

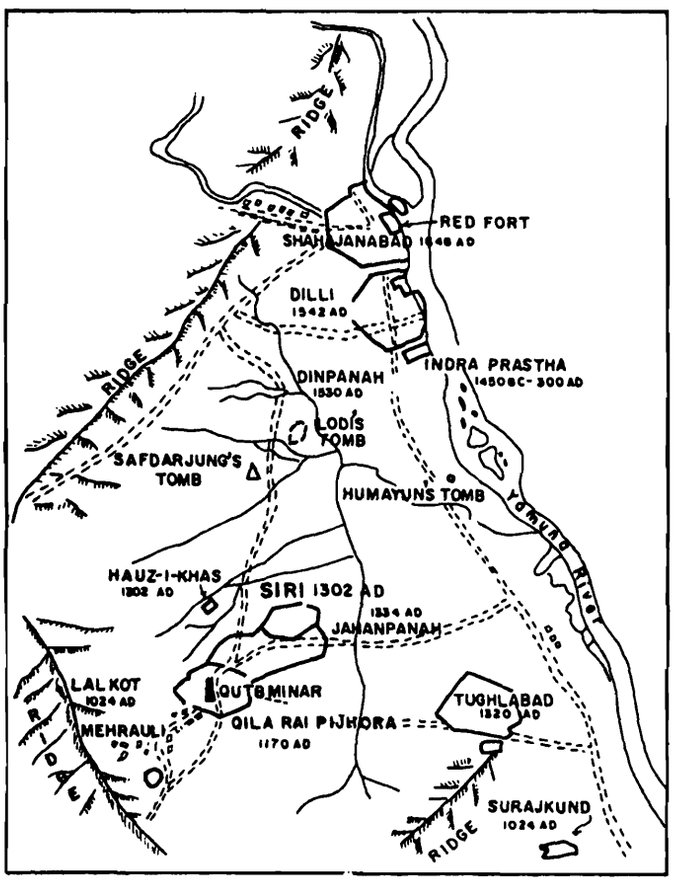

Fig.3. Sketch map showing sites of ancient cities of Delhi

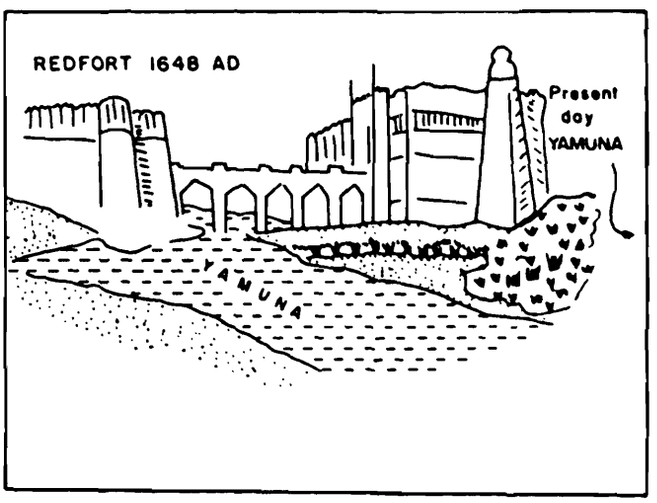

Fig.4. Sketch of A painting showing eastern limits of the Lal Qila

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PROTOZOA

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INTRODUCTION

Protozoa are eukaryotic unicellular organisms and are found to be present in every niche of various habitats from the sun-splashed mountain peaks to the darkened ocean beds and from polar snows to the tropical forests of the equator. These organisms are so diverse that they have been accommodated in seven phyla, *viz.*, Sarcomastigophora, Labyrinthomorpha, Apicomplexa, Microspora, Ascetospora, Myxozoa and Ciliophora under the subkingdom Protozoa and kingdom Protista as per latest classification (Levine, *et al.*,1980).

Although protozoa are cosmopolitan in distribution and lead life as freeliving, parasitic or symbiotic. Information on protozoa from Delhi is not adequate. So far as freeliving protozoa of this state are concerned only two species of ciliates, *viz.*, *Pleurotricha lanceolata* and *Blepharisma undulans* have been recorded from soil (Bhatia, 1936) and a freshwater pond (Seshachar and Bhandary, 1962) respectively. However, in Delhi Gazetteer (1976) occurrence of 12 genera (without mentioning any species name) and 8 species of freeliving protozoa is reported from Delhi (Table 1), with a general remark that "the habitat affords fair facilities for thriving in freshwater, soil and parasitic representatives of different groups of protozoa" The list of protozoa appearing in Gazetteer seem erroneous in several cases as explained (Table 1).

The perusal of literature reveals that there are several publications on parasitic protozoa of Delhi (Bhatia, 1938; David and Nair, 1955; Grewal, 1962-64; Grewal *et al.*, 1957; Ray and Bhatnagar, 1953; Ray *et al.*, 1953 and Singh *et al.*, 1951, 1952, 1956) recording only 12 species all belonging to the phylum Apicomplexa. In addition, occurrence of two species each of parasitic flagellates and ciliates and three species each of parasitic Rhizopods and Apicomplexa have been reported in Delhi Gazetteer (1976), which also includes one genus of flagellate symbiotes of termites, *viz.*, *Trichomonas*.

Since during present surveys of the Zoological Survey of India no one has collected protozoa from Delhi and no identified or unidentified specimens of the group from this area are available in the National Zoological Collection of ZSI, the following systematic list and subsequent key to families, genera and species of Protozoa of Delhi are based on published records, including Delhi Gazetteer (1976).

SYSTEMATIC ACCOUNT

A. Freeliving Protozoa

Subkingdom : PROTOZOA
Phylum : SARCOMASTIGOPHORA
Subphylum : MASTIGOPHORA
Class : PHYTOMASTIGOPHORA
Order : EUGLENIDA
Family : EUGLENIDAE

1. *Euglena* sp.

Order : VOLVOCIDE
Family : VOLVOCIDAE

2. *Volvox* sp.

Subphylum : SARCODINA
Class : RHIZOPODA
Order : AMOEBIDA
Family : AMOEBIDAE

3. *Amoeba proteus* Leidy

Order : PELOBIONTIDA
Family : PELOMYXIDAE

4. *Pelomyxa* sp.

Order : ARCELLINIDA
Family : ARCELLIDAE

5. *Arcella* sp.

Family : DIFFLUGIIDAE

6. *Difflugia* sp.

Class : HELIOZOA
Order : ACTINOPHRYIDA
Family : ACTINOPHRYIDAE

7. *Actinosphaerium* sp.

Phylum : CILIOPHORA
Class : KINETOFRAGMINOPHOREA

Order : PROSTOMATIDA
Family : DIDINIIDAE
8. *Didinium* sp.

Order : COLPODIDA
Family : COLPODIDAE
9. *Colpoda* sp.

Order : CYRTOPHORIDA
Family : CHILODONELLIDAE
10. *Chilodonella* sp.

Order : SUCTORIDA
Family : ACINETIDAE
11. *Acineta* sp.

Family : PODOPHRYIDAE
12. *Podophrya* sp.

Class : OLIGOHYMENOPHOREA
Order : HYMENOSTOMATIDA
Family : PARAMECIIDAE
13. *Paramecium aurelia*
14. *Paramecium bursaria*
15. *Paramecium caudatum*

Order : PERITRICHIDA
Family : VORTICELLIDAE
16. *Carchesium* sp.
17. *Vorticella* sp.

Family : EPISTYLIDAE
18. *Epistylis sp.*

Class : POLYHYMENOPHOREA
Order : HETEROTRICHIDA
Family : SPIROSTOMIDAE
19. *Blepharisma undulans*

Order : HYPOTRICHIDA
Family : OXYTRICHIDAE

20. *Pleurotricha lanceolata*
21. *Stylonychia* sp.

Family : EUPLOTIDAE

22. *Euplotes* sp.

B. Parasitic and symbiotic Protozoa

Subkingdom : PROTOZOA
Phylum : SARCOMASTIGOPHORA
Class : ZOOMASTIGOPHOREA
Order : KINETOPLASTIDA
Family : TRYPANOSOMATIDAE

Parasite	**Host**
Trypanosomes of mammals	
1. *Trypanosoma lewsi*	**Rat**
Trypanosomes of birds	
2. *Trypanosoma avium*	*Lonchura malabarica*
3. *T.delhiense*	*Lonchura malabarica*
4. *Trypanosoma* sp.	*Coturnix communis*
	Passer domesticus
	Lonchura malabarica

Order : DIPLOMONADIDA
Family : HEXAMITIDAE

5. *Giardia* sp. — man

Order : TRICHOMONADIDA
Family : TRICHOMONADIDAE

6. *Trichomonas* sp. — termite

Subphylum : OPALINATA
Class : OPALINATEA
Order : OPALINIDA
Family : OPALINIDAE

7. *Opalina* sp. : host not mentioned

	Subphylum :	SARCODINA	
	Class :	LOBOSEA	
	Order :	AMOEBIDA	
	Family :	ENDAMOEBIDAE	
8.	*Entamoeba coli*		man
9.	*Entamoeba histolytica*		man
	Phylum :	APICOMPLEXA	
	Class :	SPOROZOEA	
	Order :	EUGREGARINIDA	
	Family :	MONOCYSTIDAE	
10.	*Monocystis* sp.		host not mentioned
	Order :	EUCOCCIDA	
	Family :	HAEMOGREGARINIDAE	
11.	*Haemogregarina nucleobisecans*		*Bufo melanostictus*
	Family :	EIMERIIDAE	
12.	*Emeria* sp.		
	Family :	PLASMODIIDAE	
	Plasmodium of mammals		
13.	*Plasmodium malariae*		man
14.	*Plasmodium uivax*		man
	Plasmodium of birds		
15.	*Plasmodium polare*		*Francolinus pondicrianus interpositus*
16.	*Plasmodium relictum*		*Passer domesticus* *Lonchura malabarica* *Pycnonotus cafer* (Expt. host)
17.	*Plasmodium rouxi*		*Francolinus pondicerianus*
	Family :	HAEMOPROTEIDAE	
18.	*Haemoproteus columbae*		*Columba livia*
19.	*Haemoproteus oryzivorae* (= *H.garnhami* Grewal)		*Lonchura malabarica*
20.	*Haemoproteus* sp.		*Passer domesticus* *Lonchura malabarica*

Phylum : CILIOPHORA
Class : KINETOFRAGMINOPHOREA
Order : TRICHOSTOMATIDA
Family : BALANTIDIIDAE

21. *Balantidium* sp. Host not mentioned

Class : POLYHYMENOPHOREA
Order : HETEROTRICHIDA
Family : NYCTOTHERIDAE

22. *Nyctotherus* sp. : Host not mentioned

Key to families, genera and species

The following key includes all the families, genera and species of protozoa reported so far from Delhi. Key to the freeliving and parasitic protozoa has been prepared separately following usual practice for convenience of identification of concerned taxonomic categories.

A. Freeliving Protozoa

la Flagella, pseudopodia or both types of locomotor organelles present 2
lb Simple cilia or compound ciliary organelles present 16

2a(1) One or more flagella typically present in trophozoites, typically with chloroplasts 3
2b Pseudopods with or without axial filaments 6

3a(2) One flagellum emerging from cell invagination and directed anteriorly, stigma usually present.....Family Euglenidae, 4
3b Colonial individuals with two equal smooth apical flagella .....Family Volvocidae, 5

4(3a) Body spindle shaped, chromatophores discoid, fusiform or band-shaped, pyrenoid present .....Genus *Euglena*

5(3b) Colonies often large, spherical or subspherical, consisting of large number of cells, differentiated into somatic and reproductive cells.....Genus *Volvox*

6a(2) Pseudopods without axial filaments 7
6b Pseudopods with axial filaments, central capsule lacking, axial filaments arising from centrally located nucleus.....Family Actinophryidae, 15

7a(6) Naked uni or multinucleate, no flagellate stage 8
7b Body enclosed by test which is composed of either inorganic or organic material or both 12

8a(7) Typically uninucleate, usually polypodial.....Family Amoebidae, 9
8b Typically multinucleate, monopodial and with a villous uroid.....Family Pelomyxidae, 11

9(8) Commonly polypodial but one pseudopodia dominant at one time with a few shorter pseudopodia originating from main stem.....Genus *Amoeba*, 10

10(9) Pseudopodia with conspicuous longitudinal ridges.....*A.proteus*

11(8) Large to very large amoebae, moving mostly by fountain streaming or hemispherical eruption of cytoplasm .....Genus *Pelomyxa*

12a(7) Test simple and usually without any foreign material .....Family Arcellidae, 13
12b Test with foreign material.....Family Difflugiidae, 14

13(12a) Test transparent with hexagonal markings, oval or circular in shape, encrusted with chitinous particles, aperture circular and central.....Genus *Arcella*

14(12b) Test composed of cemented quartz sand, diatoms and other bodies, aperture terminal, pseudopodia cylindrical, simple or branching.....Genus *Difflugia*

15 (6) Body spherical, cytoplasm consisting entirely of large vacuoles in one or several layers, endoplasm with numerous small vacuoles, nuclei numerous, axial filaments terminate in inner zone of cytoplasm.....Genus *Actinosphaerium*

16a(1) Oral aperture only slightly distinct from somatic infraciliature.....17
16b Oral aperture clearly distinct from somatic infraciliature 26

17a(16) Cilia present throughout active (unencysted) life, no suctoral tentacles 18
17b Cilia present during free-swimming juvenile stages only, suctoral tentacles present 23

18a(17) Mouth at anterior pole surrounded by an unciliated area which often raised as blunt cone, cell body encircled by 1 to 3 rings of strong cilia .....Family Didiniidae, 9
18(b) Mouth ventral often with trichites in the gullet wall.....20

19(18) Barrel shaped body with rounded posterior end with 1-3 girdles of cilia, cytostome expansible and located at the tip of proboscis, macronucleus horse-shoe shaped .....Genus *Didinium*

20a(18) Body usually flattened with a distinct beak to the left; ventral surface ciliated, dorsal surface bare or with few tactile cilia .....Family Chilodonellidae, 21

20b Body roundish in cross section sometimes slightly falattened ventrally, ciliated all over, cell indented near middle of one side where oral groove passing around mouth ....Family Colpodidae, 22

21(20a) Body ovoid, dorsal surface convex, ventral surface flat, mouth opening round, gullet trichites forming a tube, a cross row of bristles present on anteriorly flattened dorsal surface .....Genus *Chilodonella*

22(20b) Body typically reniform with distorted ciliary rows, mouth present near lateral margin, oral notch noticeable to quite distinct.....Genus *Colpoda*

23a(17) Tentacles usually not in fascicles, embryos budded off externally, size like parents ....Family Podophryidae, 24

23b Tentacles commonly in fascicles, embryos budded off internally, size smaller than parents .....Family Acinetidae, 25

24(23a) Usually with rigid stalk, tentacles evenly distributed .....Genus *Podophrya*

25(23b) Body partly adherent to lorica and partly exposed, usually with two fascicles-Genus *Acineta*

26a(16) Well developed conspicuous adoral zone of numerous buccal or peristomeal organelles often extending out onto body surface 33

27a(26) Buccal cavity well develped, prebuccal cavity conspicuous leading to equatorially located buccal cavity, two peniculi in buccal cavity, cytostome not expansible, contractile vacuole two .....Family Parameciidae, 28

27b Oral ciliary field prominent, covering apical end of body and dipping into infundibulum, somatic ciliature reduced to temporary posterior circlet of locomotor cilia 30

28(27) Body cigar-shaped, peristome long, broad and slightly oblique, cytopharynx moderately long, with a row of very fine cilia attached to its dorsal wall .....Genus *Paramecium*, 29

29a(28) Foot-shaped, somewhat compressed, green with zoochlorellae as symbiotes.....*P.bursaria*

29b Cigar shaped, anterior end broader and rounded, posterior end gradually tapering, micronucleus single and compact, no green zoochlorellae.....*P.caudata*

29c Posterior end rounded, two small vesicular micronuclei, green zoochlorellae lacking .....*P.aurelia*

30a(27) Stalk contractile, often colonial.....Family Vorticellidae, 31

30b Stalk non-contractile but body may be highly contractile, solitary or colonial..... .....Family Epistylidae, 32

31a(30) Inverted bell form, solitary .....Genus *Vorticella*

31b Inverted bell form, colonial but individual stalk contracting independently .....Genus *Carchesium*

32(30) Inverted bell form, individuals usually on dichotomous non-contractile stalk, forming large colonies.....Genus *Epistylis*

33a(26) Body large, highly contractile, peristomeal field long and narrow, body ciliation uniform, no cirri on ventral surface.....Family Spirostomidae, 34

33b Strong cilia or cirri restricted to ventral surface, peristome very large with well developed adoral zone 36

34(33) Body pyriform or ellipsoidal, somewhat narrowed anteriorly, peristome twisted to right at posterior end and connected with oral funnel without membrane .....Genus *Blepharisma*, 35

35(34) Cytoplasm colourless, peristome extending about half the length of the body, macronucleus consisting of 2-6 nodes, connected by a thin strand .....*B.undulans*

36a(33) Distinctive rows of right and left marginal cirri present, adoral zone of membranellae restricted to anterior third or quarter of the elongated body.....Family *Oxytrichidae*, 37

36b Marginal cirri absent or greatly reduced, adoral zone well developed, transverse and fronto ventral cirri often tremendously developed, 5 of anal cirri conspicuous .....Family *Euplotidae*, 38

37b Ventral cirri 5, anal cirri 5 and 3, well developed caudal cirri.....Genus *Stylonychia*

38(37) Body elongate-lanceolate, one complete and one incomplete row of ventral cirri on right side only..... *P.lanceolata*

39(36) Body ovoid, peristome well developed and broadly triangular, fronto-ventral cirri more than 9, anal cirri 4 and 4, scattered caudal cirri.....Genus *Euplotes*

B.Parasitic and symbiotic Protozoa

la Flagella, pseudopodia or both types of locomotor organellae present 2

lb Apical complex generally consisting of polar ring (s), rhoptries, micronemes, conoid or subpellicular microtubules present, micropore (s) generally present at some stage.....13

lc Simple cilia or compound ciliary organella present 27

2a(1) Flagella usually present in trophozoites.....3

2b Pseudopodia present in trophozoites.....9

2c Numerous cilia in oblique longitudinal rows over entire body surface, cytostome absent, nucleus of one kind ranging from one to many.....Family *Opalinidae*, 12

3a(2) Single flagellum attached to the body by undulating membrane, kinetoplast located near flagellar kinetosomes, body characteristically leaf-like .....Family *Trypanosomatidae*, 4

3b Body with two-fold rotational symmetry or bilateral symmetry, two karyomastigonts, each mastigont with 4 flagella, one of them recurrent.....Family *Hexamitidae*, 7

3c Body roughly pyriform, anterior flagella variable in number, undulating membrane bordered by a flagella, a filamentous costa arising from the blepharoplast .....Genus *Trypanosoma*, 5

4(30) Body leaf-like, pointed at flagellar end and bluntly rounded or pointed at the other, parasitic in circular system of vertebrates.....Genus *Trypanosoma* 5

5a(4) Parasitic in birds 6

5b Parasitic in rats.....*T.lewisi*

6a(5) With free flagellum, occurring in wide range of avian hosts.....*T.avium*

6b Lack of free flagellum, occurring only in white-throated Munia.....*T. delhiense*

7(3b) Body pyriform to ellipsoid with anterior end broadly round and posterior end drawn out, bilaterally symmetrical, ventral side with a sucking disc in anterior half, 2 slender axostyles and 8 flagella in 4 pairs .....Genus *Giardia*

8(3c) Anterior flagella 4 in number.....Genus *Trichomonas*

9(2) Parasitic amoebae, trophozoites usually relatively small, encystment common and live in the alimentary canal of various host animals.....Family Entamoebidae (10)

10(9) Nucleus vesicular with comparatively small endosome located at or near its centre, with varying number of peripheral granules.....Genus *Entamoeba*, 11

11a(10) Mature cysts tetranucleate.....*E.histolytica*
11b Mature cysts octonucleate.....*E.coli*

12(2) Body highly flattened, multinucleate.....Genus *Opalina*

13a(1) Mature gamonts large, extracellular, with mucron or epimerite in mature organisms, trophozoites usually without any differentiation at anterior end, sporocyst biconical, octozoic .....*Monocystidae*, 14
13b Mature gamonts small, typically intracellular, without mucron or epimerite in mature organisms.....15
14(13) Trophozoite monomorphic, ovoid .....Genus *Monocystis*

15a(13) Macrogamete and microgamont usually associated in syzygy during development, microgamont producing 1-4 microgametes, zygote active (ookinete), life cycle involving two hosts, one vertebrate and other invertebrate .....Family *Haemogregarinidae* (16)
15b Macrogamete and microgamont develop independently, syzygy absent, microgamont typically producing many microgametes.....18

16(15) Oocyst with 8 or more naked sporozoites, infection of vertebrate hosts by bite of invertebrates, schizogony occurring in erythrocytes of lower vertebrates .....
.....Genus *Haemogregarina*, 17
17(16) Mature macrogametocyte sausage-shaped.....*H.nucleobisecans*

18a(15) Sporozoites typically enclosed in a sporocyst within oocyst, zygote nonmotile, merogony and gamogony within hosts, sporogony typically outside .....Family *Eimeriidae*, 19
18b Sporozoites naked with three membrane wall.....20
19(18a) Each sporocyst with 2 sporozoites.....Genus *Eimeria*

20a(18b)Parasites having sexual phase in mosquito and asexual cycle in tissue and blood cells of vertebrates, distinguished by erythrocytic schizogony.....*Plasmodiidae*, 21
20b Parasites having sexual phase in insects other than mosquito, pigmented gametocytes in erythrocytes of vertebrate host, erythrocytic schizogony lacking .....*Haemoproteidae*, 25
21(20) Parasitic in mammals, birds and reptiles, pigment granules present in gametocysts and schizonts.....Genus *Plasmodium*, 22

22a(21) Plasmodium in birds.....23
22b Plasmodium in mammals.....24

23a(22) Gametocytes round, mature segmenter with 8-32 merozoites .....*P. relictun*
23b Gametocytes elongate, mature segmenter with 4 merozoites.....*P.rouxi*

24a (22)Full grown schizonts rounded, nearly filling erythrocytes, schizogony in 72 hours .....*P.malariae*
24b Full grown schizonts irregular in form filling half to two-third of erythrocytes, gametocysts round oval, infected erythrocytes hypertrophid .....*P.vivax*

25(20) Merogony in endothelial cells of blood vessels, specially lungs, parasitic in vertebrates other than mammals .....Genus *Haemoproteus*(26)

26a(25) Parasite causing marked displacement of host cell nucleus, mean number of pigment granules 17.....*H. oryzivorae*
26b Parasite not causing marked displacement of host cell nucleus, mean number of pigment granules 33, parasitic in *Columba* .....*H. columbae*

27a(1) Oral aperture only slightly distinct from somatic infraciliature, vestibulum anteriorly located, cytostome located at the base of vestibulum, somatic ciliation uniform .....*Balantidiidae*, 28
27b Oral aperture clearly distinct from somatic infra ciliature, body ovoid to slightly reniform, plump, no sucker on ventral side.....*Nyctotheridae*, 29
28(27a) Peristome starting at or near anterior end, cytopharynx not well developed, contractile vacuole or cytopyge terminal.....Genus *Balantidium*

29(27b) Body generally less flat, micronucleus most often located above macronucleus, commensal in both vertebrates and invertebrates.....Genus *Nyctotherus*

GENERAL REMARKS

Although exactly equal number of freeliving and parasitic/symbiotic protozoan species have been recorded from Delhi, still so far more attention has been paid to study the parasitic protozoa. Out of 22 species of freeliving protozoa only 5 are known by their specific names, while rest of 17 are reported by their generic names. On the other hand, out of same number of parasitic/symbiotic species 14 are known by their species names and only 8 by generic names. Again, amongst parasitic protozoa blood parasites of birds have been studied in details from 1505 specimens of 7 bird species.

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*Status of *Plasmodium polare* doubtful, hence it is excluded from the key to the species.

From the foregoing elaboration it is clearly revealed that excepting avian blood parasites, that too of only 7 species of birds (Table 3), no other protozoan group from Delhi is well studied. In this context and in view of cosmopolitan distribtuion of protozoa it is quite inevitable that many more species of protozoa could be collected from this state if systematic survey from different habitats and hosts are made.

SUMMARY

Forty four species of protozoa (22 species freeliving, 21 species parasitic and 1 species symbiotic) have been reported so far from Delhi. A systematic list of these according to the current classification, and a key to their families, genera and species are incorporated in the present communication along with some analysis.

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REFERENCES

Anonymous, 1976. The Delhi Gazetteer. Delhi Admn., Delhi.

Bhatia, B.L. 1936. *The Fauna of British India, including Ceylon and Burma, Protozoa : Ciliophora.* xxii + 493 pp. Taylor and Francis, London.

Bhatia, B.L.1938. *The Fauna of British India, including Ceylon and Burma, Protozoa : Sporozoa.* xx + 497 pp. Taylor and Francis, London.

David, A. and Nair, C.P. 1955. Observation on a natural (cryptic) infection of trypanosomes in sparrow (*Passer domesticus* Linnaeus). Part I. Susceptibility of birds and mammals to the trypanosomes. *Indian J. Malar.*,**9** : 95-98.

Grewal, M.S. 1962. Studies on the blood parasities of the white throated munia, *Uroloncha malabarica* Linnaeus, *Plasmodium (relictum) praecox* Grassi and Feletti 1890.*Indian J. Malar.*, **16** : 99-109.

Grewal, M.S. 1963. Studies on the blood parasites of the white-throated munia, *Uroloncha malabarica* Linnaeus, (A) *Trypanosoma avium* Danilewsky, 1995, (B) *Trypanosoma delhiense* sp. nov. *Indian J. Malar.*, **17** : 55-64.

Grewal, M.S. 1964a. Studies on the blood parasites of the white-throated munia, *Lonchura malabarica* (Linnaeus). Status of *Haemoproteus wenyoni* Sergent and Sergent, 1948 (Protozoa : Sporozoa).*Proc. zool. soc., Calcutta,* **17** : 21-25.

Grewal, M.S. 1964b. Experimental infection of the Punjab red-vented bulbul, *Pycnonotus cafer intermedius* Blyth, with *Plasmodium* (relictum) *praecox* Grassi and Feletti, 1890 (Protozoa Sporozoa). *Proc. zool. Soc., Calcutta,* **17** : 89-93.

Grewal, M.S., David, A. and Chowdhary, D.S.1957. Preliminary report of the further studies on the "So-called" natural cryptic (occult) trypanosomes of the house sparrow, *Passer domesticus* Linnaeus. *Indian J. Malar.*, **11** : 415-418.

Levine, N.D., Corliss, J.O., Cox, G.E.F., Deroux, G., Grain, J., Honigberg, B.M., Leedsle, G.E., Loeblich, A.R., Lom, J., Lynn, D., Merinfelds, G.E., Page, F.C., Poljansky, G., Sprague, V., Vaura, J. and Wallace, F.G. 1980. A newly revised classification of the Protozoa. *J.Protozool.*, **27** : 37-58.

Ray, A.P. and Bhatnagar, V.N. 1953. Avian *Plasmodium* in Indian birds, 1. *Indian J.Malar.*, **7** (2) : 121-124.

Seshachar, B.R. and Bhandary, A.V. 1962. Observation on the life cycle of a new race of *Blepharisma undulans* from India.*J.Protozool.*, **9** : 265-270.

Singh, J., Basu, P.C. and David, A. 1956. A natural trypanosome (sp.) infection in Indian quail (*Coturnix communis*), study of the morphology in different avian hosts. *Indian J. Malar.*, **10** : 167-173.

Singh, J., Krishnan, K.S. and David, A. 1952. Natural infection of *P.relictum* in weaver bird, the baya *(Ploceus philippinus). Indian J. Malar.*, **6** : 471-473.

Singh, J., Nair, C.P. and David, A. 1951. Five years observations on the incidence of blood protozoa in house sparrows (*Passer domesticus*) Linnaeus) and in pigeons (*Columba livia* Gmelin) in Delhi. *Indian J. Malar.*, **5** : 229-233.

Singh, J.,Nair, C.P. and David, A. 1956. A natural trypanosome (sp.) infection in wild grey patridge (*Francolinus pondicarianus*). *Bull. Nat. Soc. Ind. Mal. Mosq. Dis..*, **4** : 129-130.

Ray, A.P., Menon, M.K., Bhatnagar, V.N., Naranyan Das, M.G. and Chandrasekhar, G.R. 1953. Avian *Plasmodium* in Indian birds (*P.polare*). Part *II. Indian J. Malar.*, **7** : 249-252.

Table - 1. List of Protozoa from Delhi Gazetteer (1976)

Generic/species name recorded in Delhi Gazetteer (1976)	Valid names/Remarks
Flagellates	
Euglena	*Euglena*
Volvox	*Volvox*
Ponderima	*Such generic name is not traceable*
Rhizopods	
Amoeba proteus	*Amoeba proteus*
**A.lobosa*	No such species name availabe; rather Genus *Amoeba* is under the class Lobosea as per current classification.
A.pelomyzaz	No such species name is available, probably names of two genera, *viz.*, *Amoeba* and *Pelomyxa* are combined.
Actionsphaerium	*Actinosphaerium*
Arcella	*Arcella*
Diffusia	*Difflugia*
Ciliates	
Paramecium caudatum	*Paramecium caudatum*
P. aurelia	*P.aurelia*
P.bursalia	*P.bursaria*
Stylonchia	*Stylonychia*
Euplotes	*Euplotes*
Colpoda	*Colpoda*
Chilodonella didnum	No such species name available; probably names of two genera, *viz.*, *Chilodonella* and *Didinium* are combined.
Vorticella	*Vorticella*
Epistylis	*Epistylis*
Carchesium	*Carchesium*
Acineta podoprya	No such species name available; probably names of two genera, *viz.*, *Acineta* and *Podophrya* are combined.

* *A.Lobosa* is not included in the systematic list since its taxonomic status is doubtful.

Table 2. Prevalence of Avian Blood Protozoa as reported by different workers in Delhi.

References	Total birds examined / infected		No. of birds infected with			
			Haemo-proteus		*Plasmo-dium*	*Trypanosoma*
Singh et al. (1951)	1083	340	105	-	256	-
Singh et al. (1952)	278	35	-	-	35	-
Ray and Bhatnagar (1953)	62	22	-	-	22	-
Ray et al. (1953)						
Singh et al. (1956)	13	5	-	-	-	5
Grewal (1962,1963,1964)	69	29	3		3	28
Total	1505	431	108	-	316	33

Table 3. **Prevalence of Blood Protozoa in different Avian hosts examined in Delhi :**

Host species	Total Birds Examined/Infected		*Haemoproteus columbae*	*Haemoproteus oryzivorae*	*Hamoproteus sp.*	*Plasmodium relictum*	*P.rouxi*	*P.polare*	*Trypanosoma avium*	*T.delhiense*	*Trypansoma sp.*
1.*Amandava amandava*	23										
2. *Columba livia*	235	46	46								
3. *Francolinus pondicerianus*	75	27					1	21			5
4. *Lonchura malabarica* (=*Uroloncha malabarica*)	69	29		3		4			28	10	
5. *Passer domesticus*	1089	327			59	289					+
6. *Pioceus philippinus*	14	2				2					
7. *Coturnix communis*	?	?									+
Total	**1505**	**431**	**46**	**3**	**59**	**295**	**1**	**21**	**28**	**10**	**5***

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SPECIES KNOWN FROM DELHI

compiled by
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PORIFERA

1. *Spongiella* sp.

COELENTERATA

1. *Hydra vulgaris*
2. *H.oligactis*

HELMINTHES

1. *Ascaris lumbricoides* "Round Worm"
2. *Entrobius vermicularis* "Pin Worm"
3. *Ancyclostoma duodenale* "Hook Worm"
4. *Dracunculus medinensis* "Guinea Worm"
5. *Moniezia expansa* "Tape Worm"
6. *Moniezia benedeni* "Tape Worm"
7. *Avitellina lahorea* "Tape Worm"
8. *Stilesia globipunctata* "Tape Worm"
9. *Fasciola gigantica* "Fluke"
10. *Fasciola indica* "Fluke"
11. *Taenia solium* "Pork Tape Worm"
12. *T. saginata* "Beef Tapeworm"
13. *Echinococcus granulosus* "Hydated cyst"
14. *Echinorhynchus gigas*
15. *Fasciolopsis buski* "Shinghara Fluke"
16. *Placocephalus kewensi*
17. *Taenia taeniformes*
18. *Diplydum canium*
19. *Cotugnia* sp.
20. *Raillietina sp.*

REFERENCES

Anonymous, 1976. *Gazetteer of Delhi.* Compiled and published, Delhi Administration.

Raj, B. & K.C. Sehgal. 1964. *Census of India 1961 : Delhi*, District Census Handbook : 9-12.

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PLANT AND SOIL NEMATODES

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INTRODUCTION

The nematodes (Nematoda) are highly diversified organisms and are commonly known as roundworms, threadworms or eelworms because most of them are cylindrical in shape. However, a few of them may be saccate or fusiform in shape. They have appendage less and non-segmented body, mostly mircoscopic in size but some of them, specially parasites of vertebrates can be seen with naked eyes. Interestingly their habitat is unsurpassed by any other metazoan invertebrate group because they are found in all types of habitats, i.e., as free living in soil, freshwater and ocean while others as parasites of plants, invertebrates and vertebrates. Since the nematodes are highly diversified organisms having a wide range of habitats and food preferences, the identification of each taxonomical/ecological group has become a highly speciliased job. Baqri and Jairajpuri (1995) have provided the historical review and discussed the economic importance of different ecological groups of nematodes. Though the nematologists have estimated about half a million nematode species on earth, only 25,000 species have been identified till date. Baqri and Jairajpuri (l.c.) have also discussed the reasons of delay and the constraints till the 16th century in the discovery of smaller nematodes like soil, marine and freshwater nematodes and parasites of plants and invertebrates. As a result the economic importance of these nematodes could be realised rather late, i.e., in the late 19th century in Europe.

Among all the ecological groups of nematodes, the parasites of plants are of great importance for us because they cause considerable damage to the agricultural and horticultural crops. With the increased demand of food over the world during the second half of the present century, the study of plant parasitic and soil inhabiting nematodes has attracted a significant number of scientists in recent decades.

The present paper reports the species of palnt and soil nematodes from Delhi. Which is one of the significantly surveyed states in India because of the contribution of scientists of Nematology Division (a centre of international repute), Indian Agricultural Research Institute (IARI), New Delhi. This may easily be concluded from the fact that 57 species have been reported from Delhi.

These speceis have been reported under 34 genera and 22 families of four orders, namely Tylenchida (39 spp.), Aphelenchida (5 spp.), Dorylaimida (12. spp.) and Triplonchida (1 sp.). Most of the species of Tylenchida and Aphelenchida, a few species are either ecto, semi-endo or endo parasites of agricultural crops. Out of 57 speceis, *32 have been described as new to science*. It is further interesting to note that *29 species are endemic* in their distribution

As per nematological records, the first phytophagous nematode species from Delhi was reported by Jairajpuri & Siddiqui (1964). Subsequently Swarup, Prasad and Raski (1964), Prasad, Khan and Mathur (1965), Prasad and Chawla (1965), Chawla, Bhamburkar, Khan and Prasad (1968), Khan, Chawla and Seshadri (1969), Khan, Chawla and Prasad (1969), Nanjappa & Khan (1970), Upadhyay, Swarup and Sethi (1972), Khan and Singh (1975), Sethi and Swarup (1988) and others have made significant contribution in the field of survey and identification of plant and soil nematodes from Delhi.

The present authors have not been able to examine the material, mostly registered at Nematology Division, IARI, New Delhi. Hence, the measurements and the diagnostic characters of speceis provided hereunder are based on the nematology literature.

Order : TYLENCHIDA
Suborder : TYLENCHINA
Superfamily : TYLENCHOIDEA
Family : TYLENCHIDAE
Gennus ***Basiria*** Siddiqi

1. ***Basiria indica*** (Chawla, Bhamburkar, Khan & Prasad)

1968. *Trophurus indicus* Chawla *et al. Labdev. J. Sci. Technol.*, **6** B : 86-100.

Measurements : *Female* : L = 0.5-0.6 mm : a = 37-42; b = 5-6; c = 13-17; V= 25-30, 67-71.

Diagnostic characters : *Female* : Body slightly ventrally arcuate upon fixation, tapering gradually towards both ends. Lip region bluntly conoid, smooth, continuous with body; with lightly sclerotized framework. Amphidial slits arcuate, located at base of lateral lips. Lateral fields marked by four incisures. Stylet 10 μm long, with rounded basal knobs. Orifice of dorsal oesophageal gland at about 2/3rd of stylet length below stylet base. Excretory pore in the anterior region of basal oesophageal bulb. Reproductive system monoprodelphic; posterior uterine sac about two vulvar body-width long. Spermatheca present. Tail elongate, with clavate smooth terminus. Phasmids located in the posterior half of tail. *Male* : Not known.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of Custard apple, *Annona squamosa* L. Karol Bagh, New Delhi.

Genus ***Ottolenchus*** Husain & Khan

2. ***Tylenchus (Ottolenchus) equisetus*** Husain & Khan

1967. *Ottolenchus (Ottolenchus) equisetus* Husain & Khan, *Proc. Helminth. Soc. Wash.*, **34** (2) :

175-186.

Diagnostic characters : Lip region low. Labial annules three. Stylet slender, about 11 μm long with minute, rounded basal knobs. Vulva a transverse slit. Posterior uterine sac present. Tail long, filiform. Bursa adanal, spicules tylenchoid. gubernaculum slender, linear or trough shaped in males.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of unknown host at Delhi.

Superfamily : DOLICHODOROIDEA
Family : DOLICHODORIDAE
Genus : ***Tylenchorhynchus*** Cobb

3. *Tylenchorhynchus mashhoodi* Siddiqi & Basir

1968. *Tylenchorhynchus zeae*, Sethi & Swarup, *Nematologica*, **14** : 77-78.

Measurements : *Female* : L = 0.54-0.72 mm; a = 28-37; b = 4.4-5.8; c = 13-18; V = 52-58. *Male* : L = 0.57-0.66 mm; a = 27-35; b = 4.5-5.6, C = 14-17, T = 36-50.

Diagnostic characters : *Female* : Body slightly curved ventrally in posterior half of its length upon fixation. Lip region continuous with body, marked by 3-4 striae, with weakly sclerotized framework. Lateral fields marked by four incisures. Stylet 16-19 μm long, with rounded basal knobs. Basal oesophageal bulb set off from intestine. Cardia present. Female reproductive system amphidelphic; spermatheca functional. Tail cylindrical to subcylindrical, 2.5-4.0 anal body-width long, marked with 14-29 striae ventrally, with rounded to bluntly rounded unstriated terminus. Phasmids in anterior third (28-37%) of tail. *Male* : Similar to female in general morphology. Spicules 18-22 μm long medially. Gubernaculum 10-15 μm long. Tail elongate conoid, with acute or sub acute terminus; 2.3-3-0 anal body-width long. Phasmids in the anterior half (31-50%) of tail.

Distribution : India : Bihar, Delhi, Haryana, Punjab, Rajasthan, Sikkim, Uttar Pradesh, West Bengal.

Remarks : The species has a wide range of hosts and distribution and is regarded as a potential pests of agricultural crops.

4. *Tylenchorhynchus brassicae* Siddiqi

1961. *Tylenchorhnchus brassicae* Siddiqi, *Ztschr. Parasitenk*, **21** : 46-64.

Measurments : *Female* : L =0.58-0.72mm; a = 26-35; b = 5-6; c = 14-17; V=52-58. *Male* : L = 0.53-0.67 mm; a = 29-35; b = 4.8; c = 15-17; T = 47-60.

Diagnostic characters : *Female* : Body almost straight upon fixation. Cuticle marked by coarse striae, about 2 μm apart in mid-body. Lateral fields marked by four incisures. Lip region rounded, set off by a constriction, marked by three coarse transverse striae, 7.5 μm high. Stylet 17

μm long with rounded basal knobs. Excretory pore at the base of isthmus. Reproductive system amphidelphic; ovaries outstretched; spermatheca functional. Tail about 2.5-3.0, anal body-width long, conoid with a large conoid obtuse terminus. Phasmids located a little anterior to middle of tail. *Male* : Similar to female in general morphology. Spicules ventrally arcuate, cephalated, 21 μm long, Gubernaculum 10 μm long. Bursa large with coarsely crenate margins, completely enveloping tail. Phasmids located at 1/3 of tail length from cloaca.

Distribution : India : Delhi, Haryana, Maharashtra, Punjab, Uttar Pradesh.

Remarks : Collected from soil around roots of unknown host at Delhi.

5. *Tylenchorhynchus delhiensis* Chawla, Bhamburkar, Khan & Prasad

1968. *Tylenchorhynchus delhiensis* Chawla *et al., Labdev. J. Sci. Tech.*, **6B** : 86-100.

Measurments : *Female* : L = 0.6-0.7 mm; a = 24-33; b = 5-6; 13-18; V = 47-58.

Diagnostic characters : *Female* : Body slightly ventrally arcuate upon fixation, tapering gradually at both extremities. Lip region rounded, marked by two striae. Labial framework poorly developed. Lateral fields marked by four incisures. Stylet 14-16 μm long; with rounded basal knobs. Excretory pore in region of basal oesophageal bulb. Reproductive system amphidelphic. Tail sub cylindrical, about four anal body-width long, marked by about 30 striae, with rounded terminus. Phasmids located in the anterior half of tail. *Male* : Not known.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of custard apple at Karol Bagh, New Delhi.

Genus *Bitylenchus* (Filipjev)

6. *Bitylenchus vulgaris* (Upadhyay, Swarup & Sethi)

1972. *Tylenchorhynchus vulgaris* Upadhyay *et al., Indian J. Nematol.*, **2** : 129-138.

Measurments : L = 0.56-0.67 mm; a = 25-30; b =4-6; c= 14-20; V=52-57. *Male* : L = 0.53-0.75 mm; a=25-36; b=4-6; c=14-18; T=43-60.

Diagnostic characters : *Female* : Body tapering gradually at both ends. Lip region broadly rounded, set off, marked by 6-7 striae, with moderately sclerotized framework. Lateral fields marked by four incisures. Stylet 14-16 μm long, with 2-3 μm wide basal nobs. Median oesophageal bulb pyriform. Excretory pore posterior to nerve ring. Reproductive system amphidelphic. Spermatheca functional. Intestine extends up to anterior 1/3rd of tail to form the post-anal blind sac. Tail cylindrical, tapering posteriorly, with bluntly rounded smooth terminus, marked by 35-42 striae. *Male* : Similar to female in general shape and morphology, except the reproductive system and tail shape. Spicules 22-25 μm long, arcuate. Gubernaculum trough-shaped, 13-16 μm long. Phasmids located anterior to the middle of tail. Bursa terminal. Tail conoid, 45-50 μm long, with acute terminus.

Distribution : India : Delhi, Punjab, Uttar Pradesh.

Remarks : Collected from soil around roots of *Zea mays* at IARI Campus, New Delhi.

7. *Bitylenchus brevilineatus* (Williams)

1960. *Tylenchorhynchus brevilineatus* Williams,J.R. *Mauritius Sug. Ind. Res. Inst. Occ. Paper,* **4** : 1-30.

1986. *Bitylenchus brevilineatus* : Siddiqi, *Tylenchida : Parasites of Plants and Insects* : 189.

Measurments : *Female* : L=0.50-0.65 mm; a=34; b=5.6; c=14; V=53-56.

Diagnostic characters : *Female* : Body slightly ventrally arcuate upon fixation. Lip region set off, marked by 5-6 striae. Lateral fields marked by 4 incisures. Stylet 16 μm long with posteriorly sloping basal knobs. Basal oesophageal bulb set off from body. Female reproductive system amphidelphic. Tail sub-cylindrical with hemispherical and smooth terminus, marked by 40-41 striae, about 3 anal body-width long. *Male* : Similar to female in general morphology. Spicules 23 μm long, gubernaculum 12 μm long. Tail conoid. Phasmids in anterior half of tail.

Distribution : Andhra Pradesh, Bihar, Delhi, Gujarat, Haryana.

Remarks : Collected from soil around roots of unknown host in Delhi.

Genus *Quinisulcius* Siddiqi

8. *Quinisulcius cacti* (Chawla, Bhamburkar, Khan & Prasad)

1968. *Tylenchorhynchus cacti* Chawla, Bhamburkar, Khan & Prasad, *Labdev. J. Sci. Tech.*, **6** : 86-100.

1971. *Quinisulcius cacti* : Siddiqi, *Proc. Helminth. Soc. Wash.*, **37** : 68-77.

Measurements : *Female* : L=0.6-0.7 mm; a= 25-33; b= 4-6; c= 14-19; V= 54-59.

Diagnostic characters : Body open `C' shaped upon fixation, tapering gradually towards both ends. Lip region rounded, bearing 6 annules, set off by constriction. Lateral fields marked by 5 incisures. Stylet 15-19 μm long, with anteriorly directed basal nobs. Excretory pore situated in the region of basal oesophageal bulb. According to Chawla *et al.* (1968) oesophageal bulb slightly overlaps intestine. However, the cardia is distinct. Reproductive system amphidelphic. Tail conoid, marked by 23 annules, with rounded and smooth terminus. Phasmids posterior to the middle of tail. *Male* : Not known.

Distribution : India : Delhi, West Bengal.

Remarks : Collected from soil around roots of cactus, Karol Bagh, Delhi.

Superfamily : HOPLOLAIMOIDEA
Family : HOPLOLAIMIDAE
Genus *Hoplolaimus* Daday

9. *Hoplolaimus indicus* Sher

1963. *Hoplolaimus indicus* Sher, *Nematologica*, **9** : 267-295.

1979. *Basiyolaimus indicus*: Shamsi,*Nematol. medit.*,**7** :15-19.

Measurments : *Female* : L=1.18-1.37 mm (1.37); a=28-34 (31.7); b=8.6-9.9 (9.0); b = 6.0-6.9 (6.7); c=58-68; V=54-57 (55.8); O=10.5-12 (11). *Male* : L=0.90-1 mm; a= 26-33; b= 9.4-12, b = 6.2-9; c=32-38; stylet = 33-37 μm, gubernaculum = 16-20 μm ; spicules = 37-42 μm.

Diagnostic characters : *Female* : Body almost straight or slightly ventrally curved upon fixation. Transverse striae about μm apart at mid-body. Lateral fields marked by 2-4 irregularly broken incisures at different level of the body. Head set off, conical, marked by 3 annules. Stylet 38-45 μm long; metenchium 18.5-22.5 μm or about 50% of stylet length. Median bulb 65-74% of the total oesophageal length from anterior end. Oesophageal glands with six nuclei, overlapping intestine dorsally. Excretory pore between the nerve ring and oesophago-intestinal junction. Hemizonid 8-10 annules below excretory pore. Reproductive system amphidelphic. Spermatheca functional. Epiptygma single, attached anteriorly. Rectum 18-20 μm long slightly overlapped by intestine. Tail rounded, short, marked by 8-9 striae. *Male* : Similar to female in general morphology except for reproductive system and tail shape. Testis single out stretched; spicules arcuate and cephalated; gubernaculum with titillae. Tail conoid, enveloped by bursa.

Distribution : India : Bihar, Delhi, Haryana, Karnataka, Maharashtra, Orissa, Punjab, Rajasthan, Sikkim, West Bengal.

Remarks : Collected from soil around roots of unknown host at Delhi.

Genus *Helicotylenchus* Steiner

10. *Helicotylenchus delhiensis* Khan & Nanjappa

1972. *Helicotylenchus delhiensis* Khan & Nanjappa, *Bull. Ent.* **11** (2) : 143-149.

Measurements : *Female*: L= 0.54-0.70 mm; a=21-30; b=4-6; c=43-54; V= 59-65.

Diagnostic characters : *Female* : Body spirally curved upon fixation. Lip region continuous, hemispherical, marked by 2-3 annules. Labial sclerotization moderate. According to Khan & Nanjappa (1972), stylet knobs anteriorly cupped, though appear flattened anteriorly in the original diagram provided by them. Excretory pore 100 μm from anterior end. Reporductive system amphidelphic. Spermatheca non-functional. Phasmids 9 annules anterior to anus. Tail dorsally convex conoid, marked by seven coarse annules, with bluntly rounded terminus. *Male* : Not known.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of Canna (*Canna indica*) at IARI, New Delhi.

11. *Helicotylenchus aquili* Khan and Nanjappa

1972. *Helicotylenchus aquili* Khan and Nanjappa, *Bull. Ent.*, **11** (2) : 143-149.

Measurements : *Female* : L= 0.55-0.70 mm; a= 21-33; b= 4-5; c= 55-61; V=60-68.

Diagnostic characters : *Female* : Body spiral upon fixation. Lip region hemispherical, marked by four annules. Stylet 23-24 μm long, with anteriorly cupped basal knobs. Excretory pore 5 annules anterior to oesophago-intestinal junction. Reproductive system typical to the genus. Spermatheca non-functional. Phasmids 9 annules anterior to anus. Tail hemispherical, bearing 9 annules, with smooth terminus. *Male* : Not known.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of *Bougainvillea* sp. at IARI Campus, New Delhi.

12. *Helicotylenchus astriatus* Khan and Nanjappa

1972. *Helicotylenchus astriatus* Khan and Nanjappa, *Bull. Ent.*, **11** (2) : 143-149.

Measurement : *Female* : L= 0.56-0.65 mm; a= 28; b= 4.6-7.4; c= 38.5-45.5; V=61-44.

Female : Body spiral. Lip region truncated, smooth, stylet 20-23 μm long, with anteriorly directed cupped-shape basal knobs. Excretory pore at the level of oesophago-intestinal junction. Reproductive system amphidelphic. Spermatheca non-functional. Tail dorsally curved, marked by 4-6 annules, with smooth terminus. Phasmids three annules anterior to anus. *Male* : Not known.

Distribution : India : Delhi.

Remarks : Collected form soil around roots of banana at IARI, New Delhi.

Family : ROTYLENCHULIDAE

Genus *Rotylenchulus* Linford & Oliveira

13. *Rotylenchulus reniformis* Linford & Oliveira

1940. *Rotylenchulus reniformis*, Linford & Oliveira, *Proc. Helminth. Soc. Washington*, **7** (1) : 35-42.

1957. *Rotylenchulus elisenis* Carvalho, Sher, 1961, *Nematologica*, **6** (2) : 155-169.

Measurements : *Female* : L= 0.34-0.42 mm; a= 22-27;, b=3.6-4.3; b= 2.4-3.5; c = 14-17; V=68-73; stylet = 16-18 μm. *Male* : L= 0.38-0.43; a= 24-29; b= 2.6-4.8; c=12-17; T= 35-45; spicules = 19-23 μm gubernaculum = 7.9 μm. *Juvenile* (2nd stage) L= 0.35-41 mm; a= 20-24; b= 3.5-4.1; c= 12-16.

Diagnostic characters : *Female (immature)* : Body slender or `C' shaped. Lip region elevated, conoid, continuous with body, marked by 4-6 striae. Lateral fields occupy 1/5 1/4 of body-width near middle. Stylet with posteriorly sloping basal knobs. Median oesophageal bulb oval. Hemizonid posterior to the anus. Tail gradually tapering to a narrow rounded terminus, marked by

20-24 annules, hyaline portion 4-8 μm long. *Mature female* : Body ventrally arcuate, obese, neck contour irregular. Vulva raised. Spermatheca rounded to irregular, usually with sperms. Body beyond anus hemispherical, with a slender terminal portion, 5-8 μm long. *Male* : Labial sclerotization and stylet weaker than in immature females. Spicules elongate slender, ventrally arcuate; gubernaculum linear, non protruding bursa reduced, subterminal. *Juvenile* : Similar to immature female except tail stouter and more rounded. Genital primordium 4-celled.

Distribution : India; Andhra Pradesh, Delhi, Gujarat, Haryana, Karnataka, Kerala, Orissa, Punjab, West Bengal. *Elsewhere* : Tropical and sub tropical countries.

Remarks : Reported from soil around roots of number of plants at Delhi. Found throughout tropical and subtropical countries and parasitizes a large number of cultivated plants and fruit trees. In India, this species has been considered a serious pest of vegetables, leguminous and cereal crops.

Family : PRATYLENCHIDAE

Genus ***Pratylenchus*** Filipjev

14. ***Pratylenchus zeae*** Graham

1951. *Pratylenchus zeae* Graham, Sher and Allen, 1953, *University California Publ. Zool.*, **57** (6) : 441-470.

Measurements : *Female* : L= 0.65 mm; a= 20.5-32.8; b= 5.5-7.9; c= 13-17.7.

Diagnostic characters : *Female* : Body slightly curved ventrally upon fixation. Lip region continuous with body. Lateral fields marked by four incisures. Stylet 13.6 to 16.6 μm long; its knobs rounded to slightly anteriorly concave. Oesophagus typical of the genus. Hemizonid located on annule anteriorly to the excretory pore. Reproductive system mono-prodelphic. Posterior uterine branch about one vulvar body-width long. Tail generally pointed. *Male* : Not known.

Distribution : India : Delhi, Gujarat, Haryana, Himachal Pradesh, Madhya Pradesh, Punjab, Rajasthan.

Remarks : collected from soil around roots of unknown host at Delhi.

15. ***Paratylenchus impar*** Khan & Singh

1975. *Paratylenchus impar* Khan & Singh, *Indian J. Nematol.*, **4** : 199-211.

Measurements : *Female* : L= 0.42-0.47 mm; a= 22.8-25.2; b= 3.6-4.8; c= 11.5-19.0; V= 66-72; stylet = 15-17 μm.

Diagnostic characters : *Female* : Body slightly ventrally curved in its posterior half of its length upon fixation. Lip region low, conoid, marked by two annules. First labial annule comparatively larger than second. Labial sclerotization well developed, extending up to three body annules. Lateral fields marked by four incisures. Oesophagus typical of the genus. Excretory pore at oesophago-intestinal junction. Reproductive system mono-prodelphic. Spermatheca nonfunctional. Posterior uterine sac one and half times the vulvar body width. Tail conoid, marked ventrally by 20-

35 annules, with indented terminus. Phasmids situated in posterior third of tail. *Male* : Not known

Distribution : India : Delhi.

Remarks : Collected from soil around roots of guava (*Psidium guajava*) at Burwala, Delhi.

16. *Pratylenchus ranjani* Khan & Singh

1975. *Pratylenchus ranjani* Khan & Singh, *Indian J. Nematol.*, **4** : 199-211.

Measurements : *Female* : L=0.47-0.61 mm; a= 24.5-32.1; b=3.6-5.3; c= 11.7-21.4; V= 74-80; stylet = 15-17 μm.

Diagnostic characters : *Female* : Body ventrally curved at mid-body and assumes open `C' shaped upon fixation. Lip region truncated, marked by four annules; its sclerotization comparatively weaker and extending up to one body annule. Lateral fields marked by four incisures. Stylet with flattened basal knobs. Oesophagus typical of the genus. Excretory pore posterior to oesophago-intestinal junction. Reproductive system mono-prodelphic. Spermatheca non-functional. Posterior uterine sac two vulvar body-width long. Tail long conoid, with blunt and smooth terminus, marked by 25-35 annules ventrally. Phasmids at about 1/3rd of tail from tip. *Male* : Not known.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of mustard (*Brassica campestris*) at Gheora, Delhi.

Family : MELOIDOGYNIDAE

Genus *Meloidogyne* Goeldi

The members of the genus *Meloidogyne* incite the root galls and thus are called as root-knot nematodes. They are obligate endoparasites of all kinds of plants in the temperate as well as tropical countries. The second stage larvae, infective stage, penetrate the rootlets of the host plants and establish the feeding site. These juveniles become adult in 2-3 weeks. The adult female becomes spheroid and starts laying a large number of eggs in a gelatinous material secreted by the rectal glands through the anus. The galls are formed at the feeding sites due to extensive hypertrophy and hyperlasia of the roots. The males do not feed on host plants and survive only to fertilize the females. In fact, these nematodes are the perfect example of highly adapted root parasitism and cause serious damage to the agricultural as well as horticultural crops.

17. *Meloidogyne incognita* (Kofoid & White)

1919. *Oxyuris incognita* Kofoid & White, *J.Am. Med. Ass.*, **72** (8) : 567-569.

1949. *Meloidogyne incognita* : Chitwood,Goodey, T.1963. London: *Methuen 2nd ed. revised by* J.B. Goodey, 544 pp.

Measurement : *Female* : L= 0.500-0.723 mm; width= 331-520 μm; stylet = 13-16 μm. *Male* : L= 1.108-1.953 mm; a= 31-35; head height = 6.8-8.6 μm; gubernaculum = 24.9-31.5

μm. *Second stage juvenile* : L= 0.337-0.403 mm; a= 24.9-31.5; b=2.02-2.14; b= 6.4-8.4; stylet = 9.6-11.7 μm.

Diagnostic characters : *Female* : Body spherical with projecting neck. Lip region bearing two or three annules behind head cap. Lateral fields not clear, sometimes marked by breaks in striae, broken ends often forked, acreta type. Stylet knobs rounded. Excretory pore 10 to 20 annules behind lip region. Posterior cuticular pattern highly variable, typical incognita type, with striae closely spaced very wavy to zig-zag, specially dorsally and laterally. *Male* : Body slender. Cuticle transversely striated. Lateral fields marked by four incisures. Lip region almost continuous with body, truncate cone-shaped, marked by distinct annules. Stylet with flat concave basal knobs. Excretory pore posterior to isthmus. Tail bluntly rounded with smooth terminus. Phasmids at cloacal level spicules slightly curved. Gubernaculum crescent-shaped. *Second stage juvenile* : Lateral fields marked by four incisures. Lip region almost continuous, truncate cone-shaped in lateral view, subspherical in dorso-ventral view, marked by two annules in lateral view and three annules in dorsal or ventral view. Head cap wide. Tail tapering to subacute terminus.

Distribution : India : Andhra Pradesh, Arunachal Pradesh, Bihar, Delhi, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Orissa, Punjab, Rajasthan, Tamil Nadu. *Elsewhere* : Tropical countries.

Remarks : M. incognita has a wide range of hosts throughout tropical and warmer countries.

18. *Meloidogyne javanica* (Treub)

1885. *Heterodera javanica* Treub, Gillard, A. and J. van den Brande, 1955, *Parasitica*, **11** (3) : 74-80.

1949. *Meloidogyne javanica* : Chitwood, Goody T. London : *Methuen* 2nd ed. revised by J.B. Goodey, 544 pp,

Measurements : *Female* : L= 0.541-0.804 mm; width = 311-581 μm, stylet = 14-18 μm. *Male* : L= 0.757-1.297 mm; a= 17.5.3; stylet = 20-23 μm, spicules = 21-32 μm, gubernaculum = 7.2-9.4 μm. *Second stage juvenile* : L= 0.387-0.459 mm; a= 27-36; b=2.1-3.3; b= 7.1-8.; stylet = 9.4-11.4 μm.

Diagnostic characters : *Female* : Body almost spherical, with projecting neck, rounded posteriorly but perineal region protruding slightly. Lateral fields marked by two incisures. Lip region slightly wider than adjoining body, marked by one annule behind head cap. Stylet slender with rounded basal knobs. Perineal pattern round or oval to pear-shaped, dorsal arch varying from rounded to moderate height, may be flattened dorsally; striae smooth to wavy. *Male* Lip region rounded in dorso-ventral view, continuous with body, the basal annule wider than first annule. lateral fields marked by four incisures. Stylet knobs rounded. Tail shape variable, digitate in lateral view and bluntly rounded in ventral. Phasmids situated at cloacal level Spicules slightly curved. Gubernaculum thin crescentic. *Second stage juvenile* : Lip region continuous, truncate cone-shaped in lateral view, marked by three annules behind head cap. Stylet knobs not prominent. Lateral fields

marked by four incisures. Tail tapering to subacute or finely rounded terminus.

Distribution : India : Bihar, Delhi, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Punjab, Rajasthan, Tamil Nadu. *Elsewhere* : Tropical countries.

Remarks : *M. javanica* also has a wide range of hosts and distribution in warm and tropical regions of the world.

19. *Meloidogyne graminicola* Golden & Birchfield

1965. *Meloidogyne graminicola* Golden & Birchfield, *Proc. Helminth Soc.* Washington. **32** (2) : 228-231.

Measurements : *Female* : L= 0.44-0.76 mm; width = 275-520 μm. a= 1.2-1.8; stylet = 10.6-11.2 μm. *Male*: L= 1.02-1.42 mm; a= 72.8-215, stylet = 16.2-17.3 μm. *2nd stage juvenile* : L= 0.41-0-0.48 mm; a= 22.3-27.3; b= 2.8-4; c= 5.5-6.7; stylet = 11.2-12.3 μm.

Diagnostic characters : *Mature female* : Body globular, pear-shaped, white with small neck. Lip region smooth, flattened, not distinctly set off from neck. Stylet slender, with posteriorly sloping rounded basal knobs. Posterior cuticular pattern dorso-ventrally oval, sometimes almost circular, dorsal arch low with smooth striae. Tail tip marked by coarse striae. Phasmids minute. *Male* : Body slender, tapering gradually towards both ends. Lip region continuous or slightly set off by constriction, flat anteriorly, marked by a prominent anterior annule followed by 1-2 post labials. Lateral fields marked by four incisures in young while 8 in old males. Stylet with posteriorly directed rounded basal knobs. Excretory pore 51-64 annules behind lip region. Spicules arcuate, 27-29 μm long; gubernaculum rod shaped. Tail with smooth terminus. Phasmids posterior to anus. *Second stage juvenile* : Body cylindrical, tapering posteriorly. Lip region continuous with body, marked by 3 faint post-labial annules. Labial sclerotization weakly developed. Lateral fields marked with three incisures. Stylet delicate, with posteriorly sloping basal knobs. Excretory pore at the level of nerve ring. Hemizonid anterior to excretory pore. Median oesophageal bulb spherical. Tail 67-76 μm long including the hyaline portion which is irregularly striated, with rounded or clavate terminus; 4-5 anal body width long.

Distribution : India : Andhra Pradesh, Assam, Delhi, Kerala, Madhya Pradesh, Orissa, Sikkim, South India, Tripura,Uttar Pradesh, West Bengal. *Elsewhere* : Bangladesh and other south-east Asian countries.

Remarks : According to Jairajpuri & Baqri (1991), *Meloidogyne graminicola* is one of the most widely distributed serious nematode pests of rice in India. The loss in rice yield due to this species has been estimated to 10-50%.

20. *Meloidogyne triticoryzae* Gaur, Saha & Khan

1993 *Meloidogyne triticoryzae* Gaur, Saha & Khan, *Ann. Plt. Protec. Sci.* **1** (1) : 18-26.

Measurements : *Mature female* : L= 0.33.0.48 mm; width = 200-320 μm; stylet = 12-14 μm. *Male* : L=1.10-1.59mm; a= 55-74; b= 5.4-10.5; c= 216-397; c= 0.22-0.38; spicules = 26-

32 μm; gubernaculum = 8-11 μm. *2nd stage juvenile* : L= 380-425; a= 29.7-39.7; b=8.3-9.1; b= 3.4-4.4; c= 5.7-7.4 c= 5.5-6.8.

Diagnostic characters : *Mature female* : Body elongate, lemon-shaped to nearly rounded with elevated perineum. Neck 110-185 μm long, slightly bent ventrally, head continuous with weak sclerotized framework. Stylet with posteriorly sloping basal knobs. Excretory pore located posterior to dorsal oesophageal gland opening. Ovaries two, prodelphic, highly coiled. Perineal pattern (posterior cuticular pattern) on top of the protuberance, rounded to ovoid dorso-ventrally, dorsal arch hemispherical with widely spaced striae striae smooth and continuous except near the tail tip. Lateral fields marked by broken striae. *Male* : Body vermiform, gets twisted at about 90 upon fixation. Lip region marked by 2-3 annules, continuous, moderately sclerotized, Lateral fields marked by four incisures. Stylet with rounded posteriorly sloping basal knobs. Excretory pore posterior to nerve ring. Tail rounded to asymmetrically conoid, with a smooth terminus. Spicules ventrally arcuate. Phasmids at the middle of tail. *Second stage juvenile* : Body slightly ventrally arcuate upon fixation. Lip region hemispherical, smooth, continuous with body, sclerotization weak. Lateral fields marked by four incisures. Stylet weak with rounded posteriorly sloping basal knobs. Tail long, tapering to a rounded terminus.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of wheat (*Triticum aestivum*L.) at IARI Campus, New Delhi.

Family : HETERODERIDAE
Genus *Heterodera* Schmidt

The nematodes belonging to the genus *Heterodera* are known as cyst nematodes which are very well adapted to a variety of climatic conditions. Formation of cyst among *Heterodera* is an example of defensive adaptation found among phytonematodes. Within the cyst, larvae may lie quiescent for long period when favourable conditions are not available. *Cyst* : Mature female and cyst are generally lemon-shaped with a short neck and terminal cone. Cysts are generally brown to black in colour, with a zig-zag pattern. Vulva terminal, slit 10-16 μm long, Anus dorsally sub terminal, near vulva. Vulval fenestration present; ambifenetrate, bifenestrate or very rarely circum fenestrate; anal fenestration absent. Vaginal remnant, under bridge and bullae often present. Cyst may contain 10-600 viable eggs.

The eggs are variable in size, generally two to three times as long as wide. The second stage pre-parasitic juveniles are hatched within the cyst which usually contain mixture of juveniles and unhatched eggs. They are usually 0.4-0.5 mm long. Body is robust and stylet well developed. These infective larvae are released from the cysts under the influence of certain hatching factors. Some larvae are released in the first year while others remain two, four, six or even 10 years or more in the cyst.

Depending on the species, the second stage juveniles (J2) that invade the host become fully developed within seven to eight days after entering the host and undergo second moult. The third stage juveniles are slender and almost of the same length as the second stage. Upto this stage sexes are not differentiated but the mid-region of the body becomes wider. As the development proceeds, the females become obese and flask-shaped, while the males remain more or less cylindrical. In about 10-12 days after infection, the juveniles of third stage are fully developed and undergo 4th moult.

In 16-17 days after penetration of the host, the obese fourth stage females become flask-shaped. The flask-shaped body breaks through root cortex. The fully developed adult female after the final moult has an elongated neck region embedded in the root tissue while the swollen portion remains outside.

The males reach full adulthood in 20 to 21 days after entering the host and come out of the roots into soil.

The cyst nematodes show a remarkable host specificity and due to this host specificity they are commonly known by their host, for example *H.avenae* as cereal cyst nematode *H.zeae* as maize cyst nematode.

Following five species of *Heterodera* have been reported from Delhi, viz., *H.avenae, H. trifolii, H. galeopsides, H.sacchari, H. zeae.* Their measurements are being furnished in TABLE - I as diagnostic characters.

Economic importance : Among the species found in Delhi, *H.avenae* and *H.zeae* are economically very important. *H.avenae* (cereal cyst nematode) is being reported from most of the wheat, barley, and oats growing regions of the world and causes severe yield losses in these crops. It is one of the most important crop pests in Europe, Russian States, Canada, Australia and India. In India it is commonly known as the cause of `Molya Disease' of wheat and barley in Rajasthan, Haryana, and Punjab. In the infested area more than 50 percent of the wheat crop is lost due to cereal cyst nematode infestation every year. The losses may go to 100 percent in severely infested areas. According to Seshadri & Sethi (1978), the annual losses in Rajasthan range from 8.2 to 28.8 percent or Rs. 4 million in wheat & Rs. 3 million in barley.

H.zeae, maize cyst nematode causes a loss of about 12 to 26 percent in sandy loam soils in kharif season (Anon, 1987).

Suborder : CRICONEMATINA
Superfamily : CRICONEMATOIDEA
Family : CRICONEMATIDAE

Genus ***Macroposthonia*** De-Man

21. ***Macroposthonia sphaerocephala*** (Taylor)

1965. *Criconemoides georgii* Prasad, Khan and Mathur, *Curr. Sci.*, **34** : 667-668.

Measurements : *Female* : L= 243-478mm; a= 6-13; b=3-4; V= 90-97; R= 55-79; Rst= 12-20; Roes = 17-28; Rv= 3-7; Ran= 2-5 stylet = 43-69 μm.

Diagnostic characters : *Female* : Body almost straight. Lip region not set off from body. Labial annules two of unequal size. Body annules coarse and anastomosing laterally in a zigzag pattern. Oesophagus typical criconematoid. Reproductive system mono- prodelphic. Vulva transverse. Spermatheca absent. Rectum not distinct, anus obscure. Tail bluntly rounded. *Male* : Not known.

Distribution : India : Delhi.

Remarks : Collected at IARI Campus, New Delhi.

Superfamily : HEMICYCLIOPHOROIDEA
Family : HEMICYCLIOPHORIDAE
Genus ***Aulosphora*** Siddiqi

22. ***Aulosphora indica*** (Siddiqi)

1972. *Hemicycliophora musae* Khan & Nanjappa, *Indian J.Nematol.*, **2** : 59-68.

1980. *Aulosphora indica* : *Proc. Helminth. Soc.* Washington, **28** (1) : 19-34.

Measurements : *Female* : L= 0.80-1.5 mm; a=22-35; b= 6-9; c= 7-10; V=75-92; stylet= 60-80 μm ; R= 270-295; Rv= 65-72; Ran= 44-49.

Diagnostic characters : *Female* : Body ventrally arcuate upon fixation. Cuticle loosely attached at head and vulva. Lip region continuous with body, marked by three annules. Lateral fields marked by three incisures. Stylet 60-80 μm long; with sloping basal knobs, 5 μm wide. Orifice of dorsal oesophageal gland at 12 μm from stylet knobs. Median oesophageal bulb amalgamated with procorpus, 15 μm wide with a distinct valve. Lips elongate, tubular, over three annules long, directed backward. Spermatheca absent. Tail elongate conoid, gradually tapering to a rounded terminus, about 4 anal body-width long. Post anal blind sac present. *Male* : Not known.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of banana at Hyderpur, Delhi.

Superfamily : TYLENCHULOIDEA
Family : TYLENCHULIDAE
Genus ***Tylenchulus*** Cobb

23. *Tylenchulus semipenetrans* Cobb

Measurements : *Mature female* : L= 0.349-0.406 mm; a= 3.75-5.07; b= 2.80-3.12 ; stylet = 13 μm.*Male* : L= 0.33-0.41 mm; a= 29-39; b= 3.28-4.23; c= 7.83-10.1; T= 36; stylet = 10-12 μm. *Immature Female* : L= 0.25-0.36 mm; a= 15-20; b= 2.15-3.00; stylet = 12-15 u.*IInd stage juveniles* : *Female* : L= 0.295-0.364mm; stylet = 12-4 u *IInd stage juveniles* : *Male* : L= 0.284-0.344 mm; stylet = 11-13 u.

Diagnostic characters : *Immature female* : Body vermiform with transverse striae. Lip region conoid-rounded, smooth, continuous with body; labial framework moderately sclerotized. Stylet 13 μm long, with rounded basal knobs. Median oesophageal bulb strongly muscular. Basal oesophageal bulb saccate. Cardia present. Rectum and anus atrophied, non functional. Vulva near posterior end, with thick labia. Posterior uterine sac absent. Tail end bluntly rounded. *Mature female* : Body below neck swollen and irregular, ventrally arcuate; maximum width 68-106 μm, neck region distorted often broken off; body behind vulva digitate, 32-43 μm long; vulva body-width 10-27 μm. Reproductive system mono-prodelphic; ovary coiled. Rectum and anus absent. Excretory pore in front of vulva.Sometimes the gelatinous matrix is also produced through the excretory pore. *Male* : Body slender, almost straight, may be slightly curved near tail upon fixation. Lip region smooth, conoid, with slightly sclerotized framework. Stylet and oesophagus degenerated. Basal oesophageal bulb set off from intestine, Excretory pore posterior to mid-body. Bursa absent. Spicules slender, arcuate, 14-18 μm long, gubernaculum straight or crescent-shaped, fixed 3-4 μm long. Cloacal aperture on a prominent conoid protuberance of body. Tail elongate-conoid with a rounded terminus. *Second stage juvenile* : Body straight or slightly arcuate, transverse striae about 0.8 μ apart. Lateral fields marked by 2 incisures. Lip region, stylet and oesophagus similar to immature females. Excretory pore behind middle of the body. Genital premordium 2-4 celled, posterior to excretory pore. Rectum and functional anus absent. Tail of male larvae slightly shorter than female larvae.

Distribution : India : Delhi, Haryana, Kerala, Maharashtra, Punjab, Rajasthan, Sikkim, Uttar Pradesh, West Bengal. *Elsewhere* : Nepal.

Remarks : Collected from soil around roots of unknown host. It is a serious endo-parasitic pest of various fruit trees and vegetables. This is popularly called as `*Citrus nematode* because of its association with citrus. The second stage juveniles and males are commonly found in soil whereas adult females are attached with roots of hot. The high infestation of *T.semipenetrans* causes damage to the root system which results in the reduction of growth of the trees and finally in the decline of the yield.

Genus *Trophotylenchulus* Raski

24. *Trophotylenchulus indicus* Raski

1957. *Trophotylenchulus indicus*, Raski, *Nematologica*, **2**: 85-90.

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Diagnostic characters : Body small, cuticle thin, finely annulated. Lip region of females and juveniles continuous, anteriorly tapering, surmounted with a circum oral elevation or disc. Excretory pore situated behind oesophageal base, in males and juveniles anterior to middle of body. Stylet 11-15 μm long with prominent knobs. In males stylet is greatly reduced. Ovary extending anteriorly, with flexures. Post vulval uterine sac absent. Tail in all stages elongate-conoid, with a rounded terminus. In males spicules ventrally arcuate. cloacal lips raised, hypoptygma present. Bursa absent.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of unknown host at Delhi.

Family : PRATYLENCHIDAE

Genus ***Paratylenchus*** Micoletzky

25. ***Paratylenchus curvitatus*** van der Linde

1938. *Paratylenchus curvitatus* van der Linde, ***Entom. Mem. Dept. Agric. and Forest, Union South Africa,*** **2** (3) : 1-40.

Distribution : Delhi, Himachal Pradesh, Punjab, Rajasthan.

Remarks : Collected from soil around roots of unknown host at Delhi. *Paratylenchus curvitatus* was reported by Sethi and Swarup (1988) from Delhi. While providing the revision of genus *Paratylenchus*, Raski (1975) mentioned that the extreme truncate cone-shaped head in *curvitatus* appears to be the only distinguishing character. The original description provided by van der Linde (1938) is so poor that even the exact stylet length of the species has not been mentioned. Under the circumstances, *P.curvitatus* has been considered as *species inquirendae*

26. ***Paratylenchus dianthus*** Jenkins & Taylor

1956. *Paratylenchus dianthus* Jenkins & Taylor, ***Proc. Helminth. Soc. Washington,*** **23** (2) : 124-127.

Measurement : *Female* : L= 0.34-0.41 mm; a= 22-33, b= 4-4.9; c= 11-13; V=82-85.

Diagnostic characters : *Female* : Body slightly curved in its posterior half. Lip region conoid with rounded terminus. Stylet 23-26 μm long with basal rounded knobs. Reproductive system mono-prodelphic, spermatheca functional. Female tail conoid with a rounded terminus. *Male*: Body more cylinderical than female. Stylet absent. Tail mostly straight; conoid with rounded terminus.

Distribution : India : Delhi, Punjab, Rajasthan, West Bengal.

Remarks : Collected from soil around roots of unknown host at Delhi.

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27. *Paratylenchus nainianus* Edward & Misra

1963. *Paratylenchus nainianus* Edward & Misra, *Nematologica*,**9** : 215-217.

Diagnostic characters : *Female* : Body almost straight upon fixation, 0.27-0.28 mm long. Head with fine annules terminating anteriorly with small rounded submedian lobe. Stylet length varies from 26-28 μm. Reproductive system mono-prodelphic. Tail narrows gradually to a bluntly rounded terminus. *Male* : Similar to female in general shape and morphology, except in having head narrow conoid with small rounded lips and very short blunt rounded tail.

Distribution : India : Delhi, Himachal Pradesh, Punjab, Rajasthan.

Remarks : Collected from soil around roots of unknown host at Delhi.

28. *Paratylenchus obtusicaudatus* Raski

1975. *Paratylenchus obtusicaudatus* Raski, *J.Nematol.*, **1** (3) : 15-34.

Measurements : *Female* : L= 0.24-0.28 mm; a= 20-25; b= 3.6-4.3; c=15-19; V=81-83.

Diagnostic character : *Female* : Body `C' shaped upon fixation. Lip region bluntly rounded, truncated anteriorly, marked by fine striae, with slight depression in outline at oral aperture. Lateral fields marked by four incisures. Stylet 19-23 μm long, moderately robust. Excretory pore at the base of posterior bulb of oesophagus. Hemizonid one annules anterior to excretory pore. Reproductive system mono-prodelphic. Spermatheca functional. Vulvar flap small, distinct. Tail narrows gradually to a blunt squared-off terminus. *Male* : Not known.

Distribution : India : Delhi, Himachal Pradesh, Punjab.*Elsewhere* : European countries.

Remarks : Collected from soil around roots of unknown host at Delhi.

Genus *Gracilacus* Raski

29. *Gracilacus mira* Raski

1962. *Gracilacus mira* Raski, *Proc. Helminth. Soc. Washington*, **29** (2) : 189-207.

Diagnostic character : Body 0.24-0.44 mm long. Labial sclerotization weak. Stylet 41-49 μm long.

Distribution : India : Delhi, Punjab.

Remarks : Collected from around roots of unknown host at Delhi.

Suborder : HEXATYLINA
Superfamily : ANGUINOIDEA
Family : ANGUINIDAE
Genus *Ditylenchus* Filipjev

30. *Ditylenchus emus* Khan, Chawla & Prasad

1969. *Ditylenchus emus* Khan, Chawla & Prasad, *Labdev. J. Sci. Tech.* 7 (4) : 311-314.

Measurements : *Female* : L= 0.8-1.0 mm; a= 35-45; b=6-7; c= 12-15; V= 64-68. *Male* : L= 0.62 mm; a = 42; c=10; spicules= 16 μm; gubernaculum = μm.

Diagnostic characters : *Female* : Body almost straight upon fixation, tapering gradually at both ends. Lip region continuous with body, smooth. Lateral fields marked by four incisures, of which outer two are crenate. Stylet 8 μm long, weakly developed, with conspicuous basal knobs. The junction of basal oesophageal bulb and intestine distinct, but cardia absent. Excretory pore posterior to nerve ring Reproductive system mono-prodelphic. Vulva a transverse slit. Posterior uterine sac about one and half body-width long. Tail elongate, conoid, ventrally arcuate in its posterior third, tapering to sub acute terminus. *Male* : Similar to female in general shape and morphology except the reproductive system. Stylet comparatively weaker than female. Oesophagus degenerated. Spicule 16 μm long, ventrally arcuate; gubernaculum trough-shaped. Bursa adanal, enveloping 1/3rd of tail. Tail ventrally arcuate with sub acute terminus.

Distribution : India : Delhi.

Remarks : Collected at soil around roots of mango (*Mangifera indica*) at IARI, New Delhi.

31. *Diptenchus indicus* Khan, Chawla & Seshadri

1969. *Diptenchus indicus* Khan, Chawla & Seshadri, *Nematologica,* **15** : 337-340.

1982. *Ditylenchus khani* : Fortuner, *Revue Nematol.,* **5** : 17-38.

Measurements : *Female* : L= 0.8-1.1 mm; a= 30-45; b= 6.5-8.5; c= 12-15; V=82-86; stylet = 8-9 μm. *Male* : L= 0.6-0.8 mm; a= 31-37; b= 5.7; c= 11.5-14; T= 35-55; stylet = 8-9 μm.

Diagnostic characters : *Female* : Body slightly ventrally curved upon fixation, tapering gradually towards anterior end while more abruptly posterior to vulva. Lip region low, flat, continuous with body, marked by two annules; with inconspicuous labial framework. Lateral fields marked by 5 incisures. Stylet weak,, 8-9 μm long, with basal knobs in the form of slight thickening. Median oesophageal bulb ovate, valvate. Basal oesophageal bulb pyriform. Excretory pore situated at the level of oesophago-intestinal junction. Reproductive system mono-prodelphic. Post-vulval sac absent. Spermatheca functional. Tail conical, 5 times the anal body-width, with acute tip. Phasmids situated anterior to middle of tail. *Male* : Similar to female in general shape and morphology except the reproductive system and tail shape. Spicules 22 μm long, arcuate. Gubernaculum 8 μm long. Bursa enveloping about 2/3rd of tail.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of grape vine *Vitis vinifera* at IARI Campus, New Delhi.

Genus *Nothotylenchus* Thorne

32. *Nothotylenchus citri* (Varaprasad, Khan & Lal)

1981. *Paurodontus citri* Varaprasad *et al., Indian J. Nematol.*, **10** : 182-188.

1986. *Nothotylenchus citri* Siddiqi, *Tylenchida : Parasites of Plants & Insects* : 491.

Measurements : *Female* : L=0.71-0.84 mm; a=43-47; b= 5.8-6.6; c= 12-15; V=78-80. *Male* : L= 0.65-0.71 mm; a= 37-44; b= 5.5-7.2; c=13; spicules = 20-22 μm ; gubernaculum = 6-7 μm.

Diagnostic characters : *Female* : Body tapering gradually towards both ends. Lip region continuous and indistinctly annulated. Lateral fields marked by six equally spaced incisures. Stylet 8-10 μm long, with posteriorly flattened basal knobs. Excretory pore 97-106 μm from anterior end. Reproductive system mono-prodelphic. Posterior uterine sac about two vulvar body-width long. Tail elongate-conoid, 4-6 anal body-width long, with subacute terminus. *Male* : Similar to female in general shape and morphology. Spicules ventrally arcuate; 3/4th of tail. Tail conoid, with subacute terminus..

Distribution : India : Delhi.

Remarks : Collected from soil around roots of *Citrus* sp. at Bartal village, Delhi.

33. *Nothotylenchus solani* (Varaprasad, Khan & Lal)

1981. *Paurodontus solani* Varaprasad *et al., Indian J. Nematol.*, **10** (2) : 182-188.

Measurements : *Female* : L= 0.66-0.83 mm; a= 33-46; b= 5.2-7.8; c= 13; V= 79-80. *Male* : L= 0.62-0.83 mm; a= 39-47; b= 5.2-7.5; c= 10-14; spicules = 18-21 μm; gubernaculum = 8-10 μm.

Diagnostic characters : Female : Body straight upon fixation. Lip region continuous, truncate, marked by indistinct annules. Lateral field marked by six equally spaced incisures. Stylet 6-8 μm long, with posteriorly flattened basal knobs. Excretory pore 90-110 μm from anterior end. Reproductive system mono-prodelphic. Posterior uterine sac more than one vulva body-width long. Tail elongate-conoid, first dorsally curved then straight in its posterior third, with rounded terminus. *Male* : Similar to female in general shape and morphology except the reproductive system. Spicules ventrally arcuate; gubernaculum trough-shaped. Bursa envelops about half of tail. Tail conoid with rounded terminus.

Distribution India : Delhi.

Remarks : Collected from soil around roots of brinjal (*Solanum melongenea* L.) at Bhartal village, Delhi.

Family : PAURODONTIDAE

Genus *Paurodontus* Thorne

34. *Paurodontus indicus* Nanjappa & Khan

1970. *Paurodontus indicus* Nanjappa & Khan, *Bull. Entomo.*, **11** : 138-142.

Measurements : *Female* : L= 0.61-0.83 mm; a= 34-44; b= 5-7; c= 10.5-14.5; V=76-82. *Male* : L= 0.61-0.71 mm; a= 34-43; b= 4.5-6; c= 8-14; spicules = 14-16 μm; gubernaculum = 5-7 μm.

Diagnostic characters : *Female* : Body almost straight upon fixation. Lip region low, truncated. Lateral fields marked by 5 incisures, occupying about 1/3rd of body width at mid-body. Stylet weakly developed, 8-11 μm long. With rounded basal knobs. Excretory pore 90 μm from anterior end. Reproductive system mono-prodelphic. Posterior uterine sac about one vulva body-width long. Tail tapering, with sub acute terminus, 4-6 anal body-width long. *Male* : Similar to female in general shape and morphology except the reproductive system and tail shape. Spicules ventrally arcuate, cephalated. Gubernaculum simple, trough-shaped. Bursa envelops about 3/4th of tail region. Tail length with sub acute terminus.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of grape vine (*Vitis vinifera*) at IARI, New Delhi.

Order : APHELENCHIDA
Suborder : APHELONCHINA
Superfamily : APHELENCHOIDEA
Family : APHELENCHIDAE
Subfamily : APHELENCHINAE
Genus ***Aphelenchus*** Bastian

35. *Aphelenchus avenae* Bastian

1965. *Aphelenchus avenae* Bastian, *Tr. Linn. Soc. London*, **25** : 3-184.

1913. *Isonchus radicicolus* Cobb, *J. Wash. Acad. Sci.*,**3** : 432-446.

Measurements : *Female* : L= 0.61-0.75 mm; a= 31-45.5; b= 5.0-5.7; b= 3.6-4.4; c= 22-33; V=76-79; V= 76-79; G_1 = 31-50; G_2 = 4.4-7.6. *Male* : L= 0.70 mm; a= 28; b= 6.7; b=4.3; c= 27; T= 70.

Diagnostic characters : *Female* : Body slightly ventrally curved and tapering towards both ends. Cuticle 1.5-2.0 μm thick, striae 1.2 μm apart. Lateral fields marked by 10-12 incisures. Head slightly set off. Median oesophageal bulb and oesophageal glands typical to the genus. Excretory pore at the level of the excretory pore or posterior to it. Stylet 13-15 μm long, without basal knobs. Reproductive system mono-prodelphic. Posterior uterine sac 32-54 μm or 2.0-3.0 vulvar body-width long. Rectum 11-13 μm. Tail short, cylindrical, 20-30 μm or 2.0-2.3 anal body-width long. *Male* : Similar to female in general shape and morphology except the reproductive system and tail shape. Spicules 27 μm long medially. Gubernaculum 14 μm long. Bursa typical to the genus.

Distribution : India : Delhi : widely distributed in other States. *Elsewhere* : Bangladesh ; Nepal; Pakistan.

Superfamily : APHELENCHOIDOIDEA
Family : APHELENCHOIDIDAE
Genus ***Aphelenchoides*** Fischer

36. *Aphelenchoides delhiensis* Chawla, Bhamburkar Khan & Prasad

1968. *Aphelenchoides delhiensis* Chawla et al., *Labdev.J. Sci. Tech.* **6B** (2) : 86-100.

Measurements : *Female* : L= 0.5-.0.6 mm; a= 28-40; b= 9-11; c= 11-18; V= 65-72. *Male* : L= 0.5 mm; a= 39; b=8, c=16; T= 54.

Diagnostic characters : *Female* : Body slightly ventrally curved upon fixation, lip region smooth, slightly set off from body. Lateral fields marked by 3 incisures, occupying about 1/3rd of body-width near middle. Stylet 11-13 μm long, with poorly developed basal knobs. Excretory pore between the nerve ring and median oesophageal bulb. Reproductive system typical to the genus. Spermatheca three times as long as wide. Posterior uterine sac about 4 times the body-width. Tail conoid with rounded terminus having a central mucro. *Male* : Similar to female in general shape and morphology except in reproductive system and tail shape. Spicules typically aphelenchoid type, dorsal arm measuring 19 μm and ventral 10 μm. Three pairs of ventro-submedian papillae present in the tail region.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of custard apple, *Annona squamosa* L. at Karol Bagh, New Delhi.

37. *Aphelenchoides indicus* Chawla, Bhamburkar, Khan & Prasad

1968. *Aphelenchoides indicus* Chawla, *et.al, Labdev. J. Sci. Tech.*, **6B** (2) : 86-100.

Measurement : *Female* : L= 0.6 mm; a= 20-33; b= 9-10; c= 9-15; V= 65-74. *Male* : L= 0.6 mm; a= 33; b= 8; c= 13; T= 55.

Diagnostic characters : *Female* : Body ventrally curved upon fixation, tapering gradually towards both ends. Lip region slightly set off from body. Lateral fields with 3 incisures, about 1/5th of body-width near middle. Stylet 10-11 μm long, with conspicuous basal knobs. Excretory pore at the level or posterior to nerve ring. Reproductive system typical to the genus. Spermatheca present. Posterior uterine sac about 3 vulvar body-width long. Tail conoid, concave, with truncate tip having pointed mucro. *Male* : Similar to female in general morphology, except in reproductive system and tail shape. Spicules typical aphelenchoid type; dorsal arm 18 μm, ventral side 12 μm long. Tail about 3 anal body-width long, with three pairs of sub ventral papillae.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of cotton, *Gossypium indicum*, at IARI, New Delhi.

38. *Aphelenchoides parascalacaudatus* Chawla, Bhamburkar, Khan & Prasad

1968. *Aphelenchoides parascalacaudatus* Chawla, *et. al. Labdev. J. Sci. Tech.*, **6B** (2) : 86-100.

Measurements : *Female* : L= 0.4-0.5 mm; a= 28-32, b= 10-11; c= 13-16; V= 66-70 stylet = 10-11 μm

Diagnostic characters : *Female* : Body slightly ventrally curved upon fixation. Lip region distinctly set off from body, without annules. Lateral fields marked by 3 incisures, about 1/8th of body-width near middle. Stylet 10-11 μm long, without basal knobs. Excretory pore posterior to the nerve ring. Reproductive system typical to the genus. Spermatheca 6 times as long as wide, functional. Posterior uterine sac about 4 vulvar body-width long. Tail conoid, concave dorsally/ ventrally, with sharply pointed mucro at its tip. *Male* : Not known

Distribution : India : Delhi.

Remarks : Collected from soil around roots of grass, *Cynadon dactylon* Pers. at Karol Bagh, New Delhi.

39. *Aphelenchoides chalonus* Chawla & Khan

1968. *Aphelenchoides teres* Chawla, *et.al.* nec. *A. teres* (Schneider, 1927). Filipjev, (Russian Text): 440 pp. 1-333 Maskva, Leningrad.

Measurement : *Female* : L= 0.4-0.5 mm; a= 21-35; b= 9-11; c= 10-14; V=64-69.

Diagnostic characters : *Female*: Body ventrally arcuate upon fixation. Lip region distinctly set off by constriction, without annules. Lateral fields marked with 3 incisures, occupying about 1/6th of body-width near middle. Stylet 10-11 μm long, without basal knobs. Excretory pore posterior to median oesophageal bulb. Reproductive system mono-prodelphic. Spermatheca functional, 2.5 times as long as wide. Posterior uterine sac present. Tail conoid, its terminus bearing a small mucro. *Male* : Not known.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of cotton, *Gossypium indicum* L., at IARI Campus, New Delhi.

Order : DORYLAIMIDA
Suborder : DORYLAIMINA
Superfamily : DORYLAIMOIDEA
Family : DORYLAIMIDAE
Genus ***Thornenema*** Andrassy

40. *Thornenema mauritianum* (Williams)

1965. *Thornenema delhiensis*, Prasad & Chawla, *Indian J. Ent.*, **27** : 140-143.

1969. *Thornenema mauritianum* : Baqri & Jairajpuri, *Nematologica*, **13** : 353-366.

Measurements : *Female* : L= 1.63-2.01 mm; a= 40.2-48.5; b= 5.4-6.7; c= 6.2-7.1; V=

29.1-34.4.

Diagnostic characters : *Female* : Body ventrally arcuate. Lip region narrow, amalgamated, rounded, slightly sclerotized, marked by a slight depression. Odontostyle 10-13 μm long; aperture 1/6 to 1/5 of its length. Odontophore one and half to two times as long as odontostyle. Basal expanded portion of oesophageous about 30-45% of total oesophageal length. Female reproductive system mono-opisthodelphic. Vulva transverse. Tail usually filliform, 1--14 anal body-width long. According to Baqri & Jairajpuri (1967), the tail in some specimens may be only 4-6 anal body-width long.*Male* : Not known.

Distribution : India : Andhra Pradesh, Delhi, Maharashtra, Port Blair (Andaman), Uttar Pradesh.

Remarks : Collected from soil around roots of citrus *(C. reticulata)* at IARI, Delhi.

Family : QUIDSIANEMATIDAE

Genus ***Discolaimus*** Cobb

41. ***Discolaimus laksi*** Khan and Laha

1982. *Discolaimus laksi* Khan and Laha, *Indian J. Nematol.*, **12** (2) : 232-249.

Measurements : *Female* : L= 0.81-1.09 mm; a= 25.3-36.8; b= 3.1-4.3; c= 40.5-52.1; V= 48-5.

Diagnostic characters : *Female* : Body ventrally arcuate upon fixation. Lip region distinctly set off from body, expanded, discoid. Odontostyle 15 μm long; slightly smaller than lip region; aperture about 1/3 of odontostyle length. Odontophore slightly longer than odontostyle. Female reproductive system amphidelphic. Prerectum more than one anal body-width long. Tail dorsally convex conoid, about one anal body-width long. *Male* : Not known.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of mango (*Mangifera indica* L.) from Shadipur, Delhi.

42. ***Discolaimus rotundicaudatus*** Khan and Laha

1982. *Discolaimus rotundicaudatus* Khan and Laha,*India J. Nematol.*, **12** (2) 232-249.

Measurements : *Female* : L= 0.82-0.9 mm; a= 22.6-25; b= 2.9-4.5; c= 37.8-41; V= 51-53.

Diagnostic characters : *Female* : Body ventrally arcuate, tapering at both extremeties. Lip region expanded, discoid. Odontostyle 15 μm long. Basal oesophageal bulb strongly muscular. Reproductive system amphidelphic. Vulva a transverse slit. Pre-rectum one and half times the anal body-width. Tail dorsally convex, conoid with rounded terminus. *Male* : Not known.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of pomegranate (*Punica granatum* L.) at

Shadipur, Delhi.

Genus ***Discolaimoides*** Heyns

43. ***Discolaimoides spatilabium*** Khan and Laha

1982. *Discolaimoides spatilabium* Khan and Laha, *Indian J. Nematol.*, **12** (2) : 232-249.

Measurements : L=1.34-1.70 mm; a= 44.7-54; b= 4.3-5; c= 30.7-39.6; V= 40-46.4.

Diagnostic characters: *Female* : Body gradually tapering at both ends. Lip region set off by a deep constriction, wider than body, angular in outline. Lateral hypodermal glands distinct. Odontostyle 13-14 μm long, aperture less than 1/3 of odontostyle length. Odontophore 14-16 μm long. Guiding ring less than half of lip region width from anterior end. Basal expanded portion of oesophagus about half of oesophageal length. Reproductive system amphidelphic. Vulva a transverse slit. Pre-rectum about 1.5 times the anal body-width.Tail conoid, ventrally arcuate, more than two anal body-width long. *Male* : Not known.

Distribution: India : Delhi.

Remarks : Collected from soil around roots of carrot (*Dacus carota* L.) at IARI Campus, New Delhi.

44. ***Discolaimoides teres*** Khan and Laha

1982. *Discolaimoides teres* Khan & Laha, *Indian J. Nematol.*, **12** : 232-249.

Measurements : *Female* : L= 1.1-1.3 mm; a= 34.3-40.1; b= 3.9-4.3; c= 25.5-30.8; V= 43.5-46.1.

Diagnostic characters : *Female* : Body slightly ventrally curved upon fixation. Lip region wider than body, expanded, set off by constriction. Lateral hypodermal glands conspicuous. Odontostyle 11-12 μm long; aperture 4 μm or about 1/3rd of odontostyle length. Odontophore about one odontostyle length. Guiding ring about 2 μm from anterior end. Basal expanded portion of oesophagus occupies about half of neck region. Female reproductive system amphidelphic. Vulva a transverse slit. Pre-rectum about 3 anal body-width long. Tail dorso-ventrally curved, about 2.5 times the anal body-width, with a sub digitate terminus.*Male*: Not known

Distribution : India : Delhi.

Remarks : Collected from soil around roots of mango (*Mangifera indica* L.), Shadipur Block, Delhi.

Family : NORDIIDAE

Genus ***Longidorella*** Thorne

45. ***Longidorella okhlaenis*** (Jairajpuri and Siddiqi)

1964. *Nordia okhlaenis* Jairajpuri and Siddiqi, *Proc. Helminth. soc.*, **37** (1) : 1-9.

1969. *Longidorella okhlaensis* : Jairajpuri and Hooper, *Nematologica*, **15** : 275-284.

Measurements : *Female* : L= 0.5-0.6 mm; a= 13-16; b= 2.9-3.5; c= 22-26; V=57-61.

Diagnostic characters : *Female* : Body small and robust, tapering both extremities. Lip region set off from body by a deep constriction; lips prominent. Odontostyle 32-36 μm long. Odontophore as long as odontostyle; guiding ring situated in middle of odontostyle. Oesophagus dorylaimoid type. Cardia prominent. Reproductive system amphidelphic. Vulva a transverse slit. Pre-rectum and rectum equal in length. Tail blunt, convex conoid, about one anal body-width long. *Male* : Not known

Distribution : India : Delhi.

Remarks : Collected from soil around roots of banana, *Musa paradisiaca L.* at Okhla, New Delhi.

Superfamily : LONGIDOROIDEA
Family : LONGIDORIDAE
Genus ***Longidorus*** Micoletzky

46. ***Longidorus brevicaudatus*** Schuurmans Stekhoven

1951. *Neolongidorus brevicaudatus* Sch. Stekhoven, *Indian J. Nematol.*, **16** : 185-193.

Measurements : *Female* : L= 3.5-3.88 mm; a= 125-138; b= 11.3-14.7; c= 87.5-107.4; V= 49-53.

Diagnostic characters : *Female* : Body tapering towards both extremities. Lip region knob-like. Odontostyle and odontophore 68 μm long respectively. Guiding ring situated at about one head-width from anterior end. Reproductive system amphidelphic. Vulva a transverse slit. Pre-rectum about 8% of total body length. Tail cylindrical with rounded terminus, more than two anal body-width long, with three caudal pores on each side.*Male* : Not known

Distribution : India : Delhi.

Remarks : Collected from soil around roots of citrus.

47. ***Longidorus mirus*** Khan, Chawla and Seshadri

1971. *Longidorus mirus* Khan, Chawla and Seshadri, *Bull. Entom.*, **12** : 113-117.

Measurements : *Female* : L= 3-3.6 mm; a= 70-90; b= 90-14; c= 85-98; V= 44-48.

Diagnostic characters : *Female* : Body open `C' shaped. Lip region continuous with body, rounded. Odontostyle and odontophore 78 μm and 45 μm long, respectively. Guiding ring at 25 μm or about 2.5 lip region-width from anterior end. Reproductive system amphidelphic. Vulva a transverse slit. Tail dorsally convex-conoid with bluntly rounded terminus, 1.3-1.6 anal body-width long, with 4 caudal pores. *Male* : Not known.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of maize (*Zea mays*) at IARI Campus, New Delhi.

Superfamily : TYLENCHOLAIMIDAE
Family : TYLENCHOLAIMINAE
Genus ***Tylencholaimus*** De Man

48. ***Tylencholaimus rumjhumi*** Khan and Laha

1982. *Tylencholaimus rumjhumi* Khan and Laha, *Indian J. Nematol.*, **12**: 232-249.

Measurements : *Female* : L= 0.48-0,.65 mm; a= 2.5-3.1; c= 31.2-42; V= 70-78.

Diagnostic characters : *Female* : Body slightly ventrally curved upon fixation. Inner layers of cuticle finely striated. Lip region cap-like, set off, slightly wider than body. Odontostyle 6 μm long with thin lumen; aperture about 1/4th of odontostyle length. Odontophore with distinct basal knobs. Basal expanded portion occupies about 40% of the neck region. Reproductive system mono-prodelphic. Posterior uterine sac absent. Pre-rectum two and half times the anal body-width. Rectum about 3/4th of anal body-width. Tail dorsally bent 0.8-1.0 anal-width long, with obtusely rounded terminus. *Male* : Not known.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of phalsa (*Grewia subinaequalis* D.C) at IARI Campus. New Delhi.

Genus ***Meylonema*** Andrassy

49. ***Meylonema indicus*** (Chawla,Bhamburkar, Khan & Prasad, 1968)

1968. *Leptonchulus indicus* Chawla *et al. Labdev J. Sci. Tech.*, **6B** : 86-100.

1992. *Meylonema indicus* : Jairajpuri & Ahmad, *Dorylaimida; Free living Predaceous and Plant Parasitic Nematodes*, 458 pp.

Measurements : *Female* : L= 0.7-0.8; a= 29-33; b= 3.3-4; c= 38-43; V= 62-65.

Diagnostic characters : *Female* : Body ventrally curved upon fixation. Lip region cap-like, set off from body by a deep constriction. Cuticle finely striated. Odontostyle slender with thin lumen, 8 μm long. Odontophore rod-like, about 1.5 times the odontostyle length. Basal expanded portion of oesophagus about half of the total oesophageal length. Female reproductive system mono-prodelphic. Posterior uterine sac about half of the corresponding body-width long. Tail rounded, about one anal body-width long. *Male* : Not known.

Distribution : India : Delhi.

Remarks : Collected from tap water, Water Works, Delhi.

Family : LEPTONCHIDAE
Genus ***Leptonchus*** Cobb

50. *Leptonchus neobaccatus* Khan and Laha

1982. *Leptonchus neobaccatus* Khan and Laha, *Indian J. Nematol.*, **12** : 232-249.

Measurements : *Female* : L= 0.95-1.05 mm; a= 24.5-28.9; b= 4.1-5.7; c= 67.4-76.5; V= 55-64.

Diagnostic characters : *Female* : Body slightly ventrally curved upon fixation. Cuticle finely striated. Sub-cuticle coarsely striated, radial refractive elements present. Lip region conical, set off from body with rounded contour. Odontostyle with a fine lumen. 10-13 μm long. Odontophore typically arcuate, 13-15 μm long. Oesophageal terminal bulb about 20% of oesophagus length. Reproductive system amphidelphic. Vulva a transverse slit. Pre-rectum very long, starts about three body-width before vulva. Tail rounded, hemispherical to conoid, about one anal body-width long.*Male* : Not known.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of phalsa (*Grewia subinaequalis* D.C) at IARI Campus, New Delhi.

Genus *Tylencholaimellus* Cobb

51. *Tylencholaimellus sagerus* Khan and Laha

1982. *Tylencholaimellus sagerus* Khan and Laha, *Indian J. Nematol.*, **12** : 232-249.

Measurements : *Female* : L= 0.45-0.56 mm; a= 33-35; b= 3.3-4.0; c= 29.5- 37.8; V= 40-42.

Diagnostic characters : *Female* : Body ventrally arcuate upon fixation. Lip region button-like, set off by constriction. Odontostyle 8-9 μm long. Odontophore about half of odontostyle length, with distinct knobs at base. Basal expanded portion of oesophagus in the form of a bulb, about 23% of the neck region. Reproductive system mono-opisthodelphic. Pre-rectum two and half times the anal body-width. Tail short rounded or conoid, one anal body-width long. *Male* : Not known.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of peach (*Prunus persica* Batsch.) at IARI Campus, New Delhi.

Order : TRIPLONCHIDA
Superfamily : TRICHODOROIDEA
Family : TRICHODORIDAE
Genus *Paratrichodorus* Siddiqi
Subgenus *Atlantodorus* Siddiqi

52. ***Paratrichodorus (Atlantodorus) delhiensis*** Khan, Saha & Lal

1993. *Atlantodorus delhiensis* Khan, Saha & Lal, *Ann. Pl. Prot. Sci.*, **1** : 15-17.

Measurements : *Female* : L= 440-595 μm; a= 19.8-25.8; b= 5.5-7; c= subterminal; V= 50.1-56.6; onchiostyle= 31-36 μm. *Male* : L= 410-520 μm a= 20.5-26.5; b= 4.9-6.3; T= 52.2-55.8; Onchiostyle 31-35 μm; spicules = 30-34 μm.

Diagnostic characters : *Female* : Body slightly curved; tapering gradually at both ends. Onchiostyle 31-36 μm long. Guiding ring 16-17 μm from anterior end. Basal oesophageal bulb 25x8 μm with four gland nuclei. Reproductive system amphidelphic. Vulva a circular opening. Rectum 7-8 μm long. Anus sub dorsal in position. (subterminal).*Male* : Similar to female in general shape and morphology. Ventro median supplements two. Spicules paired; gubernaculum linear. Bursa flap-like, enveloping tail.

Distribution : India : Delhi.

Remarks : Collected from soil around roots of Mullberry (*M. alba*) at Mehrauli, New Delhi.

SUMMARY

The present paper reports 57 known species of plant and soil nematodes from Delhi. These species belong to 34 genera, 22 families spread over four Orders Tylenchida (39 spp.), Aphelenchida (5 spp.), Dorylaimida (12 spp.) and Triplonchida (one sp.).

The perusal of nematology literature reveals that Delhi has extensively been surveyed for the nematode fauna. Out of 57 species, 32 are being added as new to science while 29 are endemic to Delhi.

The following 39 species of the Order Tylenchida under 13 families and 21 genera have been reported from Delhi; *Basiria indica* (Chawla, Bhamburkar, Khan & Prasad, 1968 Khan & Nanjappa, 1971; *Ottolenchus equisetus* (Husain & Khan, 1967) Wu, 1970; *Tylenchorhynchus mashhoodi* Siddiqi & Basir, 1959; *T. brassicae* Siddiqi, 1961; *T. delhiensis,* Chawla, Bhamburkar, Khan & Prasad, 1968; *Bitylenchus brevilineatus* (Williams, 1960), Siddiqi, 1986; *B. vulgaris* Upadhyay *et al.*, 1972; *Quinisulcius cacti* (Chawla, Bhamburkar, Khan & Prasad, 1968) Siddiqi, 1971; *Hoplolaimus indicus* Sher, 1963; *H.astriatus* Khan & Nanjappa, 1972; *H.aquili* Khan & Nanjappa, 1972; *H. delhiensis* Khan & Nanjappa, 1972; *Rotylenchulus reniformis* Linford & Oliveira, 1940; *Pratylenchus zeae* Graham, 1951; *P. ranjani* Khan and Singh, 1975; *P.impar* Khan & Singh, 1975; *Meloidogyne javanica* (Treub, 1885) Chitwood, 1949; *M. incognita* (Kofoid & White, 1919) Chitwood, 1949; *M.graminicola* Golden & Birchfield, 1965; *M.triticoryzae* Gaur, Saha & Khan, 1993; *Heterodera avenae* Wollenweber, 1924; *H.trifolii* Goffart, 1932; *H. galeopsides* Goffart, 1936; *H.sacchari* Luc & Merny, 1963; H.zeae Koshy, Swarup & Sethi, 1971; *Macroposthonia sphaerocephala* (Taylor, 1936) De Grisse & Loof, 1965; *Aulosphera indica*

(Siddiqi, 1961), Siddiqi, 1986; *Tylenchulus semipenetrans* Cobb, 1913; *Trophotylenchulus indicus* Raski, 1957; *Paratylenchus curvitatus* van der Linde, 1938; *P.dianthus* Jenkins & Taylor, 1956; *P. nainianus* Edward & Misra, 1963; *P. obtusicaudatus* Raski, 1975; *Gracilacus mira* (Raski, 1962) Siddiqi & Goodey, 1964; *Ditylenchus emus* Khan, Chawla & Prasad, 1969; *Diptenchus indicus* Khan Chawla & Seshadri, 1969; *Nothotylenchus citri* (Varaprasad, Khan & Lal, 1981) Siddiqi, 1986; *N.solani* (Varaprasad, Khan & Lal, 1981); and *Paurodontus indicus* Nanjappa & Khan, 1970.

The Order Aphelenchida is being represented by five species belonging to two families and two genera in Delhi. The species are : *Aphelenchus avenae*.Bastian, 1865; *Aphelenchoides indicus* Chawla, Bhamburkar, Khan & Prasad, 1968; *A. delhiensis* Chawla, Bhamburkar, Khan & Prasad, 1968; *A. parascalacaudaus* Chawla, Bhamburkar, Khan & Prasad, 1968; and *A. chalonus* Chawla & Khan, 1978.

The following 12 species belonging to six families and ten genera under the Order Dorylaimida have been reported from Delhi; *Thornenema mauritianum* (Williams, 1959) Baqri & Jairajpuri, 1969; *Discolaimus laksi* Khan & Laha, 1982; *D., rotundicaudatus* Khan & Laha, 1982; *Discolaimoides spatilabium* Khan & Laha, 1982; *D. teres* Khan & Laha, 1982; *Longidorella okhlaensis* (Jairajpuri & Siddiqi, 1964) Jairajpuri & Hooper, 1969; *Longidorus brevicaudatus* Schuurmans Stekhoven, 1951; *L. mirus* Khan, Chawla & Seshadri, 1971; *Tylencholaimus rumjhumi* Khan & Laha, 1982; *Meylonema indicus* (Chawla, Bhamburkar, Khan & Prasad, 1968) Jairajpuri & Ahmad 1992; *Leptonchus neobaccatus*, Khan and Laha, 1982; and *Tylencholaimellus sagerus* Khan & Laha, 1982; and *Tylencholaimellus sagerus* Khan & Laha, 1982

The Order Tiplonchida is represented by only one species, *Paratrichodorus (Atlantodorus) delhiensis*, Khan, Saha & Lal, 1993 belonging to family Trichodoridae.

The nematode fauna of Delhi includes free living as well plant parasitic nematodes. The list of the plant parasites includes some serious pests of Agricultural crops like *Hoplolaimus* sp., *Helicotylenchus* spp., *Rotylenchulus reniformis, Meloidogyne* spp., *Heterodera* spp., *Tylenchulus semipenetrans,* Criconematids, *Longidorus* spp. *Aphelenchoides* spp. and *Paratrichodorus* spp.

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REFERENCES

Anonymous, 1987. First Annual Technical Report PL-480, Project. FG-In-673 (IN-ARS-326), 31 pp.

Baqri. Q.H. and Jairajpuri. M.S. 1967. Review of the genus *Thornenema* Andrassy 1959 and proposal of *Willinema* n. gen. *Nematologica*, **13** : 353-366.

Baqri. Q.H. Jairajpuri, M.S. 1995. *Bibliography of Nematology of India.* CBS Publishers & Distributors, New Delhi, India; 279 pp.

Chawla, M.L., Bhamburkar, B.L., Khan, E. and Prasad, S.K. 1968. One new genus and seven new species of nematodes from India. *Labdev. J. Sci. Tech.*, **6B** (2) 86-92, 18 plates (93-100).

Gaur. H.S., Saha, M. and Khan, E. 1993. *Meloidogyne triticoryzae* sp. n. (Nematoda : Meloidogynidae) a root-knot nematode damaging wheat and rice in India. *Annals of Plant Protection Sciences*, **1** (1) : 18-26.

Jairajpuri, M.S. and Ahmad, Wasim. 1992. *Dorylaimida : Free living, Predaceous and Plant Parasitic nematodes.* Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, India, 458 pp.

Jairajpuri, M.S and Baqri, Q.H. 1991. *Nematode pests of Rice.* Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, India, 66 pp.

Jairajpuri, M.S. and Siddiqi, A.H. 1964. On a new nematode genus *Nordia* (Dorylaimoidea : Nordianaen. Subfamily) with remarks on the genus *Longidorella* Thorne, 1939. *Proceedings of the Helmintholigical Society*, Washington, **31** (1) : 1-9.

Khan, E. and Laha, S.K. 1982. Seven new Dorylaimid nematodes from Indian Agricultural Research Institute Farm, Delhi, India. *Indian J. Nematol.*, **12** (2) : 232-249.

Khan E. and Nanjappa, C.K. 1970. Four new species in the superfamily Hoplolaimoidea (Tylenchida : Nematoda) from India. *Bull. Ent.* **11** (2) : 143-149.

Khan, E. and Nanjappa, C.K. 1972. Four new species of Criconematoidea (Nematoda) from India. *Indian J. Nematol.*, **2** : 59-68.

Khan, E. and Singh, D.B. 1975. Five new species of Pratylenchus (Nematoda : Pratylenchidae) from India. *Indian J. Nematol.*, **4** : 199-211.

Khan, E. Chawla, M.L. and Prasad, S.K. 1969. *Tylenchus (Aglenchus) indicus* n.sp. and *Ditylenchus emus n.sp. (Nematoda : Tylenchidae) from India.* Labdev. J. Sci. Tech., **7-B** (4) : 311-314.

Khan, E., Chawla, M.L. and Seshadri, A.R. 1969. *Diptenchus indicus* n.gen., n.sp. (Nematoda : Tylenchidae) from soil around roots of grape vine from Delhi, India. *Nematologica,* **15** : 337-340.

Khan, E., Chawla, M.L. and Seshadri, A.R. 1971. *Longidorus mirus sp. nov. (Nematoda : Longidoridae)* from soil around the roots of maize from Delhi, India. *Bull. Ent.,* **12** (2) : 113-117.

Khan, E., Saha, M. and Lal, M. 1993. A new species of *Atlantodorus* Siddiqi, 1974, (Nematoda: Trichodoroidea) from Delhi. *Annals Plant Prot. Sci.*, **1**(1) : 15-17.

Van der Linde, W.J. 1938. A contribution to the study of nematodes.*Entomol. Mem. Dept. Agric. for Union South Africa,***2** : 1-40.

Nanjappa, C.K. and Khan, E. 1970. *Paurodontus indicus* sp. nov. and *Boleodorus teres* sp.nov. (Nematoda : Tylenchida) from India. *Bull. Entom.*, **11** (2) : 138-142.

Prasad, S.K. and Chawla, M.L. 1965. *Thornenema delhiensis,* a new nematode species from Delhi with a key to the species of *Thornenema* C (Dorylaimidae : Nematoda). *Indian J. Ent.*,**27** (1) : 140-143.

Prasad, S.K., Khan, E. and Mathur, V.K. 1965. *Criconemoides georgii* n. sp. (Nematoda: Criconematidae) from India. *Curr. Sci.*, **23** (5) : 667.

Raski, D.J. 1975. Revision of the Genus *Paratylenchus* Micoletzky, 1922 and description of new species, Part I of three parts. *Journal of Nematology,* **7** (1) : 15-33.

Raski, D.J. 1975. Revision of the Genus *Paratylenchus* Micoletzky, 1922, and description of new species, Part II of three parts. *Journal of Nematology,* **7** (3) : 274-295.

Sesdhadri, A.R. and C.L Sethi, 1978. In : *Wheat Research in India (1966-1976)*, pp. 168-187. ICAR, New Delhi.

Sethi, C.L. and Swarup, G. 1988. Plant parasitic nematodes of northern-western India-IV. The genera *Paratylenchus* and *Gracilacus. Indian J. Nematol.*, **18** : 399-400.

Siddiqi, M.R. 1986. *Tylenchida : Parasites of Plants and Insects*. CAB: Commonwealth Institute of Parasitology - United Kingdom. 644 pp.

Swarup. G., Prasad, S.K. and Raski, D.J. 1964.. Some *Heterodera* species from India. *Plant Dis. Reptr.*, **48**: 235.

Swarup, G., Sethi, C.L. and Gill, J.S. 1964. Some records of plant parasitic nematodes in india. *Curr. Sci.*, **33** (19) : 593.

Upadhyay, K.D., Swarup, G., and Sethi, C.L. 1972. *Tylenchorhynchus vulgaris* sp. n. associated with maize roots in India, with notes on its embryology and life history. *Indian J. Nematol.*, **2** : 129-138.

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Table 1. - Differential diagnostic characters of *Heterodera* spp. from Delhi :

	H.avenae Woolen Weber	*H.trifolli* Goffart	*H.galeopsides* Goffart	*H.sacchari* Luc & Merny	*H.zeae* Koshy, Swarup & Sethi
1. *Female* (Cyst) :					
Shape	Lemon	Lemon	Lemon	Lemon	Lemon
Length	0.58-0.93 mm	0.31-0.99 mm	0.45-0.90 mm	0.38-1.03 mm	0.34-0.68 mm
Width	0.41-0.68 μm	190-612 μm	0.42-0.70 μm	0.28-0.83 μm	260-537 μm
Colour	Dark brown to black	Light brown to brown	Brown to dark brown	Brown	Light brown thin walled
L/B ratio	1-1.47			1.02-2.2	1.0-1.5
Fenestral Measurements :					
Fenestration	Bifenestration	Ambifenestrate	Ambifenestrate	Ambifenestrate	Ambifenestrate
Position of bullae	Bullatae	Bullatae	Bullatae	Bullatae	Bullatae
Length of Fenestra	43-44 μm	40-58 μm	41-46 μm	45-55 μm	24-46 μm
Width of Fenestra	21-23 μm	30-48 μm	31-38 μm	35-45 μm	22-25 μm
Vulval slit	10-13 μm	39-50 μm	40-50 μm	50-52 μm	38-46 μm
2. *2nd Stage juvenile*					
Length	0.520-0.620 mm	0.494-0.535 mm		0.420-530 mm	0.360-0.440 mm
Width	20-24 μm	18-21 μm			

	H.avenae Woolen Weber	*H.trifolli* Goffart	*H.galeopsides* Goffart	*H.sacchari* Luc & Merny	*H.zeae* Koshy, Swarup & Sethi
`a'	21.2-27.3				19-25.4
Stylet	25-28 μm	26.5-29 μm		21-24 μm	20-25 μm
Tail length	45-70 μm	56-70 μm	-		32-58 μm
3. *Male* :			Not Known		Not known
Length	1.34-1.65 mm	0.63-1.32 mm	-	0.66-0.90 μm	-
Width	35-43	-	-	-	-
`a'	35-43	-	-	-	-
Stylet	28-31	-	-	-	-
Spicule size	34-38 arcuate	-	-	-	-
Gubernaculum	10-12	-	-	-	-
4. Host	*Avena sativa*	*Trifolium repens*	Soil	*Saccharum officinale*	*Zea mays*
5. Distribution	India : Delhi, Haryana Himachal Pradesh, Jammu & Kashmir, Punjab, Rajasthan Uttar Pradesh.	Arunachal Pradesh, Delhi	Delhi, Haryana, Kerala, Maharashtra, Punjab.	Delhi, Uttar Pradesh	Arunachal Pradesh, Bihar, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Maharashtra, Punjab, Rajasthan, Uttar Pradesh.

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MOLLUSCA

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INTRODUCTION

Our knowledge on Indian molluscs is based on contributions made by several earlier workers and is well scattered in the literature. A resume of work on Indian molluscs was dealt in the book, *Animal Resources of India : State of the Art : Mollusca* by Subba Rao (1991). The most important and comprehensive work on Indian land and freshwater molluscs are, *Fauna of British India : Mollusca* by Blanford and Godwin-Austin (1908), Gude (1914, 1921) and Preston (1915); and more recently the, *"Handbook: Freshwater Molluscs of India"* by Subba Rao (1989) are worth to mention. The present studies are based on the collections made from Delhi by Northern Regional Station, Zoological Survey of India, Dehra Dun and collections received from Dr. Brij Gopal, JNU, New Delhi.

SYSTEMATIC ACCOUNT

A. Freshwater Molluscs

Class : GASTROPODA
Subclass : PROSOBRANCHIA
Order : MESOGASTROPODA
Family I : VIVIPARIDAE
1. Genus ***Bellamya*** Jousseaume

1. *Bellamya bengalensis* f.*typica* (Lamarck)
   f. *mandiensis* (Kobelt)
2. *B. dissimilis* (Mueller)

Family II : BITHYNIIDAE
2. Genus ***Digoniostoma*** Annandale

3. *Digoniostoma cerameopoma* (Benson)
4. *Digoniostoma pulchella* (Benson)

3. Genus ***Gabbia*** Tryon

5. *Gabbia orcula* (Frauenfeld)

Family III : THIARIDAE

4. Genus ***Thiara*** Roeding

Subgenus ***Melanoides*** Olivier

6. *Thiara (Melanoides) tuberculatus* (Mueller)

Order : BASOMMATOPHORA

Family IV : LYMANAEIDAE

5. Genus ***Lymnaea*** Lamarch

Subgenus ***Pseudosuccinea*** Baker

7. *Lymnaea (Psudosuccinea) acuminate* f. *typica* Lamarck
   - f. *chalamys* Benson
   - f. *gracilior* Martens
   - f. *rufescens* Gray

8. *Lymnaea (Psudosuccinea) luteola* f. *typica* Lamarck
   - f. *australis* Annandale & Rao
   - f. *impura* (Troschel)
   - f. *ovalis* Gray

Family V: PLANORBIDAE

6. Genus ***Indoplanorbis*** Annandale & Prashad

9. *Indoplanorbis exustus* (Deshayes)

7. Genus ***Gyraulus*** Charpentier

10. *Gyraulus convexiusculus* (Hutton)
11. *G.euphraticus* (Mousson)

8. Genus ***Segmentina*** Flemming

Subgenus ***Polypylis*** Pilsbry

12. *Segmentina (Polypylis) calatha* (Benson)

Family VI : PHYSIDAE

9. Genus ***Physa*** Draparnaud

13. *Physa acuta* Draparnaud

Class : BIVALVIA

Order : UNIONIDA

Family VII : UNIONIDAE

10. Genus ***Lamellidens*** Simpson

14. *Lamelliaens marginalis* (Lamarck)

Family VIII : AMBLEMIDAE

11. Genus ***Parreysia*** Conrad

Subgenus ***Parreysia*** S.str.

15. *Parreysia (P.) favidens* (Benson)

Subgenus *Radiatula* Simpson

16. *Parreysia (Radiatula) caerulea* (Lea)

Order : VENEROIDA

Family IX : CORBICULIDAE

12. Genus ***Corbicula*** Megerle von Muehlfeld

17. *Corbicula stritella* Deshayes

B. Land Molluscs

Subclass : PULMONATA

Order : STYLOMMATOPHORA

Family X : SUCCINEIDAE

13. Genus ***Succinea*** Draparnaud

18. *Succinea elegantior* Annandale

Family XI : SUBULINIDAE

14. Genus ***Allopeas*** Baker

19. *Allopeas gracile* (Hutton)

15. Genus ***Zootecus*** Westerlund

20. *Zootecus pullus* (Gray)

Family XII : ARIOPHANTIDAE

16. Genus ***Macrochlamys*** Gray

21. *Macrochlamys indica* Godwin-Austen

22. *M.petrosa* (Hutton)

Order : SOLEOLIFERA

Family XIII : VERONICELLIDAE

17. Genus ***Laevicaulis*** Simroth

23. *Laevicaulis alte* (Ferussac)

A. Freshwater Molluscs

Key to families

1. Shell with single valve, spirally coiled 2
   Shell with two valves, dorsally attached by hinge 7

2. Shell operculate 3
   Shell without operculum.....5

3. Operculum with concentric growth lines ; shall pyramidal, whorls increase gradually in size .....Viviparidae
   Operculum with spiral growth lines ; shell either turrited or globose 4

4. Shell linear, whorls more than five, sculptured with tubercles, more than 10 mm in size; operculum horny, small, can be withdrawn inside .....Thiaridae
   Shell globose, whorles not more than five, smooth, less than 10 mm in size ; operculum calcareous, larger than aperture, can not be withdrawn inside .....Bithyniidae

5. Shell discoidal, columellar axis not twisted ....Planorbidae
   Shell extended, columellar axis twisted 6

6. Shell dextral.....Lymanaeidae
   Shell sinistral.....Physidae

7. Shell transversely elongate ; ligament internal; outer surface concentrically ribbed ; interior not nacreous 8
   Shell trâingularly ovate ; ligament external, outer surface concentrically ribbed ; interior not nacreous ....Corbiculidae

8. Umbo rudimentary, sculptured with concentric straitions ; outer two gills marsupial ....Unionidae
   Umbo developed, sculptured with striations, corrugations ; all four gills marsupials .....Amblemidae

Class :GASTROPODA
Order : MESOGASTROPODA
Family I : VIVIPARIDAE
Subfamily : BELLAMYINAE
1. Genus ***Bellamya*** Jousseaume

Key to species

Shell with dark spiral bands ; body whorl rounded .....*B.bengalensis*
Shell withouit spiral bands ; body whorl subangulate ; with a faint light band in middle .....*B. dissimilis*

1. ***Bellamya bengalensis* f. *typica*** (Lamarck)
Banded Pond snail

1822. *Paludina bengalensis* Lamarck, Hist. nat. Anim. sans Vert. **6** (2) : 174.
1989. *Bellamya bengalensis f. typica* : Subba Rao, In : *Handbook Freshwater Molluscs of India* : 45, fig. 55.
1995. *Bellamya bengalensis f. typica* : Subba Rao *et al.*, Fauna of Meghalaya : Mollusca. *State Fauna Series*, 4(8) :16.

Material examined : Delhi; total no. of exs. : 312, N. Zoological Park, June 1993; Ridge, June 1993, coll. V.Khanna & party; Ridge near Dhaula Kuan, October 1993, Najafgarh, 27.x.1993, Bawana, October, 1993, coll. N.K. Sinha & party; Pond near Yamuna barrage, Okhla, 10.v.1994, Pond near Indira Gandhi Indoor stadium, 11.vi.1994; Okhla dam, 15.v.1994, Yamuna river near Yudhishtar bridge, I.S.B.T., 16.v.1994, coll. A. Husain & party; Gopalpur nala near Wazirabad, 8.xi.1994, Patparganj near Yamuna bridge, 10.xi.1994; Indira Gandhi indoor stadium, 10.xi.1994, coll. J.P. Sati & party; Yamuna reservoir, Ramghat, 17.xii.1994, Sabhaypur, Ghaziabad road, 17.xii.1994, Okhla Reservoir, 18.xii.1994; Piggery farm nala, Uri enclave, 18.xii.1994, coll. A.Husain & party; Yamuna barrage, Wazirabad, 11.ii.1995, coll. J.P. Sati & party, flood plains of Yamuna river, coll. Brij Gopal.

Diagnostic characters : Shell ovately conoidal, thin, body whorl equal to spire; unbilicus narrow, aperture subcircular with black margin; olive green colour with dark spiral bands alternating broad and narrow.

Distribution : India; common throughout. Elsewhere : Bangladesh; Myanmar;, Sri Lanka.

Remarks : This species also occurs in the paddy fields, and is edible in West Bengal and N.E. India. A sinistral shell of this species, a rare occurrence, has been collected from a ditch at Damalgiri, Tura in Meghalaya State recently for the first time. There are eight forms recognised under the species *bengalenis* (Subba Rao, 1989).

form ***mandiensis*** (Kobelt)

1909. *Viviparus bengalensis* var. *mandiensis* Kobelt, *Nachr. Malak, Ges., 60* : 414 ; in Martini Chemnitz, *Conch. Cab. 2* : 414, pl. 77, figs. 8-9.
1989. *Belamya bengalensis* f. *mandiensis* : Subba Rao, in *Handbook Freshwater Mollusc of India* : 46. fig. 56.

Material examined : Delhi; total no. of exs. 8, NZP, 7.vi.1993, coll. V.Khanna; I.A.R.I. Campus, 19.ii.1995, coll. J.P. Sati and party.

Diagnostic characters : Similar to typical form but narrower, more conical in shape, umbilicus broader, dark bands well marked, alternating broad and narrow.

Distribution : India : Delhi, Bihar, Gujarat, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Uttar Pradesh, West Bengal.

2. *Bellamya dissimilis* (Mueller)
Common Pond snail

1774. *Nerita dissimilis* Mueller, *Hist. Verm. Test.*, **2** : 184.

1989. *Bellamya dissimilis* : Subba Rao, In *Handbook : Freshwater molluscs of India* : 48, figs. 64-67.

Material examined : Delhi; total no. of exs. 52, Bhalsawa, 26.x.1993, Swampy area near Wazirabad bridge, 28.x.1993, Bawana, 30.x.1993, coll. N.K. Sinha & party; Horse-shoe lake, Jahangir puri near Bhalsawa, 16.v.1994, Bhalsawa lake, Karnal Road, 15.xii.1994, Okhla Reservoir, 18.xii.1994, coll. A. Husain & party; Bhalsawa Lake, 11.ii.1995, Yamuna barrage, Wazirabad, 11.ii.1995, coll. J.P. Sati & party.

Diagnostic characters : Shell smaller than preceeding species, narrow, without dark bands, suture deeply impressed, body whorl slightly angled, with a pale spiral band in middle, apertural margin often black, sculptured with fine microscopic spiral striae.

Distribution : India : Common throughout. *Elsewhere* : Bangladesh; Malayasia; Myanmar; Pakistan; Sri Lanka.

Family : BITHYNIIDAE

Key to genera

Shell more elongate, outer lip thickened, umbilicus with oblique groove downwards; operculum thin, transparent, paucispiral ....*Digoniostoma*
Shell small subglobose, outerlip thin, umbilicus usually closed ; operculum thick, concentric .....*Gabbia* (*G. orcula*)

2. Genus *Digoniostoma* Annandale

Key to species

Columeller base not produced ; spire longer than body whorl..... *D. pulchella*
Columellar base prominently produced ; spire shorter than body whorl .....*D.cerameopoma*

3. *Digoniostoma cerameopoma* (Benson)

1830. *Paludina cerameopoma* Benson, *Gleanings in Science,* Calcutta, **2** : 125.

1989. *Dignonistoma cerameopoma* : Subba Rao, in *Handbook Freshwater Molluscs of India* : 79, fig. 121.

Material examined : Delhi; total no. of exs. 67, Bawana, 30.x.1993, coll. N.K. Sinha & pauty; Old fort lake near Pragati Maidan, Mathura Road, 10.v.1994, Horse-shoe lake Jahangir near Bhalsawa, 16.v.1994, Chhawla pul, Najafgarh, 20.xii.1994, coll. A.Husain & party; I.A.R.I. Campus, Pusa, 19.ii.1995, river Yamuna, coll. Brij Gopal.

Diagnostic characters : Shell oblong ovate, spire shorter than body, five whorls, rapidly increase in size, sculptured with fine spiral striae ; suture impressed ; umbilicus narrow, deep ; aperture oval and oblique ; operculum thick, subcentral nucleus.

Distribution : India : Delhi, Assam, Bihar, Madhya Pradesh, Meghalaya, Punjab, Rajasthan, West Bengal. *Elsewhere* : Pakistan.

Remarks : Commonly found in ponds and stagnant pools.

4. *Diagoniostoma pulchella* (Benson)

1836. *Paludina pulchella* Benson, *J. Asiat. Soc. Beng.*, **5** : 746.

1989. *Digoniostoma pulchella* : Subba Rao, in *Handbook : Freshwater Molluscs of India* : 80, figs. 113, 114, 119, 120.

Material examined : Delhi, total no. of exs. 5 ; Flood plains, river Yamuna, coll. Brij Gopal.

Diagnostic characters : Shell elongate, spire longer than body whorl ; suture depresed ; umbilicus almost closed ; aperture oval.

Distribution : India : Throughtout, including Andamans. *Elsewhere* : Myanmar; Malay Archipelago.

3. Genus *Gabbia* Tryon

5. *Gabbia orcula* (Frauenfeld)

1862. *Bithynia orcula* Frauenfeld, *Verhandl. Zool. Bot. Geschaft.* : 1154.

1989. *Gabbia orcula* : Subba Rao, in *Handbook Freshwater Mollusc of India* : 76.

Material examined : Delhi; total no. of exs. 177 ; Bawana, 30.x.1993, coll. N.K. Sinha & party; Horse-shoe lake, Bhalsawa, 16.v.1994, coll. A. Husain & party; Flood Plain, river Yamuna near Okhla, coll. Brij Gopal.

Diagnostic characters : Shell small, globose, smooth, whorls four, imperforate, sutures deep ; collumellar margin not much reflected.

Distribution : India : Delhi, Assam, Bihar, Maharashtra, Punjab, Rajasthan, Uttar

Pradesh, West Bengal.

Remarks : A few cercariae were recorded from this species (Sewell, 1922).

Family III : THIARIDAE

4. Genus ***Thiara*** Roeding

Subgenus ***Melanoides*** Oliver

6. ***Thiara (Melanoides) tuberculata*** (Mueller)

1774. *Nerita tuberculata* Mueller, *Hist. Verm. Terr. Fluv.* , **2** : 191.

1989. *Thiara (Melanoides) tuberculata* : Subba Rao, in *Handbook Freshwater Mollusc of India* : 103, figs. 183, 184.

Material examined : Delhi; total no. of exs. 152, NZP, 7.vi.1993, Dhaulakuan Ridge, Cantonment area, 10.vi.1993, coll. V.Khanna and party; Ridge area near Dhaulakuan, 23.x.1993, coll. N.K. Sinha & party, I.A.R.I. Campus, 9.v.1994, river Yamuna, Okhla down stream 10.v.1994, Horse-shoe lake, Bhalsawa, 16.v.1994, coll. A. Husain and party ; Bhalsawa lake, Karnal road, 15.xii.1994, coll. A.Husain & party; Piggery Farm near Dhaulakuan, 16.ii.1995, coll. J.P. Sati and party; Flood plains, river Yamuna, Okhla, coll. Brij Gopal.

Diagnostic characters : Shell narrow, elongated, thick, whorls rounded, distinct and raised vertical ribs and spiral striae on the surface of the shell giving appearance as tubercles, flanked with red brown lines and dots.

Distribution : India : Throughtout. *Elsewhere* : Africa; Australia; China; East Mediterranean countries, Malaysia; Malay Archipelago; Pacific Islands; south east Asia.

Remarks : Found in streams, rivers, stagnant ponds and brackish waters. Highly variable species, hence known under several names. Starmuehlner (1976) gave complete synonymies of this species.

Order : BASOMMATOPHORA

Family IV : LYMNAEIDAE

5. Genus ***Lymnaea*** Lamarck

Subgenus ***Pseudosuccinea*** Baker

Key to species

Spire comparatively shorter but more acuminate, outer lip widely expanded.....*L.acuminata*

Spire comparatively large, less acuminate, outer lip more or less straight not expanded .....*L.luteola*

7. *Lymnaea (Psudosuccinea) accuminata* f. *typica* Lamarck

1822. *Limnaea acuminata* Lamarck, *Hist. nat. Anim. sans. Vert.*, 6 (2) : 106.

1989. *Lymnaea (Psudosuccinea) acuminate* f. *typica* : Subba Rao, In *Handbook : Freshwater Molluscs of India* : 126, figs. 258, 259.

Material examined : Delhi; total no. of exs. 132 ; Bhalsawa, 16.x.1993, coll. N.K.Sinha & party; Pond near Yamuna barrage, Okhla, 10.v.1994, lake near Pragati maidan, Mathura Road, 10.iii.1994, Pond and vicinity, Indira Gandhi indoor Stadium complex, 11.v.1994, river Yamuna and vicinity, Wazirabad, 14.v.1994, Bhalsawa lake, Karnal Road, 15.xii.1994, Nala across Okhla reservoir, 18.xii.1994, Piggery farm, Uri enclave, 18.xii.1994, A.N. Jha Deer Park, Hauz Khas, 22.xii.1994, coll. A.Husain & party ; Yamuna barrage, Wazirabad, 11.ii.1995, Piggery farm near Dhaulakuan, 16.ii.1995, I.A.R.I. Campus, 19.ii.1995, col. J.P. Sati & party; Flood plains, river Yamuna near Okhla, coll. Brij Gopal.

Diagnostic characters : Shell thin, semi-transparent, ovate, body whorl large, outer lip very much expanded, convex in outline, spire acuminate, columella twisted.

Distribution : India : Throughout very common. *Elsewhere* : Bangladesh ; Myanmar ; Pakistan.

Remarks : This species is highly variable. Nature of spiral course of the shell, form of outer lip and a number of other negative characters are used in the specific diagnosis of the shell (Anandale & Rao, 1925). There are nine forms recognised under this species, of which three are recorded from Delhi in addition to the typical form. It occurs in permanent waterbodies with abundant vegetation. Good intermediate host for larval trematodes. 15 species of trematodes are recorded from *Lamminata typica* (Subba Rao, 1989).

form *chlamys* Benson

1836. *Limnaea chlamya* Benson, *J.Asiat. Soc. Beng., 5* : 44.

1836. *Lymnaea (Pseudosuccinea) acuminata* f. *chlamys* : Subba Rao, In *Handbook Freshwater Molluscs of India* : 127.

Material examined : Delhi, total no. of exs. 6, Pond near Yamuna barrage, Okhla, 10.v.1994, Yamuna reservoir, Ramghat, 17.xii.1994, coll. A. Husain and party.

Diagnostic characters - Similar to typical form but spire slightly larger than preceeding one, columella more twisted. Colour golden yellow.

Distribution : India : Widely distributed throughout. *Elsewhere* : Bangaldesh ; Myanmar.

form *gracilior* Martens

1881. *Limnaea acuminata* var. *gracilior* Martens, *Conch. Mittheil*, 1 : 77.

1989. *Lymnaea (Psudosuccinea) acuminata* f. *gracilior* : Subba Rao, in *Handbook Freshwater Molluscs of India* : 127, figs. 262, 265.

Material examined : Delhi; total no. of exs 3, Okhla dam, 15.v.1994, coll. A. Husain & party.

Diagnostic characters : Shell thin, linear, body whorl large, with long narrow spire, colour greyish to pinkish-yellow.

form ***rufescens*** Gray

1820. *Limnea rufescens* Gray, in Sowerby's *Genera Rec. Foss. Shells*, **1**, pl. 178, fig. 2.

1989. *Lymnaea (Psudosuccinea) acuminata* f. *rufescens* : Subba Rao, In *Handbook : Freshwater Molluscs of India* : 127, figs. 254, 255.

Material examined : Delhi; Dhaulakuan Ridge, Cantonment area, 10.vi.1993, coll. V.Khanna and party; Swampy area near Wazirabad bridge, 28.x.1993, coll. N.K. Sinha & party; Pond by the side of Yamuna barrage, Okhla, 10.v.1994, river Yamuna & vicinity Barrage, Okhla-Noida Rd., 10.v.1994, Pond and vicnity, Indira Gandhi indoor stadium complex, 11.v.1994, coll. A Husain & party.

Diagnostic characters : Shell thin, narrower than typical form, spire large; aperture shorter, uniformly less expanded, reddish in colour.

Distribution : India : Widely distributed. *Elsewhere* : Bangladesh; Myanmar; Pakistan.

8. ***Lymnaea (Psudosuccinea) luteola f. typica*** Lamarck

1822. *Limnaea luteola* Lamarck, *Hist. nat. Anim. Sans. ert.*, **6** (2) : 160.

1989. *Lymnaea (Pseudosuccinea) luteola* f. *typica* : Subba Rao, in *Handbook Freshwater Molluscs of India* : 129, figs. 275-276.

Material examined : Delhi; Total no. of exs. 128 ; Around a pond, Saraswati Vihar, 6.ix.1993, coll. V. Khanna and party ; Swampy area near Wazirabad bridge, 28.x.1993, Lake garden, Shakur basti, 30.x.1993, coll. N.K. Sinha & party; Pond by the side Yamuna barrage, Okhla, 10.v.1994, Park and lake, Dhaulakuan, 12.v.1994, river Yamuna, Vikas Marg, 13.v.1994, coll. A. Husain & party ; Gopalpur nala near Wazirabad bridge, 8.ix.1994, I.A.R.I. Campus, 19.ii.1995, coll. J.P. Sati & party.

Diagnostic characters : Shell thin, ovate, body whorl less inflated, spire not acuminate, aperture narrow, ovate.

Distribution : India : Common throughout. *Elsewhere* : Bangladesh; Myanmar; Nepal; Pakistan.

Remarks : This species often occurs in temporary water bodies, during unfavourable season and bury itself in the mud. It is an intermediate host of some parasites of cattles ; also considered as a pest of paddy and *Azole* in West Bengal (Subba Rao, 1989).

form ***australis*** Annandale & Rao

1925. *Limnaea (Pseudosuccinea) luteola* f. *australis* Annandale & Rao, *Rec. Indian Mus.*, **27** : 184.

1989. *Lymnaea (Psudoscuccinea) luteola* f. *australis* : Subba Rao, in *Handbook Freshwater Molluscs of India* : 129.

1992. *Lymnaea (Psudosuccinea) luteola* f. *australis* : Mitra & Dey. (Part 1), *Fauna of West Bengal,* (Mollusca), *State Fauna Series*, **3** (9) : 24.

Material examined : Delhi; total no. of exs. 61; IARI campus, 24.x.1993, Bawana, 30.x.1993, coll. N.K. Sinha & party; Yamuna and vicinity, temporary bridge, 14.v.1994, Horse-shoe lake, Bhalsawa, 16.v.1994, coll. A. Husain & party; Bhalsawa lake, Karnal Road, 15.xii.1994, Pond Nagli Sakrooti near Sai Dham, 20.xii.1994, Chhawla Pul, 20.xii.1994, coll. A. Husain & party.

Diagnostic characters : Shell smaller than typical form, spire comparatively longer, body whorl rounded ; suture shallow.

Distribution : India : Common throughout. *Elsewhere* : Bangladesh; Myanmar; Pakistan Sri Lanka.

form ***impura*** Troschel

1873. *Limnaeus impurus* Troschel, *Arch. Naturgesh.*, **3** : 172.

1989. *Lymnaea (Pseudosuccinea) luteola* f. *impura* : Subba Rao, in *Handbook Freshwater Molluscs of India* : 128.

Material examined : Delhi; total no. of exs. 34; Masudabad near 38 kms. from IARI, Najafgarh, 5.vi.1993, coll. V.Khanna & party; Najafgarh, 27.x.1993, coll. N.K. Sinha & party ; Yamuna and vicinity temporary bridge, 14.v.1994 ; Okhla dam, 15.v.1994 ; Pond Nagoli Sakraoti near Sai Dham, 20.xii.1994, coll. A. Husain & party; Okhla reservoir and surroundings, 14.ii.1995; Piggery farm near Dhaulakuan, 16.ii.1995, coll. J.P. Sati & party.

Diagnostic characters : This species is similar to preceeding form but differs in being larger in size and spire being more conical.

Distribution : India : Delhi, River Ganga. *Elsewhere* : Myanmar.

form ***ovalis*** Gray

1820. *Limnaea (Limnaea) ovalis* Gray in Sowerby : *Genera Rec. Foss. Shells,* **1** : pl. 178.

1989. *Lymnaea (Psudosuccinea) luteola* f. *ovalis* : Subba Rao, in *Handbook Freshwater Molluscs of India* : 129.

Material examined : Delhi; total no. of exs 98, Park and lake, Dhaulakuan, 12.v.1994, coll. A. Husain & party; Yamuna barrage, Wazirabad, 11.ii.1994, coll. A. Husain & party; Jheel park, Ranibag, 18.ii.1995, coll. J.P. Sati & party.

Diagnostic characters : Shell thin, glossy, larger, body whorl much inflated, with oval aperture, spire very short and acuminate.

Distribution : India : common throughout. *Elsewhere* : Myanmar, Sri Lanka.

Family : PLANORBIDAE
Subfamily : BULININAE
6. Genus ***Indoplanorbis*** Annandale & Prasad

9. ***Indoplanorbis exustus*** (Deshayes)

1834. *Planorbis exustus* Deshayes, in Belanger, *Voy. Indes-Orientales,* : 417.
1989. *Indoplanorbis exustus* : Subba Rao, in *Handbook Freshwater Molluscs of India* : 142.

Material examined : Delhi; Total no. of exs. 188 ; Masudabad, Najafgarh, 5.vi.1993, coll. V. Khanna & party; Bhalsawa, 26.x.1993, Najafgarh, 27.x.1993, Swampy area near Wazirabad bridge, 28.x.1993, Bawana, 30.x.1993, Lake garden, Shakur basti, 31.x.1993, coll. N.K. Sinha & party; Pond by the side of Yamuna barrage, Okhla, 10.v.1994, river Yamuna down stream, 10.v.1994, Park & lake, Dhaulakuan, 12.v.1994, Pond by the side of river Yamuna, Vikas Marg, 13.v.1994, Okhla Dam, 15.v.1994, coll. A. Husain & party; Gopalpur nala near Wazirabad, 8.xi.1994, Okhla Reservoir, 18.xii.1994, Pond Nagli Sakrooti near Sai dham, 20.xii.1994, Chhawla Pul, 20.xii.1994, Majnu Ka tila near Wazirabad, 15.xii.1995, Okhla barrage and surroundings, 14.ii.1995, Jheel park, Ranibag, 18.ii.1995, coll. J.P. Sati & party; Flood Plain, river Yamuna near Okhla, coll. Brij Gopal.

Diagnostic characters : Shell large, thick, discoidal, sinistral, rounded at periphery, aperture ear-shaped.

Distribution : India : Widely distributed. *Elsewhere* : Bangladesh; China, Iran; Indo-china ; Java ; Malay Peninsula & Archipelago ; Myanmar ; Pakistan ; Sri Lanka ; Tibet.

Remarks : It is a monotypic species. Largest number of cercariae are recorded from this intermediate host (Subba Rao, 1989).

Subfamily : PLANORBINAE
7. Genus ***Gyraulus*** Charpentier

10. ***Gyraulus convexiusculus*** (Hutton)

1849. *Planorbis convexiusculus* Hutton, *J. Asiat. Soc. Beng.*, **18** (2) : 657.
1989. *Gyraulus convexiusculus* : Subba Rao, in *Handbook Freshwater Molluscs of India* : 154.

Material examined : Delhi; Total exs. 91 ; Bawana, 30.x.1993, coll. N.K. Sinha & party; Old fort near Pragati maidan, Mathura Road, 10.v.1995, Pond by the side of Yamuna barrage, Okhla, 10.v.1994, coll. A. Husain & party; Yamuna barrage, Wazirabad, 11.ii.1995, coll. J.P. Sati & party ; Flood plains of river Yamuna, near Okhla, coll. Brij Gopal.

Diagnostic characters : Shell small discoidal, not more than 5 mm in diameter, depressed, umbilicus wide, transparent, periphery subangulate, closely and obliquely striatulate,

aperture ovate, lunate.

Distribution : India : Common throughtout. *Elsewhere* : Iran to Philippines; Japan.

11. ***Gyraulus euphraticus*** (Mousson)

1874. *Planorbis euphraticus* Mousson, *J. Conchyl.*, **22** : 44.

1989. *Gyraulus euphraticus* : Subba Rao, in *Handbook Freshwater Molluscs of India* : 155.

Material examined : Delhi; total no. of exs. 113 ; Yamuna river, near Okhla, coll. Brij Gopal.

Diagnostic characters : Shell resembles *G. convexusculus*, but differs in more compressed body, strongly carinate, more opaque, sculptured coarsely and irregularly, body whorl deviates from spiral whorls.

Distribution : India : Salt Range, Punjab. *Elsewhere* : Afghanistan ; Baluchistan.

Remarks : A Palaearctic species.

8. Genus ***Segmentina*** Fleming
Subgenus ***Polypylis*** Pilsbry

12. ***Segmentina (Polypylis) calatha*** (Benson)

1850. *Planorbis calathus* Benson, *Ann. Mag. nat. Hist.*, (2) **5** : 348.

1989. *Segmentina (Polypylis) calatha* : Subba Rao, in *Handbook Freshwater Molluscs of India* : 150.

Material examined : Delhi; total no. examples 69 ; Flood plains of Yamuna near Okhla, coll. Brij Gopal.

Diagnostic characters : Shell small, glossy, thin, four whorls, body whorl angular, sutures impressed, aperture subtriangular, parietal laminae obliquely transferse, lamellae wide space.

Distribution : India : Assam, Bihar, Kashmir, Manipur, Uttar Pradesh, West Bengal, widely distributed in northern India. *Elsewhere* : Myanmar ; Sri Lanka.

Remarks : The only collections made at river Yamuna near Okhla, Delhi.

Family VI : PHYSIDAE
9. Genus ***Physa*** Draparnaud

13. ***Physa acuta*** Draparnaud

1805. *Physa acuta* Draparnaud, *Histoire naturelle des mollusques terrestres et fluviatiles de la France, Paris* : 55.

1980. Physa acuta : Brown, *Freshwater snails of Africa and their Medical importance* : 212.

Material examined : Delhi; total no. of exs. 378 : river Yamuna near Silampur, Ghaziabad Road, 13.v.1994; river Yamuna, Vikas Marg, 13.v.1994; Yamuna and vicinity, temporary bridge, 14.v.1994, river Yamuna and vicinity, NH No. 1, 14.v.1994, Humayun Tomb Complex, 15.v.1994, Okhla Dam, 15.v.1993, river Yamuna and vicinity, Yudhishtra bridge, ISBT, 16.v.1994, coll. A. Husain & party; Okhla bridge, 10.xi.1994, coll. J.P. Sati & party, Yamuna river reservoir, Ramghat, 17.xii.1994, coll. A. Husain & party, NZP, 10.ii.1995, coll. J.P. Sati & party; Okhla reservoir and surroundings, 14.ii.1995, I.A.R.I. campus, 18.ii.1995, coll. J.P. Sati & party.

Diagnostic characters : Shell moderate size, transparent but thick, ovate, body whorl large and round with ovate aperture, sinistral : spire raised with oblique sutures.

Distribution : India : Mahatrashtra. *Elsewhere* : North America, introduced in Europe, Africa and S.E. Asia (Pakistan).

Remarks : The species prefers polluted water, found to occur commonly in irrigation channels, dams and streams in or near towns and may be well adapted to undergo anhydrobiosis (Brown, 1940). Though this species has only very recently been recorded from India (Pune, Maharashtra) by Subba Rao *et al.*, (1994), the large number of examples collected suggest its abundant occurence in river Yamuna at Delhi.

Class : BIVALVIA
Order : UNIONOIDA
Family : UNIONIDAE
Subfamily : UNIONINAE
10. Genus ***Lamellidens*** Simpson

14. ***Lamellidens marginalis*** (Lamarck)

1819. *Unio marginalis* Lamarck, *Hist. nat. Anim. Sanks. Vert.*, **4** : 79.
1989. *Lamellidens marginalis* : Subba Rao, in *Handbook Freshwater Molluscs of India* : 168.

Material examined : Delhi; total no. of exs. 5. river Yamuna, Okhla down stream, 10.v.1994, coll. A. Husain & party.

Diagnostic characters : Shell ablong ovate, valves covered with periostracum of blackish brown with light brown border along ventral margin, umbo not elevated, posterior side broad, roundedly angular, margin produced, narrow wing, dorsal margin slightly curved, central margin slightly contracted in middle, hinge with two cardinals in right valve, interior nacreous.

Distribution : India : Common throughout. *Elsehwere* : Bangaldesh; Myanmar; Sri Lanka.

Remarks : This species is edible in Bihar, especially in south Bihar and sold in the markets of Singhbhum, Ranchi, Hazaribagh and Palamau and also in adjacent districts of West Bengal along with *Bellamya bengalensis*. Incidences of pearl production have been recorded in this species (especially in West Bengal). Technique has been developed to culture pearls from this

freshwater mussel. Due to their nacreouis nature, shells are used for making ornaments.

Family : AMBLEMIDAE

Subfamily : PARREYSIINAE

11. Genus ***Parreysia*** Conrad

Key to species

Shell thick, beak strongly sculptured, ventral margin swollen in middle upper part of shell not sculptured ....*P. favidens*

Shell thick, beak noit strongly sculptured, ventral margin entire. Upper part of shell with divaricate ridges .....*P. caerulea*

Subgenus ***Parreysia*** s.str.

15. ***Parreysia (Parreysia) favidens*** (Benson)

1862. *Unio favidens*, Benson, *Ann. Mag. nat. Hist.*, (3) **10** : 188.

1989. *Parreysia favidens* : Subba Rao, in *Handbook Freshwater Molluscs of India* : 180.

Material examined : Delhi; 19 exs. and 5 valves, river Yamuna, Okhla down stream, 10.v.1994, coll. A. Husain & party.

Diagnostic characters : Shell thick & heavy, inflated, with strong zig-zag ribs on beak, unequilateral and angulate both on anterior and posterior margins, cardinal teeth strong and broad.

Distribution : India : Common throughout. *Elsewhere* : Bangladesh; Pakistan.

Remarks : The shells of this species are used in manufacturing buttons in the north Bihar especially at Mehsi in Champaran district. Large quantities of specimens this species are being collected from the river Ganga and its t. 'butaries (Subba Rao & Dey, 1989).

Subgenus ***Radiatula*** Simpson

16. ***Parreysia (Radiatula) caerulea*** (Lea)

1831. *Unio caerulea* Lea, *Trans. Amer. Phil. Soc.*, **4** : 95.

1989. *Parreysia (Radiatula) caerulea* : Subba Rao, in *Handbook Freshwater Mollusc of India* : 188.

Material examined : Delhi; total no. of exs. 16 ; Dhaulakuan Ridge, Cantonment area, 10.vi.1993, coll. V.Khanna & party; Ridge area near Dhaulakuan, 23.x.1993, coll. N.K.Sinha & party, Najafgarh, 27.x.1993, coll. N.K. Sinha & party; river Yamuna, Okhla down stream, 10.v.1994, Piggery farm, Uri Enclave, 18.xii.1994, coll. A. Husain & party.

Diagnostic characters : Shell comparatively thin, elongated than the preceeding species,

ventral margin more or less straight, beak not strongly sculptured, highly variable in shape and structure, posterior umbonal carina very distinct, in young shells the whole umbonal region is sculptured with zic zac ribs.

Distribution : India : Common throughout. *Elsewhere* : Bangaldesh ; Myanmar ; Nepal ; Pakistan.

Remarks : Specimen studied are not so much elongated like typical *P. (R.) caerulea*, umbonal carina is also not distinct. It is edible especially in Mizoram and Arunanchal Pradesh ; also used in cottage industries for manufacturing of buttons, poultry feed and mosaic tiles especially from Mehsi to north Bihar.

Order : VENEROIDA
Family VII : CORBICULIDAE
12. Genus ***Corbicula*** Megerle von Muehlfeld

17. ***Crobicula striatella*** Deshayes

1854. *Corbicula striatella* Deshayes, *Proc. zool. Soc.* London, **22** : 334.
1989. *Corbicula striatella* : Subba Rao, in *Handbook Freshwater Molluscs of India* : 204.

Material examined : Delhi; river Yamuna, Okhla down stream, 10.v.1994, river Yamuna, Vikas Marg, 13.v.1994, Okhla dam, 15.v.1994, Majnu-ka-tila near Wazirabad, 15.xii.1994, Okhla reservoir, 18.xii.1994, coll. A. Husain & party.

Diagnostic characters : Shell small, thick, subtrigonal with regular concentric striae raised into ridges, umbo prominent, younger ones yellow in colour, while adults are dark brown, interior violet in colour ; pallial line entire slightly sinuate, muscele scars deeply developed.

Distribution : India : Common throughtout. Elsewhere : Myanmar ; Pakistan.

Remarks : Most common species of the genus found in the streams and river beds.

B. Land Molluscs

Key to families

1. Animal naked, without external shell. ....Veronicellidae
   Animal with external shell 2
2. Shell imperforate, higher than broad 3
   Shell perforate ; broader than high .....Ariophantidae
3. Shell elongately turrited, spine longer than body whorl .....Subulinidae
   Shell oval or ovately conical, spire shorter than body whorl .....Succineidae

Order : STYLOMMATOPHORA
Family IX : SUCCINEIDAE

13. Genus ***Succinea*** Draparnaud

18. ***Succinea elegantior*** Annandale

1921. *Succinea elegantior* Annandale, *Rec. Indian Mus.*, **22** : 593.

Material examined : Delhi; Total no. of examples 4; vicinity of river Yamuna at Okhla, coll. Brij Gopal.

Diagnostic characters : Shell thin, narrowly ovate, sculptured with strong curved striae, spire short, whorls three, rounded, aperture ovate, pointed above, rounded below, peristome simple, acute, columella near straight, slightly folded and ridged above.

Distribution : India : This species hitherto recorded from Manipur, reported for the first time from any other part of India.

Remarks : An amphibious mollusc prefers damp places near water bodies.

Family X : SUBULINIDAE

14. Genus ***Allopeas*** Baker

19. ***Allopeas gracile*** (Hutton)

Garden Snail

1834. *Bulimus* (mihi) *graciles* Hutton, *J. Asiat. Soc. Beng.*, **3** : 93.

1914. *Opeas gracile* : Gude, *Fauna of Brit. India Mollusca*, **2** : 355.

1993. *Allopeas gracile* : Naggs, *Bull. zool. Nomenclature*, **50** (3) : 228.

Material examined : Delhi; total no. of exs. 17, IARI Complex, 24.x.1993, Bawana, 30.x.1993, coll. N.K. Sinha & party; Majnu Ka tila at Yamuna river near Ring Road, 8.xi.1994, Dhaulakuan forest ridge, 9.x.1994, Mangal Mahadev near IGI Airport, 9.x.1994, I.A.R.I. Campus, 11.x.1994, coll. J.P. Sati & party; Humayun Tomb, 14.xii.1994, Asola WLS, 21.xii.1994, coll. A. Husain & party; Asola WLS, 12.ii.1995, coll. J.P. Sati & Party.

Diagnostic characters : Shell small, narrow, thin, turreted, yellowish, with a number of flat whorls, aperture ovate.

Distribution : India : Common throughout. *Elsewhere* : Bangladesh ; China ; East Africa ; Japan ; Malay Peninsula and Archipelago ; Myanmar ; Pakistan ; Philippines ; Polynesia; Sri Lanka.

15. Genus ***Zootecus*** Westerlund

20. ***Zootecus pullus*** Gray

1834. *Bulimus pullus* Gray, *Proc. zool. Soc.* : 66.

1914. *Zootecus pullus* : Gude, *Fauna Brit. India, Mollusca*, **2** : 371.

Material examined : Delhi; total no. of exs. 445, IARI Campus, 24.x.1993, coll. N.K.

Sinha & party; river Yamuna and vicinity, Nizamuddin bridge, 11.v.1994, Humayun Tomb complex, 15.v.1994, coll. A. Husain & party; rock climbing area, Ladu Sarai on Mehrauli Road, 7.ix.1994, Majnu Ka tila at Yamuna river near ring Road, 8.ix.1994, Mangal Mahadev near IGIA, 9.ix.1994, Opposite Runway, Palam Airport, 9.ix.1994, Asola wildlife sanctuary, 12.ix.1994, Tuglaqabad forest nursery near Air force station, 12.ix.1994, Priya Park/District Park Munirka, Vasant vihar, 13.ix.1994, coll. J.P. Sati & party; Humayun Tomb, 14.xii.1994, coll. A. Husain & party; Pond Nagli Sakraoti near Saidham, 20.xii.1994, Chhawla pul, 20.xii.1994, Qutab Minar complex, 21.xii.1994, Safdarjung Tomb comlex, Aurobinda Marg, 21.xii.1994, Asola Wildlife sanctuary, 21.xii.1994, south campus, Delhi University, 23.xii.1994, coll. A. Husain & party; NZP, 10.ii.1995, Tuglaqabad park, 12.ii.1995, Asola Wildlife sanctuary, 12.ii.1995; Lodhi garden, 13.ii.1995, Buddha Jayanti Park, 15.ii.1995, Jahanpanha Private forest, 15.ii.1995, Piggery farm near Dhaulakuan, 16.ii.1995, Kamla Nehru Ridge, 17.ii.1995, coll. J.P. Sati & party.

Diagnostic characters : Shell thick, cylindriform, tapering suddenly to obtuse apex, opaque, polished, aperture subquadrate with thick subreflected margins.

Distribution : India : Delhi (earlier recorded by Gude, 1914), Gujarat, Rajasthan, Tamil Nadu, Uttar Pradesh (bank of river Ganga). *Elsewhere* : Myanmar.

Family : ARIOPHANTIDAE

16. Genus *Macrochlamys* Gray

Key to species

Shell proportionately more broad ; excavated around umbilicus ; spire low.....*M.petrosa*
Shell proportionately less broad not excavated around umbilicus ; spire raised.....*M.indica*

21. *Macrochlamys indica* Godwin-Austen

1883. *Macrochlamys indica* Godwin-Austen, *Land and Freshwater Molluscs of India, 1* : 97.

1992. *Macrochalmys indica* : Mitra *et al. Fauna of West Bengal, Mollusca* (Land and Freshwater pt. 1) *State Fauna Ser.*, **3** (2) : 146.

Material examined : Delhi; total no. of exs. : 92, Dhaulakuan Ridge, 4.vi.1993, coll. V. Khanna & party; Kakraula nursery, Najafgarh road, 27.x.1993, coll. N.K. Sinha & party; Gurjar ghat at Yamuna bridge, Wazirabad, 8.xi.1994, Municipal nursery, Punjabi bagh, 14.xi.1994, Vasant Vihar, 13.xi.1994, Kamala Nehru Ridge area, Rajpur Road, 14.xi.1994, coll. J.P. Sati & party ; Farmers hostel campus, IARI, 16.xii.1994, Piggery farm nala Uri enclave, 18.xii.1994, A.N. Jha Deer park, Hauz Khas, 22.xii.1994, Jahanpanah park, Chirag Dilli, 22.xii.1994, south campus, Delhi University, 23.xii.1994, coll. A.Husain & party ; NZP, 10.ii.1995, Humayun's tomb, 14.ii.1995, Kamla Nehru Ridge, 17.xii.1995, IARI Campus, 19.ii.1995, coll. J.P. Sati & party.

Diagnostic characters : Shell thick, conoidally depressed, with spire little raised, perforate, sutures impressed ; whorls 5-6 convex, last whorl much wider, rounded, aperture slightly oblique, columella reflected.

Distribution : India : common throughout except Northwest region, Andamans. *Elsewehre* : Bangladesh.

Remarks : Commonest species in the genus, widely distributed.

22. *Macrochlamys petrosa* (Hutton)

1834. *Helix ? petrosa* Hutton, *J. Asiat. Soc. Beng.*, **3** : 96.

1995. *Macrochlamys petrosa* : Subba Rao, *et al. Fauna of Meghalaya, Mollusca, State Fauna Series*, **4** (8) : 76.

Material examined : Delhi; total no. of exs. 24; IARI Campus, 2.vi.1993, coll. V. Khanna & party; Safdarjang tomb complex, Aurobinda Marg, 21.ii.1994, coll. A. Husain & party ; Lake garden, Dhaulakuan, 16.ii.1995, Piggery farm near Dhaulakuan, 16.ii.1995, coll. J.P. Sati & party.

Diagnostic characters : Shell like that of *M. indica* but broader and more depressed,whorls faintly striated or not, umbilicus broader with excavated umbilical region.

Distribution : India : Delhi, Assam, Bihar, Himachal Pradesh, Maharashtra, Meghalya, Sikkim, Uttar Pradesh, West Bengal.

Order : SOLEOLIFERA
Family XII : VERONICELLIDAE
17. Genus *Laevicaulis* Simroth

23. *Laevicaulis altae* (Ferussac)

1821. *Vaginulus alte* Ferussac, *Tabl. Syst. Limaces.*, : 14.

1995. *Laevicaulis alte* : Subba Rao, *et al. Fauna of Meghalaya, Mollusca, State Fauna Series*, **4**(8) : 48.

Material examined : Delhi; total no. of exs. 85; Kakraula nursery, Najafgarh Road, 5.vi.1993, Lalbag, Model town, 8.vi.1993, coll. V.Khanna & party; Kakraula nursery, Najafgarh Road, 27.x.1993, coll. N.K. Sinha & party; A.N. Jha Deer Park, Hauz Khas, 22.ii.1994, coll. A. Husain & party; IARI Campus, 11.ix.1994, Delhi Municipality nursery, Punjabi Bagh, 14.ix.1994, Kamala Nehru ridge area, Rajpur Road, Lodhi Garden near Delhi, 15.ix.1994, coll. J.P. Sati & party; Farmer's Hostel, IARI campus, 16.xii.1994, Qutab Minar, 21.xii.1994, coll. A. Husain & party; NZP, 10.ii.1995, Yamuna barrage, Wazirabad, 11.ii.1995, Tuglaqabad park, 12.ii.1995, Lodhi garden, 13.ii.1995, coll. J.P. Sati & party.

Diagnostic characters : Animal naked, without shell, elongate, dorsally ovate, ventrally flattened, dorsal part dark brown with yellow longitudinal band in middle, ventral side white, two

pairs of tentacles, upper one longer, cylindrical, lower pair short : posterior broad and rounded.

Distribution : India : Delhi, Andamans, Andhra Pradesh, Bihar, Gujarat, Maharashtra, Meghalaya, Orissa, Pondicherry, Rajasthan, Tamil Nadu, West Bengal. *Elsewhere* : Australia ; China ; East Africa ; Hong Kong : Indonesia ; Madagascar ; Malay Peninsula and Archipelago ; Mauritius ; New Caledonia and Lyatty Island ; Sri Lanka.

Remarks : The most common species of tropical land slug, nocturnal in habit and voracious feeder on garden plants. Both self and cross fertilization occur in this hermaphrodite slug ; lays more than a hundred eggs at a time.

The wide distribution of this species is artificial and may be due to accidental transport (Mitra & Dey, 1992).

GENERAL REMARKS

A total of 23 species with 7 forms under 17 genera and 13 families of molluscs are recorded from Delhi. Out of these 17 species with 7 forms under 12 genera and 9 families are of freshwater habitat and 6 species under 5 genera and 4 families are of terrestrial habitat.

Among freshwater molluscs many are common throughout India in their distribution, except *Segmentina calatha, Gyraulus euphraticus* and *Physa acuta*. The former two species are recorded from eastern India and Salt range in Punjab respectively, whereas the last mentioned species is reported only for the second time from Indian subcontinent. Subba Rao *et al.* (1994) reported it from a river near Pimpri and a pond at Manjri near Pune in Maharashtra.

It is interesting to note that the common molluscs, *Pila globosa* is absent from the present studies. It occurs in ponds, tanks and even in the paddy fields and recorded from many parts of India, other than Punjab and Himachal Pradesh (Subba Rao, 1989).

The ambphibious snail, *Succinea elegantior*, so far recorded from Loktak lake in Manipur is reported for the first time from the banks of the river Yamuna, thus extending its westwards distribution. Rest of the snails are widely distributed but not so far reported from Delhi, except *Zootecus pullus*.

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REFERENCES

Anandale, N. and Rao, H.S. 1925. Materials for a revision of recent Indian Limnaeidae (Mollusca : Pulmonata). *Rec. Indian Mus.*, **27** : 137-189.

Blandford, W.T. and Godwin-Austen, H.H. 1908. *The Fauna of British India inlucding Ceylon and Burma*, Mollusca (Testacellidae and Zonitidae). London, Taylor and Francis : XXXIII + 311 pp., 90 text figs.

Brown, David S. 1980. *Freshwater snails of Africa and their medical importance*. London, Taylor and Francis : X + 487 pp., 150 text figs.

Gude, G.K. 1914. *The Fauna of British India including Ceylon and Burma.* Mollusca Pt. II (Trochomorphidae and Janellidae). London, Taylor and Francis : XII + 520 pp. 164 text figs.

Gude, G.K. 1921. *The Fauna of British India including Ceylon and Burma,* Mollusca pt. III. Land operculates. London, Taylor and Francis : XIV + 386 pp., 42 text figs.

*Menon, C. Lakshmi. 1990. Ecology and benthic fauna in the Flood Plain of river Yamuna affected by sewage pollution. Ph.D. Thesis, Jawaharlal Nehru Univ., New Delhi, India : 131 pp., illustr.

Mitra, S.C. and Dey, A. 1992, Land and Freshwater Molluscs Pt. 1, in *Fauna of West Bengal, State Fauna Ser., Zool. Surv. India,* **3** (9) : 52 pp.

Preston, H.B. 1915, *The Fauna of British India including Ceylon and Burma,* Mollusca (Freshwater Gastropoda and Pelecypoda). London, Taylor and Francis : XIX + 244 pp., 29 text figs.

Sewell, R.B.S. 1922. Cercariae Indicae. *Indian J. Med. Res.*, Calcutta, **10** : III + 370 pp.

Subba Rao, N.V. 1989. Handbook : Freshwater molluscs of India, *Zool. Surv. India* : XIII + 289 pp., 636 figs.

Subba Rao, N.V. 1991, Mollusca, in *Animal Resources of India : State of Art, Zool. Surv. India* : 125-147.

Subba Rao, N.V. Dey, A. 1989. Freshwater molluscs in *Handbook Freshwater Molluscs of India. Zool. Surv. India* : 225-232.

Subba Rao, N.V. Dey, A. and Barua, S. 1992, Estuarine and marine molluscs. *Fauna of West Bengal, State Fauna Ser. Zool. Surv. India*, **3** (9) : 129-268, 30 pls.

Subba Rao, N.V. Mitra, S.C. and Manna, R.N. 1989a. Mollusca (Freshwater) in Fauna of *Orissa, State Fauna Ser. Zool. Surv. India*, **1** (2) : 277-318, 17 figs.

Subba Rao, N.V. Mitra, S.C., Dey, A. and Maitra, S. 1995. Mollusca in *Fauna of Meghalaya, State Fauna Ser. Zool. Surv. India*, **4** (8) : 88 pp.,26 pls.

Subba Rao, N.V., Mitra, S.C., Parashar, B.D., Gupta G.P. and Rao, K.M. 1994. New record of two Pulmonate freshwater gastropods in India, with a description of a new species, *Bulinus indicus, J. Bombay nat. Hist. Soc.*, **91** (1) : 123-126, 6 figs.

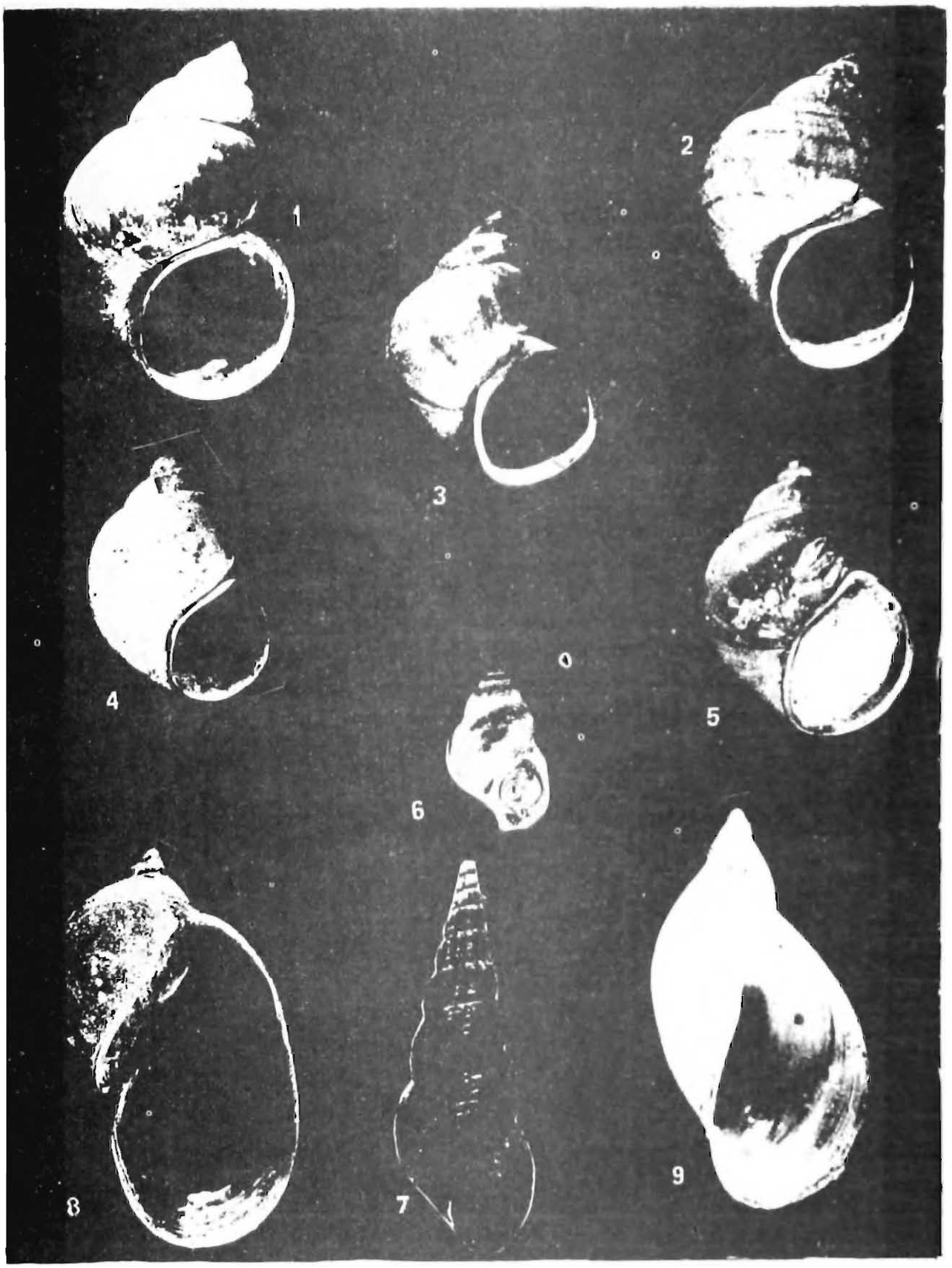
Subba Rao, N.V. Surya Rao, K.V. and Mitra, S. 1991. Marine Molluscs. *Fauna of Orissa, State Fauna ser. Zool. Surv. India*, **1** (3) : 175 pp., 30 pls.

Subba Rao, N.V. Thakur, D.K., and Mitra, S.C. 1989b, Mollusca (Terrestrial) in *Fauna of Orissa, State Fauna ser. Zool. Surv. India*, **1** (2) : 253-275, 6 figs.

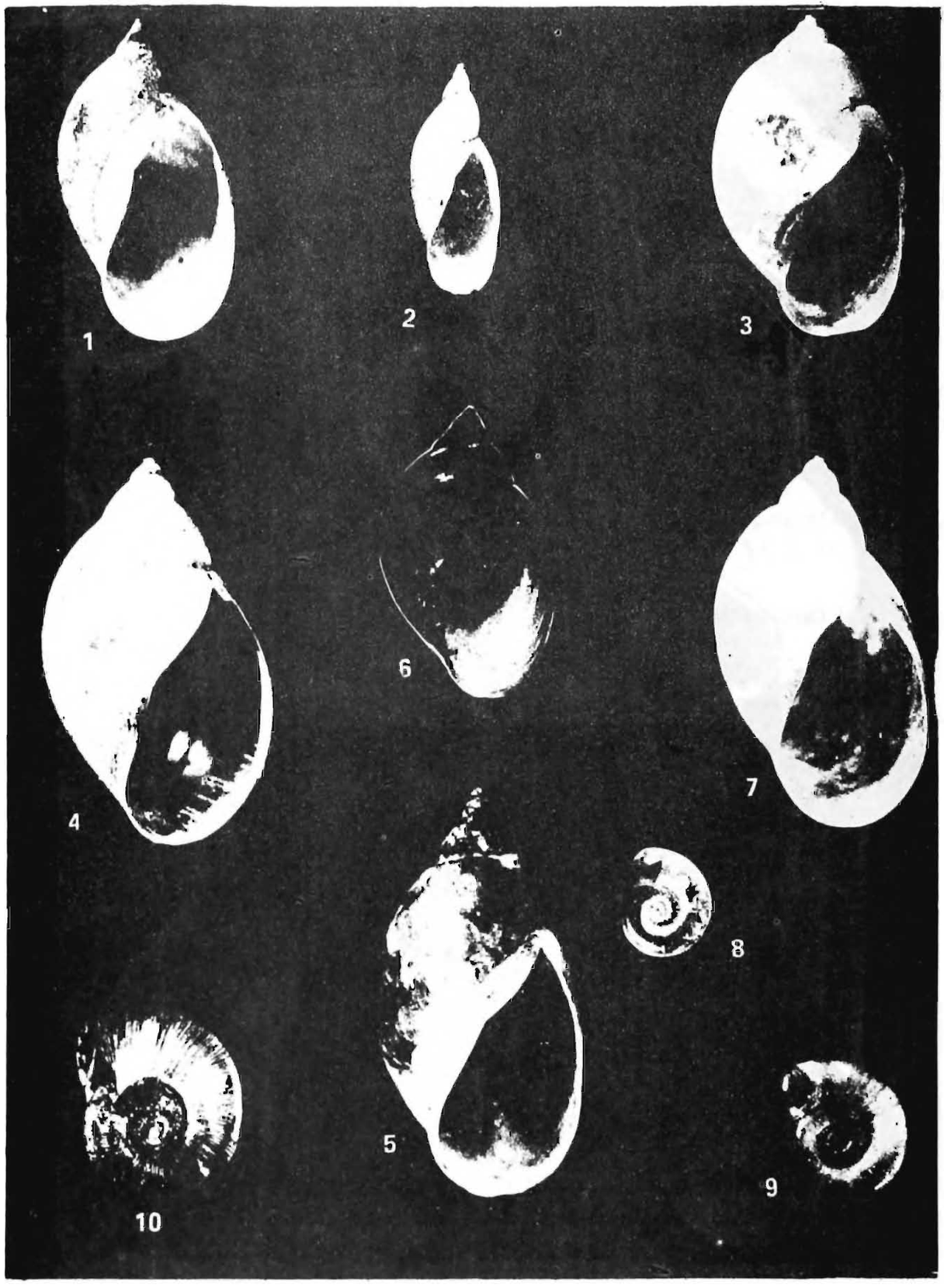
Surya Rao, K.V. and Subba Rao, N.V. 1991. Mollusca in *Fauna of Lakshadweep, State Fauna ser. Zool. Surv. India*, **2** : 273-362, 3 pls.

Thakur, D.K., Mitra, S.C. and Maitra, S. 1992. Land and Freshwater molluscs Pt. II. *Fauna of West Bengal, State Fauna ser.*, **3** (9) 53-127.

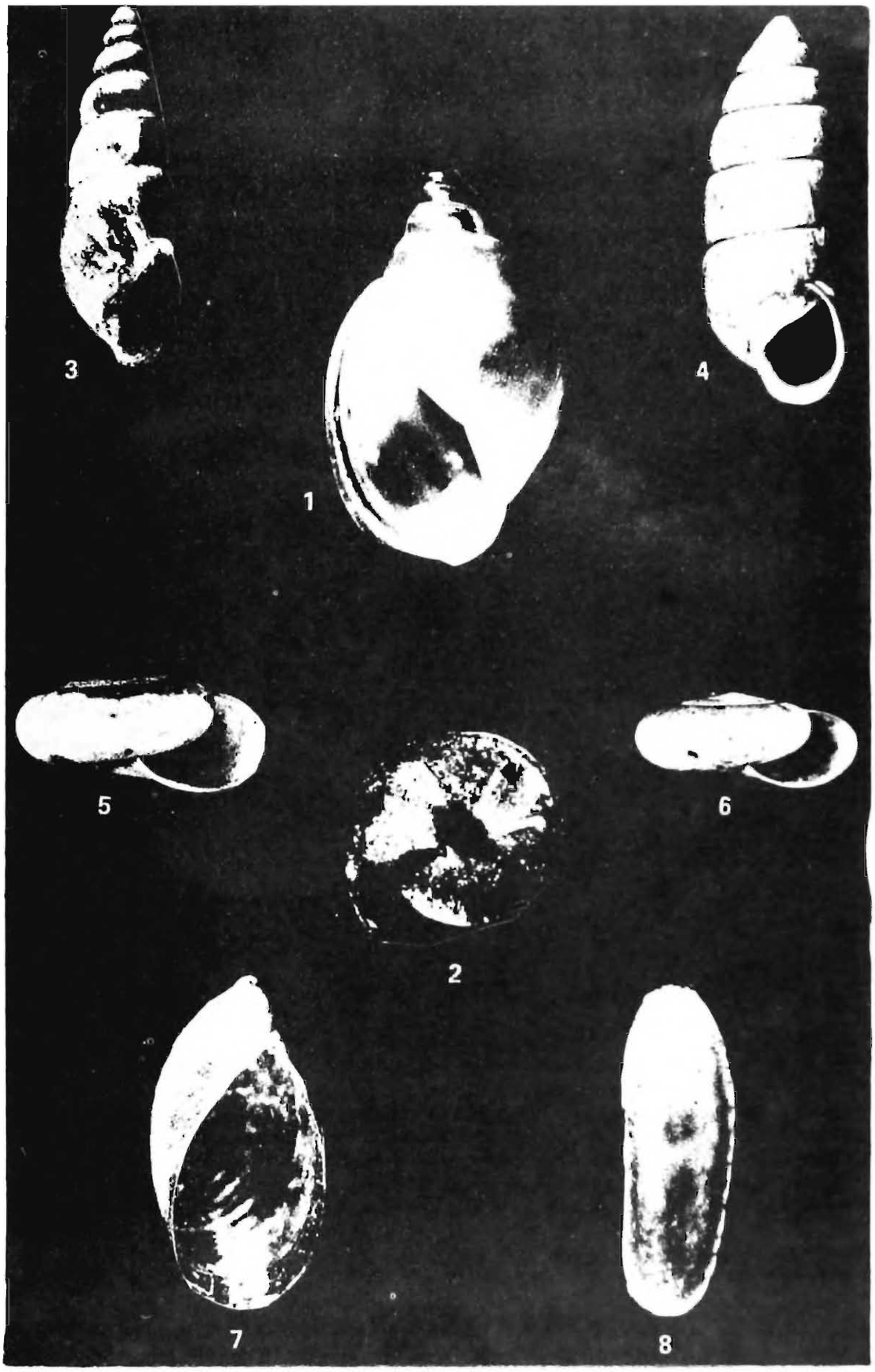
* *Original not seen.*



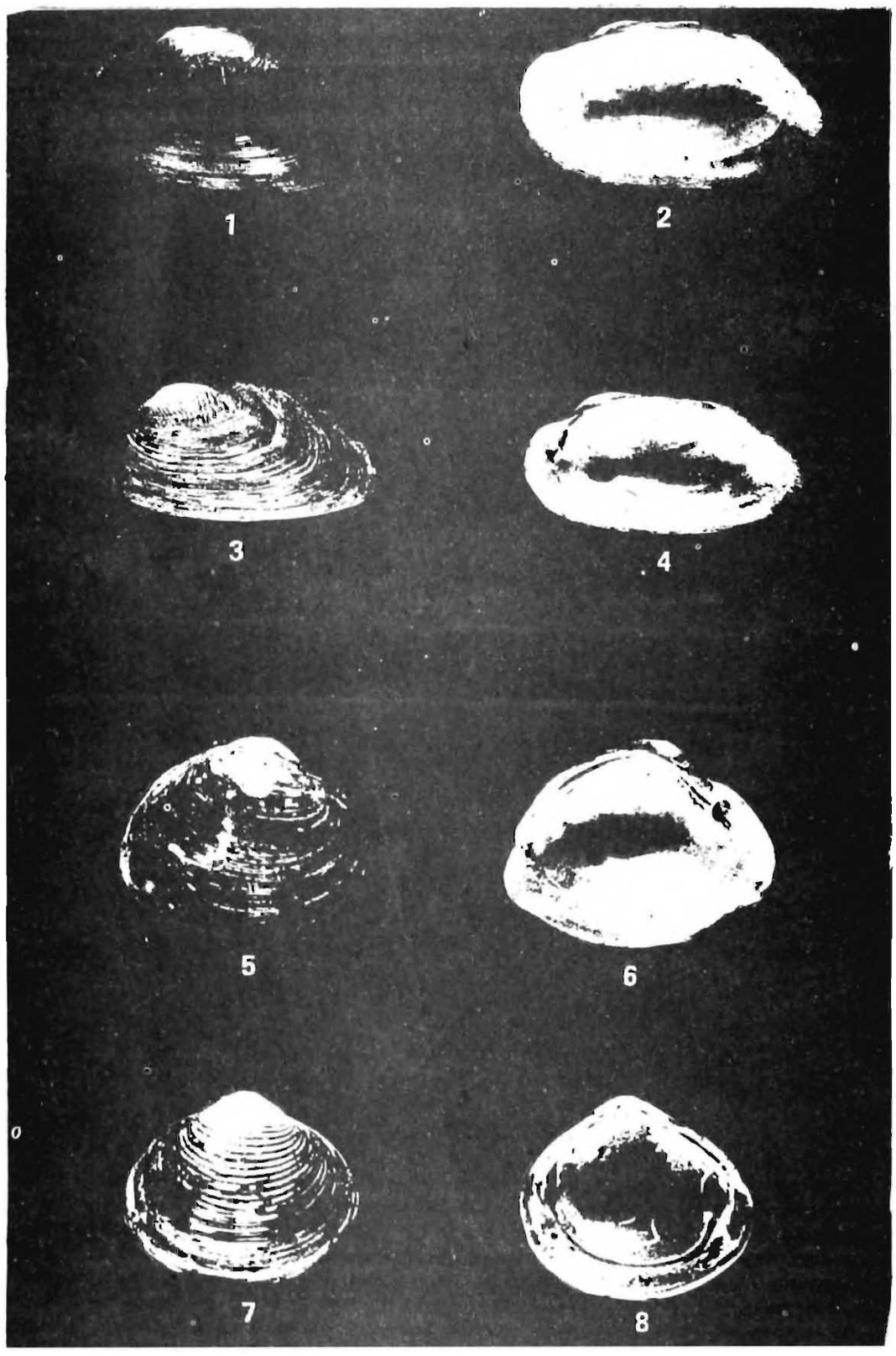
1. *Bellamya bengalensis* f.*typica* (Lamarck) (26.65 x 19.80 mm); 2. *Bellamya bengalensis* f. *mandiensis* (Kobelt) (26.30 x 21.00 mm); 3. *Bellamya dissimilis* (Mueller) (23.80 x 18.00 mm); 4. *Gabbia orcula* (Frauenfeld) (5.25 x 3.50 mm); 5. *Digoniostoma cerameopoma* (Benson) (9.20 x 5.50 mm); 6. *Digoniostoma pulchella* (Benson) (6.50 x 3.90 mm); 7. *Thiara (Melanoides) tuberculate* (Mueller) (31.85 x 10.65 mm); 8. *Lymnaea (Pseudosuccinea) acuminata* f. *typica* (Lamarck) (23.50 x 15.65 mm); 9. *Lymaea (Pseudosuccinea) acuminata rufescence* Gray (17.50 x 8.00 mm).



1. *Lymnaea (Pseudosuccinea) acuminata* f. *chlamys* Benson (27.05 x 14.70); 2. *Lymnaea (Pseudosuccinea) accuminata* f. *gracilior* Martens (21.80 x 8.60 mm); 3. *Lymnaea (Pseudosuccinea) luteola* f. *typica* Lamarck (27.15 x 16.55 mm); 4. *Lymnaea (Pseudosuccinea) luteola* f. *australis* Annandale & Rao (13.50 x 7.80 mm); 5. *Lymnaea (Pseudosuccinea) luteola* f. *impura* (Troschel) (15.70 x 8.30 mm); 6. *Lymnaea (Pseudosuccinea) luteola* f. *ovalis* Gray (12.40 x 9.00 mm); 6. *Lymnaea (Pseudosuccinea) luteola* f. *impura* (Troschel) (15.00 x 7.35 mm); 8. *Gyraulus convexiusculus* (Button) (6.80 x 1.75 mm); 9. *Gyraulus euphraticus* (Mousson) (7.35 x 1.55 mm); 10. *Indoplanorbis exustus* (Deshayes) (12.00 x 5.30 mm).



1. *Segmentina (Polypylis) calatha* (Benson) (4.30 x 1.50 mm); 2. *Physa acuta* Draparnaud (13.05 x 7.75 mm); 3. *Allopeas gracile* (Hutton) (10.30 x 3.00 mm); 4. *Zootecus pullus* (Gray) (13.00 x 5.00 mm); 5. *Macrochlamys indica* Godwin-Austen (19.60 x 10.85 mm); 6. *Macrochlamys petrosa* (Hutton) (17.80 x 7.95 mm); 7. *Succinea elegantior* Annandale (12.25 x 615 mm); 8. *Laevicaulis alte* (Ferussac) (29.15 x 10.85).



1. & 2. *Lamellidens marginalis* (Lamarck) (65.45 x 36.5 mm); 3. & 4. *Parreysia (Radiatula) caerulea* (Lea) (41.35 x 20.5 mm); 5 & 6. *Parreysia (Parreysia) favidens* (Benson) (41.50 x 31.90 mm); 7. & 8. *Corbicula striatella* Deshayes (21.85 x 18.95 mm).

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ANNELIDA

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The first record of earthworms from Delhi was made by Stephenson (1920), who reported one species, *Eutyphoeus waltoni* Michaelsen (Family : Octochaetidae). Since then no information on the systematics of earthworms of the area is available. So far there is no record of leeches as well from area under study.

The present report is based on the annelid material collected from Delhi by the Northern Regional Station, Zoological Survey of India, Dehra Dun. The material comprises seven species of earthworms and two species of leeches, all recorded for the first time from the study area.

SYSTEMATIC ACOUNT

Class : OLIGOCHAETA
Order : HAPLOTAXIDA
Suborder : LUMBRICINA
Superfamily : LUMBRICOIDEA
Family : LUMBRICIDAE

1. ***Eisenia fetida*** (Savigny)

1891. *Allolbophora foetida* Rosa, *Ann. Hofmus.* Wien. **6** : 381.
1900. *Eseia foetida* : Michaelsen,*Tierreich*, **10** : 475.
1923. *Allolopophora (Eisenia) fetida* : Stephenson, *Faun. Brit. India : Oligochaeta* : 499.

Material Examined : Delhi; Piggery Farm nala, Uri Enclave, 19 exs., 18.xii.1994, coll. A. Husain & party.

Didstribution : India : Delhi, Andaman & Niobar Islands, Himahal Pradesh, Kerala, Sikkim, Tamil Nadu, West Bengal. *Elsewhere* : Cosmopolitan species.

Remarks : This is a peregrine species originated from Europe and is widelyy distributed in India and out side. It is recorded here for the first time from Delhi.

Superfamily : MEGASCOLECOIDEA
II.Family : MEGASCOLECIDAE

2. *Amynthas morrisi* (Beddard)

1892. *Perichaeta morrisi* Beddard, *Proc. zool. Soc. Lond.*, : 166.

1937. *Pheretima morrisi* : Gates, *Rec. Indian Mus.*, **39** ; 205.

Material examined : Delhi; 3 exs., Municipality nursery, Punjabi Bag, 14.ix.1994, coll. J.P. Sati & party.

Distribution : India : Delhi, Maharashtra, Manipur, Meghalaya, Rajasthan, Uttar Pradesh, West Bengal. *Elsewhere* : Widely distributed, cosmopolitan species.

Remarks : This is a peregrine species originated from China. It is widely distributed in India and outside. Recorded here for the first time from Delhi.

3. *Lampito mauritii* Kinberg

1867. *Lampito mauritii* Kinberg, *Ofvers. K. Vetensk Acad. Forh. Stokh.*, **23** : 103.

1923. *Megascolex mauritii* : Stephenson, *Fauna Br. India, Oligochaeta* : 259.

Material examined : Delhi; 10 exs., Model town Park, Lal bag, Mall Road, 8.vi.1993, coll. V.Khanna & party.

Distribution : India : Delhi, Andaman & Nicobar Islands, Andhra Pradesh, Bihar, Gujarat, Karnataka, Kerala, Lakshadweep, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal. *Elsewhere* : Zanzibar; Comoro Is. ; Madagascar; Seychelles Is.; Mauritius; Pakistan; China; Maldives; Sri Lanka; Bangladesh; Myanmar; Thailand; Malay Peninsula; Indonesia; Philippines; Hong Kong; New Caledonia.

Remarks: Though the origin of this endemic species is assumed to be peninsular India, it is widely distributed. Reorded for the first time from Delhi.

4. *Metaphire houlleti* (Perrier)

1872. *Perichaeta houlleti*, Perrier, *N.Arh. Mus.*, Paris, **8** : 99.

1923. *Pheretima houlleti* : Stephenson, *Faun. Brit. India,* Oligochaeta : 304.

Remarks : Gates (1972) recognized seven morphs within the *houlleti* complex. The specimens of *houlleti* recorded here from Delhi belong to H morph.

Metaphire houlleti H morph (Gates)

Material examined : Delhi; 2 exs., 11.xi.94, coll. J.P. Sati & party.

Distribution : India : Delhi, Andaman & Nicobar Islands, West Bengal. *Elsewhere* : Myanmar; Malay Peninsula; Indonesia.

Remarks : It is a peregrine species originated from Southeast Asia, and is rare in India. Reorded for the first time from Delhi.

5. *Metaphire posthuma* (Vaillant)

1883. *Megascolex affinis*, Beddard, *Ann. Mag. nat. Hist.* **12** : 214.
1900. *Pheretima posthuma* : Michaelsen, *Tierreich* **10** : 295.
1923. *Pheretima posthuma* : *Faun. Brit. India*, Oligochaeta : 309.

Material examined : Delhi; 1 ex., IARI Campus, 11.ix.1994 ; 3 exs., Priya park/District Park, Munirka, Vasant Vihar, 13.ix.1994, coll. J.P. Sati & party.

Distribution : India : Delhi, Andaman & Nicobar Islands, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Punjab, Rajasthan, Sikkim, Uttar Pradesh, West Bengal. *Elsewhere* : Pakistan; Bangladesh; Myanmar; Thailand; Vietnam; Malaya Peninsula; Indonesia; Philipppines; U.S.A.

Remarks : Though the original home of this peregrine species is Southeast Asia, it is widely distributed in India and is recorded here for the first time from Delhi.

6. *Perionyx sansibaricus* Michaelsen

1909. *Perionyx sasnsibaricus* Michaelsen, *Mem. Ind. Mus.*, **1** : 174.
1923. *Perionyx sansibaricus* : Stephenson, *Faun. British Ind.* : Oligochaeta : 338 -57.

Material examined : Delhi; 15 exs., Yamuna, Kalindi Kunj, Okhla Dam, 15.v.1994, coll. A. Husain & party.

Distribution : India : Delhi, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu, Uttar Pradesh.

Remarks : This endemic species is widely distributed in the northern, western and southern part of India. It is recorded for the first time from Delhi.

III. Family : OCTOCHAETIDAE

7. *Dichogaster bolaui* (Michaelsen)

1891. *Benhamia bolaui* Michaelsen, *Jb. hamb. wiss Anst.*, **8** : 9.
1900. *Dichogaster bolaui*, Michaelsen, *Tierreich*, **10** ; 340.

Material examined : Delhi; 1 ex., Gurjar ghat at Yamuna, Wazirabad, 8.ix.1994, coll. J.P. Sati & party.

Distribution : India : Delhi, Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Goa, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, West Bengal. *Elsewhere* : Widely distributed, cosmopolitan species.

Remarks : This peregrine species has originated from West Africa and is widely distributed in India. Recorded for the first time from Delhi.

Class : CLITELLATA
Order : HIRUDINEA
Suborder : RHYNCHOLODELLAE
Family IV : GLOSSIPHONIDAE

8. ***Paraclepsis praedatrix*** Harding

1924. *Paraclepsis praedatrix* Harding, *Ann. Mag. nat. Hist. (ser. 9)*, **14** : 489.

1927. *Paraclepsis praedatrix* : Harding, *Fauna Br. India, Hirudinea* : 88.

Material examined : Delhi; 1 ex., Yamuna Barrage, Wazirabad, 11.ii.1995, coll. J.P. Sati & party.

Distribution : India : Delhi, Andhra Pradesh, Assam, Bihar, Haryana, Himachal Pradesh, Maharashtra, Rajasthan, Tamil Nadu, West Bengal. *Elsewhere* : Thailand.

Remarks : This species is widely distributed in India. Recorded for the first time from Delhi.

Suborder : ARHYNCHEBDELLAE
V. Family : HIRUDINIDAE

9. ***Hirudinaria granulosa*** (Savigny)

1820. *Sanguisuga granulosa* Savigny, *Systeme des Annelides,* Paris (1822).

1927. *Hirudinaria granulosa* : Moore, *Fauna Brit. India., Hirudinea,* : 226-238.

1977. *Hirudinaria granulosa* : Chandra, *Rec. zool. Surv. India,* **73** (1-4) : 193.

Material examined : Delhi; 1 ex., Dhaulakuan Ridge, Cantonment area, 10.vi.1993, coll. V.Khanna & party; 1 ex., 30.x.1993, Bawana, coll. J.P. Sati & party.

Distribution : India : Delhi, Andhra Pradesh, Assam, Bihar, Gujarat, Himachal Pradesh, Jammu & Kashmir, Kerala, Madhya Pradesh, Manipur, Orissa, Pondicherry, Punjab, Rajasthan, Sikkim, Tamil Nadu, Uttar Pradesh, West Bengal. *Elsewhere* : In the upper land (up to 500 m) of the entire Oriental Region.

Remarks : This is a common medicinal leech widely distributed in India. Recorded here for the first time from Delhi.

REFERENCES

Chandra, M. 1977. A check-list of leeches of Himachal Pradesh, *Rec. zool. Surv. India,* **73** : 189-195.

Chandra, M. 1983, A check-list of leeches of India. *Rec. zool. Surv. India*, **8** : 265-290.

Gates, G.E. 1972. Burmese earthworms. An introduction to the systematics and biology of megadril oligochaetes with special reference to southeast Asia. *Trans. Am. phil. Soc.*, **62** (7) : 1-326.

Harding, W.A. and Moore, J.P. 927. *The Fauna of British India including Ceylon and Burma* : Hirudinea. Taylor & Francis Ltd, London, 1-302 pp.

Julka, J.M. 1988. *Fauna of India. Megadrile Olilgochaeta (earthworms) : Haplotaxida : Lumbricina : Megascoleocoidea : Octochaetidae*. Zoological Survey of India, Calcutta, xiv + 400 pp.

Stephenson, J. 1920. On a collection of Oligochaeta from the lesser known parts of India and from eastern Persia. *Mem. Indian Mus.*, **7** : 191-261.

Stephenson. J. 1923. *Oligochaeta. The Fauna of British India. including Ceylon and Burma*. xxiv + 518 pp. Taylor and Francis Ltd., London.

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CRUSTACEA : DECAPODA

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INTRODUCTION

The palaemonids are freshwater prawns. Tiwari (1955) has described the distribution of 34 species of the genus *Palaemon* from India and Myanmar. Many of these *Palaemon* are now described as *Macrobrachium*. About 40 species of fresh water prawns under the genus *Macrobrachium* Bate have so far been recorded from India.

During the studies of freshwater palaemonid prawns from Delhi only two species, belonging to the genus *Macrobrachium* are recorded for first time from the area, in addition one species of Potamonidae crab is also listed on the basis of the earlier material collected from Delhi.

SYSTEMATIC ACCOUNT

Class : CRUSTACEA
Order : DECAPODA
Family : PALAEMONIDAE

The family is characterised by carpus of 2nd pair of pereopods entire; no epipods on legs; upper antennular flageppum bifid; 3rd maxillipede normal.

Genus *Macrobrachium* Bate

1868. *Macrobrachium* Bate, *Proc.Zool.Soc.*Lond. : 363.

Diagnostic characters : Prawns with rostrum well-developed, compressed and toothed. Carapace armed with antennal and hepatic spines, branchiostegal spine absent, dactylus of last three legs simple.

1. *Macrobrachium lamarrei lamarrei* (H.M.Edwards)

1837. *Palaemon lamarrei* H.M. Edwards., *Hist.nat.Crust.*, **2** : 397.
1950. *Macrobrachium lamarrei* : Holthmis, *Siboga Exped. Monogr.*, **39** A(9) : 119.
1988. *Macrobrachium lamarrei lamarrei* : Jalihal, Shenoy & Sankolli, *Rec. Zool. Surv. India. Occ. Paper,* **112** : 2.

Material examined: Delhi; 3 exs., Water sports complex, Bhalsawa, 26.x.1993, coll. N.K. Sinha & party : 5 exs., Okhla bridge at U.P. Border, 10.ix.1994, coll. J.P. Sati & party ; 5 exs., Indira Gandhi Indoor Stadium, 10.ix.1994, Coll. J.P. Sati & party; 22 exs. Pond in vicinity, Indira Gandhi Indoor Stadium Complex, 11.v.1994, Coll. A. Husain & party; 190 exs. from Horse Shoe lake, Bhalsawa, 16.v.94, coll. A. Husain & Party, 78 exs. Bhalsawa lake, Karnal Road, 15.xii.1994, coll. A. Husain & party; 1 ex. from Piggery farm, Dhaulakuan, 16.ii.1995, coll. J.P.Sati & party; 4 exs. Sabhaypur, Ghaziabad road, 17.xii.1994, A. Husain & party.

Diagnostic characters : Rostrum equal or longer than antennal scale and distally slightly upturned. Upper edge with a gap between proximal series of 5-9 teeth and distal of 1-2 subapical teeth, sometimes the gap being filled up by 1-2 teeth, lower edge with 4-9 teeth. Second chelipeds smooth, slender, equal and shorter than body length. Fingers of same chelipeds in adult male with 1-2 teeth in its cutting edge. Last three chelipeds nearly equal in length. Body transparent without any red spots either on chelipeds or on walking legs. Eggs greenish, large, oval or elliptical

Distribution : India : Orissa, West Bengal, Tamil Nadu (Madras). *Elsewhere* : Pakistan; Upper Myanmar.

Remarks : This species is widely distributed in small rivers. streams, ponds, tanks, etc., in the plains of India, both in the north as well as in the peninsular region. Also found in streams around bases of hills, but generally not on higher elevations.

The species closely resembles both the subspecies, *M.canarae* and *M. lamarrei lamarrei* in general appearance, shape of rostrum and absence of uropod accessory subapical spine.

2. *Macrobrachium dayanum* (Henderson)

1893. *Palaemon dayanus* Henderson,*Trans. Linn. Soc. Lond. Zool. ser.*, 2, 5 : 443.

1949 *P.dayanus* : Chopra & Tiwari, *Rec. Indian Mus.*, 45 : 215, fig. 1.

1988. *Macrobrachium dayanum* : Jalihal, Shenoy & Sankolli, *Rec. zool. surv. India, occ.paper,* 112 : 43.

Material examined : Delhi; 6 exs. Sabhaypur, Ghaziabad Road, coll. A. Husain & party, 17.xii.94; 1 ex., Yamuna Barrage, Kalindi Kunj, Okhla, 15.v.1994; 3 exs., Yamuna Reservoir, Ramghat, 17.xii.1994, coll. A. Husain & party.

Diagnostic characters : Rostrum extends upto the tip of antennal scale and its distal end distinctly upturned.Upper and lower edges of rostrum with 7-11 and 4-7 teeth respectively, Chela tuberculate and shorter than palm; carpus subcylindrical; fingers about two-third length of palm and densely pubescent. Fixed finger has one tooth and mobile finger has two conical teeth. Cutting edge may be naked or with some short hairs. The size of smallest egg bearing female being 43.8 mm while the largest male measures 75.0 mm (including rostrum). Colour of chelipeds with stripes of dark brown pigment, carapace densely mottled with the same colour.

Distribution : India : Assam, West Bengal, Orissa, Kerala, Madhya Pradesh, Uttar Pradesh, Punjab. *Elsewhere* : Pakistan.

Remarks : This species is widely distributed in plains as well as at lower altitudes in hills

throughout a large part of India and Pakistan. Not known to occur beyond south of the Krishna river in the peninsula.

Family : POTAMONIDAE

3. ***Sartoriana spinigera*** (Wood-Mason)

1871. *Paratelphusa spinigera* Wood-Mason, *J.Asiat.Soc. Bengal* **40**(2) : 194.

1910. *Paratelphusa (Paratelphusa) spinigera* : Alcach, *Cat. Ind. decap. Crust. Indian Museum,* **1** (2) : 72.

1970. *Sartoriana spinigera* : Bott, *Abh. Senekenb. natur. Ges.,* **526** : 39.

Material examined : Delhi; 1 ♂ from Cent. Regd. no 4/563, 1 ♂ from Cent Regd. no. 4/1252, 9 ♂♂ & 4 ♀♀ from Cent. Regd. no. 4/1038.

Diagnostic characters : Carapace broad and convex, its length about two-third of its greatest width, cervical groove deep, abdomen of adult male is broad and triangular, chelipeds are unequal in both sexes. The spine near the end of upper order of merns is distinct and usually acute, legs are stout.

Distribution : India : Meghalaya (East Khasi Hills, West Garo Hills), Uttar Pradesh, Punjab, Orissa, West Bengal, Assam, Bihar. *Elsewhere* : Bangla Desh; Pakistan.

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REFERENCES

Chopra, B. & Tiwari,K.K.1949. Decapoda Crustacea of the Patua State, Orissa. *Rec. Indian Mus.,* **45** (2 & 3): 213-224.

Henderson, J.R. & Matthai, G. 1910. On certain species of *Palaemon* from south India.*Rec. Indian Mus.,* **5** : 277-305.

Holthnis, L.B.,1980. FAO species catalogue, **1** Shrimps and prawns of the world An annotated catalogue of species of interest to fisheries. *FAO Fish Sympos.* 125, **1** : 1-271.

Kemp, S. 1915. Crustacea Decapoda. Fauna of the Chilka Lake.*Mem. Indian Mus.,***5** : 199-325.

Tiwari, K.K. 1955a. Distribution of Indo-Burmese freshwater prawns of the genus *Palaemon* Fabr. and its bearing on the Satpura hypothesis.*Bull. Nat. Inst. Sci. India,* **7** : 230 - 239.

Tiwari, K.K. 1955b. Trend of evolution in the *Hendersoni* group of species of *Palaemon* Fabr. (Crustacea : Decapoda). *Bull. Nat. Inst. Sci. India.* **7** : 189-197.

Tiwari, K.K. & Pillai, R.S. 1974. Shrimps of the genus *Macrobrachium* Bate, 1868 (Crustacea:Decapoda : Casidea : Palaemanida) from the A. & N. Is., I. *Zool. Soc. India,* **25** : 1-35.

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THYSANURA

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INTRODUCTION

The order Thysanura comprises popularly known insects the "Silverfish and bristle tail" belonging to suborder Apterygota. There are two suborders in this order. The suborder Microcoryphia, comprises one superfamily Machiloidea, which consists of two families Machilidae and Meinertellidae, while the suborder Zygentoma has one superfamily Lepismatoidea, which contains three families Lepidotrichidae, Nicoletiidae and Lepismatidae. These insects generally have very long multi-segmented antennae, cerci and median tail. The species occur in blind as well as eyed forms. Most species are heavily clothed with scales due to which the insects appear black, brown, silvery or golden in colour. The free living forms are found in the forest floor, under bark of trees, rocks, ant and termite nests. Some species cause damage to books and other household articles. The present study is based on the collection of only one specimen from Asola Wildlife sanctuary. More species are likely to occur from this locality. An intensive survey is required for this rare group of insects.

Ctenolepisma ciliata (Dufour)

1831. *Lepisma ciliata* Dufour, *Ann. Sci.nat.*, **22** : 420.
1838. *Lepisma ciliata* : Burmeister, Handb.d.Entomol., **2** : 458.
1846. *Lepisma quadrilineata* Lucas, *Rev. Zool.*, **9** : 254.
1890. *Lepisma ciliata* : Grassi et Rovelli, *nat. Sci.*, **9** : 80.

Material examined : Delhi ; 1 ♂, Asola WLS, 21.xi.95, coll. A. Husain & party.

Diagnostic characters : Body elongated, head broad, eyes clearly projecting. Thorax broader than the abdomen. Tergite IX small, half the length of VIII. Tergite 'X' is as long as those of IC and VII together, trapizoidal shape. Hypodermal segment on head, body and appendages. Antennae and cerci shorter than body. Abdominal terga II-VI with 3 + 3 bristle comlibs. Stylets 2 pair on VIII and IX. Ovipositor long and slender. Body length : 10 mm.

Distribution : India : Delhi, West Bengal. *Elsewhere* : U.S.A.; Mexico; Africa; Spain.

Remarks : This species is recorded for the first time from Delhi.

REFERENCES

Escherich, K. 1905. Das Syshem der lelpismatiden. *Zoologica* [Stuttgart], **43** : 1 164.

Hazra, A.K. 1993. Insecta : Thysanura in *State fauna series 3: Fauna of West Bengal* **4** : 1-17.

Mendes, L.F. 1990. On the Zoo-geographic affinities of the Thysanurans from India. *Advances in Management and Conservation of Soil Fauna* : 15-24.

Wygodzensky, P. 1972. A review of the silverfish (Lepismatidae, Thysanura) of the United States and the Caribbean Area. *American Museum, Novitates*, **2481** : 1-26.

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ODONATA : IMAGOS

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INTRODUCTION

The dragonflies are large sized predaceous, hemi-metabolous and amphibiotic insects. The immature stages are very different from the imagos. The Odonata larvae occur both in perennial and seasonal fresh water or estuarine wetlands. More than 5000 species spreading to 500 genera of these elegant insects have been recorded world over; while about 500 species are known from India alone (Parsad & Varshney, 1995).

With passage of time as the importance of wet-lands is recognised by environmentalists and conservationists the dragonflies have gained importance because of their major role in biological control of abnoxious aquatic insects like mosquito larvae and as bio-indicators of fresh water pollution and overall degradation of wetlands. They occupy apex position in invertebrate food chain in a fresh-water habitat and are known to constitute a major food source for carnivorous fishes and water fowls.

Within the Indian-subregion the Odonata fauna of Himalaya has been studied most extensively. Consequently about 250 species have been recorded from this ecosystem, which is incidentally about 50% of the known Odonata fauna of India. This may be attributed to a variety of wetlands occurring in Himalaya (Kumar, 1994), nevertheless the plains of the country also have major aquatic biotopes in the form of rivers, lakes, reservoirs and monsoon pans, etc. Thus, the state of Delhi present a suitable area for the study of Odonata fauna in having several major wetlands like R.Yamuna, Wazirabad; Okhla, Ramghat reservoirs and horse shoe lake, besides a number of ornamental and garden ponds, etc., which have been duly colonised by various dragonfly species.

Ghorpade (unpublished, 1991) listed 53 species of dragonflies from Delhi area, of which he says that some are actually recorded from Delhi, while others are likely to be present here. Out of this list I do not agree with the possibility of the occurrence of the following nine species in Delhi, since the studies so far carried out on their altitudinal/zoogeographical distribution in India records their distribution in quite different climatological regimes. These species are -

I. Suborder Zygoptera

1. *Copera vittata* Selys (all the three subspecies do not occur in north India)

2. *Aciagrion hisopa* (both the subspecies occur in western Ghats & Peninsula)
3. *Libellago lineata lineata* (Burmeister)
4. *Neurobasis ch. chinensis* (Linn.)
5. *Vestalis gracilis* Rambur
6. *Vestalis apicalis* Selys

Out of the above, species at s.no. 3 to 6 breed in submontane streams around 1000m altitude in Himalaya.

II. Suborder Anisoptera

7. *Rhodothemis rufa* Rambur (known only from west Coastal India)
8. *Tramea limbata similata* (Rambur) (Maharashtra)
9. *Macrodiplax cora* Brauer (South India)

The collections made during present series of surveys reveal the material belonging to 21 species, of which four species are new records from Delhi. Therefore, after deducting the above listed nine species from the dragonfly reported by Ghorpade (l.c) and adding the four presently new records made in the current studies, the approximate number of known dragonfly species of Delhi can be put as 47.

Annotated list of the Odonata of Delhi

I. Suborder : ZYGOPTERA
Family: COENAGRIIDAE

1. *Lestes p. praemorsa* Selys
2. *L.thoracica* Laidlaw
3. *Copera marginipes* Rambur
4. *Pseudagrion microcephalum* Rambur
5. *P.decorum* Rambur
6. *P.laidlawi*Fraser
7. *P.rubriceps* Selys
8. *Ceriagrion coromandelianum* Fabricius
9. *C.cerinorubellum* Brauer
10. *Aciagrion pallidum* Selys
11. *Ischnura senegalensis* Rambur
12. *I.aurora aurora* (Brauer)
13. *Rhodischnura nursei* Morton
14. *Enallagma parvum* Selys

15. *Agriocnemis pygmaea* Rambur

II. Suborder : ANISOPTERA
Family : GOMPHIDAE

16. *Mesogomphus lineatus* Selys
17. *Onychogomphus grammicus* Rambur
18. *Ictinogomphus rapax* Rambur

Family : AESHNIDAE

19. *Anax guttatus* Burmeister
20. *A.parthenope* Selys
21. *Hemianax ephippiger* Burmeister

Family : LIBELLULIDAE

22. *Lathrecista asiatica asiatica* Fabr.
23. *Cratilla lineata calverti* (Forester)
24. *Potamarcha obscura* Rambur
25. *Orthetrum taeniolatum* Schn.
26. *O.chrysostigma luzonicum* (Brauer)
27. *O.sabina sabina* Drury
28. *O.pruinosum neglectum* (Rmb.)
29. *Palpopleura sexmaculata sexmaculata* Fabr.
30. *Acisoma panarpoides panarpoides* Rmb.
31. *Diplacodes lefebevrei* Rmb.
32. *D.nebulosa* Fabr.
33. *D.trivialis* Rmb.
34. *Crocothemis servilia servilia* (Drury)
35. *Bradinopyga geminata* (Rmb.)
36. *Neurothemis fulvia* Drury
37. *N.tullia tullia* (Drury)
38. *Brachythemis contaminata* Fabr.
39. *Trithemis aurora aurora* Burm.
40. *T.festiva* Rmb.
41. *T.kirbyi kirbyi* Selys
42. *T.pallidinervis* Kirby
43. *Zyxomma petiolatum* Ramb.
44. *Tholymis tillarga* Fabr.

45. *Pantala juvescens* Fabr.
46. *Rhyothemis variegata* Linn.
47. *Tramea basilaris burmeisteri* Kirby

SYSTEMATIC ACCOUNT

Suborder : ZYGOPTERA
Family : PLATYSTICTIDAE

1. *Copera marginipes* (Rmb.)

1842. *Platycnemis marginipes* Rambur, *Ins. Neverop* : 240.

Material examined : Delhi; 1 ♂, Boat club, India Gate, 3.v.95, coll. P.C.Tak & party.

Diagnostic characters : The species is characterized by its peculiar colouration which varies from whitish to bronze with the age of the specimens; legs bright orange to dull reddish. Many geographical forms are known.

Larva chacterstically dark sienna; caudal lamellae small paddle like, with irregular margins.

Distribution : India : Widely distributed, west. Himalaya, W.Bengal, Maharastra, Deccan, Assam, Kerala. *Elsewhere* : Malaysia; Sumatra; Myanmar; Thailand; Java; Sunda Island; Sumba; Throughout southern Asia.

Remarks : Imagos are rare on wings; flight period June-November; oviposition August-September Larval habitat - slow running marshy streams and marshy parts of fresh water lakes.

Family : COENAGRIONIDAE
Subfamily : PSEUDAGRIONINAE

2. *Ceriagrion coromandelianum* (Fabricius)

1798. *Agrion coromandelianum* Fabricius, *Ent.Syst. Suppl.* : 287.

Material examined : Delhi; 1 ♀, Ridge area nr. Dhaulakuan, 10.vi.93, coll. V. Khanna & party; 10 ♂♂, Ramghat, 24.vii.1995; 3 ♂♂, 1♀, Lodhi Garden, 25.vii.1995; 4♂♂, Okhla Barrage, 29.vii.1995, coll. J.P. Sati & party; 2 ♂♂, Bawana, 30.x.1993; 17♂♂, 7♀♀, Lake garden, Shakur Basti, 31.x.1993, coll. N.K.Sinha & party.

Diagnostic characters : India : throughout, western Himalaya (U.P & H.P.), hilly tracts of W.Bengal. *Elsewhere* : Thailand; Malaysia; Sumatra; Java; Borneo; Nepal; Sri Lanka; Myanmar; south China.

Remarks : The species in multivoltine and has been found to lay eggs almost throughout the year in the foot hills of W. Himalaya (Kumar, 1986).

3. *Ischnura a. aurora* (Brauer)

1858. *Agrion delicatum* Hagen, *verh. zool.bot.ges,* Wien, **81** : 479.

Material examined : Delhi : 1♂, Kakraula Nursery, Nazafgarh Road, 5.vi.1993; coll. V.Khanna & party; 3♂♂, Bhalsawa lake, 26.x.1993, coll. N.K.Sinha & party.

Diagnostic characters : Species is distinguished by citron-yellow abdomen except segments 8 to 10, which are azure blue (male). Larvae are bright green in colour and are easily recognisable. They have foliaceous duplex lamellae which are almost transparent with greenish tracheation.

Distribution : India : U.P., H.P., W.Bengal, western Himalaya; widely distributed in Southern Asia. *Elsewhere* : Malaysia; Borneo; Philippines; Samoa; Sundaic Archipelago; New Guinea; Austral-asia.

Remarks : Bivoltine species, common on wings from spring to monsoon. Larvae occur in slow running steams, weedy banks of large rivers and temporary monsoon ponds.

4. *Ischnura senegalensis* (Rambur)

1842. *Agrion senegalensis* Rambur, *Ins. Nevrop* : 276.

Material examined : Delhi; 1♂, near Kedia Nursery, Karnal Road; 67♂♂, 37♀♀, Lake Garden, Shakur Basti, coll. N.K. Sinha & party; 1♂, 1♀, Boat Club, India Gate, 3.v.1995, coll. P.C Tak & party.

Diagnostic characters : In males the head is bright orange, eyes green, thorax also bright orange; abdomen with segments 1 and 2 bright orange; segments 3 to 6 pale blue while partly of 7 and 8 to 10 again orange. A dominant species found from sea level to 2500 m in colonies. Larvae dark greenish to sienna, remain attached to the submerged vegetation; caudal lamellae foliaceous, duplex tapering at both ends, light brown with darker tracheae.

Distribution : India : western Himalaya, H.P. *Elsewhere* : Philippines; Java; Borneo; Sumba; Timor; Bali; Sumbaria; Lambok; Moluccas; Sunda Island; Japan; Monocco; African continent.

Remarkes: So far the studies indicate it to be a univoltine species, the emergence occur for a short period between April to June. During breeding season (July-August) pairs in tandem can be seen amidst vegetation.

5. *Rhodischnura nursei* (Morton)

1907. *Ischnura nursei* Morton, *Trans. Ent. Soc.* : 306-307.

Material examined : Delhi; 1♂, Kakraula nursery, Nazafgarh Road, 5.v.1993, coll. V.Khanna & party; 1♂, nr. Kedia nursery, Karnal Road, 25.x.1993, coll. N.K. Sinha & party.

Diagnostic characters: The bright crimson citron-yellow and black abdomen will serve to distinguish this species from any other Moderately common around tanks and small streams.

Larvae yellowish-brown, slow swimmers, generally remain attached to the submerged vegetation, caudal lamellae fusiform, duplex, uniformly dark.

Distribution : India : W.Bengal, Bihar, M.P., W.Himalaya. *Elsewhere* : Pakistan.

Remarks : The field studies indicate it to be a univoltine species, breeding in tanks; on wings from June to October.

Suborder : ANISOPTERA
Family : GOMPHIDAE
Subfamily : GOMPHINAE

6. *Mesogomphus lineatus* (Selys)

1850. *Gomphus lineatus* Selys, *Rev.Odon.* : 386

Material examined : Delhi; 1♂, Kedia nursery, Karnal Road, 25.x.1995, coll. N.K.Sinha & party.

Diagnostic characters : The species can easily be identified by the shape of anal appendages, which are closely apposed, the apical ends curling strongly downwards; interior appendages, its branches closely apposed and curled up hook wise; also segments 8 and 9 with lateral foliated dilatations. Larva cylindrical, antenna four segmented, clubbed, the last segment very minute. Larva can easily be recognised because of the above characters.

Distribution : India : W.Bengal, Maharashtra, Karnataka, Tamil Nadu, w.Himalaya. *Elsewhere* : Nepal; Sri Lanka.

Remarks : It is a very wary and shy insect generally confining themselves around streams; range 300-800 m, larvae burrow superficially in coarse sand with the help of their fore- and middle-legs and move forward by jet propulsion by expelling water through anus.

Family : LIBELLULIDAE

7. *Orthetrum chrysostigma luzonicum* (Brauer)

1868. *Libellula luzonica* Brauer, *Verh. zool bot. Ges Wien*, **38** : 169,732.

Material examined : Delhi; 1♂, 1♀ Ridge, near Dhaulakuan, 23.x.93, coll. N.K. Sinha & party.

Diagnostic characters : Abdomen dorso-ventrally dilated at base, then narrow and tapered, pruinosed pale azure-blue except at sides of segments 1,2 and base of 3, which are bright yellow; in old adults even the thorax pruinosed pale azure blue. Larva sluggish muddy to sienna coloured; hairy and bottom dweller in habit.

Distribution : India : Mountane and sub-mountany areas in the south (W.Coast, Tamil Nadu, Andhra Pradesh), W.Bengal, Assam, W.Himalaya, H.P. *Elsewhere* : Nepal; Myanmar; Sri Lanka; Philippines; Java; Sumatra.

Remarks : Imagos common on wings from May-November from 300-800m; swarms recorded from Nilgiri hills. One of the common species of this genus in India.

8. *Orthetrum pruinosum neglectum* (Rambur)

1842. *Libellula neglecta* Rambur, *Ins. Neverop.* : 86.

Material examined : Delhi; 4♂♂, 1♀, Ridge, Dhaulakuan, 10.vi.1993, coll. N.K.Sinha and party.

Diagnostic characters : Robust species with sides violaceous-red due to the overlying pruinescence; wings enfumed pale brown toward apices in old adults. The species can easily be identified by its unique violet coloured abdomen, quite different to the red of *O.chrysis* and *O.testaceum*. Larva robust, dirty brownish, hairy, occur in muddy substratum; found both in standing as well as slow running streams.

Distribution : India : Throughout, widly distributed in western Himalaya, H.P. *Elsewhere* : Nepal; Myanmar; Sri Lanka; Tibet, Indo-China; Hong-Kong; Thailand; Malaysia.

Remarks : One of the most common species of Odonata in plains of India and found almost throughout the year around both seasonal and perennial wetlands.

9. *Orthetrum sabina sabina* (Drury)

1770. *Libellula sabina* Drury, *Ill. Exot. Ins.* 1 : 114.

Material examined : Delhi; 1♂, nursery, Ring Road, 6.vi.1993, coll. V.Khanna & party; 3♂♂, 1♀, Ridge, Dhaulakuan, 23.x.1993; 2♂♂, IARI, 24.x.1993; 1♂, 6♀♀, Kedia nursery, Karnal Road, 25.10.93. 1♂, 6♀♀, Water Sports Complex, Bhalsawa, 26.x.1993; 6♀♀, Kakraula nursery, Nazafagarh Road, 27.x.1993; 1♂, 2♀, Swamp, Wazirabad, 28.x.1993; 2♂♂, 1♀, Bawana, 30.x.1995; 1♀, Lake Garden, Shakur Basti, 31.x.1993 coll. N.K. Sinha & party; 2♂, Dhauakuan Park, 2.v.1995; 3♂, 1♀ Boat Club, India Gate, 3.v.1995, coll. P.C. Tak & party.

Diagnostic characters : Abdomen greenish yellow marked with black; it is distinctly identified in the field due to enormously swollen abdominal segments 1 to 3, both dorso-ventrally and laterally; segments 4 to 6 very narrow, cylindrical, segments 7 to 9 all dilated but compressed laterally. Both male and female almost similar in appearance.

Distribution : India : Throughout, western Himalaya. *Elsewhere* : Nepal; Myanmar; Sri Lanka; Mesopotamia; Iraq; Iran; Thailand; Java; Oceania; Samoa, Somaliland; Sumba; Timor; New Guinea; Australia; Egypt; Angola; African continent.

Remarks : It is one of the most predaceous dragonfly and also cannibalistic in habits. It is a multivoltine species and the imagos are found on wings almost throughout the year.

10. *Acisoma panarpoides panarpoides* (Rmb.)

1842. *Acisoma panarpoides* Rambur, *Ins. Nevrop* : 28.

Material examined : Delhi; 1♂, 2♀, Kakraula nursery, Nazafgarh Road, 27.x.1993, coll. N.K.Sinha & party, 1♂, Dhaulakuan Park, 2.v.1995, coll. P.C. Tak & party; 2♂♂, 3♀, Ramghat, 24.vii.95, coll. J.P.Sati & party.

Diagnostic characters: It is rather a small species in which the characteristic shape of abdomen serves to distinguish it from all other Indian dragonflies. Abdomen laterally and dorso-ventrally widely dilated from segments 1 to 5, then abruptly slimmed and cylindrical from segments 6 to 10; azure blue in colour.

Distribution : India : Widely distributed, M.P., Assam, Sikkim, W. Bengal (Darjeeling, Jalpaiguri), western Himalyaya. *Elsewhere* : Nepal; Sri Lanka; Philippines; Malaysia; Archipelago; Indonesia; Celebes; Sumba; Lesser Sunda Island; China; Japan; Thailand and Singapore.

Remarks : Kumar (1979, 1984) has recorded it as a multivoltine species in the foothills of W. Himalaya. The adults are present around weedy ponds and tanks for the major portion of the year. Hassan (1978) also reported the occurrence of the imagos of *A.panarpoides inflatum* round the year at Nigeria.

11. *Brachythemis contaminata* (Fabricius)

1793. *Libellula contaminata* Fabricius, *Ent. syst.* **2**: 382.

Material examined : Delhi; 1♂, 1♀, IARI campus, 3.vi.1993; 3♂♂, 1♀, Masoodabad, Nazafagarh Road, 5.vi.1993; 1♂, NZP, 7.vi.1993, coll. V.Khanna & party; 3♀, Ridge, Dhaulakuan, 23.x.1993, 2♀, Bawana lake, 26.x.1993, coll. N.K.Sinha & party; 3♂, 6♀, Chawala Bridge, Nazafgarh, 25.vii.1995; 1♂, Lodi Garden, 25.vii.1995; 13♂, 7♀ Okhla Barrage, 29.vii.1995, J.P. Sati & party.

Diagnostic characters : Small built but robust insects. The males can easily be identified by reddish reticulation in wings, with a broad bright orange fascia extending fron base to within 2 to 3 cells of ptero-stigma in fore-wing and as far as that organ in the hind, intensifying in colour distally.

Distribution : India : Throughout the plains, foot hills of Himalaya. *Elsewhere* : Nepal; Mynamar; Sri Lanka; Thailand; Singapore; Malaysia; Taiwan; Philippines; Java; Sumatra; China.

Remarks : Teneral imagos fly in large numbers around the banks of ponds and marshy streams, especially during monsoon. Males are very conspicuous because of distinct orange fascia on their wings.

12. *Bradinopyga geminata* (Rambur)

1842. *Libellula geminata* Rambur, *Ins. Neverop* : 90.

Material examined : Delhi; 3♀, Humayun's Tomb, 28.vii.1995, coll. J.P. Sati & party.

Diagnostic characters : Moderate sized species with cryptic colouring in black, grey and white wings with bicolorous pterostigma, which is black at centre, pure white at distal and proximal ends, between black nervures ; anal appendages pale creamy white.

Distribution : India : Peninsula, western Himalaya (foot hills), Uttar Pradesh, Bihar, Haryana, Orissa, Rajasthan, W.Bengal and Delhi.

Remarks : The species has invaded the populated areas and human dwellings as well. It breeds in wells, cemented tanks, drums, etc., In such localities it is found by the well side or on plastered cemented walls. The imagos aestivate in sheltered sites from October-March; common at larval biotopes from March-October.

13. *Crocothemis servilia servilia* (Drury)

1778. *Libellula servilia* Drury, *Ill. Ex. Ins.* **1** : 112.

Material examined : Delhi; 1♂ 1♀, IARI, 3.vi.1993; 2♂, Kakraula nursery, Nazafgarh Road, 5.vi.1993, 1♂, 2♀♀, Masudabad, Nazafgarh Road, 5.vi.1993, coll. V.Khanna & party; 2♂♂, 1♀, Ridge, Dhaulakuan, 23.x.1993, 3♂, 3♀, Kedia nursery, Karnal Road, 25.x.1993, 4♂♂, 3♀♀, Kakraula nursery, 4♂♂, Bawana, 30.x.1993; 2♂, 1♀, Swampy area, Wazirabad, 4♂♂, Bawana, 30.x.1993. 1♂, 3♀, Lake Garden, Shakur basti, 31.x.1993, coll. N.K. Sinha & party; 2♂♂, Dhaulakuan Park, 2.v.1995, 1♀, Chhawala, Najafgarh Canal, 4.v.1995, 2♀♀, Lodi Garden, 5.v.1995, coll. P.C. Tak & party.

Diagnostic characters : Head with labrum frons and rest of the face bright blood red ; eyes during life blood red above, purple laterally ; base of all wings marked with rich amber yellow to as far distal as cubital nervure in fore-wing and to first ante-nodal nervure nearly to arc and rightly upto and including the tornal angle in hind-wing ; abdomen blood-red, segments 8 and 9 with mid-dorsal carina backish and appendages blood red.

Distribution : India : Throughout western Himalaya. *Elsewhere* : Nepal; Myanmar; Sri Lanka; throughout Tropical Asia; Phillipines; Sumba; Australia; South wards to Sundaic Archipelago; Japan.

Remarks : Due to its characteristics red colouration the species can be easily determined in the field. It is a multivoltine species ; the major activities of flight, emergences and oviposition continue almost throughout the year.

14. *Diplacodes lefebvrei* (Rambur)

1842. *Libellula lefebvrei* Rambur, *Ins. Nevrop.* : 112.

Material examined : Delhi 1♂, 1♀, Ridge, Dhaulakuan, 23.x.1993, 3♂♂, 3♀♀, Kakraula nursery, Najafgarh Road, 27.x.1993 ; Swampy area, Wazirabad, 28.x.1993 ; 5♂♂, 14♀♀, Lake Garden, Shakur basti, coll. N.K. Sinha & party.

Diagnostic characters : Dragonflies of rather small size, coloured greenish yellow,

marked with black in subadult stage and entirely black in adult stage ; wings palely enfumed with brown towards apices; anal appendages black. This species can be at times confused with *D. nebulosa*, but the diffuse dark clouding of the apical portion of the wing is quite different to the well-defined black apex found in *nebulosa*.

Distribution : India : Chandigarh, Rajasthan, along West coast, Kerala. *Elsewhere* : Africa; Mesopotamia.

Remarks : The imagos occur on open waste lands, settling on the ground, specially on foot paths, and may be found long distances from water.

15. *Diplacodes trivialis* (Rambur)

1842. *Libellula trivialis* Rambur, *Ins. Nevrop.* : 115.

Material examined : Delhi; 1♂, 2♀♀, Ridge, Dhaulakuan, 23.x.1993, coll. N.K. Sinha & party; 1♂, 1♀, Budha Jayanti Park, 6.v.1995, coll. P.C. Tak & party.

Diagnostic characters : Small dragonflies, imagos black marked with yellow or pruinosed dark blue throughout ; wings uncoloured except at base ; anal appendages yellow. The species may be confused with *D. nebulosa* but the diffuse dark clouding of the apical portion of the wing is quite different to the well defined blak apex found in *nebulosa* ; again it differs from *lefebvrei* due to the absence of blackish-brown spot at the base of hin-wing.

Distribution : India : Throughout, in wet and semi-wet areas, western Himalaya, eastern Himalaya, Karnataka, Maharashtra, Madhya Pradesh. *Elsewhere* : Nepal; Sri Lanka; Myanmar; Thailand; Mollucca; Indo-China; Sumatra.

Remarks : The imagos are found on open waste lands, setting specially on footpaths, at times they occur long distances from water.

16. *Neurothemis tullia tullia* (Drury)

1779. *Libellula tullia* Drury, *Ill. Exot. Ins.* **2** : 85.

Material examined : Delhi, 2♂, 2♀, Ramghat, 24.vii.1995, coll. J.P. Sati & party.

Diagnostic characters : Prothorax, thorax and abdomen black; wings in male hyaline for apical half, opaque steel blue-black for basal half, the border of this opaque area running in both fore-and hindwings from costal border, one cell distal to node in fore-wing, two or three cells distal in hind, to the posterior border of wings in a convex curve ; a broad opalescent white band bordering the black area in both wings.

Distribution : India : Uttar Pradesh (western Himalaya), Himachal Pradesh, Bihar, W.Bengal, Maharashtra, Tamil Nadu, Karnataka, Rajasthan, Madhya Pradesh, E. Himalaya. *Elsewhere* : Nepal ; Myanmar ; Sri Lanka ; Thailand ; Penang ; Malaya ; Mollucca ; Indo-China.

Remarks : The species can easily be distinguished from other of the genus since the black base of wings with opalescent white outer bordering is very characteristic (male), whilst, in the females,the broad black apices of wings and sickle shaped stripe on basal half are equally

diagnostic. The imagos occur in large colonies in swamps or heavily weeded tanks.

17. *Trithemis aurora* (Burmeister)

1839. *Libellula aurora* Burmeister, *Hand. Ent.*,**2** : 859.

Material examined : Delhi; 2♂♂, IARI Campus, 2.v.1995; 3♂♂, Dhaulakuan Park, 2.v.1995, 2♂♂, Chhawala village, 4.v.1995, coll. P.C. Tak & party.

Diagnostic characters : Thorax and abdomen violaceous crimson ; base of hind wing with reddish-brown spot; neuration crimson; abdomen violaceous throughout ; anal appendages red. Female differs considerably from the male both in colour and shape.

Distribution : India : Throughout foothills of western Himalaya. *Elsewhere* : Nepal; Myanmar; Sri Lanka; Indonesia; Phillipines; Taiwan; Celebes; Timor; Molluccas; Sumba; New Guinea; Pakistan.

Remarks : The almost general violaceous colouring of the male will serve to determine it from all other species of the genus ; the only species with which it may be confused is *O. pruinosum neglectum* (Rmb). with somewhat alike colouring, which, however is much larger and with blackish thorax and wing venation.

18. *Trithemis kirbyi kirbyi* Selys

1891. *Trithemis kirbyi* Selys, *Ann. Mus. Civ. Genova,* **30** : 465.

Material examined : Delhi; 1♂, Lodhi Garden, 25.xii.1995, J.P.Sati & party.

Diagnostic characters : Thorax and abdomen bright vermilion red ; a broad basal bright reddish-yellow marking present on all wings, pterostigma black with a narrow red stripe at its middle, venation yellow ; abdomen brilliant vermilion red.

Distribution : India : Himachal Pradesh, U.P. Himalaya, Maharashtra, Karnataka, Tamil Nadu. *Elsewhere* : Sri Lanka.

Remarks : It is a very local species, the males are protectively mimic showing close resemblance with large Hymenoptera genus *Salius*, they display warning colours though conspicuous.

19. *Trithemis pallidinervis* (Kirby)

1889. *Sympetrum pallidinervis* Kirby, *Trans. zool. soc.* Lond : 12.

Material examined : Delhi; 8♂♂, 3♀♀, Boat Club, India Gate, 3.v.1995, coll. P.C. Tak & party.

Diagnostic characters : Yellow coloured species marked with black; wings hyaline with reddish reticulation, a bright amber yellow basal marking at extreme base in forewing, but extending distally to first antenodal nervure in the hind wing, pterostigma black with creamy-

white ends; abdomen black marked with bright yellow.

Distribution : India : throughout, except desert areas; Maharashtra, Andhra Pradesh, Tamil Nadu, Karnataka, Bihar, W.Bengal. *Elsewhere* : Sri Lanka; Nepal; Myanmar; Phillipines; Taiwan; Thailand; Malaysia; Singapore.

Remarks : The species breed in stagnant waters and marshy zones, the imagos generally perch on top of tall reeds elevating by their long spidery legs. It is largest species of the genus and differ from other species in having hind femora extending to the end of the 2nd abdominal segment instead of end of thorax as in all other species.

20. ***Pantala flavescens*** (Fabricius)

1798. *Libellula flavescens* Fabricius, *Ent. syst. supl.* 285.

Material examined : Delhi; 1♂, 2♀♀, Kedia nursery, Karnal Road, 25.x.1993, N.K. Sinha & party; 5♂♂, 6♀♀, Lodi Garden, 25.vii.1995, 1♂,1♀, Asola WLS, 26.vii.1995, coll. J.P. Sati & party.

Diagnostic characters : Rather large and robust species coloured ocherous or reddish ; wings long and broad especially at the base, narrow and pointed at apices; base of hind-wing pale golden-yellow as distant as anal loop, pterostigma reddish brown, abdomen bright ocherous, dorsum tinted with bright brick-red. Mid-dorsal spines absent in larvae, but large lateral spines present on segments eight and nine, spine of segment eight reaching almost upto the end of 10th segment and that of ninth (larger of the two) extend upto the posterior half of the epiproct. Larvae occur in seasonal monsoon ponds.

Distribution : India : throughout the monsoon belt. *Elsewhere* : Circumtopical.

Remarks : While discussing the patterns of emergence of dragonflies in relation to monsoon in India (Kumar, 1989) a well defined pattern of development and migration was established for *Pantala falvescens* (Fab.), which indicates that it is able to complete two larval generations in a year under the influence of SW and NE monsoon respectively.

P.flavescens is a most common species occurring abundantly throughout monsoon periods. In the areas of SW monsoon it is common on wings from July to October, while in peninsular India which have the NE monsoon the imagos are common from November to January. Fraser (1936) recorded its emergence from marshes in submontane areas during September, when it commences a migratory flight which may continue upto November. Bartenef (1931) noticed that the geographical distribution of *P. flavescens* could be defined by the zone where northerly and southerly winds met in summer.

21. ***Tramea basilaris burmeisteri*** Kirby

1889. *Tramea burmeisteri* Kirby, *Trans. zool. soc. Lond.*, **12** : 316.

Material examined : Delhi; 1♂, Boar Club, India Gate, 3.v.1995, coll. P.C. Tak & party.

Diagnostic characters : Dragonflies of large size and robust build ; head with post clypeus and frons bright vermilion-red with a fine basal black line; two large black spots at base of hind-wing surrounded by a golden-yellow aveola, one in the cubital space, the other lying obliquely in anal area of wing, the two narrowly confluent near base of discoidal cell in the male, abdomen bright brick-red, marked with black, apical joints of segments 7 to 9 bright yellow ; anal appendages very long, nearly as long as the last three segments of abdomen.

Distribution : India : Bihar, M.P, Himachal Pradesh, Kerala, Meghalaya, Orissa, Rajasthan, Tamil Nadu and Uttar Pradesh. *Elsewhere* : Nepal; Sri Lanka; Myanmar; Malaysia.

Remarks : The imagos occur around small weedy tanks or marshes, the flight season in north India is from June to October, sometimes they accompany *P.flavescens* in their annual post-monsoon migration. The species can easily be determined by the irregular duplicate shape of the basal markings to the hind-wing.

REFERENCES

Bartenef, A. 1931. Uber die geographische Verbreitung von *Pantala flavescens* Fabr. (Odonta : Libellulinae). *Zool. Jb.* (Syst.), **60** : 471-480

Fraser, F.C. 1933. *Fauna of British India.* Odonta **1**. Taylor and Francis Ltd., London.

Fraser, F.C. 1934. *Fauna of British India.* Odonta **2**. Taylor and Francis Ltd., London

Fraser, F.C. 1936. *Fauna of British India.* Odonta **3**. Taylor and Francis ltd., London.

Ghorpade, K. 1991. A list of the dragonflies and damselflies of the Delhi area. *Colemania* (unpublished report).

Kumar, A. 1979. On the occurrence of multivoltine genrations in some Indian dragonflies. *Sci. & Cult.*, **45** : 126-127.

Kumar, A. 1985. A review on the bio-ecology of Indian dragonflies. *Proc. First Indian Symp. Odonatol. : 73-92.*

Kumar, A. 1994. *Odonata, Fauna of Western Himalaya, pt. 1. Uttar Pradesh. Zool. Surv. India. :* 25-33.

Prasad, M. & Varshney R.K.,1995. A Check-list of the Odonata of India including data on larval studies. *Oriental Ins.* **29**: 381-428.

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ODONATA : LARVAL STAGES

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INTRODUCTION

The R. Yamuna and its various impoundments like Okhla, Ramghat and Wazirabad provide the major wetlands of Delhi. Among the aquatic insects of these wetlands the Odonata larvae form an important component. In the first part of this communication (Kumar, 1996), the author has listed 47 species of dragonflies from Delhi. The surveys of Delhi wetlands have demonstrated the presence of a rich population of these amphibiotic insects, it is therefore imperative to provide brief taxonomic and ecological descriptions of the larvae of these dragonflies.

In earlier communications (Kumar & Khanna, 1983, Kumar, 1985) the taxonomic characters of the Odonata larvae have been discussed in details. These are based on a combination of number of morphological characters Plate I (Figs. 1-18) and Plate II (Figs 1-14) which depict general morphology, and variations therein of the taxonomic characters in the larval Odonata and explains the terms used in the key both for suborder Zygoptera and Anisoptera.

To facilitate identification of the larvae an illustrated key has been provided upto suborders, superfamilies, families and subfamilies of the known larval forms of dragonflies from Delhi. The genera whose larvae are recorded from Delhi have been listed under each subfamily; where ever possible key to genera and species have been given. The figure numbers mentioned in key refer to plate III & IV.

Key to the larvae of Odonata of Delhi

Key to Suborders

1. Larvae long and slender; abdominal pleurites infolded; abdomen terminating in three caudal lamellae .....Zygoptera (Fig.1)
- Larvae comparatively shorter and more stoutly built; abdomen with ventral pleurites present; abdomen terminating in five spine-like appendages.....Anisoptera (Fig.2)

I. Suborder : ZYGOPTERA

Key to Superfamilies

1. Antenna with scape longer than the length of remaining segments (except in Family Epallagidae); labium without major premental or palpal setae: caudal lamellae saccoid or triqueteral type.....(Agrioidea) Calopterygoidea (Fig.3) **(Not present in Delhi)**
- Antenna with scape less than the length of remaining segments; labium with major premental and palpal setae; caudal lamellae lamellate type ....2 (Fig. 4)

2. Labium greatly narrow basally, medium lobe of prementum with cleft in the middle; movable hook may or may not be armed with major setae.....
.....Lestoidea, Family Synlestidae, Genus *Lestes* (Figs. 5 A & 5B)

- Labium almost triangular in outline, median lobe of prementum without central cleft; no major setae present on the movable hook; caudal lamellae with secondary branches oblique to the median trachea .....Coenagrionoidea (Figs. 6 & 7)

Superfamily : COENAGRIONOIDEA

Key to families

1. Antenna with first segment of flagellum shorter than the pedicel, caudal lamellae sub-nodate, paddle like, marginal setae long hair like, not differentiated into ante and post-nodal setae; larvae generally occur in slow running streams with sandy or muddy bed .....Platycnemididae (Figs. 8 & 9)
- Antenna with first segment of flagellum longer than pedicel, caudal lamellae denodate or nodate type; marginal setae thick and differentiated into stout ante-nodal and fine post-nodal setae; larvae found both in lotic and lentic waters, be it permanent or temporary in nature.....Coenagrionidae (Figs. 10-12)

Family : PLATYCNEMIDIDAE

Key to subfamilies

1. An apical spine present on 6th antennal segment, caudal lamellae paddle like; larvae occur in slow running streams, remains attached to submerged vegetation .....Platycnemidinae (Fig. 13)
- Apical spine not present on 6th antennal segment; caudal lamellae saccoid and hairy; larvae occur amidst mosses near waterfalls on hillocks..... Calicnemidinae (Fig.14) .....(Genus *Calicnemia*) (Not present in Delhi)

Family : COENAGRIONIDAE

Key to subfamilies

1. Premental setae do not exceed 1+1 (though a number of setella present); caudal lamellae lamellate, rounded at apex; larvae occur in slow weedy streams and standing water..... Pseudagrioninae (Figs. 15 & 16) (Genera *Pseudagrion, Ceriagrion*)
- Premental setae more than 1+1; caudal lamellae leaf like; narrow and long at apex ....2 (Fig. 17)

2. Caudal lamellae broader in the middle, apex sharply pointed; spiniform setae present on the median trachea and laterally in the ante-nodal region; larvae occur in slow-running streams, perennial and monsoon ponds. .....Ischnurinae

.....Genus *Ischnura, Aciagrion, Enallagma and Rhodischnura* (Fig. 18)

- Caudal lamellae elongated leaf-like, apices ending into narrow processes; spiniform setae present laterally in the anti-nodal region; larvae occur only in static waters..... Agriocnemidinae, Genus *Agriocnemis* (Fig. 19)

Subfamily : PSEUDAGRIINAE

Key to genera

1. Caudal lamellae rounded, short, obtusely pointed at the apices, marked with blotches along the periphery;length 13.5 to 15.20 mm. ....*Ceriagrion* Selys (Fig. 20)
- Caudal lamellae long, lamellate, rounded at the apices and distinctly divided into ante-and post-nodal areas; length 20.0 to 23.5 mm .....*Pseudagrion* (Fig. 21)

Subfamily : ISCHNURINAE

Key to genera

1. Antenna with a distinct apical spine at 4th flagellar segment; caudal lamellae long leaf like, with apical end produced into long-narrow process .....*Rhodischnura, Enallagma* (Fig. 22)
- Antenna without an apical spine at 4th flagellar segment, caudal lamellae broader in the middle, apices sharply pointed .....*Ischnura, Aciagrion* (Fig. 23)

II.Suborder : ANISOPTERA

Key to superfamilies

1. Labium flat, without major premental or palpal setae; distal margin of palpus without crenations, produced into an end-hook .....Aeshnoidea (Figs. 24 & 25)
- Labium spoon shaped, with a number of major premental and palpal setae; distal margin of palpus with crenations or denticulated .....Libelluloidea .....(Family Libellulidae) (Fig. 26)

Superfamily : AESHNOIDEA

Key to families

1. Antenna 4-segmented; tarsi 2-segmented in fore-and middle legs and 3-segmented in hind leg; larvae generally occur at the bottom of stream, lake or large pond; burrow just under the bottom sediment, sand, mud or pebbles..... Gomphidae (Fig.27)
- Antenna 7-segmented; tarsi 3-segmented in all three pairs of legs; prementum widest in apical fourth, much narrow in basal half; larvae occur in side pools of streams or in lakes and ponds;: climb on reeds and other vegetation .....Aeshnidae .....(Subfamily Aeshninae, Genus *Anax, Hemianax*) (Fig. 28)

Family : LIBELLULIDAE

Key to subfamilies

1. Eyes capping fronto-lateral part of the head; abdomen long and tapering; mid-dorsal abdominal spines always present; palpal setae do not exceed 8 & 8, larvae generally hairy, remain superficially covered with sand or mud .....Libellulinae (Fig. 29) .....(Genera *Orthetrum, Cratilla, Lathrecista, Potamarcha, Palpopleura*)
   Eyes a little lower, more broadly rounded and lateral in position; number of palpal setae may exceed 9 & 9 2

2. Length not more than 20.0 mm; palpal setae always more than 10 & 10 (except in genus *Brachythemis*); larvae not hairy; occur in variety of habitats..... Sympetrinae (Fig. 31) .....(Genera *Acisoma, Brachythemis, Crocothemis, Neurothemis,* .....*Bradinopyga and Diplacodes*)
   Length more than 20.0 mm. (except in Tritheminae); palpal setae less than 10 & 10 (except in Pantaliinae) 3

3. Length not more than 16.0 mm; mid-dorsal protuberances on segments 3 to 9, larvae occur in slow running streams.....Tritheminae (Genus *Trithemis*) (Fig. 32)
   Length more than 16.0 mm; mid-dorsal spines may be present or absent; lateral abdominal spines well developed 4

4. Well-developed mid-dorsal spines present, larvae found in standing waters like peatish cemented tanks and ponds remains superficially covered with mud .....Zyxommatinae .....(Fig.33) (Genera *Tholymis, Zyxomma*)
- Mid-dorsal spines absent, lateral spines well developed; larvae live in ponds and paddy fields only; found amidst weeds and other vegetation .....Pantaliinae .....(Genera *Pantala, Tramea*) (Fig. 34)

Subfamily : SYMPETRINAE

Key to genera

1. Abdomen without mid-dorsal spines 2
   Abdomen with mid-dorsal spines 3

2. Length 15.0 to 17.0 mm; premental satae 14+14; palpal setae 10&10; multivoltine ..... *Crocothemis* (Fig. 35)
   Length 20.0 to 23.0 mm; premental setae 20+20, palpal setae 15 & 15; greyish to black .....*Bradinopyga* (Fig. 36)

3. Length 13.5 to 15.5 mm; premental setae 14+14, palpal setae 10 & 10; larvae occur in small ponds .....*Diplacodes* (Fig. 37)
   Length 16.0 to 18.0 mm; premental setae 11+11; palpal setae 8 & 8; tuft of long mid-

dorsal setae present on abdominal segments 2-8.....*Acisoma* (Fig. 38)

- Mid-dorsal abdominal spines present on segments 4 to 10; premental setae 14+14; palpal setae 7 & 7; breeds in monsoon ponds .....*Brachythemis* (Fig. 39)
- Small median abdominal protuberances present on segments 6 to 10; premental setae 13 + 13; palpal setae 8 & 8.....*Neurothemis* (Fig. 40)

Subfamily : ZYXOMMATINAE

Key to genera

1. Length 20.0 to 22.4 mm; premental setae 13 + 13; palpal setae 8 & 8; mid-dorsal abdominal spines on segments 4 to 9 ; larvae found in cemented tanks, emergence occurs in May..... .....*Zyxomma* (Fig. 41)
- Length 22.0 to 24.5 mm; premental setae 10+10; palpal setae 5 & 5; abdominal spines on segments 4 to 10: larvae found in monsoon ponds; emergence occurs towards the decline of southwest monsoon..... .....*Tholymis* (Fig. 42)

Subfamily : PANTALIINAE

Key to genera

- Length 20.0 mm; premental setae 17 + 17; palpal setae 13 & 13; epiproct longer than the paraprocts.....*Pantala* (Fig. 43)

- Length 22.0 to 24.5 mm; premental satae 14+15; palpal satae 10 & 10; epiproct shorter than the paraprocts.....*Tramea* (Fig.44)

REFERENCES

Corbet, P.S. 1953. A terminology for the labium of larval Odonata. *Entomologist*, **86** : 191-196.

Fraser, F.C. 1943. New Oriental Odonata larvae. *Proc. R. ent. Soc.* London,(B) **12**:81- 93.

Kumar, A. 1973a. Descriptions of the last instar larvae of Odonota from the Dehra Dun Valley (India), with notes on biology I (Suborder Zygoptera). *Oriental Ins.* 7(1) : 83 - 118.

Kumar, A. 1973b. Descriptions of the last instar larvae of Odonata from the Dehra Dun Valley (India), with notes on biology II (Suborder Anisoptera). *Oriental Ins.* 7(2) : 291 331.

Kumar, A. & Khanna, V. 1983. A review on the taxonomy and ecology of Odonata larvae from India. *Oriental Ins.*, **17**:127-157.

Kumar, A. 1996. Odonata : Imagos. *State Fauna Series 6: Fauna of Delhi. Zool. surv. India* ; m/ss 13 pp (in press).

Table 1. Habitat preferences of the Odonata larvae of Delhi :

Sl. no. Species	2	3	4	5	6	7	8	9	10	11	12
I Suborder Zygoptera											
1. *Lestes p. praemorsa* Selys								A			
2. *L. thoracica* Laid.			B		A						
3. *Copera marginipes* Ramb.			B		A						
4. *Pseudagrion microcephalum* Ramb.					A						
5. *P. decorum* Ramb.					A						
6. *P. laidlawi* Fraser			B		A						
7. *P. rubriceps* Selys			C		A			B			
8. *Ceriagrion coromandelianum* Fabr.				B	B			A			
9. *C. cerinorubellum* Brauer			-		A	B					
10. *Aciagrion pallidum* Selys								A			B
11. *Ischnura senegalensis* Ramb.				A							
12. *I. aurora aurora* Brauer				A	A	C					
13. *Rhodischnura nursei* (Morton)								A			
14. *Enallagma parvum* Selys			A			-		B			
15. *Agriocnemis pygmaea* Rambur								A			
II Suborder Anisoptera											
16. *Mesogomphus lineatus* (Selys)		A		B			-	-			
17. *Onychogomphus grammicus* Ramb.	B	A									
18. *Ictinogomphus rapax* (Ramb.)						A					
19. *Anax guttatus* (Burm.)						B	A				
20. *A.parthenope parthenope* Selys			-							-	(In lakes)
21. *Hemianax ephippiger* (Burm.)					B		-	A	-		C
22. *Lathrecista a. asiatica* (Fab.)							B	A			
23. *Cratilla lineata* (Brauer)							A	B			
24. *Potamarcha obscura* Ramb.						A		-			
25. *Orthetrum taeniolatum* (Sch.)				A	B						-
26. *O. chrysostigma luzonicum* (Brauer)					B		A				

Sl. no. Species	2	3	4	5	6	7	8	9	10	11	12
27. *O.sabina sabina* Drury							A	B			
28. *O. pruinosum neglectum* (Ramb.)					B		A			C	
29. *Palpopleura s. sexmaculata* (Fabr.)					B			A			
30. *Acisoma p. panorpoides* Ramb.								A			
31. *Diplacodes lefebvrei* (Ramb.)							A				
32. *D. nebulosa* (Fabr.)								A			
33. *D. trivialis* (Rmb.)								A			
34. *Crocothemis s. servilia* (Drury)				C	B			A			
35. *Bradinopyga geminata* (Rmb.)									A		
36. *Neurothemis fulvia* Drury							A				
37. *N. tullia tullia* (Drury)							B	A			
38. *Brachythemis contaminata* (Fabr.)							A-				
39. *Trithemis a. aurora* Burm.			A					B			
40. *T. festiva* Ramb.			B		A						
41. *T. pallidinervis* Kirby			B		A	C					
42. *T. kirbyi kirbyi* Selys			B		A						
43. *Zyxomma petiolatum* Rmb.										A	
44. *Tholymis tillarga* (Fab.)							A	B			
45. *Pantala flavescens* (Fabr.)							B	A			
46. *Rhyothemis variegata* Linn.							B	A			
47. *Tramea basilaris burmeisteri* Kriby							B	A			

A > B > C > D .....In Order of preference

Key to the habitats :

Running Water

Fast

Clingning to rocks or pebbles	2
Buried in sand	3
Clinging to banks, weeds, roots, etc.	4

Slow

Buried in mud or algal growth 5

Among weeds 6

At bottom 7

Confined Water (Still)

Ponds

At bottom 8

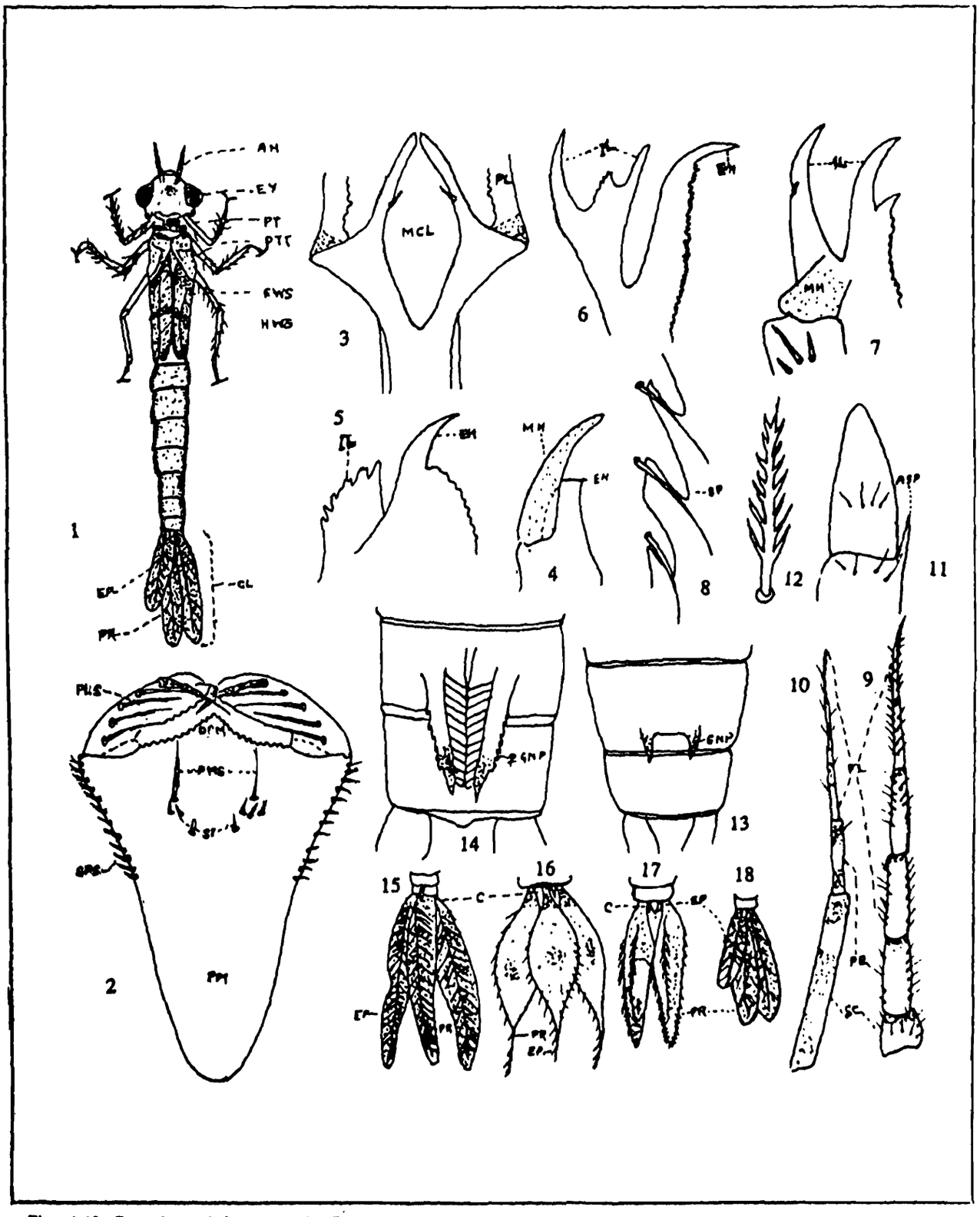
Among weeds 9

Cemented tanks

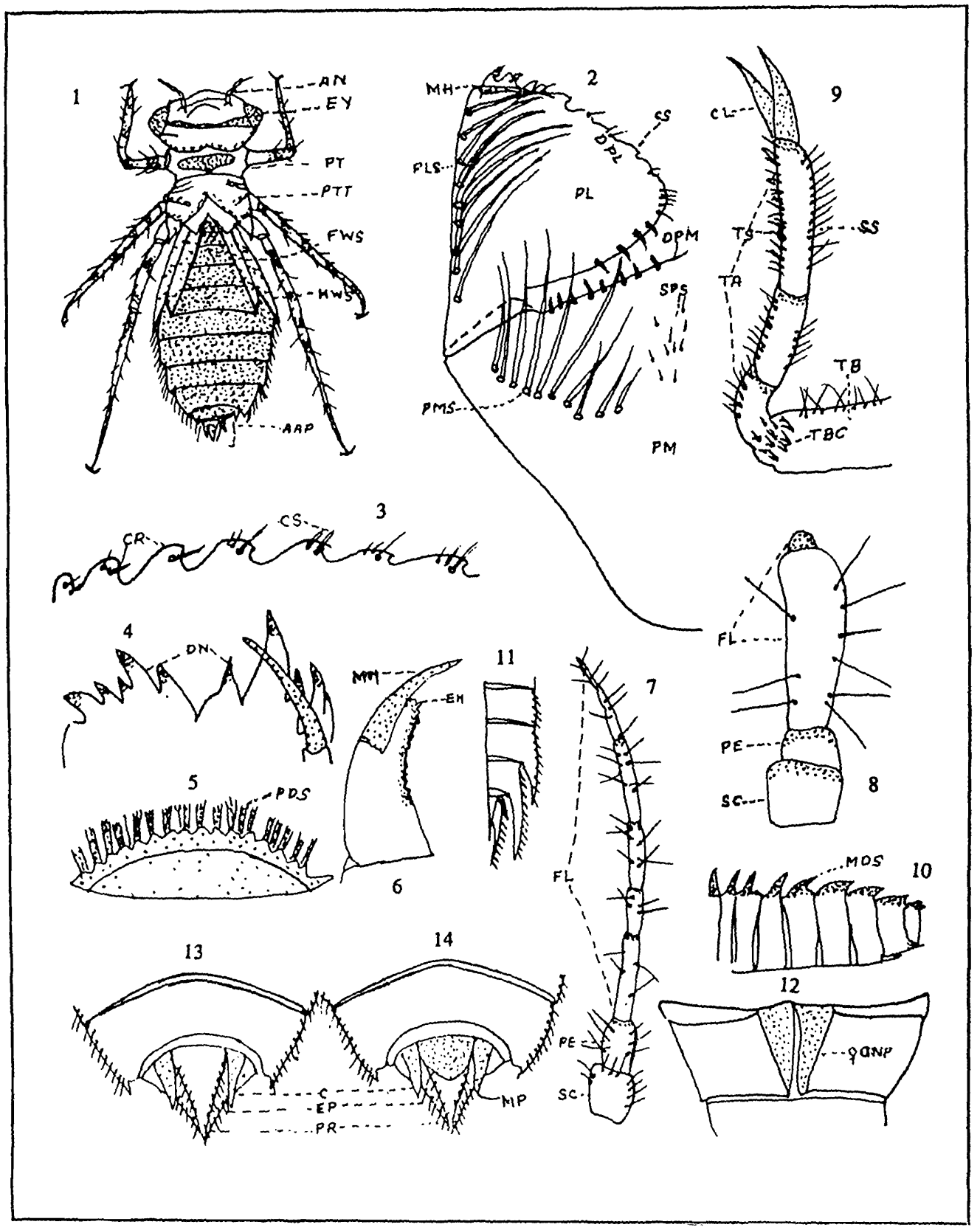
Attached to walls 10

At bottom 11

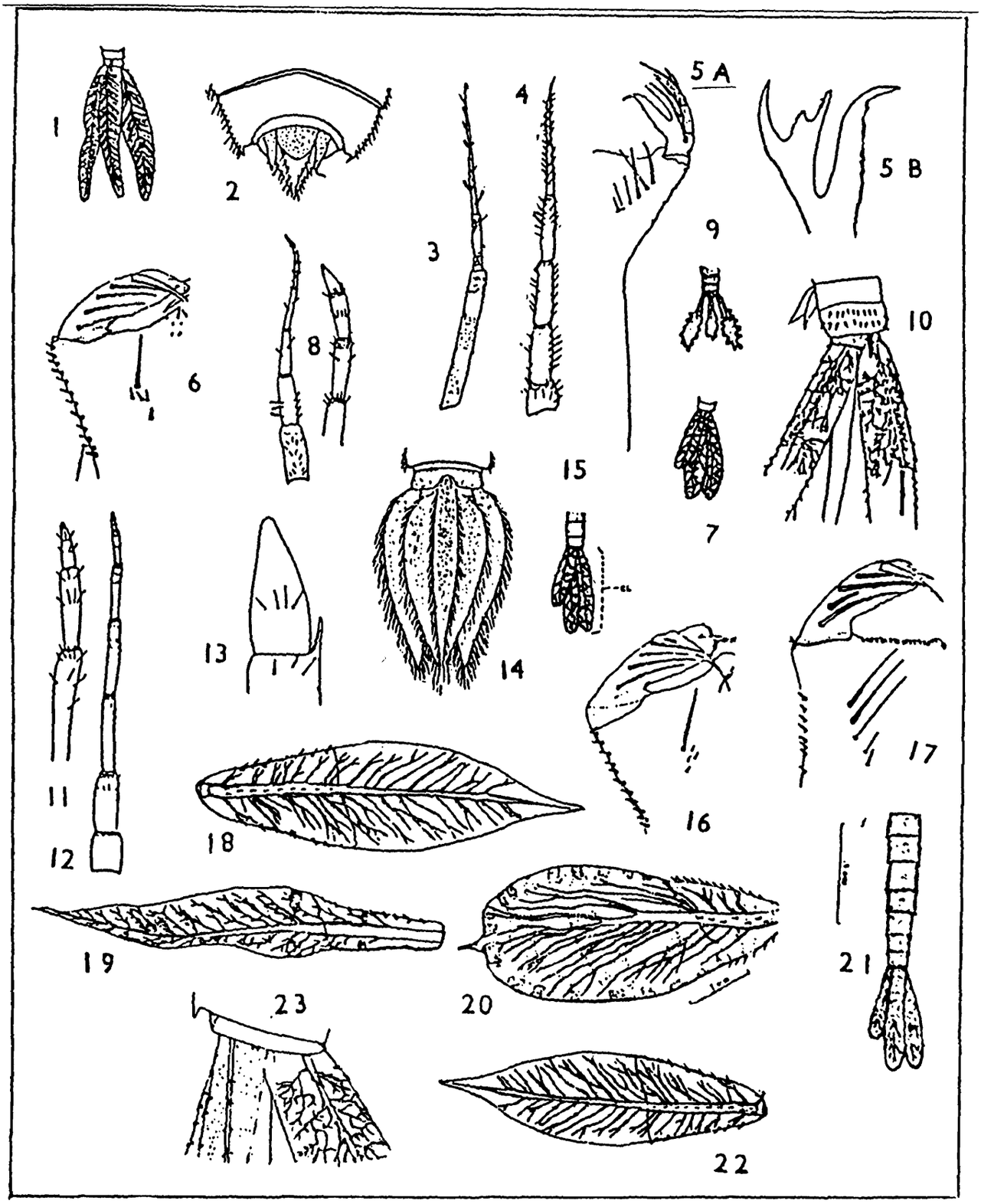
Side pools in streams 12



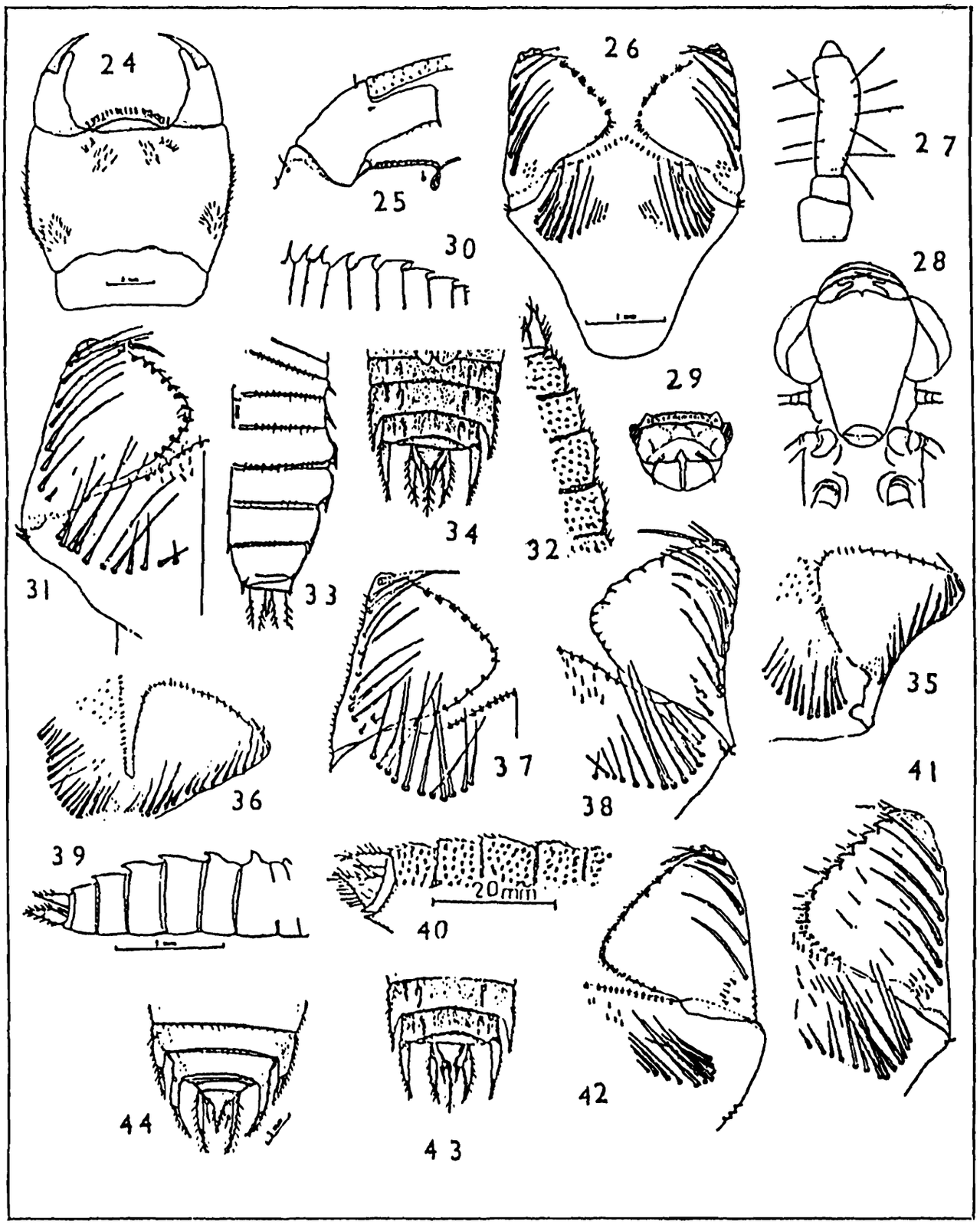
Figs. 1-18. General morphology, suborder Zygoptera: 1, larva, dorsal view; *Pseudagrion laidlawi* Fraser (Coenagriidae); 2, labium, *P. laidlawi;* 3, prementum, *Neurobasis chinensis* (L.) (Agriidae); 4, distal margin of palpus, *Desparoneura campioni* Fraser (Protoneuridae); 5, distal margin of *P.laidlawi;* 6, distal of palpus, *Lestes praemorsa praemorsa* Selys (Lestidae); 7, distal margin of palpus, *Rhinocypha unimaculata* Selys (Cholorocyphidae); 8, lateral spines of prementum, *Bayadera indica* Selys (Epallagidae); 9, antenna, *P.laidlawi;* 10, antenna, *R. unimaculata;* 11, apical spine of 4th flagellar segment, *Copera marginipes* (Platycnemidae); 12, pectinate seta; 13, male gonapophyses; 14, female gonapophyses; 15, caudal lamellae, *L. praemorsa praemorsa;* 16, caudal lamellae, *B.indica;* 17, caudal lamellae, *R. unimaculata;* 18, caudal lamellae, *P. laidlawi.*



Figs. 1-14. General morphology, suborder Aniosptera: 1, larva dorsal view, *Crocothemis servilia servilia* (Drury) (Libellulidae); 2, labium, *Orthetrum sabina* (Drury); 3, enlarged view, distal margin of palpus, *O. sabina*; 4, distal margin, palpus, *Cordulegaster* sp.; 5, distal margin, prementum, *Burmagomphus sivalikensis* Laidlawi; 6, distal margin, palpus, *B.sivalikensis*; 7, antenna, *O.sabina*; 8, antenna, *B. sivalikensis*; 9, tibial comb and tarsi, *O. sabina;* 10, mid-dorsal abdominal spines, *Macromia moorie* Selys (Corduliidae); 11, lateral abdominal spines, *Tramea basilaris burmeisteri* Kirby (Libellulidae); 12, female gonapophyses, *Cordulegaster* sp.; 13, anal appendages, male, *C. servilia servilia* 14, anal appendages, female, *C. servilia servilia.*



Figs. 24-44.24, labium, *Burmagomphus* sp.; 25, palpus, *Anax parthenope*; 26, labium. *Orthetrum* sp.; 27, antenna, *Burmagomphus* sp.; 28, labium (ventral view) *A.guttatus*; 29, head, *Orthetrum sabina* ; 30, mid-dorsal abdominal spines, *Acisoma panarpoides*; 31, labium. *O.pruinosum neglectum*; 34, lateral abdominal spines, *P.flavescens*; 35, labium, *Crocothemis servilia*; 36, labium, *Bradinopyga geminata*: 37, labium, *Diplacodes trivialis*; 38, labium, *Acisoma panarpoides*; 39, mid-dorsal abdominal spines, *Brachythemis contaminata*; 40, mid-dorsal abdominal spines, *Neurothemis tullia*; 41, labium, *Zyxomma petiolatum*, 42, labium, *Tholymis tillarga*; 43, anal appendages, *Pantala flavescens*; 44, anal appendages, *Tramea basilaris burmeisteri*.



Figs. 1-23. 1,caudal lamellae, *Lestes sp.* ; 2, anal appendages, *Crocothemis s.servilia* (♂);3, antenna, *Rhinocypha unimaculata;* 4, antenna, *Pseudagrion laidlawi*; 5 A, labium, *Lestes* sp.; 5B, distal margin palpus, *Lestes* sp.; 6, labium *P.laidlawi*; 7, caudal lamellae, *P.laidlawi*; 8, antenna, *Copera marginipes*; 9, caudal lamellae, *C.marginipes*; 10, caudal lamellae, *I.senegalensis*; 11 & 12, antenna, *Ceriagrion coromandelianum* ; 13, apical spine on 6th antennal segment, *C. marginipes* ; 14, caudal lamellae, *Calicnemia* sp.; 15, caudal lamellae, *Pseudagrion* sp.; 16, labium, *Pseudagrion* sp.; 17, labium, *Agriocnemis pygmeae*; 18, epiproct, *Ischnura aurora*,; 19, epiproct, *Rhodischnura nursei*; 20, epiproct, *C.coromandelianum*; 21, caudal lamellae, *P. rubriceps*; 22, epiproct, *Rhodischunura nursei*; 23, caudal lamellae, *Ischnura delicata.*

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ORTHOPTERA

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INTRODUCTION

The order Orthoptera includes the long and short-horned grasshoppers, crickets and mole-circkets. These insects are usually moderate to large sized (5 mm to 115 mm). The antennae of these insects are either long and thread-like (in suborder Ensifera) or simple and shorter (in suborder Caelifera). The number of known species of Orthoptera approach nearly 20,000. Out of these, only 900 species are recorded from India. They are distributed world-wide, but mostly occur in warmer regions, although they are well represented in the temperate zones. Almost all the terrestrial habitats are explored, from dense forest to savanna, prairis, desert, subterranean burrows and caves and tree tops. However, subaquatic forms are not numerous and fully aquatic species are rare.

Most of the orthopteran insects are phytophagous. Many species are camouflaged by the colourlation of the foliage. Locusts, which are widely destructive to all type of vegetation, belong to this group. Some species are also pest of crops. None is of medical or veterinary importance.

Roonwal (1956) provided a consolidated bibliography of Orthoptera from India. Many authors like Bolivar (1917), Henry (1940), Chopard (1969), Tandon & Shishodia (1974, 1976, 1977), Bhowmik (1967, 1969, 1970, 1975, 1976, 1977, 1985), Hazra *et al.* (1993) and Vasanth (1993) have worked on Indian Orthoptera, but no detailed account of fauna of Delhi State is available. The present study is a comprehensive account of the Orthoptera of Delhi. It deals with 42 species under 39 genera and eight families. Twenty-seven species marked with an asterisk (*) are new records from Delhi. Besides the species reported in the paper, a number of other species recorded by other workers from Delhi are listed under Annexure-1. The occurrence of certain species in Delhi is doubtful, these are makred by question mark (?). It is hoped that there are more species in the state, yet to be collected and reported.

SYSTEMATIC ACCOUNT

Order : ORTHOPTERA
Suborder : CAELIFERA
Family : PYRGOMORPHIDAE

1. * ***Pyrgomorpha bispinosa deserti*** Bei- Bienko

1951. *Pyrogomorpha bispinosa deserti* Bei-Bienko, *In* : Bei-Bienko & Mistshenko, L. *Opred Faun. S.S.S.R.* **38** : 273.

Material examined : Delhi ; 2exs., Tuglakabad forest nursery, near Air Force Station, 12.ix.1994, coll. J.P. Sati & party.

Diagnostic characters : Antennae 15- 16 segmented ; vertex without a constriction at the anterior margin of the eyes ; median carina of pronotum distinct, lateral carinae in the metozona not obsolete ; postero-ventral angle of lateral lobes of pronotum obliquely truncate.

Distribution : India : North west. *Elsewehre* : Soviet Central Asia ; Transcaucasia ; S.W. Asia.

Remarks : This species seems to be herbivorous in habit. It is recorded for the first time from Delhi.

2. * ***Attractomorpha crenulata crenulata*** (Fabricius)

1793. *Truxalis crenulatus* Fabricius, *Ent. Syst.*, **2** : 28.

1960. *Atractomorpha crenulata crenulata* : Banerjee & Kevan, *Treubia,* **25** : 184.

Material examined : Delhi : 1ex., I.A.R.I. Campus, 3. vi. 1992, coll. V. Khanna & party ; 2exs., same locality, 11. ix. 1994, coll. J.P. Sati & party, 1 ex., Piggery Farm nala, Uri Enclave, 18. xii. 1994, coll. A. Husain & party ; 1 ex., same locality, 19. ii. 1995, coll. J.P. Sati & party.

Diagnostic characters : Body-form slender and elongated ; fastigium of vertex short ; lateral pronotal lobe always with a membranous area near the posterior margin ; pronotal carinae ill defined ; tegmina pointed, extending for one-fourth of their length beyond the hind femora.

Distribution : India ; Andaman & Nicobar Islands, Andhra Pradesh, Bihar, Goa, Jammu & Kashmir, Kerala, Lakshadweep, Madhya Pradesh, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, Assam, Delhi, Haryana, Himachal Pradesh, Karnataka and Tripura. *Elsewhere* : Bangladesh ; Pakistan ; Sri Lanka ; Sumatra : Vietnam.

Remarks : It is commonly called tobacco or surface grasshopper. This species remains active throughout the year though reduced in winter. A pest of substantial economc importance.

3. ***Chrotogonus (Chrotogonus) trachypterus trachypterus*** (Blanchard)

1836. *Ommexycha trachypterus* Blanchard, *Annls. Soc. ent. Fr.*, **5** : 618.

1959. *Chrotogonus (Chrotogonus) trachypterus trachypterus* : Keven, *Publcoes cult. Co. Diam. Angola,* **43** : 147.

Material examined : Delhi ; 1 nymph., Road side forest near Kedia nursery, Karnal Road, 25.x. 1993, coll. N.K. Sinha & party ; 1 ex., Pond by the side of Okhla barrage, 10. v. 1994, coll. A. Husain & party ; 1 ex., Municipal nursery, Punjabi Bagh, 14.ix. 1994, coll. J.P.

Sati & party.

Diagnostic characters : Body short and robust ; anterior margin of prosternum strongly reflexed and dilated ; hind wings hyaline or occasionally faintly tinged yellowish brown but never infumated or infuscated, always at least two-third as long as tegmina.

Distribution : India : Andhra Pradesh, Assam, Bihar, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Punjab, Rajasthan, Uttar Pradesh, West Bengal. *Elsewhere* : Afghanistan ; Bangladesh ; Iran ; Nepal ; Pakistan.

Remarks : Commonly known as surface grasshopper. It is multivorous and terricolous. This species is found on bare soil, in fallow fields, including those covered with presumably regenerated grasses on newly sown and waste land, among grass and low crops. It is a pest occasionally of substantial importance.

4. *Poekilocerus pictus* (Fabricius)

1775. *Gryllus pictus* Fabricius, *Syst. Ent.* : 287.

1966. *Poekilocerus pictus* : *Akbar, Sind Univ. Sci. Res. J.* : **1.**

Material examined : Delhi : 1 ex., Opposite Runway, Palam Air Port, 9. ix. 1994, coll. J.P. Sati & party.

Diagnostic characters : Large sized with robust body ; head and pronotum with faint median carina ; pronotum gradually widened behind, the third sulcus placed about the middle ; tegmina and hind wing about as long as the abdomen ; base of wings coloured.

Distribution : India : Andhra Pradesh, Bihar, Delhi, Karnataka, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal. *Elsewhere* : Afghanistan ; Bangladesh ; Nepal ; Pakistan.

Remarks : Commonly known as AK grasshopper. It is a pest of *Caloptropis procera*. Occurs in drier parts of India.

Family : ACRIDIDAE
Subfamily : ACRIDINAE

5. *Acrida exaltata* (Walker)

1859. *Truxalis exaltata* Walker, *Ann. Mag. nat. Hist.*, **4** (3) : 222.

1954. *Acrida exaltata* : Dirsh, *Bull. Soc. Fouad Entom.*, **38** : 149.

Material examined : Delhi : 1 ex.,; A nala on Ring Road near Naraina village, 6. vi. 1993, coll. V. Khanna & party ; 1 ex., Najafgarh, 27. x. 1993, coll. N.K. Sinha & party ; 1 ex., Okhla Bridge at U.P. Border, 10. ix. 1994, coll. J.P. Sati & party, 2 ♀, 1 nymph, Asola WLS, 12. ix. 1994, coll. J.P. Sati & party.

Diagnostic characters : Head conically ascending ; fastigium broad, laminate and

truncate at apex ; eyes near the apex ; transverse sulcus of pronotum present about the middle of pronotal disc ; male subgenital plate comparatively long ; tegmina a little produced beyond the hind knee and wings slightly shorter than tegmina.

Distribution India : Assam, Andhra Pradesh, Arunachal Pradesh, Bihar, Delhi, Goa, Himachal Pradesh, Haryana, Kerala, Maharshtra, Madhya Pradesh, Meghalaya, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, Uttar Pradesh, West Bengal. *Elsewhere* : Afghanistan ; Bangladesh ; Iran ; Nepal ; Pakistan ; Saudi Arabia ; Sri Lanka ; S.E. China ; Yemen.

Remarks : It is strictly graminivorous, and is common in areas of high rainfall. This species is an occasional minor pest.

6. * *Ceracris nigrocornis nigrocornis* Walker

1870. *Ceracris nigrocornis* Walker, *Cat. Derm. Salt. Br. Musc.*, **4** : 791.

1925. *Ceracris nigrocornis nigrocornis* : Uvarov, *Ent. Mitt. Beri.*, **14** : 13.

Material examined : Delhi : 3 ♂, I.A.R.I. Campus, 1. ix. 1994, coll. J.P. Sati & party.

Diagnostic characters : Olive-green in colour ; face and pronotum coarsely punctured ; lateral fascia present on the head and the upper margin of pronotal lobes, not extending on the disc of metazona ; anal field of tegmina apple green or olige-green ; hind femora with a narrow pale pre-apical ring, preceded by a narrow blackish ring, knee black ; hind tibiae dirty-bluish, with the base black, a pale basal ring, followed by a blackish ring.

Distribution : India : Arunachal Pradesh, Assam, Bihar, Haryana, Himachal Pradesh, Manipur, Tamil Nadu, Uttar Pradesh and West Bengal. *Elsewhere* : Afghanistan ; S.China ; Myanmar ; Taiwan ; Thailand ; Vietnam.

Remarks : This species is graminivorous.

7. *Phlaeoba infumata* Brunner

1893. *Phlaeoba infumata* Brunner, *Annali Mus. civ. Stor. nat. Giacomo Doria*, **33** : 124.

1914. *Phlaeoba infumata* : Kirby, *Faun. Brit. India. Orth.*, **1** : 103.

Material examined : Delhi ; 1 nymph, 1 ex., NZP, 10. ii. 1995, coll. J.P. Sati & party.

Diagnostic characters : Antennae ensiform ; lateral carinae of pronotum straight, disc of pronotum rugose ; wings fusco-hyaline, infumated towards apex ; subgenital plate of male acute.

Distribution : India : Arunachal Pradesh, Bihar, Delhi, Haryana, Himachal Pradesh, Madhya Pradesh, Punjab, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal. *Elsewhere*: S. China ; Hainan Island ; Kampuchia ; S.N. Kuangtung ; Kwangsi ; Malacca ; Malaysia ; Myanmar, Nepal ; Taiwan ; Thailand ; Yunan.

Remarks : Commonly found in outskirts of forest and in grasslands adjacent to crop fields. It has a few records of minor damages.

Subfamily : OEDIPODINAE

8. ***Acrotylus humbertianus*** Saussure

1864. *Acrotylus humbertianus* Saussure, *Mem. Soc. Phys. Hist. nat. Geneve,* **28** (9) : 189.

1914. *Acrotylus humbertianus* : Kirby, *Fauna Brit. India, Orth.*, **1** : 153.

Material examined : Delhi ; 1 ♀, Pond by the side of river Yamuna, Vikas Marg, 13. v. 1994, coll. A. Husain & party.

Diagnostic characters : Body pubescent ; tip of vertex conical, concave ; pronotum finely carinate ; prozona with two fuscous fascia, the lateral margin white below ; wings hyaline, yellow at the base ; radial area with a semilunar fuscous fascia ; posterior femora fasciate.

Distribution : India : Andhra Pradesh, Assam, Bihar, Delhi, Goa, Haryana, Madhya Pradesh, Punjab, Rajasthan, Tamil Nadu, U.P., West Bengal. *Elsewhere* : Afghanistan ; Bangladesh ; Nepal ; Pakistan ; Sri Lanka.

Remarks : It is terricolous and is particularly associated with grasses, especially in sandy places. It has been reported to cause minor damage to rice and bulrush millet in India.

9. ***Aiolopus thalassinus tamulus*** (Fabricius)

1798. *Gryllus tamulus* Fabricius, *Ent. Syst. Suppl.*, : 195.

1968. *Aiolopus thalassinus tamulus* : Hollis, *Bull. Br. Mus. nat. Hist.* (Ent.), **22** (7) : 347.

Material examined : Delhi ; 1 ♂, River Yamuna & vicinity, Nizamuddin bridge, 11. v. 1994, coll. A. Husain & party ; 1 ♀. Majnu-Ka-Tila, 8.ix.1994, coll. J.P. Sati & party, 1 ♀, Dhaulakuan Forest, Ridge, 9. ix. 1994, coll. J.P. Sati & party; 2 ♂♂, Municipality Nursery, Punjabi bagh, 14. ix. 1994, coll. J.P. Sati & party ; 1 ♀, Kamla Nehru Ridge at Rajpur Road, 14. ix. 1994, coll. J.P. Sati & party.

Diagnostic characters : Fastigium with forward angle more acute ; face coarsely and sparsely punctured ; frontal ridge narrow, gradually and continuously narrowing upwards ; hind tibiae with red colouration and broadly separated from basal black band by bluish grey band.

Distribution : India : Andaman & Nicobar Islands, Bihar, Delhi, Haryana, Himachal Pradesh, Karnataka, Madhya Pradesh, Punjab, Orissa, Rajasthan, Tamil Nadu, U.P., West Bengal. *Elsewhere* : Australia ; Bangladesh ; Brunei ; China ; Hainan ; Hong Kong ; Indonesia ; Japan ; Java ; Malaya ; Myanmar ; New Guinea ; Singapore ; Sri Lanka ; Sumatra ; Taiwan ; Thailand.

Remarks : This species is found on grassy places, irrigated land, crop fields, abandoned cultivation and salt marshes. Several authors refer to its attraction to light in large numbers. Though minor pest but sometimes does considerable damage, especially to crops in the seedling stage.

10. ***Trilophidia annulata*** (Thunberg)

1815. *Gryllus annulatus* Thunberg, *Mem. Acad. Sci. St. - Petersb.* **5** : 234.

1914. *Trilophidia annulata* : Kirby, *Fauna Brit. India, Orth,*, **1** : 149.

Material examined : Delhi : 1 ex., Tuglakabad Park, 12. ii. 1995, coll. J.P. Sati & party.

Diagnostic characters : Pronotum rugose, with a high median carina, forming two teeth in front, and with lateral carinae ; hind wings yellow at base, and brown or black beyond ; hind tibiae brown, with a pale band towards the base and another beyond the middle.

Distribution : India : Andhra Pradesh, Arunachal Pradesh, Bihar, Dehi, Goa, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Orissa, Rajasthan, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal. *Elsewhere* : Afghanistan ; Bangladesh ; S.China ; Hong Kong ; Japan; Korea ; Malaya ; Myanmar ; Mongolia ; Nepal ; Pakistan ; Philippines ; Sarawak ; Singapore ; Sri Lanka ; Taiwan ; Thailand and N. Vietnam ; Indonesia.

Remarks : Geophilous and cryptically coloured. It occurs in forest outskirts, gardens and plantations, in places overgrown with grass and sugar cane fields. It is a major pest of pastures throughout the year in India.

Subfamily : HEMIACRIDINAE

11. * ***Hieroglyphus nigrorepletus*** Bolivar

1912. *Hieroglyphus nigrorepletus* Bolivar, *Trab. Mus. nac. Cienc. nat. Madr.*, **6** : 56.

1973. *Hieroglyphus nigrorepletus* : Mason, *Bull. Br. Mus. nat. Hist.* (Ent.), **28** (7) : 526.

Material examined : Delhi ; 1 ♂, 1 ♀, Rock Climbiing area Ladu Sarai, Mehrauli Road, 7. ix. 1994, coll. J.P. Sati & party ; 1 ♂, 1 ♀, Priya Park, Munirka/Vasant Vihar, 13. ix. 1994, coll. J.P. Sati & party ; 1 ♂, 1 ♀, Tuglaqabad Forest Nursery near Air Force Station, 12. ix. 1994, coll. J.P. Sati & party ; 1 ♂, 1 ♀, Priya Park, Munirka/Vasant Vihar, 13. ix. 1994, coll. J.P. Sati & party ; 1 ♂, 1 ♀, Humayun Tomb, 14.ii. 1995, coll. J.P. Sati & party.

Diagnostic chracters : Pronotum with sides markedly expanded in metazone ; dorsum with characteristic black pattern connecting all the sulci by two irregular stripes ; first and third sulci joined by a black band ; posterior margin of pronotum obtuse-angular ; male cercus with elongate acute apex, oblique on upper margin ; female genital plate without parallel ridges.

Distribution : India : Assam, Bihar, Jammu & Kashmir, Karnatka, Maharashtra, Madhya Pradesh, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal. *Elsewhere* : Bangladesh ; Pakistan.

Remarks : Commonly known as phadka grasshopper. Generally found in swamps and irrigated lands, and is phytophilous in habits. It is a major pest of rice, sugarcane, hemp, maize and sorghum. Normally it is non-migratory, but sometimes it develops the habit of swarming. It is found in both macro and brachypterous forms.

12. *Spathospternum prasiniferum prasiniferum* (Walker)

1871. *Heteracris* (?) *prasinifera* Walker, *Cat. Derm. Salt. Brit. Mus.*, **5** Suppl. : 65.

1936. *Spathosternum prasiniferum prasiniferum* : Tinkham, *Lingnan. Sci. J.*, **15** : 51.

Material examined : Delhi ; 1 ex., Budha Jayanti Park, 4. vi. 1993, coll. V.Khanna & party ; 8 exs., NZP, 7. vi. 1993, coll. V. Khanna & party ; 2 ♂, Road side forest near Kedia Nursery, Karnal road, 25. x. 1993, coll. N.K. Sinha & party ; 2exs., Kakraula nursery, near Najafgarh road, 27. ix. 1993, coll. N.K. Sinha & party ; 1 ♂. Masudpur, Vasant Kunj, 13. ix. 1994, coll. J.P. Sati & party ; 1 exs., Chawla Pul, Najafgarh - Bijwasan Road, 20. xii. 1994, coll. A. Hussain & party ; 2 ex., Asola WLS, 21. xii. 1994, coll. A. Husain & party ; 1 ♂, Lodhi garden, 13. ii. 1995, coll. J.P. Sati & party.

Diagnostic characters : Broad blackish or dark green stripe run behind the lower part of the eyes and below the lateral carinae of the pronotum ; prosternal process spathulate ; central area of tegmina with a longitudinal black streak, generally almost obsolete in male and well marked in female, but very variable, sometimes being entire.

Distribution : India : Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Bihar, Delhi, Goa, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu, West Bengal. *Elsewhere* : Bangladesh ; S.E. China; Hainan ; W.Malayasia ; Myanmar ; Nepal ; Pakistan ; Sri Lanka ; Thailand ; Vietnam.

Remarks : This species is generally found on either side of road, in pastures and in crop fields. It is a pest of crops.

13. * *Gesonula punctifrons* (Stol)

1860. *Acridium (Oxya) punctifrons* Stol, *Kong. Svens. Freq. Eug. Resa Omk. Jorden* : 172.

1965. *Gesonula punctifrons* : Mishchenko, *Locusts and grasshoppers* of U.S.S.R. and adjacent countries, Catantopinae, Leningrad : 172.

Material examined : Delhi ; 3 exs., 11. viii. 1970, coll. Reeta.

Diagnostic characters : Size medium ; antennae longer than head and pronotum together; pronotum long, narrow, rugose ; lateral lobes very wide, anterior margin oblique, antero-ventral angles rounded ; supra-anal plate spoon-shaped, wide basally, with ide longitudinal median groove ; hind tibiae dirty bluish, reddish at base, blackish at apex ; the apical part of hind tibiae modified for swimming.

Distribution : India : Andaman & Nicobar Islands, Arunachal Prdesh, Assam, Goa, Kerala, Manipur, Meghalaya, Orissa, Punjab, Tamil Nadu, Tripura, West Bengal. *Elsewhere* : Bangaldesh ; Borneo ; China ; Hainan ; Japan ; Java ; Malacca ; Myanmar ; Philippines ; Sri Lanka ; Taiwan ; Tongking ; Thailand ; N. Vietnam.

Remarks : This species occurs near the vicinity of ponds, lakes or marshy places where the water hyacinth plants are grown. It is also found in rice fields.

Subfamily : OXYINAE

14. * ***Oxya hyla hyla*** Serville

1831. *Oxya hyla* Serville, *Annls. Sci. nat.* (Zool), **22** : 287.

1971. *Oxya hyla hyla* : Hollis, *Bull. Br. Mus. nat. Hist.* (Ent.), **26** (7) : 282.

Material examined : Delhi : 2 exs., Chhawla Village, Najafgarh Road, 5. vi. 1993, coll. V. Khanna & party , 1 ex., Road side forest near Kedia Nursery, Karnal Road, 25. x. 1993, coll, N.K. Sinha & party ; 1 ex., Bhaleswa Lake, Karnal Road, 15. xii. 1994, coll. A. Husain & party; 1 ♂, 1 ♀, NZP, 10.ii. 1995, coll. J.P. Sati & party.

Diagnostic characters : Body finally pitted, shiny ; male supra-anal plate trapezoid with triangular apical projection on both sides of supra-anal plate small tubercles present ; male cercus conical or compressed laterally with subacute or truncate apex ; female subgenital plate with two longitudinal ridges extending forward from posterior margin.

Distribution : India : Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal. *Elsewhere* : Afghanistan ; Africa ; Bangladesh ; Madagascar ; Nepal ; Pakistan ; Iran ; Sri Lanka.

Remarks : Commonly known as rice grasshopper, this species mainly inhabits rice fields and low-lying grasslands and is found near streams on grasses of many genera.

Subfamily : TROPIDOPOLINES

15.* ***Tristria pulvinata*** (Uvarov)

1921. *Tapinophyma pulvinata* Uvarov, *Ann. mag. nat. His.*, (9) **7** : 497.

1929. *Tristria pulvinata* : Uvarov, *Ravue suisse Zool*, **36** : 559.

Material examined : Delhi ; 1 ex., NZP, 7. vi. 1993, coll. V. Khanna & party.

Diagnostic characters : Antenna filiform ; prosternal process curved backwards, with slightly concave apical surface ; male cercus in apical third incurved, down curved and laterally flattened ; female subgenital plate with an angular projection on the posterior margin on either side of mid-line ; male subgenital plate almost liner, compressed knife-like.

Distribution : India : Assam, Bihar, Delhi, Haryana, Karnataka, Maharashtra, Tamil Nadu, Uttar Pradesh, West Bangal. *Elsewhere* : Sri Lanka.

Subfamily : CALLIPTAMINAE

16. * ***Caloptenopsis glaucopsis liturifer*** (Walker)

1870. *Caloptenus liturifer* Walker, *Cat. Derm. Salt. Brit. Mus.*, **4** : 701.

1950. *Caloptenopsis glaucopsis liturifer* : Uvarov, *Eos, Madr.*, Suppl. : 388.

Material examined : Delhi : 4 exs., Asola WLS, 12. ix. 1994, coll. J.P. Sati & party.

Diagnotstic characters : Fastigium of vertex with its depression smooth at the bottom and continuing without break between eyes ; pronotum not constricted in prozona with regular lateral carinae ; median carina cut by the principal sulcus, not gibbose in profile ; lateral pronotal lobe with an oblique straight callous ridge on the upper part of prozona ; inner face of hind femur yellowish-testaceous, and strongly fasciated above ; tegmina with sharp withish pattern along the middle.

Distribution : India : S.India, Karnataka, Tamil Nadu.

Remarks : A geophilous species inhabiting open, stony or gravelly plains with only sparse growth of short annual grasses and herbs.

Subfamily : EUPREPOCNEMEDINAE

17 * ***Euprepocnemis alacris alacris*** (Serville)

1839. *Acridium alacre* Serville, *Ins. Orth.* : 682.

1958. *Euprepocnemis alacris alacris* : Dirsh, *Proc. R. ent. Soc. Lond.* B **27** : 40.

Material examined : Delhi ; 4 exs., Municipality Nursery, Punjabi Bag, 14. ix. 1994, coll. J.P. Sati & party.

Diagnostic characters : Concavity of fastigium of vertex distinct, with a low apical carinula separating it from frontal ridge ; pronotum above with a characteristic narrow dark spot; lateral carinae of pronotum converging forward, dark spots present on the wings ; hind tibiae bluish-grey, with two whitish rings at the base and reddish apex and tarsus.

Distribution : India : Andhra Pradesh, Bihar, Delhi, Goa, Himachal Pradesh, Haryana, Kerala, Madhya Pradesh, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal. *Elsewehre* : Afghanistan ; Bangladesh ; Pakistan ; Iran; Sri Lanka.

18. * ***Chroedocus capensis*** (Stol)

1815. *Gryllus capensis* Thunberg, *Mem. Acad. Sci. St.-Petersb.*, **5** : 240.

1921. *Chroedocus capensis* : Uvarov, *Trans. ent. Soc. Lond.* : 108.

Material examined : Delhi : 3 exs., Tuglakabad Forest Nursery near Air Force Station, 12. ix. 1994, coll. J.P. Sati & party.

Diagnostic characters : Fastigium of the vertex depressed, a narrow black line runs below the eyes ; frontal ridge sparingly punctured ; vertex and disc of pronotum with a broad brown longitudinal stripe, broadly bordered with yellow on both sides ; hind femora reddish above and yellowish below ; hind tibiae yellowish, with 11 to 23 black-tipped spines ; tegmina with numerous brown spots.

Distribution : India : Tamil Nadu, West Bengal. *Elsewhere* : S.E. China ; Kampuchea ; Myanmar ; Sri Lanka ; Thailand ; Vietnam.

19. * *Heteracris pulchra* Bolivar

1902. *Euprepocnemis pulchra* Bolivar, *Annls. Soc. ent. Fr.*, **70** : 630.

1958. *Heteracris pulchra* : Dirsh, *Tijdschr. Ent.*, **101** : 54.

Material examined : Delhi : 1 ex., Tuglaqabad Forest Nursery near Air Force Station, 12.ix.1994, coll. J.P. Sati & party.

Diagnostic characters : Colour olivaceous ; head pale red, broadly banded with black below the eyes ; fastigium of the vertex smooth, slightly sulcated ; pronotum with a broad velvety black stripe on the dorsum ; prosternal tubercle subcylindrical, compressed in front, obtuse at apex ; tegmina thickly spotted with brown ; cerci compressed and curved.

Distribution : India : Orissa, Tamil Nadu, Uttar Pradesh, West Bengal. *Elsewhere* : Sri Lanka.

20. * *Heteracris littoralis* (Rambur)

1838. *Gryllus littoralis* Rambur, *Faune Entomol.*, Orthopt. **2** : 78.

1958. *Heteracris littoralis* : Dirsh, *Tijdschr. Ent.*, **101** : 54.

Material examined : Delhi, 3 exs., Delhi University compound, 11. x. 1960, coll. Alam.

Diagnostic characters : Frontal ridge on fastigium distinctly narrowed ; pronotum short, lateral carinae in metazona obliterated ; tegmina narrow, extending beyond distal end of hind femur ; wings narrow, shorter than tegmina ; hind femur slender ; subgenital plate short ; bluntly conical ; apical part of hind tibiae red-violet or light red.

Distribution : India : Bihar Rajasthan. *Elsewhere* : Azerbaijan ; Central Asia ; Southeastern Asia ; Egypt ; Greece ; Iberian peninsula and southern Kazakistan.

Remarks : It is injurious to cultivated plants.

Subfamily : CATANTOPINAE

21. *Diabolocatantops innotabilis* (Walker)

1870. **Acridium innotabile* Walker, *Cat. Derm. Salt. Brit. Mus.*, **4** : 629.

1984. *Diabolocatantops innotabilis* : Jago, *Trans. Am. ent. Soc.*, **110** : 371.

Material examined : Delhi : 1 ex. , I.A.R.I. campus, 3. vi. 1993, coll. V. Khanna & party : 1 ex., Kakraula Nursery on Najafgarh Road, 27. x. 1993. coll. N.K. Sinha & party ; 2 exs., Tuglakabad Forest Nursery, near Air Force Station, 12. ix. 1994, coll. J.P. Sati & party ; 1 ex., Tuglakabad Park, 12. ii. 1995, coll. J.P. Sati & party ; 1 ex., Budha Jayanti Park, 15. ii. 1995, coll. J.P. Sati & party

Diagnostic characters : Prosternal process short, subcylindrical, weakly compressed at base, rounded at apex ; lateral lobe of pronotum without coloured pattern ; tegmina extended to hind knee by more than the length of pronotum ; external disc of hind femur without the black median spot below the upper carinula ; male cercus more upcurved, with more broadened apex and more projecting upper apical angle.

Distribution : India : Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Delhi, Goa, Haryana, Himachal Pradesh, Jammu & Kashmir, Kerala, Lakshadweep Island, Orissa, Madhya Pradesh, Punjab, Rajasthan, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal. *Elsewehre* : Indo-China ; Java ; Malaya ; Myanmar ; New Guinea ; Philippines ; Sri Lanka ; Sumatra ; South Tibet ; Thailand and Yunnan.

22. * *Paraconophyma scabra* (Walker)

1870. *Caloptenus scaber* Walker, *Cat. Derm. Salt. Brit. Mus.*, **4** : 707.

1921. *Paraconophyma scabra* : Uvarov, *Ann. Mag. nat. Hist.*, (9) **7** : 500-501.

Material examined : Delhi : 1 ♀, Delhi University campus, 30.x.1971, coll. not known.

Diagnostic characters : Size small ; dark-brown in colour, with black markings ; puncture marks on pronotal disc very coarse and strong ; median carina of pronotum crossed by 2 sulci ; lateral carinae developed before the first sulcus only and distinctly convergent behind ; tegmina with upper part rugulose and lower polished, shape narrow, apex truncate ; hind femora, in the lighter coloured specimen bear two indefinite transverse fasciae on the externo-median area ; hind tibiae muddy-green, with a pale sub-apical ring ; supra-anal plate of male with hind angle straight and sharp.

Distribution : India : Himachal Pradesh, Jammu & Kashmir, Karnataka, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal.

23. * *Xenocatantops karnyi* (Kirby)

1910. *Catantops karnyi* Kirby, *Syn. Cat. Orth.*, **3** : 483.

1982. *Xenocatantops karnyi* : Jago, *Trans. Am. ent. Soc.*, **108** (3) : 454.

Material examined : Delhi : 1 ex., Hauz Khas, 15. ii. 1995 ; 1 ex., Lake Garden, Dhaula Kuan, 16. ii. 1995, coll. J.P. Sati & party.

Diagnostic characters : Prosternal process not or scarcely compressed laterally, being more or less acutely conical ; pronotum slightly constricted in the middle ; inner side of hind femur orange-red or red, with brown or black markings ; male cercus clearly bifurcate apically, apical bifurcation bluntly pointed and sub-equal.

Distribution : Known only from north, west and south India.

Subfamily : CYRATACANTHACRIDINAE

24. *Cyrtacanthacris tatarica* (Linnaeus)

1758. *Gryllus locusta tataricus* Linnaeus, *Syst. Nat.* (10 ed.) **1** : 432.

1923. *Cyrtacanthacris tatarica* : Uvarov, *Bull ent. Res.*, **14** : 39.

Material examined : Delhi, 1 ex., Asola WLS, 12. ix. 1994, coll. J.P. Sati & party.

Diagnostic characters : Size large ; prosternal tubercle strongly curved backwards and almost touching mesosternum ; pronotum moderately tectiform, slightly constricted ; male cercus with subacute apex ; wings lemon-yellowish ; costal area of tegmina with coarse net-like reticulations.

Distribution : India : Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Dehi, Goa, Haryana, Himachal Pradesh, Jammu & Kashmir, Kerala, Orissa, Rajasthan, Tamil Nadu, U.P. and West Bengal. *Elsewhere* : Afrïca (Sahara) ; Bangladesh ; Hainan ; Indonesia ; Madagascar ; Myanmar ; Nepal ; Philippines ; Seychelles ; Sri Lanka ; Thiland.

Remarks : Multivorous, and is found on many wild and cultivated plants. It is also found in crop fields. There are few records of minor damages.

25. * *Anacridium rubrispinum* (Bei-Bianko)

1948. *Anacridium aegyptium rubrispinum* Bei-Bienko, *C.R. Acad. Sci. U.S.S.R.*, **60** : 499.

1953. *Anacridium rubrispinum* : Dirsh & Uvarov, *Tijdschr. Ent.*, **96** (4) : 50.

Material examined : Delhi : 2 exs., Talkatora garden, 10. ix. 1956, coll. Raghunath.

Diagnostic characters : Body length under 73 mm or so ; median carina of pronotum deeply incised by transverse sulci ; prozona constricted, convex ; metazona weekly widened with tectangular posterior margin ; prosternal tubercle subconical, slightly compressed laterally, apex more or less acute ; basal disc of wing light violet or yellowish, fascia light brownish infumate ; subgenital plate narrow, with narrow lower and comparatively broad upper lobe ; middle lobe elongate, tongue-shaped with rounded apex ; cercus short, weakly incurved, slightly projecting beyond the middle of subgenital plate.

Distribution : Rajasthan (Jodhpur) and Uttar Pradesh (Dehra Dun). *Elsewhere* : Afghanistan ; Iran ; Pakistan ; Iran.

Family : TETRIGIDAE

26. * *Euparatettix tenuis* Hancock

1912. *Euparatettix tenuis* Hancock, *Mem. Dep. Agric. India. ent. Ser.*, **4** : 153.

1991. *Euparatettix tenuis* : Shishodia, *Rec. zool. Surv. India., Occ. Paper*, **140** : 133.

Material examined : Delhi : 1 ex., Municipality Nursery, Punjabi Bag, 14. ix. 1994, coll. J.P. Sati & party ; 2 exs., Lake Garden, Shakurpur Basti, 31. x. 1993, coll. N.K. Sinha & party.

Diagnostic characters : Size medium, body slender ; head and eyes exserted ; vertex narrower than eye ; frontal costa moderately sulcated ; antennae placed on the lower margin of eyes ; pronotum extended beyond the middle of posterior tibiae ; dorsum a little or not at all convex between the shoulders ; median carina nearly straight ; wings extended beyond the pronotal apex.

Distribution : India : Arunachal Pradesh, Assam, Bihar, Manipur, Meghalaya, Sikkim, Tripura, Uttar Pradesh and West Bengal. *Elsewhere* : Bangladesh ; Myanmar.

27. * *Euparatettix histricus* (Stol)

1860. *Tetrix histrica* Stol, *Frag. Eugenies Resa Orth.* : 347.

1887. *Paratettix histricus* : Bolivar, *Annls. Soc. ent. Belg.*, **33** : 188, 271, 279.

Material examined : Delhi : 2 exs., Water Sports Complex, Bhaleswa vill., 26. x. 1993, coll. N.K. Sinha & party.

Diagnostic characters : Size a bit larger than the preceding species ; body stature a bit more robust ; head a little exserted ; vertex narrower than eye ; paired ocelli placed in the middle of eyes ; antennae situated on the border line of eyes ; pronotum extended beyond the middle of hind tibiae ; dorsum smooth, convex and wide between shoulders ; median carina distinct but low.

Distribution : India : Andhra Pradesh, Assam, Bihar, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Tamil Nadu and West Bengal. *Elsewhere* : E.Africa ; E.Afghanistan ; N.Australia ; N. Caledonia ; S.China ; Celebes ; Holland ; Iran ; Indonesia ; Malaya Island ; Myanmar ; Mindanao ; Nepal ; Pakistan ; Philippines ; Saudi Arabia ; Sri Lanka ; Sumatra; Taiwan ; Indonesia.

28. **Ergatettix dorsifera* (Walker)

1871. *Tettix dorsifera* Walker, *Cat. Derm. Salt. Brit. Mus.*, **5** : 825.

1929. *Ergatettix dorsifera* : hebard, *Revue suisse Zool.*, **36** : 588.

Material examined : Delhi ; 1 ♂, Dhaulakuan, Ridge, Cantonment area, 10.vi.1993, coll. V.Khanna & party.

Diagnostic characters : Size medium, head distinctly exserted ; vertex narrower than eye; paired ocelli placed below the middle of eyes ; antennae situated below the inferior margin of eyes ; eyes raised above the vertex ; median and lateral carinae without dilated lobes on hind pronotal process.

Distribution : India : Arunachal Pradesh, Assam, Bihar, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Orissa, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal. *Elsewhere* : Afghanistan ; Bangladesh ; Central Asia ; S.China ; Greater Sunda Island ; Iran ; Indonesia ; Myanmar ; Sri Lanka ; Taiwan ; Turkmenia.

Family : TETTIGONIIDAE

29. ***Letana inflata*** Brunner

1878. *Pyrrhicia inflata* Brunner, Monogr. Phan. : 116.

1906. *Letana inflata* : Kirby, *Syn. Cat. Orth.*, **2** : 116.

Material examined : Delhi : 1 ex., Dhaulakuan Forest, Ridge, 9.ix. 1994, coll. J.P. Sati & party.

Diagnostic characters : Antennae very long ; body large, green and parapterous ; pronotum strongly inflated in male, normal in female ; prolongation of ninth tergite short, rounded ; tegmina surpassing hind knees, radial sector forked ; cerci long, curved in basal third, substraight behind ; supra-anal plate with almost parallel lateral margins, depressed in middle, apex subtruncate to slightly concave, apico-lateral angles slightly protruding ; subgenital plate lateral lobes with apex rounded ; phallus sclerite elongated, small, weakly sclerotised ; female supra-anal plate circa semicircular, with a short baso-medial furrow ; cerci long, slender, apex subobtuse ; subgenital plate triangular, apex slightly incised ; ovipositor short, sickle-shaped, dorsal and ventral margins serrulate in apical parts.

Distribution : India : S.India.*Elsewhere* : Sri Lanka.

Family : GRYLLIDAE
Subfamily : GRYLLINAE

30. ***Gymnogryllus sp.***

Material examined : Delhi, 3 nymphs, Priya Park, Munirka, Vasant Vihar, 13.ix. 1994, coll. J.P. Sati & party 1 ex., nymph, Delhi Municipality Nursery, Punjabi bagh, 14. ix. 1994, coll. J.P. Sati & party ; 1 ex., Kamla Nehru Ridge, Rajpur Road, 14. ix. 1994, coll. J.P. Sati & party.

Diagnostic characters : Body glabrous ; ocelli disposed in a straight line ; pronotum not enlarged in front ; anterior and middle tibiae covered with abundant pubescence ; anterior meta tarsi longer ; posterior femora long, usually as long as tibia and tarsus together.

Distribution : Tropical Asia including India ; Africa south of the Sahara.

31. ***Gryllus bimaculatus*** De Geer

1883. *Gryllus bimaculatus* De Geer, *Mem. Ins.*, **3** : 521.

1969. *Gryllus bimaculatus* : Chopard, *Fauna of India,* Orthoptera, **2**, Grylloidea : 35.

Material examined : Delhi : 1 ex., Pitampura, outer ring road, 9. vi. 1993, coll. V. Khanna & party ; 2 exs., Rock climbing area Lado Sarai, Mehrauli Road, 7. ix. 1994. coll. J.P. Sati & party ; 1 ex., Asola WLS, 12. ix. 1994, coll. J.P. Sati & party, 1 ex., Kamla Nehru

Ridge, 17.ii. 1995, coll. J.P. Sati & party.

Diagnostic characters : Body and legs almost glabrous; typically black colour with a yellow spot at base of each tegmen ; body not convex ; head rounded, frontal rostrum wide ; antennae inserted above the middle of the face ; ocelli disposed as a triangle posterior femora not longer than tibia and metatarsus together.

Distribution : India : Assam, Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Bihar, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Maharashtra, Madhya Pradesh, Meghalaya, Orissa, Pondichery, Punjab, Rajasthan, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal. *Elsewhere* : Malaysia ; Myanmar ; Nepal ; Pakistan ; Singapore ; Sri Lanka.

32. **Acheta domesticus* Linnaeus

1758. *Gryllus acheta domesticus* Linnaeus, *Sys. Nat.* (10th ed.) **1** : 428.

1967. *Acheta domesticus* : Chopard, *Orthopterorum Catalogus*,**10** : 62.

Material examined : Delhi : 4 exs., Asola WLS, 12. ix. 1994, coll. J.P. Sati & party ; 1 ex., Masudpur, Vasant Kunj, 13. ix. 1994, coll. J.P. Sati & party.

Diagnostic characters : Body somewhat depressed, pubescent ; head with two wide transverse testaceous bands ; tegmina extending to the apex of abdomen or a little shorter ; wings usually longer than tegmina ; mirror as wide as long, almost rounded, divided behind the middle ; 4-5 oblique veins ; female tegminal veins oblique, regular ; ovipositor long, acute.

Distribution : India : Himachal Pradesh, Jammu & Kashmir, Kerala, Maharashtra, Punjab, Rajasthan, Uttar Pradesh and West Bengal. *Elsewhere* : Pakistan.

33. * *Modicogryllus confirmatus* (Walker)

1859. *Acheta confirmata* Walker, *Ann. Mag. nat. Hist.*, (3) **4** : 221.

1961. *Modicogryllus confirmatus* : Chopard, *Eos, Madr.*, **37** : 272.

Material examined : Delhi : 3 exs., Tuglaqabad Forest Nursery near Air Force Station, 12. ix. 1994, coll. J.P. Sati & party ; 1 ex., Lodhi garden, 15. ix. 1994, coll. J.P. Sati & party.

Diagnostic characters : Head blackish with 6 longitudinal yellow lines on the occiput, and a transverse yellow band between the lateral ocelli ; lateral field of tegmina with widely separated veins ; mirror longer than wide, divided by a curved vein, oblique, 2 in number ; wings caudate ; ovipositor long with acute apical valves.

Distribution : India : Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Karnataka, Maharashtra, Manipur, Madhya Pradesh, Meghalaya, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal. *Elsewhere*: Bangladesh; Indo-China; Iran; Malaya; Myanmar; Nepal; Pakistan; Sri Lanka; Thailand.

34. **Plebeiogryllus guttiventris* (Walker)

1871. *Gryllus guttiventris* Walker, *Cat. Derm. Salt. Brit. Mus.*, **5** Suppl. : 6.

1964. *Plebeiogryllus guttiventris* : Randell, *Can. Ent.*, **96** : 1598.

Material examined : Delhi : 2 exs., Rock Climbing area Lado Sarai, Mehrauli Road, 7. ix. 1994, coll. J.P. Sati & party , 1 ex., I.A.R.I., 11.ix.1994, coll. J.P. Sati & party, 1 ex., Majnu ka tila, 15. xii. 1994, coll. A. Husain & party, 1 ♂, Asola WLS, 12. ii. 1995, coll. A. Husain & party ; 1 ex., Budha Jayanti Park, 15. ii. 1995, coll. J.P. Sati & party.

Diagnostic characters : Body medium in size, pubescent ; head blackish with 6 yellow lines on the occiput ; lateral lobes of pronotum blackish ; posterior femora short and thick, feebly striated with brown ; mirror as wide as long, divided behind the middle by a curved vein ; 4 to 5 oblique veins ; wings caudate ; genitalia formed of a large piece with sinuated sides, ending into a blunt point ; ovipositor long, straight, apical valves acute.

Distribution : India : Andhra Prdesh, Bihar, Goa, Haryana, Karnataka, Kerala, Maharshtra, Madhya Pradesh, Manipur, Orissa, Pondicherry, Uttar Pradesh, Tamil Nadu and West Bengal. *Elsewhere* : Myanmar ; Sri Lanka.

35. **Valarifictorus aspersus* (Walker)

1869. *Gryllus aspersus* Walker, *Cat. Derm. Salt. Brit. Mus.*, **1** : 39.

1964. *Velarifictorus aspersus* : Randell, *Can. Ent.*, **96** : 1587.

Material examined : Delhi ; 1 ♂, I.A.R.I., 24.x.1993, coll. N.K.Sinha & party ; 1 ♂, Kamala Nehru ridge, 14.ix.1994, coll. J.P. Sati & party.

Diagnostic characters : Head with a transverse yellow band between the ocelli ; mandibles long, prominent ; tegmina may or may not reach upto the apex of abdomen ; mirror divided by a curved vein, 2 oblique veins present ; wings short, but absent in one specimen. *Measurement* (in mm) : Body length 12.0 ; pronotum length 2.9 ; posterior femora 7.0 ; tegmina length 7.0.

Distribution : India : Andhra Pradesh, Arunachal Pradesh, Assam, Jammu & Kashmir, Karnataka, Maharashtra, Meghalaya, Uttar Pradesh and West Bengal. *Elsewhere* : Annam ; China ; Hong Kong ; Kualalampur ; Malaya ; Myanmar ; Selangor and Singapore ; Indonesia.

36. **Gryllodes sigillatus* (Walker)

1869. *Gryllus sigillatus* Walker, *Cat. Derm. Salt. Brit. Mus.* , **1** : 46.

1877. *Gryllodes sigillatus* : Saussure, *Mem. Soc. Phys. Hist. nat. Geneva.*, **25** : 210.

Material examined : Delhi ; 1ex, Tuglaqabad Forest Nursery near Air Force Station, 12. ix. 1994, coll. J.P. Sati & party ; 1 nymph, Delhi Municipality Nursery, Punjabi bag, 14. ix. 1994, coll. J.P. Sati & party; 2 nymphs, Okhla Reservoir, 18. xii. 1994, coll. A. Husain & party; 2 exs., 10 nymphs, Asola WLS, 21. xii. 1994, coll. A. Husain & party.

Diagnostic characters : Head small, a little flattened, frontal rostrum much narrower ; tegmina of male not over reaching the middle of abdomen, truncated at apex ; tegmina of female very short and widely separated ; wings absent in both sexes.

Distribution : India : Andaman & Nicobar Islands, Andhra Pradesh, Assam, Bihar, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Maharashtra, Madhya Pradesh, Manipur, Meghalaya, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal. *Elsewhere* : Malacca ; Malaya ; Pakistan ; Sri Lanka.

37. * ***Gryllopsis*** sp.

Material examined : Delhi : 1 ex., I.A.R.I. campus, 24. x. 1993, coll. N.K. Sinha & party, 1 ♀, Asola WLS, 12. ix. 1994, coll. J.P. Sati & party ; 1 ex., Kamla Nehru Ridge, Rajpur Road, 14. ix. 1994, coll. J.P. Sati & party ; 1 nymph, Delhi University campus, 23. xi. 1994, coll. A. Husain & party.

Diagnostic characters : Body very convex ; head big flabular ; anterior tibiae without internal tympanum ; posterior metatarsus usually stouter and shorter ; tegmina wide in male, often very short or sometimes reduced to lateral pads in female.

Distribution : India : Delhi. *Elsewhere* : Africa south of Sahara, Tropical Asia, Australia, Egypt and Iran.

Remarks : The female specimens could not be identified upto specific level.

Subfamily : NEMOBIINAE

38. ***Pteronemobius fascipes*** (Walker)

1869. *Eneoptera fascipes* Walker, *Cat. Derm. Salt. Brit. Mus.*, **1** : 67.

1931. *Pteronemobius fascipes* : Chopard, *Bull. Raffles Mus.*, **6** : 134.

Material examined : Delhi : 1 ex., I.A.R.I., campus, 11, ix. 1994, coll. J.P. Sati & party.

Diagnostic characters : Size small ; maxillary palpi very dark at base, with 4th and 5th joints nearly white ; lateral lobes of pronotum blackish ; tegmina with normal venation ; posterior femora adorned with blackish bands ; spines of posterior tibiae movable, pubescent, male with 3 external and 4 internal spines.

Distribution : India : Arunachal Pradesh, Assam, Bihar, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal. *Elsewhere* : Java ; Myanmar ; Singapore ; Sri Lanka.

Family : TRIGONIDIIDAE

39. **Trigonildium cicindeloides* Rambur

1839. *Trigonidium cicindeloides* Rambur, *Faune Andal.*, **2** : 39.

1929. *Trigonidium cicindeloides* : Rambur, *Fauna of India* Orthopt. **2** Grylloidea : 304.

Material examined : Delhi : 1 ex., A nala on Ring road, near Naraina village 6. vi. 1993, coll. V. Khanna & party ; 9 exs., NZP, 7. vi. 1993, coll. V. Khanna & party ; 3 exs., Dhaula Kuan Ridge, Cantonment area, 10. vi. 1993, coll. V. Khanna & party 1 ex., A nala across Okhla Reservoir, 18. xii. 1994, coll. A. Husain & party ; 1 ex., Chawla Pul, Najafgarh - Bijwasan road, 20. xii. 1994, coll. A. Husain & party.

Diagnostic characters : Size small, body black, shining ; tegmina strongly convex, venation similar in both the sexes, false veins present between the principal veins ; anterior tibiae unperforated ; 2nd segment of tarsi compressed and minute ; posterior tibiae non-serrulated, armed with 3 spines on each margin ; wings short.

Distribution : India : Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Bihar, Goa, Himachal Pradesh, J & K, Karnataka, Lakshdweep, Maharashtra, Manipur, Meghalaya, Mizoram, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal. *Elsewhere* : Africa ; Bhutan ; Malaya ; Myanmar ; Nepal ; Sri Lanka ; South Europe to S. Asia and all over Africa.

40. **Trigonidium humbertianum* (Saussure)

1878. *Homoeoxiphus humbertianum* Saussure, *Mem. Soc. Phys. Hist.*

1925. *Trigonidium humbertianum* : Chopard, *Ann. Mag. nat. Hist.* (9) **15** : 525.

Material examined : Delhi : 1 ex., Dhaulakuan Ridge, Cantonment area, 10. vi. 1993, coll. V. Khanna & party ; 4 exs., Kakraula Nursery on Najafgarh road, 27.x.1993, coll. N.K. Sinha & party ; 2 ♂♂, lake garden, Shakur Basti, 31. x. 1993, coll. N.K. Sinha & party ; Bhaleswa lake, Karnal road, 15. xii. 1994, coll. A. Husain & party.

Diagnostic characters : Similar to preceeding species, except the anterior tibiae which is perforated, tegmina longer and less convex, and wings usually caudate.

Distribution : India : Arunachal Pradesh, Assam, Bihar, H.P., Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Orissa, Tamil Nadu, U.P., West Bengal. *Elsewhere* : Widely distributed in Oriental Region.

Family : ENEOPTERIDAE
Subfamily : PODOSCIRTINAE

41 * **Euscyrtus** sp.

Material examined : Delhi : 1 ♂, nymph, Okhla bridge at U.P. border, 10. ix. 1994, coll. J.P. Sati & party.

Diagnostic characters : General shape long and narrow ; head short ; pronotum flattened

above ; anterior tibiae usually perforated on both the sides ; 2nd segment of tarsi depressed ; posterior tibiae serrulated between the spines ; tegminal venation similar in both sexes ; ovipositor long.

Distribution : Africa ; S.Asia ; N.Australia ; Madagascar ; Mauritius ; Mexico ; Philippines ; South of Sahara and Seychelles.

Family : GRYLLOTALPIDAE

42. **Gryllotalpa africana* Beauvois

1805. *Gryllotalpa africana* Beauvois, *Ins. Afr. Amer.*, : 229.

1924. *Gryllotalpa africana* : Chopard, *Rec. Indian Mus.*, **26** : 181.

Material examined : Delhi : 1 ex., Ramghat, Yamuna Reservoir, 17. xii. 1994, coll. A. Husain & party ; 1 ♂, Chhawla Pul, Najafgarh Bijwasan road, 20. xii. 1994, coll. A. Husain & party ; 1 ex., Bhaleswa, 11. ii. 1995, coll. J.P. Sati & party.

Diagnostic characters : Size medium (20-30 mm.) ; eyes reduced ; anterior legs short, presenting a special conformation for digging ; anterior tibiae armed with four dactyle ; tegminal veins somewhat diverging and curved at base ; wings caudate.

Distribution : India : Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Himachal Pradesh, Karnataka, Madhya Pradesh. *Elsewhere* : Africa; Tropical Asia; Australia; Madagascar; and S. Spain.

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REFERENCES

Bhowmik, H.K. 1967. Six new species of Gryllidae from India. *Proc. 55th Indian Sci. Cong.*, Part B : 491-492.

Bhowmik, H.K. 1969. Studies on Indian Circkets (Orthoptera : Insecta) Part I. *Zool. Anz.*, **182** (1/2) : 143 - 152.

Bhowmik, H.K. 1970. The gryllid fauna (Orthoptera : Insecta) of the Great Nicobar Island, India. *J. zool. Soc. India*, **22** (1&2) : 69-86.

Bhowmik, H.K. 1975. Studies on Indian crickets (Orth. : Insecta), Part III. *J. Bombay nat. Hist. Soc.*, **72** (2) : 368-382.

Bhowmik, H.K. 1976. On the Gryllid fauna (Gryllidae : Orthopotera) of the districts of the North Bengal with descriptions of three new species. *Indian Mus. Bull.*, **11** (1) : 42-48.

Bhowmik, H.K. 1977. Studies on Indian crickets (Orth. : Insecta) with descriptions of two new species. *Rec. zool. Surv. India*, **73** : 23 - 39.

Bhowmik, H.K. 1985. Contribution to the gryllid fauna of the Westerna Himalaya (Orthoptera : Gryllidae). *Rec. zool. Surv. India, occ. paper*, **73** : 1 - 85.

Bolivar, I. 1917. Contribution al concocimento de la fauna India, Orthoptera (Locustidae vel Acrididae). *Revista R. Acad. Cient. exact.* (fisic. Y mat), Madrid, **16** : 278 - 412.

Chopard, L. 1969. The Fauna of India and the adjacent countries, Orthoptera, 2, Grylloidea : xviii + 421 pp.

C.O.P.R. 1982. *The Locust and Grasshopper.* Agricultural Manual.

Dirsh, V.M. and Uvarov, B.P. 1953. Tree locusts of the genus *Anacridium* (Orthoptera, Acrididae). *Eos, Madr.*, **29** : 7-69.

Hazra, A.K., Tandon, S.K., Shishodia, M.S., Dey, A. and Mondal, S.K. 1993. Acridoidea (Insecta : Orthoptera). *State Fauna Series* **3**, *Fauna of West Bengal*, part **4** : 287 - 354.

Henry, G.M. 1940. New and little known south Indian Acrididae (Orthoptera). *Trans. R. ent. Soc. Lond.*, **90** : 497 - 540.

Narula, J.S. 1989. Short Notes-Some crickets of Delhi. Part I & II. *Bull. Ent.*, **28** (1) 1987 : 59-61 & 62-64.

Roonwal, M.L. 1956. Bibliographia Acrididorum. *Rec. Indian Mus.*, **56** : 1 - 611.

Tandon, S.K. and Shishodia, M.S. 1974. Description of two new species of *Velarifictorus* (Orthoptera : Grylloidea) from India. *Orient. Ins.*, **8** (3) : 299 - 302.

Tandon, S.K. and Shishodia, M.S. 1977. On a collection of Acridoidea (Orthoptera) from Rajasthan, India. *Newsl. zool. Surv. India*, **2** : 7 - 11.

Tandon, S.K. and Shishodia, M.S. 1976. Acridoidea (Insecta : Orthoptera) collected along the banks of river Tawi (Jammu & Kashmir) India. *Newsl. zool. surv. India*, Calcutta, **2** (2) : 58 - 61.

Vasanth, M. 1993. Studies on crickets (Insecta : Orthoptera : Gryllidae) of Northeast India. *Rec. zool. Surv. India*, occ. Paper,**132** : 1-178.

ANNEXURE-1

Besides above, some other species recorded from Delhi by Mahto & Bhanotar - (1977), Uvarov (1942) and Ingrisch - (1990) have been listed below. However, the occurrence of species marked with question mark (?) seems doubtful records to the present author.

Family : ACRIDIDAE
Subfamily : ACRIDINAE

1. ?*Duroniella gracilis* Uvarov
2. ?*Duroniella kalmyka* (Adelung)
3. ?*Phlaeoba sinensis* Bolivar
4. ?*Phlaeoba tenebrosa* Walker
5. *Orthoctha indica* Uvarov
6. *Perella* sp.

Subfamily : TRUXALINAE

7. *Truxalis nasuta* (Linn.)

Subfamily : GOMPHOCERINAE

8. *Dnopherula (Aulacobothrus) luteipes* (Walker)
9. *Dnopherula (Aulacobothrus) sven-hedini* Sjosted.
10. *Leva indica* (Bolivar)
11. *Mesopsis* sp. (= *Kirmania* sp.)
12. ?*Acryptera coreana* Shiraki
13. ?*Acryptera fusca fusca* (Pallas)
14. ?*Paracryptera labiata* Brulle
15. ?*Paracryptera brevipennis* (Br.-W.)
16. ?*Paracryptera m. microptera* (F.-W.)
17. ?*Paracryptera m. transcaucasica* (Uvarov)
18. ?*Paracryptera m. turanica* Uvarov

Subfamily : OEDIPODINAE

19. ?*Aiolopus oxianus* Uvarov
20. *Aiolopus thalassinus thalassinus* (Fabricius)
21. *Gastrimargus africanus orientalis* Sjosted.
22. *Gastrimargus sulphureus* Bei-Bienko

23. *Locusta migratoria* (Linnaeus)
24. *Oedaleus abruptus* (Thunberg)
25. *?Oedaleus manjius* Chang.
26. *Oedaleus senegalensis* (Krauss)
27. *?Sphingonotus pilosus* Saussure
28. *Pusana* sp.
29. *Pternoscirta* sp.

Subfamily : HEMICARIDINAE

30. *Hieroglyphus annulicornis* (Shiraki)
31. *Hieroglyphus concolor* (Walker)
32. *Hieroglyphus tonkinensis* Bolivar

Subfamily : OXYINAE

33. *Oxyina bidentata* (Willemse)
34. *?Oxya chinensis* (Thunberg)
35. *Oxya fuscovittata* (Marschall)
36. *Oxya hyla intricata* (Stol)
37. *Oxya nitidula* (Walker)
38. *Oxya velox* (Fabricius)

Subfamily : CALLIPTAMINAE

38. *Caloptenopsis glaucopsis* (Walker)

Subfamily : COPTACRIDINAE

39. *Eucoptacra saturata* (Walker)

Subfamily : CATANTOPINAE

40. *Stenocatantops splendens* (Thunberg)

Subfamiy : CYRATACANTHACRIDINAE

41. *Patanga succincta* (Johansson)

Subfamily : EUPREPOCNAMIDINAE

42. *Euprepocnemis alacris impicta* Uvarov
43. *Chroedocus illustris* (Walker) = (*Heteracris illustris* (Walker)
44. *Cataloipus cognatus* (Walker) = (*Heteracris elegans* Walker)
45. *Cataloipus indicus* Uvarov

Family : TETTIGONIIDAE

46. *Letana intermedia* Ingrisch

Family : GRYLLIDAE

47. *Brachytrupes portentosus* Lichtenstein
48. *Gymnogryllus minor* Chopard
49. *Teleogryllus occipitalis* (Serville) = (*Gryllus mitratus* Burmeister)
50. *Modicogryllus signipes* (Walker) = (*Gryllus mitratus* Burmeister)
50. *Modicogryllus signipes* (Walker) = (*Gryllus signipes* Walker)
51. *Loxoblemmus taicoun* Saussure
52. *Loxoblemmus haani* Saussure

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BLATTARIAE AND MANTODEA

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INTRODUCTION

Earlier included under the Order Dictyoptera (Imms, 1963). Presently, these two groups are placed under two separate new Orders, *i.e.*, Blattariae (dealing with Cockroaches) and Mantodea (dealing with Praying mantids). Both the groups are terrestrial and arborial in habitat and occur predominently in tropical and subtropical regions. Most of the species of Blattariae are found among fallen leaves, under stones, on thick grass, inside the buildings, while some are cave dwellers. Mantids are found mostly on vegetation. They are carnivorous with peculiar habits of prey-capture, comouflage and reproductive behaviour. Nearly 3,500 species of Blattariae and 2,210 of Mantodea are reported from the world, of which 148 species of Blattariae and 162 species of Mantodea are known from India.

The present paper deals with 9 species distributed under 8 genera,5 families and 2 orders collected from Delhi during the surveys conducted by Northern Regional Station, Zoological Survey of India, Dehra Dun. All the species are first records from Delhi.

The classification followed here is after Rehn (1951), Princes (1960) and Beier (1964).

SYSTEMATIC ACCOUNT

Order : BLATTARIAE
Suborder : BLATTOIDEA
Family : BLATTIDAE
Subfamily : BLATTINAE

1. *Periplaneta americana* (Linnaeus)

1768. *Blatta americana* Linnaeus,*Syst.Naturae*(10 ed.), **1** : 424.
1966. *Periplaneta americana*: Princis, *Orthopterorum Catalogus*, **8** : 405.

Material examined : Delhi ; 1 ♂, I.A.R.I campus, 3. vi. 1993, coll. V.Khanna & party.

Diagnostic characters : Heavily pigmented reddish species. Size large; pronotum with a yellow narrow band at both lateral margins, and it is broad at posterior margin; inter-ocular distance less than the distance between antennal sockets; male supra-anal plate with a deep median incision.

Distribution : India : widely distributed. *Elsewhere* : Cosmopolitan.

Remarks : The common name of the species is *ship cockroach, Bombay canary or American cockroach*. It is a principal pest of kitchen.

Family : BLATTELLIDAE

2. *Blattella germanica* (Linnaeus)

1767.*Blatta germanica* Linnaeus,*Syst.Naturae*, **1** (2) (12 ed.): 688.
1969.*Blattella germanica* : Princes, *Orthopterorum Catalogus*, **13** : 809.

Material examined : Delhi ; 1 ♂, Kamla Nehru ridge at Rajpur road, 14. ix.1994, coll, J.P.Sati & party; 1 ♀, Humayun's tomb, Mathura road, 14.xii. 1994, coll. A. Husain & party.

Diagnostic characters: *Male* : Colour testaceous, a narrow yellow stripe present longitudinally in the middle of pronotm; head with vertex slightly exposed; pronotum transverse, gradually rounded laterally; antero-ventral margin of front femur spined on basal half and with three unequal spines near apex; subgenital plate at the posterior margin with a large broad rounded lobe. *Female* has large sub-genital plate.

Distribution : India : widely distributed. *Elsewhere* : Cosmopolitan.

Remarks : This species is called German cockraoch and preferes warm and moist climate. It is also a common pest of house, grocery, restaurant, dinning hall, bathroom and bakery.

3. *Blattella humbertiana* (Saussure)

1863.*Polyzosteria humbertiana* Saussure,*Mem.Soc.*Geneva, **17**:131.
1969. *Blattella humbertiana* :Princes, *Orthopterorum Catalogus*, **13** : 842.

Material examined: Delhi ; 2 ♀♀, Najafgarh, 27.x.1993, coll. N.K. Sinha & party : 1 ♂, Tuglaqabad park, 12.ii.1995, coll. J.P Sati & party ; 1 ♂, Budha Jayanti Park, 15.ii.1995, coll. J.P. Sati & party.

Diagnostic characters: Colour brownish, front yellow brown; size small; head with vertex exposed; subgenital plate of male symmetrical, apex slightly convex; female subgenital plate with posterior margin broadly convex.

Distribution : India : Widely distributed.

Remarks : This species can be easily identified by a narrow longitudinal yellow and white stripe on the middle of pronotum.

4. *Symploce biligata* (Walker)

1868. *Ischnoptera biligata* Walker, *Cat.Blatt.Brit.Mus.* : 123.
1969. *Symploce biligata*:Princes,*Orthopterorum Catalogus*, **13** : 886.

Material examined : Delhi ; 1 ♀, I.A.R.I. campus, 11.ix.1994, coll. J.P. Sati & party.

Diagnostic characters : Medium sized; head exposed; ocelli large and round; pronotum

smooth, anterior margin much rounded, posterior margin obtusely-angulate; 7th tergite at base with two big rounded tubercles before a glandular depression; subgenital plate large, a little asymmetrical.

Distribution : India:Delhi,Meghalaya,Orissa. *Elsewhere* : Sri Lanka; Indonesia.

Remarks : This species is very close to *Gislenia himalyica* (Br.), but the fore head of the species here shows a distinct brown band.

Family : PYCNOSCELIDAE
Subfamily : PYCNOSCELINAE

5. *Pycnoscelus surinamensis* (Linnaeus)

1758. *Blatta surinamensis* Linnaeus, *Syst. Naturae* (10 ed.) 1 : 424.

1967. *Pycnoscelus surinamensis*: Roth,*Mem.Mus.Victoria,* 50 (2).

Material examined : Delhi; 1 ♀, Vasant Vihar, 13.ix.1994, coll. J.P. Sati & party.

Diagnostic characters: Medium sized ; ocelli large, approximate to eye; inter-ocular distance smaller than the distance between the antennal sockets; subgenital plate large, symmetrical, apex rounded.

Distribution: Inida : Widely distributed.*Elsewhere*: Cosmopolitan.

Remarks : Generally,this species is found in female form only. Occasionally parthenogenetic males occur in the culture, but they are non-functional when mated to parthenogenetic females (Roth, 1967). Eighth sternite of male rounded, 9th completely hidden and bear single style.

Family : ECTOBIIDAE
Subfamily : THEGANOPTERYGINAE

6. *Hemithyrsocera* sp.

1893. *Hemithyrsocera* Saussure,*Soc. ent.*, 8 : 57.

Material examined : Delhi; 1 nymph, Deer park, 15.ix.1994, coll. J.P. Sati & party.

Diagnostic characters :Size small; pronotum blotch with golden yellow margin; tegmina and wings absent (immature stage); supra-anal plate triangular.It can be easily recognised by remarkable shape of pronotum.

Distribution : India : Delhi,Meghalaya,Orissa and Tripura. *Elsewhre* : Myanmar.

Remarks : It can be easily recognised by the remarkable shape of pronotum.

Order : MANTODEA
Family : MANTIDAE

7. ***Humbertiella indica*** Saussure

1869. *Humbertiella indica* Saussure, *Mitt. Schweiz. Entomol.*, **3** : 62.

1995. *Humbertiella indica* : Mukherjee et al., *Oriental Ins.* **29** : 241.

Material examined: Delhi; 1 ♂, Budha Jayanti Park, 4. vi. 1993, coll. V. Khanna & party.

Diagnostic characters : Body pale brown to brown ; frontal sclerite blackish, superior margin almost straight or feebly arched in female; tubercles of pronotum more or less prominent; fore-femur externally brown, internally with a black longitudinal line, often divided into two; black patches present on claw groove and inside of the Ist external spine, longer internal spines black at their apical halves only ; basal halves deep brown, but blackish only in the distal one or two internal spines only; fore wing with parallel transverse veinules in costal area and with 3 branched and anal vein; this in female dark brown, reaches upto 7- 8th tergite, with blackish oblique patches.

Distribution : India: Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Tamil Nadu, Uttar Pradesh. *Elsewhere* : Sri Lanka.

Remarks : It is recorded for the first time from Delhi.

8. ***Iris orientalis*** Wood - Mason

1882. *Iris orientalis* Wood-Mason,*J.Asiat. Soc. Bengal,* **51** (2) :32.

1995. *Iris orientalis*: Mukherjee *et al., Oriental Ins.*, **29** : 286.

Material examined : Delhi; 1 ♂, Masudpur/Vasant kunj, 13.ix.1994, coll. J.P. Sati & party.

Diagnostic characters : Frontal sclerite pale yellowish, pentagonal with granules at each lateral corner; pronotum dorsally rounded, supra-coxal dilation less prominent; metazona a little shorter than fore coxae, with a narrow linear carina; fore femora with 4 discoidal and 5 external spines; middle and hind femora devoid of any lobulations or hardly preapical lobe ; hind wing with a large violet-fuscous blotch and 4-5 concentric rings of the same colour; supra-anal plate triangular, rounded at tip.

Distribution : India : Himachal Pradesh, Rajasthan. *Elsewhere* : Indonesia.

9. ***Hierodula (Hierodula) tenuidentata*** Saussure

1869. *Hierodula tenuidentata* Saussure, *Mitt. Scheweiz. Entomol.*,**3** : 68.

1923. *Hierodula (Hierodula) tenuidentata* : Giglio-Tos,*Das Tierreich*, **50** : 444.

Material examined : Delhi; 1 ♀, I.A.R.I. campus, 3.vi.1993, coll. V.Khanna & party.

Diagnostic characters: Head not concealed by pronotum; eyes large, rounded, their upper edge reaching the level of vertex, spineless; antennae and anterior border of fore wing not setaceous in male; fore femora with 4 discoidal and 4 external spines, the edge of the latter

smooth, and furrow between Ist and 2nd external spines; fore coxae with shorter marginal spines; hind femur with an apical spine; anterior border of fore wing smooth; hind wing without any transverse bands.

Distribution : India : Andaman & Nicobar Islands ; Bihar, Lakshadweep, Madhya Pradesh, Orissa, Tamil Nadu, Uttar Pradesh, West Bengal. *Elsewhere* : Indonesia;Kalimantan; Western Asia.

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REFERENCES

Beier, M.1964. Arthropoda. Insecta. Blattopteroidea : Ordnung Mantodea Burmeister, 1838. Bronn's Klassen Ordn. *Das Tierreich,* (5) **6** (3) : 840-970.

Imms, A.D.1963. *A General Text Book of Entomology* (revised by O.W.Richards and R.G.Davies), Asia Publishing House, Bombay; 1 - 833 pp.

Mukherjee, T.K.,Hazra, A.K. and Ghosh, A.K. 1995. The Mantid Fauna of India (Insecta : Mantodea). *Oriental Ins.* **29** : 185 - 358.

Princes, K. 1960. Zur Systematic der Blatterien.*Eos Madr.,* **36** : 427 - 449.

Rehn, J.W.H. 1951. Classification of the Blattaria as indicated by their wings. *Mem.Amer. ent. Soc.,* **14** : 1 - 134.

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DERMAPTERA

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INTRODUCTION

Altogether three common species are represented in the collections. Besides, one species of *Diplatys* since represented by single female, could not be identified up to species level. Due to urbanised and semi-urbanised nature of the area the occurrence of common species is quite natural.

Family : PYGIDICRANIDAE
Subfamily : DIPLATYINAE

1. ***Diplatys*** sp.

Material examined : Delhi; 1 ♀, Safdarjang complex, Aurbindo Marg, 21.xii.1994, coll. A. Husain & party.

Remarks : In the absence of a male, it is difficult to determine up to specific level. It is generally not possible to collect them in large numbers.

Family : ANISOLABIDIDAE
Subfamily : ANISOLABIDINAE

2. ***Euborellia annulipes*** (Lucas)

1847. *Forficesila annulipes, Annls. Soc. ent. Fr.*, (2) **5**:84 (Sex?; Jardine des Plantes, Paris (Introduced).
1853. *Forficula (Labidura) annulipes* : Fisher, *Orthoropera Europ, Leipzig*, **69**, pl.6, figs. 6a-c.
1864. *Forficelisa annulipes* : Dohra, *Stettine ent. Ztg.*, **25** : 290.
1910. *Anisolabis annulipes* : Burr, *Fauna Britisn India, Dermaptera* : 84, pl. 3, fig. 24.
1915. *Euborellia annulipes* : Burr, *J.R. micr.Soc.*, : 527, 528 and 545.
1959. *Anisolabia (Euborellia) annulipes* : Bey-Bienko, *Ent. Obozr*, **38** (3) : 607.
1989. *Euborellia annulipes* : Srivastava, *Fauna of Orissa State, State Fauna Series*, **1** (2) : 157,figs.19-21.

Material examined : Delhi ; 1 ♂, 3 ♀♀, Dhaulakuan Ridge, 9.ix.1994, coll. J.P. Sati & party ; 1♀, 2 nymphs, Lake Garden, 16.ii.1995, coll. J.P.Sati & party; 7 exs. (♀ with nymphs), Tughlaqabad Park, 12.ii.1995, 1 ♀, 1 nymph, Hauj Khas Park, 15.ii.1995, 1 ♀, Okhla reservoir, 14.ii.1995 ; 2♀♀, 1 nymph, IARI campus, 19.ii.1995, coll. J.P. Sati & party; 4♀♀, 2 nymph, NZ Park, 10.v.1995, coll. P.C.Tak & party; 2 ♂♂, 2 ♀♀, Kamla Nehru Ridge, 17.ii.1995, coll. J.P.

Sati & party; 7 exs. (♀ with nymphs), Masudpur, Vasant Kunj, 12.ii.1995, Coll. J.P. Sati & party; 1 ♀, Dhaulakuan, Lake garden, 10.vi.1993, coll. J.P.Sati & party ; 1 ♀, Dhaulakuan, Lake garden, 10.vi.1993, coll. V.Khanna & party ; 7 exs. (♀ with nymphs), Jahanpanah park, Chirag Dilli, 22.xii.1994, coll. A. Husain & party ; 2 nymphs, Qutab Minar Complex, 21.xii.1994, coll. A. Husain & party ; 1 ♀, 1 nymph, Yamuna R., Lok Nayak Bridge, 13.v.1995, coll. P.C.Tak & party; 2 nymphs, pond Nagli Sakroti, 20.xii.1994, coll. A.Husain & party ; 1 ♂, 2 ♀♀, 2 nymphs, Najafgarh, 27.x.1993, coll. N.K.Sinha & party.

Distribution : India throughout. *Elsewhere* : Worldwide.

Remarks: A common species throughout India occurring under diverse habitats.

Family : LABIDURIDAE
Subfamily : LABIDURINAE

3. ***Labidura riparia*** (Pallas)

1773. *Forficala riparia Pallas, Reise Russ. Reichs.*, **2** : 727 (Sex ? ; Shores of Irtyshch River, Western Siberia).

1863. *Labidura riparia* : Dohrn, *Stettin.ent.Ztg.*, **24** : 313.

1954. *Diplatys himalayana* : Baijal and Singh, *Agra Univ. J. Res.* (Sci.), **3** (2) : 455 (3 nymphs, not M ; India : U.P. Nainital dist.).

1954. *Spongiphora nainitalensis* : Baijal and Singh, *Agra Univ. J. Res.* (Sci.) **3** (2):456 (M; India : U.P., Nainital dist.).

1954. *Elaunon nainitalensis* : Baijal and Singh, *Agra Univ. J.Res.* (Sci.) **3** (2) : 460 (M; India : U.P., Nainital dist.).

1986. *Labidura riparia* : Srivastava, *Rec. zool. Surv. India, occ. pap.*, **89** : 4 (Above synonymy proposed).

Material examined : 1 ♂, 2 ♀♀, Jahanpanah Park, Chirag Dilli, 22.xii.1994, coll. A.Husain & party ; 1 nymph, near Okhla Reservoir, 18.xii.1994, coll. A.Husain & party ; 10 exs. (♂, ♀ and nymphs), Majnu Ka Tila, 15.ii.1995, coll. J.P. Sati & party ; 2 ♂♂, 1♀, Majnu Ka Tila, 9.ix.1994, coll. J.P. Sati & party ; 1 ♀, Gopalpur Nala, near Wazirabad, 8.ix.1994, coll. J.P. Sati & party ; 1 nymph, Palam Airport, 9.ix.1994, coll. J.P. Sati & party ; 1 nymph, Lodi Garden, 13.ii.1995, coll. J.P. Sati & party ; 1 nymph, Ladu Sarai, Mehrauli Road, 7.ix.1994, coll. J.P. Sati & party ; 1 ♂, 1 ♀, 1 nymph, Masoodpur, Vasant Kunj, 13.ix.1994, coll. J.P. Sati & party.

Distribution : India : throughout. *Elsewhere :* Worldwide.

Remarks : Another common species found in large numbers in different habitats.

Subfamily : NALINAE

4. ***Nala lividipes*** (Dufour)

1820. *Forficula pallipes* Dufour, *Ann. gener, des Phys.* Bruxelles, **4** : 316, pl. 116, figs., 7, 7a and 7b (M, F ; Lower Catalonia, Spain).

1828. *Forficula lividipes* : Dufour, *Ann. Sci. Nat.*, **13** : 340 (New name proposed).

1900. *Labidura lividipes* : Bormans and Krauss, *Das Tierreich,* **11** : 36.

1910. *Paralabidura lividipes* : Burr, *Trans. R.ent.Soc. Lond.*, : 184.

1911. *Nala lividipes* : Burr, *General Insect.*, **122** : 36.

1976. *Nala lividipes* : Srivastava, *Rec. zool. Surv. India, Occ. pap.*, **2** : 41.

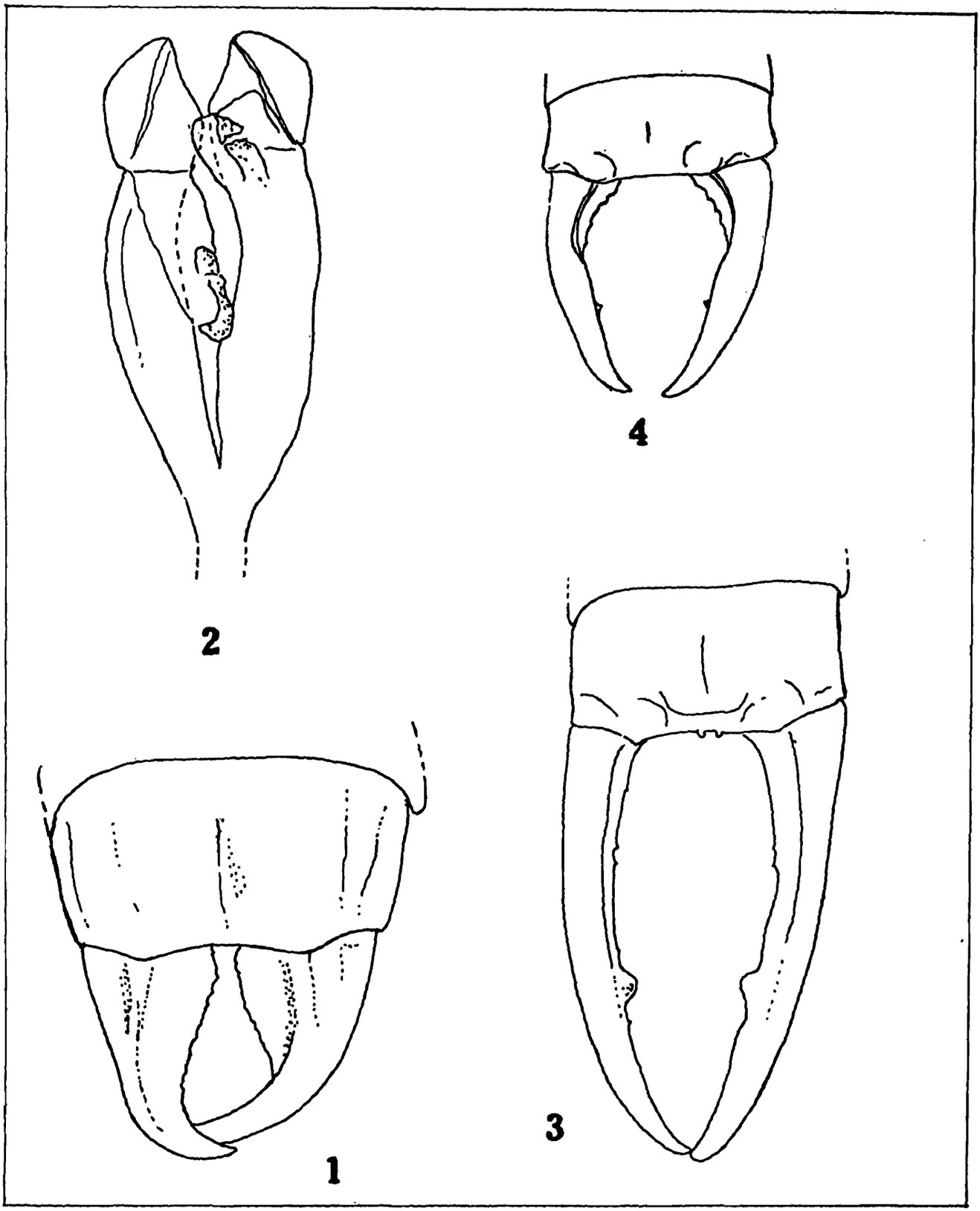
Material examined : 1 ♂, Yamuna Reservoir, 17.xii.1994, coll. A. Husain & party ; 1 ♀, Masudpur, Vasant Kunj, 13.ix.1994, coll. J.P. Sati & party; 1 ♂, NZ Park, 10.ii.1995, coll. J.P. Sati & party.

Distribution : India : throughout. *Elsewhere* : Worldwide.

Remarks : More common in tropical parts of the world, often attracted to light in large numbers.

REFERENCES

Srivastava, G.K. 1988. *Fauna of India and Adjacent countries.* Dermaptera, **1** : xii+268. Zoological Survey of India, Calcutta.



Figs. 1-4 : *Euborellia annulipes* (Lucas), ♂, 1. Ultimate tergite & forceps, 2. Genitalia; *Labidura riparia* (Passas), ♂, 3. Ultimate tergite & forceps; *Nala lividipes* (Dufour), ♂, 4. Ultimate tergite & forceps.

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ISOPTERA

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INTRODUCTION

Termite fauna of Delhi and its vicinity was unknown until 1939, when Pruthi reported two unidentified species. Vishnoi(1957) referred to the occurrence of seven swarming termites from Delhi; Vishnoi (1962) again reported some 13 species including the above mentioned ones as well as three unidentified species under the genera *Odontotermes, Microtermes and Heterotermes*.Out of these occurrence of *Bifiditermes beesoni* (Gardner) from Delhi by Vishnoi (l.c.) seems to be doubtful, it is not yet referred to the fauna of Delhi by subsequent authors including Roonwal and Chhotani (1989) in *Fauna of India.*

Recently, a small collection of termites from Delhi made by Northern Regional Station, Dehra Dun, has been studied and found to belong to six species. These are *Odontotermes bhagwatii* Roonwal and Bose, *O.giriensis* Roonwal and Chhotani, *O.obesus* (Rambur), *O.wallonensis* (Wasm.) *Microtermes obesi* Holmgren and *Trinervitermes biformis* (Wasmann), *O.obesus and M. obesi* are already on record (Vishnoi, 1962).Thus to sum up, a total of 14 species so far known from the area.

SYSTEMATIC ACCOUNT

Four species marked with asterisk(*), are recorded for the first time from Delhi and all others are reported by *Vishnoi (1962)*.

Family : KALOTERMITIDAE

1. *Bifiditermes beesoni* (Gardner)

Family : RHINOTERMITIDAE
Subfamily : COPTOTERMITINAE

2. *Coptotermes heimi* (Wasmann)

Family : TERMITIDAE
Subfamily : AMITERMITINAE

3. *Amitermes belli* (Desneux)
4. *Eremotermes paradoxalis* Holmgren

Subfamily : TERMITINAE

5. *Microcerotermes beesoni* Snyder
6. *M. tenuignathus* Holmgren
7. *Microtermes mycophagus* (Desneux)
8. *M. obesi* Holmgren
9.* *Odontotermes bhagwatii* Chatterjee and Thakur
10. *O.dehraduni* (Snyder)
11.* *O. giriensis* Roonwal and Chhotani
12. *O. obesus* (Rambur)
13.* *O.wallonensis* (Wasmann)
14.* *Trinervitermes biformis* (Wasmann)

1. *Bifiditermes beesoni* (Gardner)

1945. *Kalotermes beesoni* Gardner, *Indian J. Ent.*,**6** : 103 (S. *Type-locality* : India, Uttar Pradesh).

1960. *Kalotermes beesoni* : Vishnoi, *Termites in the Humid Tropics* : 107.

1989. *Bifiditermes beesoni :* Roonwal & Chhotani, *The Fauna of India and Adjacent countries,* **1** :339- 343.

Material examined : From literature.

Distribution : India : Delhi and Uttar Pradesh. *Elsewhere* : Pakistan.

Remarks : Reported by Vishnoi (1962) from Delhi based on imagos only, the species has not been further collected from the area. Neither the report of the species from Delhi is mentioned in the Fauna of India (Roonwal and Chhotani, 1989) nor any material is available for study. However, the species is very rarely found in India.

2. *Coptotermes heimi* (Wasmann)

1902. *Arrhinotermes heimi* Wasmann, *Zool. Jb. (Syst.),* **17** (1) : 104 (Im., *Type-locality* : India : Maharashtra).

1989. *Coptotermes heimi* : Roonwal & Chhotani, *The Fauna of India and adjacent countries,* Isoptera, **1** : 449.

Distribution : India : Throughout, including Delhi. *Elsewhere* : Pakistan, Bangladesh; Bhutan; Nepal; Oman.

Remarks : It is a very common species occurring throughout India. The species is very much destructive to wooden logs, stumps, fence-poles and even trees, such as *Acacia, pear,* etc. The same author also reported the species to spoil the top layer of flour during monsoon.

3. *Amitermes belli* (Desneux)

1906. *Termes belli* Desneux, *Ann. Soc. Ent.Belg.*, **49** (12) :352 (Im., s.w, W.,*Type-locality* : Pakistan, Karachi).

1949. *Amitermes belli* : Snyder, *Smith misc.Coll.*, **112** : 114.

1962. *Amitermes belli*, Vishnoi, *Termites in the Humid Tropics* : 107.

1989. *Amitermes belli*, Thakur, *Indian Forest Rec.(N.S.) Ent.* **15** (1) : 21.

Material examined: Delhi; 1♂, several s.& w., coll. *P.C.Dhar*, 18.v.1959.

Distribution : India : Delhi, Maharashtra, Gujarat, Punjab and Rajasthan. *Elsewhere* : Pakistan.

Remarks : The species is rarely found but sparsely occur in the north-western part of India, mostly inhabiting soil or dead wood with soil connection. It is reported to cause damage to wooden beams in the ceiling of a residential house (Vishnoi, 1962).

4. *Eremotermes paradoxalis* Holmgren

1912. *Eremotemes paradoxalis* Holmgren, *K.Svenska Vetensk. Akad. Handl.*, **48**(4):95 (s., *Type-locality*: India, Bangalore).

1962. *Eremotermes paradoxalis* : Vishnoi, *Termites in the Humid Tropics* : 107.

1989. *Eremotermes paradoxalis* : Thakur, *Indian Forest Rec. (N.S.) Ent.*, **15**(1) : 27-28.

Material examined : From literature.

Distribution : India : Delhi, Andhra Pradesh, Bihar, Gujarat and Rajasthan. *Elsewhere* Pakistan.

Remarks : It is a rare species mostly found in open land in certain parts of the country. The species swarms during day time every year on cloudy days in Delhi and shows normal tandem after swarming (Vishnoi, 1962).

5. *Microcerotermes beesoni* Snyder

1933. *Microcerotermes beesoni* Snyder, *Proc. U.S.nat.Mus.*, **82**(16) : 12-14 (Im. *Type-locality* : India, Uttar Pradesh).

1962. *Microcerotermes beesoni* : Vishnoi, *Termites in the Humid Tropics* : 107.

Material examined : From literature.

Distribution : India : Delhi, Uttar Pradesh and West Bengal.

Remarks: It is carton nest building species, occurring almost throughout India. it was collected from the stump of a pear tree in Delhi (Vishnoi, 1962).

6. *Microcerotermes tenuignathus* Holmgren

1913. *Microcerotermes tenuignathus* Holmgren, *J.Bombay nat. Hist. Soc.*, **22**(1) : 116-117.

(s.and w.Type-locality: Vadtal, Gujarat).

1962. *Microcerotermes tenuignathus* : Vishnoi, *Termites in the Humid Tropics* : 107.

Material examined : From literature.

Distribution : India : Delhi, Gujarat, Rajasthan and Maharashtra. *Elsewhere*: Australia.

Remarks : The species was first reported by Vishnoi (1962) from Delhi, it is so far reported to be confined to semi-arid tracts of northwest India including Pakistan. The species is reported to cause damage to some journals in a library in Delhi (Vishnoi, 1962).

7. *Microtermes mycophagus* (Desneux)

1906. *Termes mycophagus* Desneux, *Ann. Soc. Ent. Belg.*, **49**(12) 348-352 (I., S. & W., Type-locality : Pakistan, Karachi).

1962. *Microtermes mycophagus*: Vishnoi,*Termites in the Humid Tropics* : 107, Delhi.

Distribution : India : Delhi, Gujarat, Punjab, Rajasthan. *Elsewhere* : Pakistan.

Remarks : The species is found mostly in the north-western part of India generally infesting dead logs and stumps of different shrubs and trees. It is destructive to house hold belongings of cellulose origin. The species readily attacks the cupboards, almirahs, boxes, books and furniture and living citrus hedges (Vishnoi, 1962).

8. *Microtermes obesi* Holmgren

1923. *Microtermes obesi* Holmgen, *K.Sv. Vet. Akad. Handl.*, **50** (2) : 150 (Type-locality : India : Khandala near Bombay).

1962. *Microtermes obesi* : Vishnoi, *Termites in the Humid Tropics* : 107.

1989. *Microtermes obesi* : Thakur, *Indian Forest Rec. (N.S.) Ent.*, **15**(1) : 68-69.

Material examined : Delhi : several s. and w., Kakraula nursery, Najafgarh Rd. Delhi (Ca. 36 Km from IARI), 5.vi.1993, coll. V.Khanna & party.

Distribution : *India* : Throughout, including Delhi. *Elsewhere* : Sri Lanka; Pakistan; Myanmar; Thailand; Cambodia; Vietnam.

Remarks : This is one of the most common and widely distributed species in India and is of considerable economic importance. It has been found to attack logs, poles, bamboos, fence posts, roots of agricultural crops, etc. The species is taken only on winged individuals in Delhi.

9. *Odontotermes bhagwatii* Chatterjee and Thakur

1967. *Odontotermes bhagwatii* Chatterjee and Thakur, *Indian Forest Rec.*, **11** (1) : 33-35 (Type locality : India : Punjab).

1981. *Odontotermes bhagwatii* : Thakur, *Indian Forest Rec. (N.S.) Ent.*, **14**(2) : 25-30.

Material examined : Delhi; several s. and w., Dhaulakuan Ridge, 4.vi.1993, coll. V.Khanna & party.

Distribution : India : Delhi, Madhya Pradesh, Punjab, Uttar Pradesh.

Remarks : The species is recorded here for the first time from Delhi. It is not very common and found only in some localities in central India.

10. *Odontotermes dehraduni* (Snyder)

1933. *Termes (Termes) dehraduni* Snyder, *Proc. U.S. Nat. Hist.* **82**(16) : 6-7 (Type-locality : India : U.P., Dehra Dun).

1949. *Odontotermes (Odontotermes) dehraduni,* Snyder, *Smith misc. Coll.,* **112** : 224.

1962. *Odontotermes dehraduni* : Vishnoi, *Termites in the Humid Tropics* : 107-108

1981. *Odontotermes dehraduni* : Thakur, *Indian Forest Rec. (N.S.) Ent.,* **14**(2) : 42-44.

Material examined: From literature.

Distribution : *India*: Delhi and Uttar Pradesh (Doon valley). *Elsewhere* : Pakistan.

Remarks : It is a very rare species so far known only by imagos from Dehra Dun and Delhi in India.

11. *Odontotermes girienis* Roonwal and Chhotani

1962. *Odontotermes giriensis* Roonwal and Chhotani, *Proc. nat. Inst. Sci. India,* New Delhi, (B) **28** (4) : 341-345 (Type-locality : India : Meghalaya : Rongrengiri).

1981. *Odontotermes giriensis* : Thakur,*Indian Forest Rec. (N.S.) Ent.***14** (2): 55-59.

Material examined : Delhi; several s. and w., Lodhi garden, 13.ii.1995, coll. J.P. Sati & party; several w. and s., Bawana, 30.x.1993, coll. N.K. Sinha & party.

Distribution : India : Delhi, Arunachal Pradesh, Assam Gujarat, Meghalaya, Rajasthan, Tripura and Uttar Pradesh.

Remarks : The species is recorded for the first time from Delhi.

12. *Odontotermes obesus* (Rambur)

1842. *Termes obesus* Rambur, *Histore naturelle der Insects,* Paris : 304 (Type-locality : India : Maharashtra : Bombay).

1962. *Odontotermes obesus* : Vishnoi, *Termites in the Humid Tropics* : 107.

1989. *Odontotermes obesus* : Thakur, *Indian Forest Rec. (N.S.) Ent.,* **15**(1) : 55-57.

Material examined : Delhi; several s. and w., Humayun's Tomb Complex, 14.ii.1995, coll. J.P. Sati & party; several s. and w., Piggery Farm near Dhaulakuan, 16.ii.1995, coll. J.P. Sati & party.

Distribution : India : All over. *Elsewhere*: Pakistan; Bangladesh; Myanmar.

Remarks: It is the most common mound building species found throughout India and is very closely allied to another mound building species *O.redemanni*. Both the species are causing damage to different seedlings and plants including agricultural crops (Roonwal, 1970).

13. *Odontotermes wallonensis* (Wasmann)

1902. *Termes obesus wallonensis* Wasmann, *Zool.Jahrb. Aby. Syst. Jena,* **17**(1) : 106 (Type-locality : India :Maharashtra, Wallon).

1949. *Odontotermes (Odontotermes) wallonesis* : Snyder, *Smiths. misc. coll., Washington,* **112** : 243.

1989. *Odontotermes wallonensis* : Thakur, *Indian Forest Rec. (N.S.) Ent.,* **15**(1) : 65-66.

Material examined : Delhi; 1 s. and several w., Tuglaqabad park, 12.ii.1995, coll. J.P. Sati & party; several s. and w., Safdarjung Tomb Complex, Aurbindo Marg, 21.xii.1994, coll. A. Husain & party; several s. and w., south campus, Delhi University, 23.xii.1994, coll. A. Husain & party.

Distribution : Delhi, Andhra Pradesh, Bihar, Gujarat, Maharashtra, Orissa, Rajasthan, Tamil Nadu.

Remarks : The species occurs sparsely in different parts of the country. it builds solid, low earthen mound of irregular shape with a number of chimney's emerging from the surface. It is known to be injurious to plantations of *Casurarina* and *Dalbergia* in India (Roonwal, 1970); not known to build nests in Delhi.

14. *Trinervitermes biformis* (Wasmann)

1902. *Eutermes biformis* Wasmann, *Zool. Jb. (Syst.),* **17**(1) : 133-135 (Type-localities : Sri Lanka and India : Khandala).

1949. *Trinervitermes biformis* : Snyder, *Smith. misc. Coll.,* **112** : 323-324.

1989. *Trinervitermes biformis* : Thakur, *Indian Forest Rec. (N.S.) Ent.,* **15**(1) : 71-72.

Material examined : Delhi; several s. (Minor and Major) and w., Asola Wildlife Sanctuary, 12.ii.95, coll. J.P. Sati & party.

Distribution : India : Delhi, Karnataka, Maharashtra, Madhya Pradesh, Rajasthan, Tamil Nadu, West Bengal. *Elsewhere* : Sri Lanka.

Remarks : This is a subterranean species generally found in most dry parts of the country. This is the only nasutiform termite known from Delhi. It can easily be identified by its dimorphic soldier caste.

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REFERENCE

Pruthi, H.S.1939. Emergence of winged termites of Delhi. *Indian J. Ent.* **1**(1-2) : 108.

Roonwal, M.L.1970. *Termites of the Oriental Region, in Biology of Termites,* **2** : 315-391. (*Ed.*K.Krishna and F.W. Weesner). Academic press, New York.

Roonwal, M.L. and Chhotani, O.B.1989. *The Fauna of India and Adjacent countries* (Isoptera), **1** : 1-672.

Snyder, T.E.1949. Catalogue of the termites (Isoptera) of the world. *Smiths. misc. Colls.*, **112** : ii, 1-490.

Vishnoi, H.S.1957. The swarming termites of Delhi. *J.Bombay nat. Hist. Soc.*, **54** : 792-793.

Vishnoi, H.S.1962. A review of termite fauna from Delhi and its environs. *Termites in the Humid Tropics. Proc. New Delhi Symp. UNESCO* : 107-109.

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State Fauna Series 6: Fauna of Delhi, 215-260, 1997

HEMIPTERA

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INTRODUCTION

Hemiptera, commonly known as bugs, is the largest and most important order of Exopterygote insects. It comprises all types of bugs, cicadas, leafhoppers, scale insects, etc. They feed on roots, leaves, stems, fruits and seeds.These are small to medium sized insects with piercing and sucking type of mouthparts, atrophied palpi, labium in the form of dorsally grooved sheath receiving two pairs of bristle like stylets and two pairs of wings of which forewings are often of harder consistence than hind wings.

Some (Aphididae and Psyllidae) cause malformations like galls. Some (Capsidae, Reduviidae, Pentatomidae) are predaceous in nature. Some like Cimicidae (bed bugs), the Triatominae and Polyectinidae are blood suckers on mammals. These insects are of great economic importance. Most of the species are responsible for direct or indirect injury to various plants. Some are very destructive, e.g, leafhoppers, (Cicadellidae), the white flies (Aleyrodidae), the plant lice (Aphididae) and the scale insects (Coccidae).The extensive damage caused by these insects is due to sucking of plant sap and very fast rate of reproduction in case of many homoptera. Some of the homopterans (Coccids) are, however, useful to mankind because these insects are either a source of stick lac of commerce in India or of dye stuff like Cochinal and Kermis.

Some heteropterans are predaceous and thus keep check on the populations of other insect pests.The Indian hemiptera consists of about 6,500 species distributed over 77 families and constitute a little over 8% of the hemipterans known from the world. Our knowledge of the hemipteran fauna of Delhi is fragmentary. The literature reveals that only about 100 species belonging to 62 genera of Hemiptera (excluding water bugs) are so far known from Delhi.Of these, 23 species are hitherto recorded for the first time from Delhi. Distant (1908, 1910), Pruthi (1940), Gulamllah, (1940), Samuel and Joseph (1953), Menon and Pawar (1958), Ghosh and Raychaudhuri (1962), Menon (1967) ; Menon and Ghai (1963), Doworakowska (1971, 1972, 1977, 1979), Ramakrishnan and Menon (1971, 1972, 1973, 1974) Young *et al.* (1971), Behura and Das (1973), Dutta and Ghosh (1973) and Mathur (1975).

The present paper is an attempt to provide a consolidated account of the hemipteran fauna of Delhi and also to highlight the lacunae in the knowledge.

The diagnostic characters of the species (marked *) are based on literature due to non availability of material. The species (marked **) under the family Cicadellidae are provided with reference only due to non availability of material and literature. The diagnostic characters of each species belonging to family Aphididae are based on apterous viviparous females (aptera) unless otherwise mentioned, Distribution of each species (except those marked** of Cicadellidae) both in India and elsewhere are provided. Besides, biological notes other information on economic importance of the species are given, wherever possible.

All the material examined is in the National Zoological Collection at the Zoological Survey of India, Calcutta.

SYSTEMATIC ACCOUNT

Suborder : HOMOPTERA
Family I : APHIDIDAE
Subfamily : APHIDINAE
Tribe : APHIDINI

Genus 1. ***Aphis*** Linnaeus
1. *Aphis craccivora* Koch
2. *Aphis gossypii* Glover
3. *Aphis nerii* Boyer de Fonscolombe
4. *Aphis rumicis* Linnaeus
5. *Aphis (Protaphis) carthami* (Das)

Genus 2. ***Rhopalosiphum*** Koch
6. *Rhopalosiphum maidis* (Fitch)
7. *Rhopalosiphum nymphaeae* (Linnaeus)
8. *Rhopalosiphum rufiabdominalis* (Sasaki)

Tribe : MACROSIPHINI

Genus 3. ***Acyrthosiphon*** Mordvilko
9. *Acyrthosiphon pisum* (Harris)

Genus 4. ***Brevicoryne*** van der Goot
10. *Brevicoryne brassicae* (Linnaeus)

Genus 5. ***Dactynotus*** Rafinesque
11. *Dactynotus (Uromelan) carthami* H.R.L.

Genus	6.	***Hayhurstia*** del Guercio
	12.	*Hayhurstia atriplices* (Linnaeus)
Genus	7.	***Lipaphis*** Mordvilko
	13.	*Lipaphis erysimi* (Kaltenbach)
Genus	8.	***Macrosiphum*** Passerini
	14.	*Macrosiphum centranthri* Theobald
	15.	*Macrosiphum (Sitobion) miscanthi* Takahashi
	16.	*Macrosiphum rosae* (Linnaeus)
	17.	*Macrosiphum (Sitobion) rosaeiformis* Das
	18.	*Macrosiphum (Sitobion) takahasii* Eastop
Genus	9.	***Myzus*** Passernii
	19.	*Myzus persicae* (Sulzer)
Genus	10.	***Pentalonia***
	20.	*Pentalonia nigronervosa* Coquerel

Subfamily : DREPANOSIPHINAE

Genus	11.	***Saltusaphis*** Theobald
	21.	*Saltusaphis scripus* Theobald

Subfamily : PAMPHIGINAE

Genus	12.	***Ceratopemphigella*** Menon & Pawar
	22.	*Ceratopemphigella delhiensis* Menon & Pawar
Genus	13.	***Uroleucon*** Mordvilko
	23.	*Uroleucon (Uroleucon) sonchi* (Linnaeus)
	24.	*Uroleucon* sp.

Family II : CICADELLIDAE
Subfamily : TYPHLOCYBINAE

Genus	14.	***Accacidia*** Dworakowska
	25.	*Accacidia improvisa* (Linnavuori)
Genus	15.	***Apheliona*** Kirkaldy

	*	26.	*Apheliona bioculata* (Melichar)
	*	27.	*Apheliona maculosa* Dworakowska
Genus		16.	***Cassianeura*** Ramakrishnan & Menon
		28.	*Cassianeura cassiae* (Ahmed)
		29.	*Cassianeura sexmaculata* Ramakrishnan & Menon
Genus		17.	***Dialecticopteryx*** Kirkaldy
		30.	*Dialecticopteryx centromaculata* Ramakrishnan & Menon
Genus		18.	***Empoasca*** Walsh
	*	31.	*Empoasca allbeizziae* Mahmood Ahmed
	*	32.	*Empoasca binotata* Pruthi
	*	33.	*Empoasca kerii* Pruthi
	*	34.	*Empoasca motti* Pruthi
	*	35.	*Empoasca tabaci* Pruthi
		36.	*Empoasca terminalis* Distant
Genus		19.	***Empoascanara*** Distant
	*	37.	*Empoascanara indica* Dworakowska & Viraktamath
	*	38.	*Empoascanara serrata* (Singh)
Genus		20.	***Helionidia*** Zachvatkin
	*	39.	*Helionidia karachiensis* Ahmed & Khokhar
Genus		21.	***Indianella*** Ramakrishnan & Menon
		40.	*Indianella delhiana* Ramakrishnan & Menon
		41.	*Indianella indraprasthana* Ramakrishnan & Menon
		42.	*Indianella tamaricis* Ramakrishnan & Menon
Genus		22.	***Jacobiasca*** Dworakowska
		43.	*Jacobiasca furcostylus* Ramakrishnan & Menon
Genus		23.	***Javavadikra*** Dworakowska
	*	44.	*Javadikra bipunctata* Dworakowska
Genus		24.	***Playtettix*** Matsumura
		45.	*Playtettix sudra* (Distant)
		46.	*Playtettix variegatus* Ramakrishnan & Menon

Genus	25.	***Pusaneura*** Ramakrishnan & Menon
	47.	*Pusaneura signata* Ramakrishnan & Menon
Genus	26.	***Pusatettix*** Ramakrishnan & Menon
	48.	*Pusatettix bipunctatus* Ramakrishnan & Menon
Genus	27.	***Ratburella*** Ramakrishnan & Menon
	49.	*Ratburella unipunctata* Ramakrishnan & Menon
Genus	28.	***Sirosoma*** Mc Atee
	50.	*Sirosoma indica* Ramakrishnan & Menon
Genus	29.	***Spatulostylus*** Ramakrishnan & Menon
	51.	*Spatulostylus erythromaculatus* Ramakrishnan & Menon
	52.	*Spatulostylus variegatus* Ramakrishnan & Menon
Genus	30.	***Sundara*** Ramakrishnan & Menon
	53.	*Sundara delhiana* Ramakrishnan & Menon
	54.	*Sundara quadrimaculata* Ramakrishnan & Menon
Genus	31.	***Tamaricella*** Zachvatkin
	55.	*Tamaricella dentata* Dworakowska
Genus	32.	***Togaritettix*** Matsumura
	56.	*Togaritettix serratus* Matsumura
Genus	33.	***Zygina*** Fieber
	57.	*Zygina acutivertex* Ramakrishnan & Menon
	58.	*Zygina bipunctata* Ramakrishnan & Menon
	59.	*Zygina fuscoviridis* Ramakrishnan & Menon
	60.	*Zygina minor* Ramakrishnan & Menon
	61.	*Zygina punctata* Ramakrishnan & Menon
	62.	*Zygina rajani* Datta & Ghosh
	63.	*Zygina unipunctata* Ramakrishnan & Menon
Genus	34.	***Zyginopsis*** Ramakrishnan & Menon
	64.	*Zyginopsis abundans* Ramakrishnan & Menon
	65.	*Zyginopsis basipunctatus* Ramakrishnan & Menon
	66.	*Zyginopsis erythropunctatus* Ramakrishnan & Menon
	67.	*Zyginopsis verticalis* (Ahmed)

Genus 35. ***Viridasca*** Ramakrishnan & Menon
68. *Viridasca albomaculata* Ramakrishnan & Menon

Family III : DICTYOPHORIDAE

Genus 36. ***Chanithus*** Kolenati
69. *Chanithus gramineus* Fabricius

Genus 37. ***Dictyophora***
70. *Dictyophora cummingi* Distant
71. *Dictyophora walkeri* Atkinson

Family IV : MEMBRACIDAE

Genus 38. ***Leptocentrus*** Stal
72. *Leptocentrus taurus*(Fabricius)

Genus 39. ***Otinotus*** Buckton
73. *Otinotus oneratus* (Walker)

Genus 40. ***Tricentrus*** Stal
74 *Tricentrus aeneus* Distant

Family V : PSYLLIDAE
Subfamily : PSYLLINAE

Genus 41. ***Acizzia*** Heslop Harrison
75. *Acizzia indica* Heslop Harrison

Genus 42. ***Diaphorina*** Loew
76. *Diaphorina citri* Kuwayama
77. *Diaphorina gymnosporiae* Mathur

Genus 43. ***Euphyllura*** Foerster
78. *Euphyllura obsoleta* Mathur

Genus 44. ***Trioza*** Foerster
79. *Trioza obliqua* Thomson

Subfamily : CIRIACREMINAE

Genus 45. ***Mesohomotoma*** Kuwayama
80. *Mesohomotoma geniculata* Mathur

Suborder : HETEROPTERA
Family VI : COREIDAE

Genus 46. ***Leptocorisa*** Latr.
81. *Leptocorisa acuta* (Thunberg)

Genus 47. ***Ectrychotes*** Burmeister
82. *Ectrychotes dispar* Rauter

Genus 48. ***Riptortus*** Stal
83. *Riptortus linearis* (Fabricius)

Genus 49. ***Petalocnemis*** Stall
84. *Petalocnemis obscura* (Dallas)

Genus 50. ***Cletus*** Stal
85. *Cletus bipunctatus* Westwood

Family VII : LYGAEIDAE
Subfamily : LYGAEINAE

Genus 51. ***Spilostethus*** Stal
86. *Spilostethus hospes* (Fabricius)

Genus 52. ***Graptostethus*** Stal
87. *Graptostethus* sp.

Subfamily : GEOCORINAE

Genus 53. ***Geocoris*** Fallen
88. *Geocoris orchopterus* (Fieber)

Subfamily :RHYPAROCHROMINAE

Genus 54. ***Elasmolomus*** Stal
89. *Elasmolomus sordidus* Fabricius

Family VIII : PYRRHOCORIDAE

Genus 55. ***Antilochus*** Stal
90. *Antilochus coqueberti* (Fabricius)

Family IX : PENTATOMIDAE

Genus 56. ***Bagrada*** Stal
91. *Bagrada picta* (Fabricius)

Genus 57. ***Halys*** Fabricius
92. *Halys dentatus* Fabricius

Family X : DINIDORIDAE

Genus 58. ***Coridius*** Illiger
93. *Coridius janus* (Fabricius)

Genus 59. ***Megymenum*** Laporte
94. *Megymenum* sp.

Family XI : REDUVIIDAE

Genus 60. ***Acanthaspis*** Amy. & Serv.
95. *Acanthaspis angularis* Stal
96. *Acanthaspis quinquespinosa* (Fabricius)

Genus 61. ***Coranus*** Curlis
97. *Coranus obscurus* (Kirby)

Genus 62. ***Rhinocoris*** Hahn
98. *Rhinocoris marginatus* (Fabricius)
99. *Rhinocoris nysiiphagus* Samuel and Joseph
100. *Rhinocoris lapidicola* Samuel and Joseph

Family I : APHIDIDAE
Subfamily : APHIDINAE
Tribe : APHIDINI
1. Genus ***Aphis*** Linnaeus

1758. *Aphis* Linnaeus, *Syst. Nat.*, **1** : 451.

1. *Aphis craccivora* Koch
Black Aphid

1854. *Aphis craccivora* Koch, *Die Pflanzenlause Aphiden,* **1** : 124.

1940. *Aphis craccivora* Koch : Ghulamullah, *Indian J.Ent.* **2** : 13-25.

Material examined: Delhi: Apterae and nymphs, on *Dolichos* sp., date ?, coll. Reena Dey.

Diagnostic characters (Aptera) : Body somewhat oval, blackish, Head smooth with small antennal tubercles not extending beyond vertex, Antennae 6-segmented about 0.5-0.8 times as long as body. p.t. about 1.6-2.6 times as long as base of segment vi, Rostrum reaches upto hind coxae, u.r.s about 0.85-1.0 times as long as ht_2. Abdominal dorsum rather blackish with a dark continuous medium patch with polygonal reticulations, hairs on dorsum with acuminate apices, longest hair on anterior tergites about 0.5-0.8 times as long as b.d. iii. Sipunculi black, strongly imbricated, cylindrical, about 0.14-0.20 times as long as body and 1.5-2.0 times cauda; cauda elongate, black, spinose, tapering to apex and somewhat constricted bearing 5-9 hairs including dorsal subapical one. F.T.C. - 3,3,2.

Distribution : India : Delhi, all over the country. *Elsewhere* : Cosmopolitan.

Remarks : It is commonly known as Black aphid which attacks many plants and most often leguminous crops. It is a major pest of bean and cowpea. The spcies is recorded as a vector of about 14 plant virus diseases.

2. *Aphis gossypii* Glover

1877. *Aphis gossypii* Glover, *Rept. Com. Agr. Operations Dept. for 1876* :36.

1940. *Aphis gossypii* Glover : Ghulamullah, *Indian J.Ent.*, **2** : 13 25.

Material examined : Delhi; Apterae and nymphs, on *Hibiscus rosasinensis*, I.A.R.I. Campus, 4.iv.1991, coll. Reena Dey.

Diagnostic characters (Aptera) : Body pale, about 1.3-1.5 mm. long with 0.8-0.9 mm. as maximum width. Antennae about half as long as body, p.t. 2-3.5 base of a.s. III; rostrum reaches beyond six coxae, u.r.s. longer than h.t.2. Dorsum of abdomen pale to light brownish, without any sclerite; sipunculi light brownish, cylindrical, 0.14-0.19 x body and about 1.2-1.3 x cauda being pale to dusky and bearing 5-6 hairs.

Distribution : India : Delhi, widely distributed. *Elsewhere* : Cosmopolitan.

Abbreviations :- The following abbreviations have been used in the text :

Aptera (e) : Apterous viviparous female (s); Alata(e) : Alate viviparous female (s); a.s. : antennal segment; F.T.C. : first tarsal chaetotaxy; h.t.2 : second joint of hind tarsus; p.t. : processus terminalis; u.r.s : ultimate rostral segment.

Remarks : In India, the species infests nearly 459 species of plants belonging to 85 families (L.K.Ghosh *et al.* 1989). It exhibits great range of morphological variation even on the same host (Behura & Das, 1973).Its colour in life is extremely variable. The species transmits over 44 plant viral diseases.

3. *Aphis nerii* Boyer de Fonscolombe

1841. *Aphis nerris* Boyer de Fonscolombe, *Annls. Soc.* Ent. Fr., **10** : 179.

1940. *Aphis nerii* B.d.F. : Ghulamullah, *Indian J. Ent.*, **2** : 1-25.

Material examined : Delhi, Apterae, alatae and nymphs, on *Asclepias* sp., Barakhamba Road, October, 1991, coll. Reena Dey.

Diagnostic characters (Aptera) : Body pale brown,2.3-2.6 mm long with 1.2-1.4 mm as maximum width. Antennae 0.6-0.8 x body, p.t. 3.5-4.2 x base IV; rostrum reaches beyond hind coxae, u.r.s. 1.4-1.6 x h.t.2. Dorsum of abdomen pale with distinct polygonal reticulation, without any sclerite; sipunculi brownish, stout and broad, 0.18-0.2 x body and less than twice as long as its maximum width at base, 1.5 x cauda which is rather broad, thumb shaped, dark and bears 10-11 hairs.

Distribution : India : all over; Delhi. *Elsewhere* : Cosmopolitan.

Remarks : This is a bright yellow species which is normally found on *Asclepia daceae* and *Apocynaceae.* In India, it infests about 15 species in 11 genera under 6 plant families. The species apparently leads an anholocyclic life cycle.

4. *Aphis rumicis* Linnaeus

1758. *Aphis rumicis* Linnaeus, *Systema Naturae,* **10** : 454.

1940. *Aphis rumicis* Linnaeus : Ghulamullah, *Indian J. Ent.* **2** : 13-25.

Material examined : Delhi; 4 apterae and a few nymphs, on *Cestrum nocturnum* around National Museum Natural History, October, 1991, coll. Reena Dey.

Diagnostic characters : Body oval with 1.11-1.45 mm as its maximum width, Head smooth, brown. Antennae 6 segmented, 0.35-0.39 times as long as body; secondary rhinaria absent; p.t. as long as or just shorter than base of segment *VI* ; rostrum reaches hind coxae, u.r.s. 1.4-1.6 times as long as ht_2 and with 2 secondary hairs besides 3 preapical pairs. Abdominal dorsum pale smooth, dorsal abdominal hairs with acute to acuminate apices, abdominal tergites with 2 hairs about 2.4 times as long as b.d. *III.* Sipunculi dark brown, thick, imbricated, subequal to cauda; cauda pale to brown, conical as long as its basal width bears 14-16 hairs. F.T.C., 3,3,2.

Distribution : India : Delhi, northeastern part, Uttar Pradesh. *Elsewhere* : Afganistan; Brazil; Canada; East Africa; Europe; Taiwan; Greece; Middle East; Pakistan; U.S.A

5. *Aphis (Protaphis) carthami* (Das)

1917. *Brachyunguis carthami* Das, *Mem.Indian Mus.*, **6** : 237-239.

1940. *Brachyunguis carthami* Das : Ghulamullah, *Indian J. Ent..*, **2** : 13-25.

1985. *Aphis (Protaphis) carthami*(Das): Agarwala and Ghosh, *Mem zool. Surv. India*,**16 (3)**:36.

Material examined : From literature.

Diagnostic characters (Aptera) : Body oval, 1.68-1.95 mm. long with 1.11-1.14 mm. as its maximum width near the middle of abdomen. Head smooth, brown. Antennae 6-segmented, 0.35-0.39 times as long as ht_2 and with 2 secondary hairs besides 3 preapical pairs. Abdominal dorsum rather pale smooth; dorsal abdominal hairs with acute to acuminate apices, 8th abdominal tergite with 2 hairs about 2.4 times as long as b.d. *III*. Sipunculi darkbrown, imbricated; cauda pale to brown conical, as long as its basal width and bears 14-16 hairs. F.T.C. 3,3,2.

Distribution : India : Delhi, Bihar, south India. *Elsewhere* : Pakistan.

2. Genus ***Rhopalosiphum*** Koch

1854. *Rhopalosiphum* Koch, *Die Pflanz. Aphiden*, **1** : 23.

6. ***Rhopalosiphum maidis*** (Fitch)

1856. *Aphis maidis* Fitch, *Trans. N.Y.Agr.Soc.*, **15** : 550.

1960. *Rhopalosiphum maidis* (Fitch), *Canad. Ent.*,92: 19.

Material examined : Delhi ; Many apterae, on *Triticum vulgare*, March, 1991, coll. Reena Dey.

Diagnostic characters (Aptera) : Body spindle-shaped, 1.6-2.0 mm. long with 0.8-0.9 mm as its maximum width. Antennae less than half as long as body, p.t. 2-2.5 x base *VI*, antennal segments without secondary rhinaria; rostrum hardly reaches mid coxae, u.r.s shorter than h.t.2. Siphunculi darker than body, cylindrical, imbricated, 0.07-0.1 x body and 1.2-1.6 x cauda bearing 4 hairs.

Distribution : India : Delhi, all over the country. *Elsewhere* : Cosmopolitan.

Remarks : Yellow to green in colour. This is the commonest aphid species on Maize and well known pest of a large number of other graminaceous plants.

Menon and Ghai (1969) reported sexual female (oviparae) on wheat at Delhi for the first time in India.

7. ***Rhopalosiphum nymphaeae*** (Linnaeus)

1761. *Aphis nymphaeae* Linnaeus,*Fauna Suecica*, **2** : 260.

1958. *Rhopalosiphum nymphaeae* (Linnaeus) : Ghosh and Raychaudhuri *J.Bombay nat. Hist.*

Soc., **56 (3)** : 660-664.

Material examined : Delhi ; Alatae, on wing, Barakhamba Road, October, 1991, coll. Reena Dey.

Diagnostic characters (Alata) : Body 1.6-2.4 mm long with 1.08-1.15 mm as maximum width. Antennae 6-segmented, 0.6-0.8 x body, p.t. 3.2-4.1 x base *VI* secondary rhinaria distributed on a.s. *III* 13-16,*IV* 1-6, *V* 0, rostrum reaches mid coxae, u.r.s. 1.2-1.4 x h.t.2. Abdominal dorsum spinulose, with marginal sclerites and spinopleural dark band on 8th tergite; siphunculi distinctly clavate, almost smooth, 0.15-0.2 x body as 2-2.7 x cauda bearing 4 hairs.

Distribution : India : Delhi, all over. *Elsewhere* : Cosmopolitan.

Remarks : The species can be distinguished from other species of *Rhopalosiphum* by distinctly clavate siphunculi.

8. *Rhopalosiphum rufiabdominalis* (Sasaki)

1899. *Toxoptera rufiabdominalis* Sasaki, *Rept. Vokkaido Agr. Expt.Sta.* **17** : 202.

1986. *Rhopalosiphum rufiabdominalis* (Sasaki) : Ghosh, *Tech.Mongr.* **16**, Zoological Survey of India : 38.

Material examined : Delhi, A few apterae, host ?, September, 1991, coll. Reena Dey.

Diagnostic characters (Aptera) : Body oval, 1.62-1.79 mm long with 0.85-0.90 mm as maximum width. head with i III developed lateral frontal tubercles and bears rhopalosiphine projection ; antennae 5-segmented, about half as long as body, p.t. at least 5 times as long as base *VI* ; longest hair on a.s. *III* 3-4 x b.d *III*; u.r.s. 0.8-0.9 x h.t.2; 8th tergite with 4-8 hairs; sipunculi dark, cylindrical, heavily imbricated, 0.10-0.13 x body and about twice as long as cauda which bears 4 hairs.

Distribution : India : Delhi, all over. *Elsewhere* : Africa; Japan; Malayasia; Middle East; Nepal and Taiwan.

Remarks : Young *et al.* (1971) reported the species form roots and underground stems of barley at Delhi, which is the first record of this aphid from the roots of barley in India.

3. Genus *Acyrthosiphon* Mordvilko

1914. *Acyrthosiphon* Mordvilko, *Faune de la Russic,* **1** : 75.

9. *Acyrthosiphon pisum* (Harris)

1776. *Aphis pisum* Harris, *Exposit English Insects* : 66.

Material examined : Delhi; A few apterae (damaged), host indet., March, 1991, coll. Reena Dey.

Diagnostic characters (Aptera) : Body elongate, 3.2-4.5 mm long with 1.3-2.5 mm as maximum width. Head smooth with well developed diverging frontal tubercles, dorsal cephalic

hairs 12-25 mm long; antennae 6-segmented, suequal to body, a.s. *III* with 1-4 secondary rhinaria, p.t. 3-4 x base VI ; rostrum reaches mid coxae, u.r.s. 0.6-0.7x ht2; siphunculi much slender, 0.20-0.25 x body and 1.5-1.7 x cauda bearing 7-12 hairs.

Distribution : India : Delhi, Throughout country. *Elsewhere* : Cosmopolitan.

Remarks : Light green to greenish brown aphids infest mostly the growing shoots under and upper surfaces of the leaves of the host plants belonging mostly to Papilionaceae.

4. Genus *Brevicoryne* Van der Goot

1915. *Brevicoryne* van der Goot, Bietr. Z.Kenntider *Holland*, Blattlause : 245.

10. *Brevicoryne brassicae* (Linnaeus)

1758. *Aphis brassicae* Linnaeus, *Syst. Nat.* **10** : 452.

1918. *Brevicoryne brassicae* : Das, *Mem. Indian Mus.*, **6** (4) : 187.

Material examined : Delhi; Apterae and nymphs on Mustard, February, 1991, coll. Reena Dey.

Diagnostic characters (Aptera) : Body oval lateral frontal tubercles low and median frontal prominence well developed. Antennae 6-segmented, about half as long as body, rostrum reaches mid coxae, u.r.s. shorter than h.t.2 and bears 4 secondary hairs. Abdominal dorsum with pigmented wrinkled pleural patches showing various degrees of coalescence with those ocurring spinally on abdominal segments 1-7. Sipunculi typically barrel-shaped; cauda triangular and bears 5-7 hairs.

Distribution : India : Delhi, Himachal Pradesh, Nagaland, Punjab, Uttar Pradesh, West Bengal, south India. *Elsewhere* : Cosmopolitan.

Remarks : Ghosh, L.K. *et al.* (1980) have made detailed study on the species.

5. Genus *Dactynotus* Rafinesque

1818. *Dactynotus* Rafinesque, *Amer. mon. Mag.*, **3** : 18.

11. **Uroleucon (Uromelan) carthami* H.R.L

1918. *Macrosiphum solidaginis* (Fabricius) : Das, *Mem. Indian Mus.*, **6** : 164.

1940. *Macrosiphum solidaginis* (Fabr.) : Gullamullah, *Indian J.Ent.*, **2** (1) : 13-25.

1948. *Dactynotus carthami* Hille Ris Lambers : *Trans. R.ent. Soc. Lond.*, **99** : 276.

Material examined : from litrature.

Distribution : India : Delhi, south India; *Elsewhere* : west Pakistan (Lahore); England; Java; New Mexico; Israel.

Remarks : Due to non availability of literature, diagnosis could not be given.

6. Genus *Hayhurstia* del Guercio

1917. *Hayhurstia*del Guercio, Redia, 12 : 206.

12. **Hayhurstia atriplicis* (Linnaeus)

1761. *Aphis atriplicis* Linnaeus, *Fauna Suecica* (2nd ed.) : 262.

1968. *Hayhurstia atriplicis* : Basu, *Orient. Ins.*, 3 (4) : 360.

Material examined : From litrature.

Diagnostic characters (Aptera) : Body elongated, dorsum of head usually smooth, without lateral frontal tubercles, antennae 6-segmented, a.s. III without secondary rhinaria, secondary hairs on u.r.s. usually much shorter than primary hairs ; abdominal dorsum normal, dorsal hairs also normal. Siphunculi shorter than sauda, sometimes with interconnecting striae present near the apical flange. Cauda longer than wide at base.

Distribution : India : Delhi, Arunachal Pradesh, Himachal Pradesh, Meghalaya, south India, Uttar Pradesh. *Elsewhere* : China; Europe; Japan; Korea; Middle East; North America and Taiwan.

Remarks : Ullah (1940) recorded the species for the first time from Delhi.

7. Genus *Lipaphi* Mordvilko

1928. *Lipaphis* Mordvilko,*Key for the identification of Insects of European Russia* (in Russian) : 200.

13. *Lipaphis erysimi* (Kaltenbach)

1843. *Aphis erysimi* Kaltenbach, *Mon. Fam. Pflanzen* : 99.

1986. *Lipaphis erysimi* (Kaltenbach) : Anand, *Proc. 2nd Nat. Symp., Recent Trends in Aphidological Studies*.

Material examined : Delhi; many apterae and alatae on *Brassica* sp., February, 1991, coll. Reena Dey.

Diagnostic characters (Aptera) : Body 1.4-1.9 mm long with 0.9-1.0 mm as maximum width near the middle of abdomen; head with little developed lateral frontal tubercles, antennae 0.5-0.8 x body, without secondary rhinaria, p.t. 2-2.5 x base *VI* ; u.r.s. 0.8-0.9 x ht_2. Midthoracic furcu sessile. Abdominal dorsum pale but may be with scattered sclerites, hairs on anterior tergites at most 9 m long and with acute apices; siphunculi cylindrical to weakly clavate near apex, nearly equal to or slightly longer than cauda which is elongate and conical and bears 4-6 hairs.

Distribution : India : Delhi, Arunachal Pradesh, Assam, Bihar, Himachal Pradesh, Manipur, Meghalaya, Nagaland, Orissa, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh,

West Bengal. *Elsewhere* : Cosmopolitan.

Remarks : Blackish brown insects infest both the surfaces of leaves, growing shoots and inflorescences. This species mostly infest cruciferous plants in India and carries viruses in most parts of the world. The insect shows a longitudinal row of impressed areas on each side of the mid-abdominal dorsum.

8. Genus *Macrosiphum* Passerini

1960. *Macrosiphum* Passerini, *Gli Afidi* : 27.

14. **Macrosiphum centranthi* Theobald

1915. *Macrosiphum centranthi* Theobald, *Entomologist*, **48** : 262.

1975. *Macrosiphum centranthi* Theobald : David, *Oriental Ins.*, **2** (4) : 466.

Material examined : From literature.

Diagnostic characters (Aptera) : The most diagnostic feature of the species is that the aphid has a characterstic dark band on the femora just below the joint of the tibiae. Also, a.s. *III* with 2-5 secondary rhinaria, Abdomen pale. Siphunculi pale with slightly dark apex ; h.t.2 quite long (about 0.17 mm in length).

Distribution : India : Delhi, south India.

Remarks : "The species was possibly introduced into the south Indian hills from Europe and has since continued to live there on various food plants including indigenous ones" (David, 1975 : 467).

15. **Macrosiphum (Sitobion) miscanthi* (Takahashi)

1921. *Macrosiphum miscanthi* Takahashi, *Aphididae of Formosa*, pt. **1** : 8-9.

1975. *Macrosiphum (Sitobion) miscanthi* Takahashi : David, *Orient. Ins.*, **9**(4) : 472.

Material examined : Delhi; Apterae and nymphs on indet. Graminaeae, January, 1991, coll. Reena Dey.

Diagnostic characters (Aptera) : Body dark, 2.5-3.0 mm long with 1-1.4 mm as maximum width. Head with well developed lateral frontal tubercles; antennae longer than body, a.s. *III* with 1-3 secondary rhinaria; p.t. 6-7.5x base *I*; rostrum reaches beyond mid coxae, u.r.s. blunt, 0.7-0.8 x h.t.2; abdominal dorsum with an almost continuous dark patch extending from segments 2-6; siphunculi black, 1.3-1.4 x cauda which is dark elongate and bears 7-10 hairs. F.T.C. 3,3,3.

Distribution : India : Delhi ; all over. *Elsewhere* : Cosmopolitan.

Remarks : Brown to blackish-brown aphids; infest the leaves, both basal and aerial portion of the shoots. The species exhibits colour variation.

16. *Macrosiphum (Macrosiphum) rosae* (Linnaeus)

1758. *Aphis rosae* Linnaeus, *Syst. Nat.*, 1 (10th ed.) : 452.

1975. *Macrosiphum (Macrosiphum) rosae* (Linnaeus): David, *Oriental Ins.*, **9** (4) : 475.

Material examined : Delhi; Apterae, alatae and nymphs, on *Rosa* sp., Barakhamba Road, January, 1991, coll. Reena Dey.

Diagnostic characters (Aptera) : Body spindle-shaped, 2.4-3mm long with the maximum width 1.04-1.35 mm. Head with well developed diverging lateral frontal tubercles; antennae as long as or longer than body, a.s *III* with 9-12 secondary rhinaria, p.t. 5-5.5 x base *VI* u.r.s subequal to h.t. 2 abdominal dorsum pale with ante and post siphuncular sclerites; siphunculi about half as long as body,brownish basal half and at very apex, rest pale; cauda dusky, less than half as long as siphunculi and bears 10-12 hairs. F.T.C. 3,3,3.

Distribution : India : Delhi and all over the country. *Elsewhere* : Cosmopolitan.

Remarks : Light brown aphids infest the leaves, young shoots and buds of the host plant.

17. *Macrosiphum (Sitobion) rosaeformis* (Das)

1918. *Macrosiphum rosaeformis* Das. *Mem.Indian Mus.*, **6** (4) : 158.

1957. *Macrosiphum (Sitobion) rosaeformis* (Das) : David, *Indian J. Ent.*, 19 (4) : 298.

Material examined : Delhi; Apterae and nymphs, on *Rosa indica*, February, 1991, coll. Reena Dey.

Diagnostic characters (Aptera) : Body elongated, 3-4 mm long, 1.4-1.8 mm as maximum width. head pale, lateral frontal tubercles diverging; antennae slightly shorter than body, a.s. *III* with 3-6 secondary rhinaria situated near base, p.t.5-6 x base *VI*; u.r.s. as long as h.t.2 and about 1.2 x its basal width. Abdominal dorsum pale but with scattered brown patches; siphunculi cylindrical, dark, with broad base and narrow apex, 0.25-0.3x body and a little less than to little over 2 x pale cauda which is conical and bears 9-12 hairs.

Distribution: India : Delhi, widely distributed. *Elsewhere* : Nepal ; Pakistan.

Remarks : Pink in life. The species infests the terminal portions of shoots, flower stalks and the tender leaves of the host plants. Ants attack the aphids.

18. **Macrosiphum (Sitobion) takahashii* Eastop

1959. *Macrosiphum (Sitobion) takahashii* Eastop, *Entomologist*, **92** : 104.

1976. *Macrosiphum (Sitobion) takahashii* Eastop : David, *Oriental. Ins.*, **9** (4) : 778.

Material examined : From literature.

Diagnostic characters (Aptera) : Body dark, Head with well developed lateral frontal tubercles; antennae longer than body (about 1.2 times), 6-segmented, p.t. about 6 x base *VI*, longer then a.s. *III* being smooth; u.r.s blunt, about 1.1 x h.t.2; Abdomen pale dorsal abdominal hairs very short, upto about 40/μ. Sipunculi rather dark, about 1.7 x caudal which is pale and

elongate. F.T.C. 3,3,3.

Distribution : India : Delhi, Meghalaya, Sikkim, south India, West Bengal. *Elsewhere* : Africa; Japan and Taiwan.

9. Genus *Myzus* Passerini

1860. *Myzus* Passerini, Gl. *Afidi* : 27.

19. *Myzus persicae* (Sulzer)

1776. *Aphis persicae* Sulzer, *Abgekurz. Gesch. Ins.* : 105.

1953. *Myzus persicae* (Sulzer) : Cottier, *Aphids of Newzealand* : 281.

1962. *Myzus persicae* (Sulzer) : Ghosh and Raychaudhuri, Sci. & Cult., **28** : 539-540

Material examined : Delhi; Apterae, alatae and nymphs on indet. Solanaceae, August, 1991, coll. Reena Dey.

Diagnostic characters (Aptera) : Body 1.5 2.5 mm long with 0.8-1.1 mm as maximum width. Head with prominent lateral frontal tubercles being parallel to converging and with numerous minute spinules. Antennae 6-segmented, 0.7-0.9 x body, pt. 3.4-5 x base *VI* Abdominal dorsum roughened. Siphunculi clavate, 2-2.5 x cauda being elongate and usually with 6 hairs. Hind tibiae of nymphs smooth. F.T.C 3,3,3.

Distribution : India : Delhi, throughout the country. *Elsewhere* : Cosmopolitan.

Remarks : Light green or pale brown or pinkish aphids infest the undersurface and apical tender shoots. It is a highly polyphagous species and transmits many virus diseases of tropical crops. It is a vector of about 90 virus diseases of plants. Ghosh and Raychaudhuri (1962) recorded sexual male from Delhi for the first time. The species assumes pest status on winter vegetables.

10. Genus *Pentalonia* Coquerel

1859. *Pentalonia* Conquerel, *Ann. Soc. ent. Fr.*, 3 : 259.

20. *Pentalonia nigronervosa* Coquerel

1967. *Pentalonia nigronervosa* Coquerel : Menon, *Indian J. Ent.*, **29** : 393.

Material examined : Delhi, Apterae and nymphs on *Musa* sp., October, 1991, coll. Reena Dey.

Diagnostic characters (Aptera) : Head heavily spinulose on both surfaces ; lateral frontal tubercle spinulosely scabrous, dorsal cephalic hairs short, fan-shaped and placed on raised sockets, segment *II* heavily scurbous, flagellum densely imbricated ; apterae without secondary rhinaria, p.t. much longer than base of segment *VI*. Abdominal dorsum with polygonal

reticulations particularly on antesiphuncular segments and with transverse spinular striae on postsiphuncular segments. Dorsal hairs short with expanded apices and placed on raised sockets. Siphunculi with dense spinulose imbricatons all over. Cauda short, dusky, witha bulbous base and blunt apex and bears 4-6 hairs. F.T.C 3,3,3. Nymphs with hind tibiae spinulose.

Distribution : India : Delhi ; all over the country. *Elsewhere* : virtually cosmpolitan.

Remarks : The species usually enjoys an holocyclic life cycle throughout India. However, Bhanotar and Ghosh (1969) reported apterous oviparous females of the speceis on *Curcuma longa* (Zingiberaceae) from the plains of West Benagal

11. Genus *Saltusaphis* Theobald

1915. *Saltusaphis* Theobald, *Bull. ent. Res.*, **6** : 138.

21. *Saltusaphis scripus* Theobald

1915. *Saltusaphis africana* Eastop : Menon and Pawar,*Proc. 15th Indian Sci. Congr.*, **3** : 348.

1990. *Saltusaphis scripus* Theobald : Ghosh and Quednau, *The Fauna of India* and the adjacent countries, Homoptera : Aphidoidea pt. **5**, subfamily Dreponosiphinae : 180.

Material examined : Delhi, Apterae on *Cyperus* sp. I.A.R.I., 16.11.1994, coll. R.Menon.

Diagnostic characters (Aptera) : Body elongate. Head with poorly developed lateral frontal tubercles but with a short rounded projection in the middle. Antennae 6-segmented, about as long as body, flagellum densely covered with rows of spinules, p.t. about 1.5 x base *VI*, u.r.s. about half as long as h.t.2 and with a pair of secondary hairs, Dorsum of body distinctly segmented; 8th tergite bilobed. Siphunculi elevated short, spinulose. Cauda knobbed, bearing 6-7 hairs ; subanal plate bilobed.

Distribution : India : Delhi, Karnataka. *Elsewhere* : Africa; Europe.

12. Genus *Ceratopemphigella* Menon and Pawar

1958. *Ceratopemphigella* Menon and Pawar, *Proc. 45th Indian Sci. Congr.*, **3** : 348.

22. *Ceratopemphigella delhiensis* Menon and Pawar

1958. *Ceratopemphigella delhiensis* Menon and Pawar, *Proc. 45th Indian Sci. Congr.*, **3** : 348.

1984. *Ceratopemphigella delhiensis* Menon and Pawar : Ghosh, *The Fauna of India and the adjacent countries*, Homoptera : Aphidoidea, 3 Subfamily Pemphiginae : 162.

Material examined : Delhi : One alate viviparous female, on Light trap, 31.3.1957, coll. J.G.Pawar (I.A.R.I. coll.).

Diagnostic characters (Alata) : Body elongate. Antennae 6-segmented, a.s. *III* with 9-10 and *IV* with 3 transverse secondary rhinaria p.t. short finger-shaped, about 0.2 x base *VI*. Rostrum reaches 2nd coxae, u.r.s about half as long as h.t.2. Abdominal dorsum pale, with paired spinal wax gland groups, each bearing a hair. Siphuniculi absent. F.T.C. 5,5,4. Forewings with pterostigma brown, radial sector faint; hind wings with obliques united at bae with subcosta.

Distribution : India : Delhi.

Remarks:The genus is monotypic and so far known only from Delhi.

13. Genus *Uroleucon* Mordvilko

1914. *Uroleucon* Mordvilko, *Faune de la Russie* **1** : 64.

23. *Uroleucon (Uroleucon) sonchi* (Linnaeus)

1767. *Aphis sonchi* Linnaeus, *Syst. Nat.* (12th ed.) : 735.

1972. *Uroleucon sonchi* (Linnaeus) : Ghosh, *Oriental Ins.*, **6**(2) : 174.

Material examined : Delhi : Apterae, on *Centaurea* sp., April, 1991, coll. Reena Dey.

Diagnostic characters (Aptera) : Body dark brown, 3.0-3.5 mm long with 1.5-1.6 mm as maximum diameter. Head with well developed diverging lateral frontal tubercles; antennae 6 segmented, slightly longer than body, a.s. *III* with 18-22 secondary rhinaria; p.t. 4.5-5 x base *VI*; rostrum reaches hind coxae, u.r.s. just shorter than h.t.2. Abdominal dorsum pale, with hairs not arising form distinct sclerites. Siphunculi dark, reticulated, 1.8-2 x cauda which is pale and bears 20-25 hairs; F.T.C. 5,5,5.

Distribution: India : Delhi, widely distributed in other staes. *Elsewhere* : Africa; Australia; Egypt; Europe; south America.

Remarks : Chocolate brown aphids usually infest the undersurface of the leaves and apical shoots.

24. *Uroleucon* sp.

Material examined : Delhi : Many nymphs, on *Chrysanthemun caronariun*, coll. *Reena Dey*

Remarks : Due to insufficient material identification could not be possible up to specific level.

Family : CICADELLIDAE
Subfamily : TYPHLOCYBINAE
14. Genus *Accacidia* (Dworakowska)

25. ***Accacidia improvisa* (Linnavuori)

15. Genus ***Apheliona*** (Kirkaldy)

26. *****Apheliona bioculata*** (Melichar)
27. *****A.maculosa*** (Dworakowska)

16. Genus ***Cassianeura*** Ramakrishnan & Menon

1973. *Cassianeura* Ramakrishnan & Menon, *Oriental Ins.* 7 (1) : 27.

28. *****Cassianeura cassiae*** (Ahmed)

29. ****Cassianeura sexmaculata*** Ramakrishnan & Menon

1973. *Cassianeura sexmaculata* Ramakrishnan & Menon,*Oriental Ins.*, 7 (1) : 28.

Diagnostic characters : Body broad, robust, yellow in colour, vertex short, rounded in front, vertex with two pairs of black maculae, one pair on apex other pair covering the posterior border of eyes; eyes piceous,median suture continue on face, pronotum rounded in front and truncate behind, scutellum short, broad at base, a pair of black maculae on scutellum submarginally and partly covered ; tegmina yellowish, sub-opaque; hind wings hyaline abdomen short. Yellow in colour. *Length* 2.31.

Distribution : India : Delhi (I.A.R.I)

Remarks : The species is so far known only from Delhi.

17. Genus ***Dialecticopteryx*** (Kirkaldy)

30. *****Dialecticopteryx centromaculata*** (Ramakrishnan)

18. Genus ***Empoasca*** Walsh

1864. *Empoasca* Walsh, *Proc. Bost. Soc. Nat. Hist. IX* : 316.

31. *****Empoasca albizziae*** Mahmood
32. *****Empoasca binotata*** Pruthi
33. *****E. kerri*** Pruthi
34. *****E.motti*** Pruthi
35. *****E.tabaci*** Pruthi

36. **Empoasca terminalis* Distant

1918. *Empoasca terminalis* Distant, *Fauna Brit. India,* **6** : 92.

Material examined : From literature.

Diagnostic characters : Body small in size, olivaceous green in colour, vertex of head conically produced anteriorly; posterior area of pronotum gibbous and lateral with two discal longitudinal ridges; posterior area of scutellum also gibbous; tegmina flavescent, apical area distinctly pale bronzy-brown the costral margins and legs darker olivaceous green. *Length* 3.5 mm.

Distribution : India :Delhi, south India.

19. Genus ***Empoascanara*** Distant

1918. *Empoascanara* Distant, *Fauna Brit, India,* **6** : 94

37. ** ***Empoascanara indica*** Dworakowaka and Viraktamath

38. *****Empoascanara serrata*** (Singh Pruthi)

20. Genus ***Helionidia*** Zachvatikin

39. *****Helionidia karachiensis*** Ahmed & Khokhar

21. Genus ***Indianella*** Ramakrishnan & Menon

1973. *Indianella* Ramakrishnan & Menon, *Oriental Ins.*, **7** (1) : 22.

40. ***Indianella delhiana*** Ramakrishnan & Menon

1973. *Indianella delhiana* Ramakrishnan & Menon, *Oriental Ins.*, **7** (1) : 26.

Material examined : From literature.

Diagnostice characters : Body short, light green in colour, vertex very short and transverse, anterior margin rounded, width of head slightly more than that of pronotum; median suture indiscernible; face convex; eyes black, pronotum with anterior margin convex, posterior margin transverse; Scutellum short, a transverse impression slightly distad of the middle; tegmina hyaline, basal part light green, hind wings hyaline, abdomen black dorsally, whitish ventrally. *Length* 1.23 mm.

Distribution :India : Delhi (I.A.R.I.)

Remarks : The species is originally described from Delhi and so far not recorded from elsewhere.

41. ****Indianella indraprasthana*** Ramakrishnan & Menon

1973. *Indianella indraprasthana* Ramakrishnan & Menon, *Oriental Ins.*, **7** (1) : 23-24.

Material examined : From literature.

Diagnostic characters : Body short, yellow-green in colour, eyes piceous, vertex slightly conically produced. With broadly rounded apex; median suture clearly visible at base, face convex; pronotum shorter than scutellum, anterior margin of pronotum convex; pronotum shorter than scutellum, anterior margin of pronotum convex and posterior margin concave; scutellum short and a transverse impression slightly distad at middle; tegmina yellowish green hind wings hyaline; abdomen yellowish. *Length* : 1.38 mm

Distribution : India : Delhi (I.A.R.I.).

Remarks : The species is originally described from Delhi. Not known from anywhere else.

42. * *Indianella tamaricis* Ramakrishnan & Menon

1973. *Indianella tamaricis* Ramakrishnan & Menon, *Oriental Ins.*, **7** (1) : 25.

Material examined : From literature.

Diagnostic characters : Body short, delicate,green in colour, vertex very narrow and rounded at apex,head slightly width of pronotum, median suture indiscernible, ocelli present on edge of vettex, eyes black; pronotum with anterior margin convexly rounded, posterior margin truncate; scutellum short, basal width, transverse impress more towards the base; tegmina green, hind wings hyaline with a slightly infumation; Legs yellowish green; abdomen black. *Length* : 1.35 mm.

Distribution : India : Delhi (I.A.R.I).

22. Genus *Jacobiasca* Dworakowska

43. ** *Jacobiasca furcostylus* Dworakowska

23. Genus *Javadikra* Dworakowska

44. ** *Javadikra bipunctata* Dworakowska

24. Genus *Platytettix* Matsumura

Platytettix Matsumura, *Ins.Matsumurana*, **6** (3) : 103. (Type species : *Platytettix pulchra* Matsumura).

45. *Platytettix sudra* (Distant)

1908. *Typhlocyba sudra* Distant, *Fauna Brit. India, Rhyn.*, **4** : 421.

1974. *Platytettix sudra* : Ramakrishnan & Menon, *Oriental Ins.*, **8** (4) : 439.

Material examined : From literature.

Diagnostic characters : Body small in size, robust, greyish with yellow tint, head with vertex rounded in front, shorter than width of eyes, vertex with an apical black spot beneath on the basal margin of face ; pronotum broad with its posterior margin slightly concave, scutellum with transverse impression in the middle; with two dark black shining patches, three oval large spots on mesonotum, one median, smaller and other two lateral and larger; tegmina shaded with flavecent, tinged, wings hyaline; abodomen yelowish fuscous. *Length* : 2.5 mm (Female).

Distribution : India : Delhi, West Bengal.

46. **Playtettix variegatus* Ramakrishnan & Menon

1974. *Playtettix variegatus* Ramakrishnan & Menon, *Oriental Ins.*, **8** (4) : 438-439.

Material examined : From literature.

Diagnostic characters : Body robust, medium sized, milky white in colour, vertex shorter than pronotum, head with vertex conically produced in front of eyes, an orange yellow patch in middle of vertex;ocelli and median suture indistinct, face rather short and flattened; pronotum broad, with a pair of triangular fuscous patches; scutellum short, with transverse impression in apical half, forewings orange yellow with fuscous marking ; abdomen black. *Length* : 1.88 mm (Female).

Distribution : India : Delhi (I.A.R.I).

25. Genus *Pusaneura* Ramakrishnan & Menon

1971. *Pusaneura* Ramakrishnan & Menon, *Orient. Insects*, **5** (4) : 459.

47. **Pusaneura signata* Ramakrishnan & Menon

1971. *Pusaneura signata* Ramakrishnan & Menon, *Oriental Ins.*, **5** (4) : 459-460.

Material examined : From literature.

Diagnostic characters : Body dorso-ventrally compressed, pale yellow in colour, vertex conically produced in front of eyes, at the base of vertex with a pair of yellow streak; at anterior margin of pronotum with four black spots; scutellum with transverse impression and with a pair of pale yellow streak; tegmina whitish yellow, with circular black spot in the centre of second apical cell and a black `U'- shaped marking in outer apical cell; hind wings hayline. *Length* : 2.60 mm.

Distribution : India : Delhi (I.A.R.I).

26. Genus *Pusatettic* Ramakrishnan & Menon

1971. *Pusatettix* Ramakrishnan & Menon, *Oriental Ins.* 5 (4) : 463.

48. **Pusatettic bipunctatus* Ramakrishnan & Menon

1971. *Pusatettic bipunctatus* Ramakrishnan & Menon, *Oriental Ins.*, **5** (4) : 463-465.

Material examined : From literature.

Diagnostic characters : Body light yellow, vertex short, with brownish yellow patches, and with a cental light yellow triangular patch surrounded by brown yellow V-shaped stripe; eyes black, pronotum with brownish yellow patches; scutellum with transverse impression ; tegmina light yellow, with two black dots at the base of inner and outer apical cell; hind wngs hyaline. *Length* : 2.27 mm.

Distribution : India : Delhi (I.A.R.I).

27. Genus ***Ratburella*** Ramakrishnan & Menon

1973. *Ratburella* Ramakrishnan & Menon, *Oriental Ins.*, **7** (1) : 22.

49. ****Ratburella unipunctata*** Ramakrishnan & Menon

1973. *Ratburella unipunctata* Ramakrishnan & Menon, *Oriental Ins.*, **7** (1) : 23-24.

Material examined : From literature.

Diagnostic characters : Body short, yellowish-green in colour, vertex slightly produced conically with broadly rounded apex; median suture clearly visible at base, ocelli not discernible face convex; eyes piceous; pronotum short, anterior margin convex and posterior margin concave; scutellum equilateral, traverse impression at middle; tegmina yellowish green, hind wings hyaline, abdominal apodeme developed, lamillate, yellowish green. Length : 1.38 mm.

Distribution : India : Delhi (I.A.R.I).

28. Genus *Sirosoma* Mc Atee

1933. *Sirosoma* Mc Atee, *Philippine J. Sci.*, **51** (4) : 545.

50. *Sirosoma indica* Ramakrishnan & Menon

1974. *Sirosoma indica* Ramakrishnan & Menon, *Oriental Ins.*, **8** (4) : 435-437.

Material examined : From literature.

Diagnostic characters : Body robust, yellowish fuscous in colour, vertex short, less than half the length of pronotum, two black spots on the vertex close to ocelli, medium suture distinct at base only, pronotum broad and pitted, scutellum with transverse impression at middle, two large oval black spots an mesonotum. legs yellowish brown; forewings enfumed with brownish fuscous; abdomen yellowish brown. *Length* 1.62 mm.

Distribution : India : Delhi.

29. Genus *Spatulostylus* Ramakrishnan & Menon

1973. *Spatulostylus* Ramakrishnan & Menon, *Oriental Ins.*, **7** (1) : 16.

51. *Spatulostylus erythromaculatus* Ramakrishnan & Menon

1973. *Spatulostylus erythromaculatus* Ramakrishnan & Memon, *Oriental Ins.*, **7** (1) : 10-19.

Material examined : From literature.

Diagnostic characters : Body small in size, slender; yellow with red marks in colour ; vertex conically produced in front of eyes median suture vesible at base of vertex, V-shaped marking on ocellilight yellow, vertex face flattened; pronotum short, anterior margin of its convex and posterior margins more or less transverse, venter of pronotum yellow shaded, a ``y' -shaped marking on pronotum; scutellum short, with a transverse impression in basal half of scutellum; apex of scutellum black; tegmina yellowish and an irregular red patch in apical portion; hind wings hyaline; abdomen short, fuscous. Length : 1.07 mm.

Distribution : India : Delhi (I.A.R.I).

52. **Spatulostylus variegatus* Ramakrishnan & Menon

1973. *Spatulostylus variegatus* Ramakrishnan & Menon,*Oriental Ins.*, **7** (1) : 17.

Material examined : From literature.

Diagnostic characters : Body small, whitish yellow in colour, vertex conically produced in front of eyes, head whitish with yellow patches all over, median suture faintly visible at the base only, ocelli indiscernible; pronotum rounded anteriorly and posterior margin slightly concave; scutellum shorter than pronotum , a transverse impression situated at the middle, tegmina whitish yellow, a clear black spot in the second cell and one on the costal margin in the middle, apex of tegmina fuscous, wings hyaline; abdomen whitish yellow. *Length* : 1.35 mm.

Distribution : India : Delhi (I.A.R.I).

30. Genus *Sundara* Ramakrishnan & Menon

53. *Sundara delhiana* Ramakrishnan & Menon

1972. *Sundara* Ramakrishnan & Menon, *Oriental Ins.*, **6** (2) : 188.

Material examined : From literature.

Diagnostic characters : Body small, elongate, flattened; yellowish white in colour; pronotum subequal, scutellum as long as pronotum, with a transverse impression near to apex; tegmina yellowish white, with four spots, one large at middle, other two narrow and oblique at costal margin, and last one at apical cell; hindwings hyaline; tip of abdomen black. Length : 1.77 mm.

Distribution : India : Delhi (I.A.R.I.).

54. **Sundara quadrimaculata* Ramakrishnan & Menon

1972. *Sundara quadrimaculata* Ramakrishnan & Menon, *Oriental Ins.*, **6** (2) : 187-188.

Material examined : From literature.

Diagnostic characters : Body small in size, elongate and flattened, yellowish white in colour, vertex conically produced in front of eyes; ocelli indiscernebel; pronotum subconvex; scutellum short, with a transverse impression in apical half; tegmina yellowish white, with four black spots; hind wings hyaline; abdomen infuscated. Length : 1.66 mm.

Distribution : India : Delhi (I.A.R.I.).

31. Genus *Tamaricella* Zachvatikin

55. *Tamaricella dentata* Dworakowska

32. Genus *Togaritettix* Matsumura

1931. *Togaritettix* Matsumura, *Ins. Matsumurana* **6** : 71.

56. **Togaritettix serratus* Matsumura

1931. *Togaritettix serratus* Matsumura, *Ins. Matsumurana*, **6** : 71.

1971. *Togaritettic serratus* Ramakrishnan & Menon, *Oriental Ins.*, **5** (4) : 456-457.

Material examined : From literature.

Diagnostic characters : Body yellowish; vertex conically produced in front of eyes, yellowish with black band; pronotum yellowish with black band; scutellum with transverse impression in the apical half; eyes black, tegmina yellow with longitudianl black band; hind wing hyaline; abdomen yellowish. Length : 1.71 mm.

Distribution : Inida : Delhi (I.A.R.I.).

33. Genus *Zygina* Fieber

57. *Ziygina acutivertex* Ramakrishnan & Menon

1966. *Zygina* acutivertex *Ramakrishnan & Menon,* Oriental Ins., **8** (4) : 449-450.

Material examined : From literature.

Diagnostic characters : Body small, green with slight yellowish tint in colour, vertex short, with a very closely opposed pair of triangular black spots, produced in front of eyes, eyes piceous; pronotum broadly rounded anteriorly, truncate behind; scutellum short, a transverse impression at middle; tegmina green with apices hyaline, hind wngs hyaline; abdomen black. *Length* : 1.38mm.

Distribution : India : Delhi (I.A.R.I.).

58. **Zygina bipunctata* Ramakrishnan & Menon

1974. *Zygina bipunctata* Ramakrishnan & Menon, *Oriental Ins.*, **8** (4) : 450-452.

Material examined : From literature.

Diagnostic characters : Body small and robust, green in colour, vertex short, slightly produced in front, ventrally infuscated, and with a pair of large black spots, apex obtuesely angulate,head slightly broader than pronotum; median suture distinct on the vertex and continued upto face; pronotum broadly convex in front and truncate behind; scutellum short and with a transverse impression basally located; mesonotum with a inverted `U' shaped black macula visible through the transluscent pronotum; tegmina bright green; wings hyaline; abdomen green in colour. Length : 1.57 mm.

Distribution : India : Delhi (I.A.R.I).

59. **Zygina fuscoviridis* Ramakrishnan & Menon

1974. *Zygina fuscoviridis* Ramakrishnan and Menon, *Oriental Ins.*,**8** (4) : 445.

Material examined : From literature.

Diagnostic characters: Body slightly flattened; greenish with yellow tinged; vertex short, in front of eyes slightly produced, apex angulated, breadth of head equal to width of pronotum, median suture visible at the base of vertex, face convex; pronotum anteriorly broadly rounded and posteriorly truncate; scutellum small, with a transverse impression at middle; tegmina greenish wih yellow tinge; wings hyaline; abdomen piceous. Length : 1.5 mm (female).

Distribution : India : Delhi.

60. **Zygina minor* Ramakrishnan & Menon

1974. *Zygina minor* Ramakrishnan & Menon, *Oriental Ins.*, **8** (4) : 446.

Material examined : From literature.

Diagnostic characters : Very small insects, brownish fuscous with an yellowish tinge ; vertex short, slightly produced in front of eyes, apex obtusely angulated; median suture visible at base of vertex ; ocelli creamy white;eyes piceous, face elongate and moderately convex; pronotum broadly rounded in front, somewhat concave behind; scutellum short with a transverse impression at the middle; tegmina opaque whitish; hind wings hyaline; abdomen piceous. *Length* : 1.10 mm (Female).

Distribution : India : Delhi (I.A.R.I).

61. **Zygina punctulata* Ramakrishnan & Menon

1974. *Zygina punctulata* Ramakrishnan & Menon, *Oriental Ins.*, **8** (4) :453-455.

Material examined : From literature.

Diagnostic characters : Body small but robust, green in colour; vertex extended beyond eyes ; a pair of tiny round spots and a row of tiny black spots submarginally locatedalong the anterior and lateral margin on disc; face elongate, convex ; eyes piceous; pronotum broadly rounded in front and truncate behind; mesonotum with a dark transverse band, very faintly visible through pronotum; scutellum short; tegmina green; wings hyaline; abdomen piceous. Length : 1.45 mm.

Distribution : India : Delhi (I.A.R.I).

62. *Zygina rajani* Datta & Ghosh

1973. *Zygina rajani* Datta & Ghosh, *Zool. Anz. Leipzi,* **191** : 412.

Material examined : From literature.

Diagnostic characters : Vertex at the apex subacute, on the disc three white longitudinal stripes present, face along the margin with white patches, rostrum dark brown; pronotum with three patches, one on anterior margin another two on lateral margins ; scutellum with chalky white margin and with a central broad longitudinal stripe; Legs yellowish; tegmina yellowish, apical part brownish grey, hind wing transparent, vein brownish.*Length*: 1.5 mm.

Distribution : India : Delhi, Tamil Nadu.

Remarks : The species is originally described fron the specimens collected from South India

63. *Zygina unipunctata* Ramakrishnan & Menon

1974. *Zygina unipunctata* Ramakrishnan & Menon, *Oriental Ins.*, **8** (4) : 447.

Material examined : From literature.

Diagnostic characters : Body small, bright yellow, vertex short, with a semilunar balck spot at apex, conically produced in front of eyes, its apex rounded, median suture faintly visible at the base of vertex, ocelli whitish, face elongate and moderately convex; pronotum very broadly rounded anteriorly, truncate behind; scutellum short, broad as base, a transverse impression at middle; tegmina translucent white, hind wings hyaline; abdomen bright yellow in colour. *Length* :1.38 mm.

Distribution : India : Delhi (I.A.R.I.).

34. Genus *Zyginopsis* Ramakrishnan & Menon

1973. *Zyginopsis* Ramakrishnan & Menon, *Orinental Ins.*, **7** (1) : 29.

64. **Zyginopsis abundans* Ramakrishnan & Menon

1973. *Zyginopsis abundans* Ramakrishnan & Menon, *Oriental Ins.*, **7** (1) : 30-31.

Material examined : From literature.

Diagnostic characters : Body small in size and robust, fuscous brown; vertex short, rounded, slightly enfumed, median suture visible at base; eyes black; pronotum short, rounded in front and truncate behind, pronotum with a pair of transverse opaque streaks whose posterior border is lined with very fine red dots; scutellum short, a transverse impression at apex; fore wings yellow; hind wings hyaline; legs black; abdomen slightly piceous. *Length* : 1.82 mm.

Distribution : India : Delhi (I.A.R.I.).

65. ***Zyginopsis basipunctatus** Ramakrishnan & Menon

1973. *Zyginopsis basipunctatus* Ramakrishnan & Menon *Oriental Ins.*, **7** (1) : 33.

Material examined : From literature.

Diagnostic characters : Body small in size, fuscous brown in colour, vertex obtusely rounded with median length, a crescent like fuscous spot situated at base on vertex; ocelli whitish and clypeus fuscous brown; eyes fuscous; pronotum rounded in front and transverse behind, deep black behind the pronotum; scutellum short, a transverse impression, a pair of elongate oval black spot on mesonotum; tegmina brownish fuscous; hind wings hyaline; abdomen whitish yellow. *Length* : 1.58 mm.

Distribution : India : Delhi (I.A.R.I.).

66. ***Zyginopsis erythropunctatus** Ramakrishnan & Menon

1973. *Zyginopsis erythropunctatus* Ramakrishnan & Menon,*Oriental Ins.*, **7** (1) : 32.

Material examined : From literature.

Diagnostic characters : Body small, light creamy yellow; vertex shorter than pronotum, well produced angulately in front of eyes ; eyes slightly infuscated; ocelli indiscernible; pronotum broadly rounded in front and truncate posteriorly, with a pair of red circular spots; scutellum short, median transverse impression towards apical half, a pair of red circular spots at apex of scutellum; tegmina light creamy yellow with six to eight regular red circular spots on each propleural area; hind wings hyaline ; abdomen creamy yellow. *Length* : 1.20 mm.

Distribution : India : Delhi (I.A.R.I.).

67. ****Zyginopsis verticalis** (Ahmed)

35. Genus *Viridasca* Ramakrishnan & Menon

1972. *Viridasca* Ramakrishnan & Menon, *Oriental Ins.*, **6** (2) : 185.

68. ***Viridasca albomaculata** Ramakrishnan & Menon

1972. *Viridasca albomaculata* Ramakrishnan & Menon, *Oriental Ins.*, **6** (2) : 185-186.

Material examined : From literature.

Diagnostic characters : Body small, robust, green vertex slightly conically produced in front of eyes and obtuse at apex. Ocelli distinct, eyes brownish black; pronotum subconvex, green with white speck; scutellum short, with transverse impression in the middle; tegmina green, veins whitish with white spots confluent with veins on either side, hind wings hyaline; abdomen green. *Length* : 1.30 mm.

Distribution: India : Delhi (I.A.R.I.).

Family 3 : DICTYOPHARIDAE

36. Genus ***Chanithus*** Kolenati

1857. *Chanithus* Kolenati, *Bull. Soc. Nat. Moscou* **30** : 427.

69. ***Chanithus gramineus*** Fabricius

1800. *Fulgora pallida* Donovan, *Insects of India* **1** : 8.

1946. *Chanithus gramineus* MetCalf, *General Catalogue of Homoptera* : **8** : 94.

Material examined : Delhi : 1 ex., NZP, 7.vi.1993, coll. V.Khanna & party.

Diagnostic characters: Body smaller, cephalic process shorter, pronotum with three pale virescent carinae; posterior tibiae with four spines; tegmina obsoletely infuscate. *Length* : 7.0 mm (female).

Distribution : India : Delhi (Zoo), Maharashtra, Tamil Nadu, Sikkim, West Bengal. *Elsewhere* : Bhamas; Borneo; Myanmar; Sri Lanka.

37. Genus ***Dictyophara*** Germar

1767. *Fulgora europaea* Linne, Systema Naturae. Editio Duodecima **1** (2) : 704.

1833. *Dictyophara* Germar, *Rev. Ent. Silbermann* **1** : 175.

70. ***Dictyophara cummingi*** Distant

1906. *Dictyophara cummingi* Distant, *Ann. mag. nat. Hist.* **7** (18) : 351.

1940. *Dictyophara cummingi* : Matsumura, *Ins. Matsumurana*, **15** : 14.

Material examined: 3 exs., Kakraula nursery near Najafgarh Road, 27.xii.1993, coll. N.K.Sinha & party.

Diagnostic characters: Body pale brownish; head prolonged, strongly excavate above,face tricarinate, lateral carination covering at anterior part; and carina at central part of clypeus. pronotum and mesonotum tricarinate, tegmina not trasparent, stigma and veins pale ochraceous. *Length* : 9 mm (male), 10 mm (female).

Distribution : India : Delhi, Maharashtra, West Bengal. *Elsewhere* : China; Taiwan; Japan; Pakistan.

71. ***Dictyophara walkeri*** Atkinson

1851. *Dictyophara pallida* Walker, *List of Homopterous Insect,* 2 : 320.
1886. *Dictyophara walkeri* : Atkinson, *Jour. Asiatic Soc. Bengal,* 55 : 29.
1946. *Dictyophara walkeri* : MetCalf, *General Catalogue of Homoptera* : 8.

Material examined : Delhi : 1 ex., I.A.R.I. Campus, 3.vi.1993, coll. V.Khanna & party.

Diagnostic characters : Body brownish in colour, cephalic process piceous, robust, pronotum and measonotum tricarinate, the carinae greenish in colour, tegmina hyaline, the venation and stigma of tegmina pale fuscous, posterior tibiae with four spines. *Length* : 5.5 mm (Female).

Distribution : India : Delhi (I.A.R.I. Campus).

Remarks : So far the species is apparently known from Delhi only.

Family 4 : MEMBRACIDAE

38. Genus ***Leptocentrus*** Stal

1866. *Leptocentrus* Stal, *Hem. Afr..*, 4 : 87 & 90.

72. ***Leptocentrus taurus*** (Fabricius)

1775. *Membracis taurus* Fabricius, *Syst.Ent.*, : 676.
1908. *Leptocentrus taurus*: Distant, *Fauna Brit. India,* 4 : 28.

Material examined : Delhi ; 1 ex., Kakraula nursery near Najafgarh Rd., 27.x.1993, coll.N.K. Sinha & party.

Diagnostic characters : Posterior pronotal process curved and apically touching the inner margin of tegmina; tegmina punctate at base; lateral pronotal processes narrower and less curved as seen from in front head, pronotum, body beneath black; tegmina bronzy to ochraceous, a pale piceous sub merginal streak beyond middle of the costa. *Length* : 6-8mm ; width lateral pronotal process, 5-6 mm.

Distribution : India : Delhi ; Assam, Orissa, Sikkim.

Remarks : This is a widely distributed membracid. The insects are generally found sucking sap near axils of the leaves and small twigs of the host plant. They are usually found attacked by the common ants *Camponotus compressus* atr.

Genus ***Otinotus*** Buckton

1903. *Otinotus* Buckton, *Monogr. Membrac.*, : 232.

73. ***Otinotus oneratus*** (Walker)

1858. *Centroutus oneratus* Walker, *Ins.Saund., Hom.*, 78.
1908. *Otinotus oneratus* : Distant, *Fauna Brit. India,* 4 : 40.

Material examined : Delhi ; 1 ex., Kakraula nursery near Najafgarh Road., 27.x.93, coll. N.K. Sinha & party.

Diagnostic characters : Posterior pronotal process long, slender, sinuate, its apex passing the posterior angle of the inner margin of tegmina, tegmina semi-hyaline, with its base ocherceously opaque and punctate. *Length* : 6-7mm, width : lateral pronotal process 3-3.5 mm.

Distribution : India : Delhi, Bihar, Maharashtra, Orissa, West Bengal. *Elsewhere* : Sri Lanka.

Remarks : This is a widely distributed membracid in India. It is found all the year round, but is most abundant during monsoon and autumn. The adults are parasitised by *Indoxenos* spp. (Strepsiptera).

40. Genus *Tricentrus* Stal

1866. *Tricentrus* Stal, *Hem.Afr.*, **4** : 89.

74. *Tricentrus aeneus* Distant

1908. *Tricentrus aeneus* Distant *Fauna Brit.India*, **6** : 167.

Material examined : Delhi; 1 ex., NZP, 7.ix.1993, coll. V.Khanna & party.

Diagnostic characters : Pronotum with anterior proceses upwardly obliquely directed, posterior process robust apex almost reaching the posterior angle of the inner margin of tegmina, tymina pale bronzy brown, wrinkled, basal area darker, apical area of the anterior and posterior pronotal processes darker.*Length* : 5 mm. Width lateral pronotal process 3.5 mm.

Distribution : India : Delhi : Assam, Uttar Pradesh, West Bengal.

Family 5 : PSYLLIDAE

Subfamily : PSYLLINAE

41. Genus *Acizzia* Heslop-Harrison

1951. *Acizzia* Heslop Harrison, *Ann. Mag. nat. Hist.* (12), **4** (41) : 417.

75. **Acizzia indica* Heslop-Harrison

1935. *Acizzia indica,* Mathur, *Indian Forest Rec.*, **1** (2) : 36.

1976. *Acizzia indica* Mathur, *Psyllidae of the Indian subcontinent* : 171-176.

Material examined : From literature.

Diagnostic characters : Body medium size. Head broader than thorax, finely and sparsely pubescent, finely rugulose, moderately deflexed. Frons small and completely covered by genae and anterior ocellus ; Antennae ten segmented, bearing few setae, terminal segment a little longer than penultimate segment bearing two unequal spines at apex, prothorax descending, flat, longer in middle and thinner laterally, with two foveal impressions on each side. Scutellum broadly transverse, swollen, cup-shaped, broadly rounded. Legs short, somewhat stout, sparsely

pubescent. All tibiae with apical comb of setae; hind tibia with a small but strong basal spur, and with five black apical spines. Forewings small, somewhat oval, about 2.25 x as long as broad, broadly rounded at apex. Hind wings small, colourless, veins obscure, membrane uniformly beset with minute points, costal margin armed with a series of simple and hooked setae in basal half.

Distribution: India : Delhi, Assam, Uttar Pradesh, West Bengal. *Elsewhere* : Pakistan.

42. Genus *Diaphorina* Loew

1879. *Diaphorina* Loew, Verh. *Zool. not. Ges. Wien.* **29** : 567.

76. *Diaphorina citri* Kuwayama

1907. *Diaphorina citri* Kuwayama,*Trans.Sapparo nat. Hist.Soc.*, **2** : 160.

1986. *Diaphorina citri* : Kandasamy, *Rec.zool.Surv.India*, **1** : 25.

Material examined : A few males and females, 7.iii.1953 (ZSI.R.N. 6484/117) India : West Bengal (Bankura) on *Citrus* sp.

Diagnostic characters : Vertex wider than long, lateral margins almost parallel to each other ; frons concealed by genae; gena cones 0.153-0.156 mm long, antenna about thrice as long as genal cones, apical segments black ; hind tibiae without spines at apex; tarsal segment equally long and proximal segment with two claw-like spines at apex.

Distribution : India : Delhi : West Bengal widely dustrubuted. *Elsewhere* : Taiwan ; Japan ; Philippine Islands ; Moluccas ; southern China.

77. *Diaphorina gymnosporiae* Mathur

1975. *Diaphorina gymnosporiae* Mathur, *Psyllidae of the Indian subcontinent* : 213.

Material examined : From literature.

Diagnostic characters : Body long and narrow. Head scarcely deflexed, including the eyes, narrower than thorax, pubescent and also beset with minute points; vertex about twice as wide as the length of the median line, posterior to centre and in the middle of each half, anterior foveae larger than the posterior foveae. Eyes large, recessive and somewhat reniform. Antennal sockets lateral. Colour yellowish brown, brown or orange, with greenish tinge; wings partly maculated. Apical band in forewing continuous from apex of radial sector to marginal cells. Media and cubitus banded with maculae.

Distribution : India : Delhi, Madhya Pradesh.

Remarks : The species is oringinally described from Madhya Pradesh. The adults and nymphs are commonly found infesting young buds and fresh leaves of *Gymnosporia spinosa* (Mathur, 1975)

43. Genus *Euphyllura* Foerster

1848. *Euphyllura* Foerster, *Verh. naturh. Ver. preuss. Rhcinl.*, **3** : 93.

78. **Euphyllura obsoleta* Mathur

1975. *Euphyllura obsoleta* Mathur, *Psyllidae of the Ind. subcontinent* : 238-241.

Material examined : From literature.

Diagnostic characters : Body very small, robust, moderately arched. Head large and broad, slightly broader than thorax, finely and sparsely pubescent, rugulose; vertex broader than long, about two and a half times as broad as long, Eyes large, recessive; clypeus visible in front. Antennae short, rather thick, imbricate, bearing few fine setae, ten segmented, two basal segments robust. Thorax quite broad, robust, moderately arched, finely and sparsely pubescent, finely rugulose. Forewing elongate, some what parallelogram in shape, not broader near base. Second marginal cell very large. R_1 not obsolete distally. Genae obsolete.

Distribution : India : Delhi, Punjab, Rajasthan.

Remarks : The species originally described from Punjab (W.Pakistan) on specimens collected on young shootsof *Salvodora oleoides* feeding there in cluster.

Subfamily : TIZINAE

44. Genus *Trioza* Foerster

1848. *Trioza* Foerster, A. *Verh naturh. Veh, Preust Rheins,* **3** : 67.

79. **Trioza obliqua* Thomson

1877. *Trioza obliqua* Thomson, *Opusc. Ent.,* **8** : 825.

1975. *Trioza obliqua* : Mathur, Psyllidae of the Indian subcontinent : 390-394.

Material examined : From literature.

Diagnostic characters : Head nearly as broad as thorax, finely and sparsely pubescent, finely rugulose,horizontal, vertex nearly twice as broad as long, visible in front with anterior ocellus; genal cones small, hemispherical. Antennal sockets lateral and located below the level of lower margin of eyes. Antennae ten-jointed, two basal joints robust.Thorax slightly arched. Legs moderately long, slender, pubesecent. Fore and hindwing small. Abdomen moderately long.

Distribution : India : Delhi. *Elsewhere* : Poland ; Sweden; Rumania; England; France; Csechoclovakia; U.S.S.R. and Japan.

Subfamily : CIRIACREMINAE

45. Genus *Macrohomotoma* Kuwayama

1907. *Mesohomotoma* Kuwayama, 3. *Trans. Sapporo nat. Hist. Soc.,* **2** : 180.

80. **Macrohomotoma geniculata* Mathur

1975. *Mesohomotoma geniculata* Mathur, *Psylliade of the Indian subcontinent* : 136-140.

Material examined : From literature.

Diagnostic characters : Body large and stout. Head almost as broad as thorax, Vertex broad, Genae small, swollen beneath antennal sockets. Clypeus large, visible below frons. Antennae ten-segmented, slightly smaller than the width of head with eyes. Thorax strongly arched, prothorax partly concealed by head. Scutellum small, somewhat vase shaped or hexagonal. Tibiae longer than femora of anterior and middle pairs, hind leg with tibia and femur nearly of equal length, hind tibiae wihout basal spur and with four, thick, black spines at apex. Forewing broad, hyaline, Hind wing small; costal vein armed with a few simple and hooked setae. Abdomen short and thick.

Distributon: India : Delhi, Uttar Pradesh.

Remarks : The species is originally described from Delhi. According to Mathur (1975) both adults and nymphs are commonly found during March and April on *Ficus microcorpa*.

Family 6. : COREIDAE

46. Genus *Leptocorisa* Latr.

1825. *Leptocorisa* Latr., *Fam. Nat.* : 421.

81. *Leptocorisa acuta* (Thunberg)

1783. *Cimex acuta* Thunberg, *Nov. Ins.*sp. 2 : 34.

1904. *Leptocorisa acuta* : Distant, *Fauna Brit. India*, 1 : 410.

Material examined : Delhi; 4 exs., I.A.R.I. Campus, 11.ix.1994, coll J.P.Sati & party; 1 ex., Kakraula nursery near Najafgarh Road., 27.x.1993, coll. N.K. Sinha & party.

Diagnostic character : Pronotum with a distinct central carinate line and a small distinct tubercle near each lateral angle, abdomen above reddish brown, with the margin pale greenish yellow and beneath pale greenish; antennae fuscous with the bases of second, third and fourth joints luteous. *Length* : 13 -15 mm.

Distribution : India : Delhi, West Bengal.

47. Genus *Ectrychotes* Burmister

1835. *Ectrychotes* Burmister, *Handb.* 2 : 237.

82. *Ectrychotes dispar* Reuter

1881. *Ectrychotes dispar* Reuter, *Act. Soc. Se. Feun.*, 12 : 304.

1902. *Ectrychotes dispar* : Distant, *Fauna Brit. India*, 2 : 315.

Material examined : Delhi: 1 ex., Wazirabad, Gurjarghat at Yamuna Bridge, 8.ix.1994,

coll. J.P Sati and party.

Diagnostic characters : Scutellum lateral margins of corium, lateral area of the posterior lobe of pronotum, base of claveus and corium, connecivum, abdomen bases of tarsi, basal half of posterior femora, apices of coxae, trochanters coral red; antennae and hemelytron piceous. *Length* : 12 - 14 mm.

Distribution : India : Delhi : Karnataka, Maharashtra, West Bengal.

48. Genus *Riptortus* Stal

1859. *Riptortus* Stal, *Ofv. Vet. Ak. Forh.*, 460.

83. *Riptortus linearis* (Fabricius)

1775. *Lygaeus linearis* Fabricius, *Syst. Ent.*, : 710.

1904. *Riptortus linearis*: Distant, *Fauna Brit.India*, **1** : 415.

Material examined : Delhi; 1 ex., I.A.R.I. Campus, 3.vi.1993, coll. V.Khanna & party.

Diagnostic characters : Pronotum black with a small paleaceous spot at the middle of its posterior margin, general colouration dark cinnamon brown; abdomen disk of the sternum, fascia at base of head between eyes, lateral angular spines to pronotum black, a pale ochraceous fascia margined with black on each side of head and sternum, lateral aras of abdomen, base and some spots on abdominal disk, testeous. *Length* 14-16 mm.

Distribution : India : Delhi : Karnataka, Meghalaya, Sikkim, West Bengal. *Elsewhere* : Myanmar; Sri Lanka.

49. Genus *Petalocnemis* Stal

1853. *Petalocnemis* Stal, *Ofv. Vet. -AK. Forh.*, 259.

84. *Petalocnemis obscura* (Dallas)

1852. *Acanthocoris obscura* Dallas, *List. Hem.* **2** : 518.

1904. *Petalocnemis obscura* : Distant, *Fauna Brit. India*, **1** : 386.

Material examined : Delhi : 1 ex., Priya park, District park, Munirika, Vasant Vihar, 13.ix.1994, coll. J.P. Sati & party.

Diagnostic characters : Head, pronotum with a distinct central carinate line, the surface of pronotum rugulose with its angles broadly truncate, corium with obscure, ochraceous spot on apical area and spinous hairs on the anterior lateral margin, posterior femora incrassated with double series of tubercles on the outer margin but indistinctly tuberculate on the inner area. *Length*: 13-14.5 mm., width between pronotal angles 5-5.5 mm.

Distribution : India : Delhi, Maharashtra, Meghalaya, West Bengal. *Elsewhere* : Sri Lanka.

50. Genus ***Cletus*** Stal

1859. *Cletus* Stal, *Freg. Eng. Resa. Ins. Hem.* : 236.

85. ***Cletus bipunctatus*** (Westwood)

1842. *Coreus bipunctatus* Westwood, *Hope Cat.*, **2** : 23.

1004. *Cletus bipunctatus* : Distant, *Fauna Brit. India*, **1** : 393.

Material examined : Delhi; 1 ex., Delhi Municipality nursery, Punjabi Bagh, 14.ix.1994, coll. J.P. Sati and party.

Diagnostic characters : Lateral pronotal angles shortly, acutely produced with the apices of the spines fuscous; posterior area of pronotum and coreium somewhat roseate; coreium with its lateral margins and a small spot on its inner apical margin and connexivum pale luteous; body beneath and legs luteous; a small spot on the lateral area of each sternal segment and a few black small discal spots to abdomen; abdomen above ochraceous wih transverse black markings on its basal area.*Length*: 9-10 mm. Width between pronotal angle 3.5-4 mm.

Distribution: Inida : Delhi, Karnataka, Maharashtra, West Bengal. *Elsewhere* : Myanmar; Sri Lanka.

Family 7 : LYGAEIDAE

Subfamily : LYGAEINAE

51. Genus ***Spilostethus*** Stal

1868. *Spilostethus* Stal, Kongl. Svensk. Vet. Akad,. Handl. **7** (11) : 72.

86. ***Spilostethus hospes*** (Fabricius)

1794. *Lygaeus hospes* Fabricius, *Ent. Syst.*, **4** : 150.

1988. *Spilostethus hospes* : Mukhopadhyay, *Rec. zool. Surv. India*, occ. paper, **107** : 1-72.

1994. *Spilostethus hospes* : Chakraborty and Ghosh, *Fauna of West Bengal*, State Fauna Series 3 (in Press).

Material examined : Delhi; 4 exs., Najafgarh, 27.x.1993, coll N.K.Sinha & party; 1 ex., Priya park, 13.ix.94, coll. J.P Sati & party.

Diagnostic characters : Pale sanguineous ; apex of head, antennae, rostrum, two broad central discal fasciae to pronotum, a large central spot to corium, membrane, disks of sternum; abdomen and legs black. Body finely pilose; rostrum passing the posterior coreae;femora unarmed. *Length*: 10-13 mm.

Distribution : India : Delhi, Maharashtra, Orissa, Tamil Nadu, West Bengal. *Elsewhere*: Australia ; Mayanmar ; China; Malayan Archipelago; New Caledonia; Pakistan; Sri Lanka.

Remarks : A widely distributed species; generally found on *Calotropis* sp. It is common on sugarcane and sorghum in south India. The species is characterised by red white or black spots or bands on body.

52. Genus ***Graptostethus*** Stal

1868. *Graptostethus* Stal, Longl. Svensk. Vet. Akad. Handl., **11** (7) : 73-74.

87. ***Graptostethus*** sp.

Material examined: Delhi : 1 ex., Kamala Nehru Ridge, 17.xi.1995, coll. J.P.Sati & party.

Subfamily : GEOCORINAE

53. Genus ***Geocoris*** Fallen

1814. *Geocoris* Fallen, spec. nov. *Hem. Disp. Meth.*, : 10.

88. ***Geocoris ochropterus*** (Fieber)

1859. *Geocoris ochropterus* Dohrn, *Cat. Hem.* : 35.

1988. *Geocoris ochropterus* : Mukhopadhyay, *Rec zool. Surv. India, occ. paper*, **107** : 26.

Material examined: Delhi; 2 exs., NZP, 7.vi.1993, coll. V.Khanna & party.

Diagnostic characters : Head yellowish red with black fascia at base of head and vertex; pronotum fully blackish or with lateral margins narrowly testaceous.

Distribution: Inida : Delhi, Karnataka, West Bengal. *Elsewhere* : Myanmar; Sri Lanka.

Remarks : This species feeds on insects and mites of the foliage habital and also sucks plant sap.

Subfamily : RHYPAROCHROMINAE

54. Genus ***Elasmolomus*** Stal

1872. *Elasmolomus* Stal, *Ofv. Vet. Akad. Forh.*, **89** : 58.

89. ***Elasmolomus sordidus*** (Fabricius)

1787. *Cimex sordidus* Fabricius, *Mant. Ins.*, **2** : 302.

1988. *Elasmolomus sordidus* : Mukhopadhyay, *Rec. zool. Surv. India, occ. paper*, **107** : 27.

Material examined : Delhi; 1 ex., I.A.R.I. Campus, 19.xi.1995, coll. J.P. Sati & party; 1 ex., Safdarjung Tomb Complex, 21.xii.1994; coll. A. Husain & party; 1 ex., Bhaleswa, 30.x.93, coll. N.K. Sinha & party.

Diagnostic characters: Head, anterior pronotal lobe, base of scutellum and sternum piceous or dark castaneous; apex of scutellum luteous; legs ochraceous, membrane fuliginous with a dark spot at base. *Length*: 9-10 mm.

Distribution : India : Delhi, Bihar, Maharashtra, Meghalaya, Nagaland, West Bengal. *Elsewhere* : Myanmar; China; Sri Lanka.

Remarks : Colour of anterior lobe of pronotum and base of scutellum varies ranging from bright castaneous to sordid brown. Body size varies in the same sex.

Family 8. : PYRRHOCORIDAE

55. Genus ***Antilochus*** Stal

1863. *Antilochus* Stal. *Berl. ent. Zeitschr.*, **7** : 393.

90. ***Antilochus coqueberti*** (Fabricius)

1803. *Lygaeus coqueberti* Fabricius, *Syst. Rhyng* : 222.

1902. *Antilochus coqueberti* : Distant, *Fauna Brit. India*, **2** : 101.

Diagnostic characters: Sanguineous, membrane antenae except base of first joint, sternalandventral incisures balck, pronotum with the posterior margin twic as broadas anterior margin, obscurely punctate, excepting anterior discal area which is margined with black punctures, anterior femor shortly spined beneath near apex. *Lenght* : 14-16 mm.

Distribution : Delhi, Assam, Andaman Islands, Andhra Pradesh, Meghalaya, Nagaland, West Bengal.*Elsewhere* : Myanmar ; Sri Lanka.

Family 9. : PENTATOMIDAE

56. Genus ***Bagrada*** Stal

1862. *Bagrada* Stal, *Stett. ent. Zeit.*, **23** : 105.

91. ***Bagrada picta*** (Fabricius)

1775. *Cimex picta* Fabricius,*Syst. Ent.*, : 715.

1862. *Bagrada picta* : Stal, *Stett.ent. Zeit.*, **23** : 105.

1995. *Bagrada picta* : Chakraborty & Ghosh, *Fauna of Meghalaya* : *State Fauna Series*, **3** (in press).

Material examined : Delhi; 6 exs., I.A.R.I. Campus, 3.vi.1993, coll. V.Khanna & party.

Diagnostic characters : Body black excepting lateral lobes of head before eyes and lateral margins and a central fascia to pronotum, a central fascia, a spot near basal angle and a spot on each margin before apex of scutellum, a marginal fascia to carium terminating in a rounded discal spot before apex ochraceous; membrane fuliginous; body beneath ochraceous, legs ochraceous spotted and streaked with black; antennae black.*Length*: 5-7 mm.

Distribution : India : Delhi, Bihar, Maharashtra, Manipur, Meghalaya, Uttar Pradesh, West Bengal. *Elsewhere* : Sri Lanka.

57. Genus ***Halys*** Fabricius

1803. *Halys* Fabricius, *Syst. Rhyng* : 180.

92. *Halys dentatus* Fabricius

1803. *Halys dentatus* Fabricius, *Syst.Rhyng.* : 180.

1977. *Halys dentatus* : Datta and Chakraborty, *Newsl. zool. Surv. India*, **3** (4) : 212.

1995. *Halys dentatus* : Hegde, *Rec.zool.Surv. India, occ. paper,* **168** : 21.

Material examined: Delhi; 1 ex., I.A.R.I. Campus, 3.vi.1993, coll. V.Khanna & party.

Diagnostic characters: Dull ochraceous, head long tapering in front, abdomen sulcated; pronotum with indistinct oblique fasciae, scutellum with two marginal spots before apex black; apex of scutellum pale ; body beneath and legs ochraceous; rostrum normally extend beyond 5th abdominal segment. *Length* 17-23 mm.

Distribution : India : New Delhi, Karnataka, Maharashtra, Meghalaya, Orissa,Sikkim, Tamil Nadu, West Bengal; *Elsewhere* : Africa; China; Japan; Pakistan and Sri Lanka.

Remarks : Usually found on *Acacia arabica* and on the *Casuarina equisetifolia.* This species is a new distributional record for Delhi.

Family 10. : DINIDORIDAE

58. Genus *Coridius* Illiger

1807. *Coridius* Illiger, *Faung. Etrusca* **(2) 2** : 361.

93. *Coridius janus* (Fabricius)

1995. *Coridius janus* : Hegde, *Rec. zool. Surv. India, occ. pap.,* **168** : 36-37.

Material examined : Delhi ; 2 exs., I.A.R.I. Campus, 11.xi.94, coll. J.P.Sati & Party; 1 ex., Budha Jayanti Park, 15.xi.95, coll. J.P. Sati & Party; 1 ex., Asiad village, 23.xi.94, coll. A. Husain & party; 2 exs., Dhaulakuan, 16.xi.95, coll. J.P.Sati & party.

Diagnostic characters : Ochraceous or sanguineous; head black, antennae black, 1st antennal segment extending beyond apex of head, 3rd segment a little longer than 1st but shorter than 2nd,4th and 5th segments.pronotum brown or ochraceous with a narrow, bilobed black fascia extending transversely near anterior margin; anterior half of scutellum black. corium ochraceous, longer than scutellum ; membrane black, longitudinal veins distinct. Legs dark brown,apices of femora with spines, hind tibiae of female very slightly dilated and grooved along inner surface. Lateral margins of sternum and abdomen ochraceous or sanguineous. *Length* : 16-20mm.

Distribution : India : Delhi, Assam, Bihar, Kerala, Maharashtra, Meghalaya, Uttar Pradesh, Tamil Nadu, West Bengal. *Elsewhere* : Mayanmar ; Indonesia; Malaysia; Malay Archipelago, Sri Lanka.

59. Genus *Megymenum* Laporte

1832. *Megymenum* Laporte, *Ess. Hem.* : 52.

94. ***Megymenum*** sp.

Material examined : Delhi : 1 ex., Humayun's Tomb, 14.xi.95, coll. J.P.Sati & party.

Remarks : Due to paucity of material specifice determination was not possible.

Family 11. : REDUVIDAE

60. Genus ***Acanthaspis*** Amy and Serv

1843. *Acanthaspis* Amy and Serv. *Hem* : 336.

95.***Acanthaspis angularis*** Stal

1859. *Acanthaspis angularis* Stal. *Ofv. Vet.-AK. Forh.*, : 188.

1902. *Acanthaspis angularis* : Distant, *Fauna Brit. India, Rhynch.* **2** : 262.

Material examined : Delhi : 1 ex., NZP, 10.ii.1995, coll. J.P. Sati and party ; 1 ex., Kamala Nehru ridge, 7.ii.1995, coll. J.P.Sati and party.

Diagnostic characters : Pronotum with the disc sulcate, anterior lobe strongly sculptured, hind lobe posteriorly finely ruglose; scuteller spine obliquely ascendant and recurved, large transverse spot beyond middle of corium, spots to connexivum above and beneath legs and lateral posterior angular areas of pronotum ochraceous or luteous; first joint of antennae about as long as head. *Length* : 15 17.5 mm.

Distribution : India : Delhi, Maharashtra, Tamil Nadu. *Elsewhere* : Sri Lanka.

96. ***Acanthaspis quinquespinosa*** (Fabricius)

1781. *Reduvius quinquespinosa* Fabricius, *Spec. Ins.*, **2** : 382.

1902. *Acanthaspis quinquespinosa* : Distant, *Fauna Brit. India, Rhynch.* **2** : 257.

Material examined : Delhi; 1 ex., 22.vii.1991, Mus. Coll.

Diagnostic characters : Anterior lobe of pronotum strongly sculptured, posterior lobe rugose, with a long lateral spine on each side and two discal spines between them, luteous, a long scuteller spine obliquely asending, basal joint of antennae about as long as head, a basal and a transverse spot to corium and spots to the connexivum dorsally and ventrally luteous. *Length* : 15.5-19 mm.

Distribution : India : Delhi, Assam, Bihar, Maharashtra, Meghalaya. *Elsewhere* : Myanmar ; Sri Lanka.

61. Genus ***Coranus*** Curtis

1833. *Coranus*Curtis, *Brit.Ent.* **10** : 453.

97. *Coranus obscurus* (Kirby)

1891. *Harpactor obscurus* Kirby, *J.Linn. Soc. Zool.*, **24** : 120.

1902. *Coranus obscurus* : Distant, *Fauna Brit. India, Rhynch.* **2** : 381.

Material examined : Delhi : 1 ex., Rock climbing area Lado Sarai, Mehrauli Road , 7.ix.1994, coll. J.P.Sati & party.

Diagnostic characters : Posterior pronotal lobe thickly and coarsely granulate postocular area of head with a central pale line, scutellum with a short, erect, spiny tubercle, membrane bronzy black, first joint of antennae almost as long as head, tibiae ochraceous, with basal, medial and apical piceous annulation, connexivum broadly spotted with black. *Length* 9-10 mm.

Distribution : India : Delhi, Assam, Nagaland, West Bengal. *Elsewhere* : Mayanamar; Sri Lanka.

62. Genus *Rhinocoris* Hahn

1843. *Rhinocoris* Hahn. *Wanz.Ins.*, 2 : 20.

98. *Rhinocoris marginatus* (Fabricius)

1794. *Reduvius marginatus*Fabricius, *Ent. Syst.*, **4** : 196.

1993. *Rhinocoris marginatus* : Biswas and Ghosh, *Fauna of West Bengal*, **5** (3) (in press).

Material examined: Delhi; 9 exs., Asola WLS, 21.xii.1994, coll. A. Husain & party; 3 exs., Jahanpanah forest, 15.ii.1995, coll. J.P. Sati & party.

Diagnostic characters: Pronotum with the anterior lobe sculptured and posterior lobe rugulose, corium rugulose, violaceous black; membrane black, passing abdominal apex, transverse cell near base of membrane margined with sanguineous. *Length* : 19.5-20 mm.

Distribution : India : Delhi, Andhra Pradesh. *Elsewhere* : Sri Lanka.

99. **Rhinocoris nysiiphagus* Samuel and Joseph

1953. *Rhinocorisnysiiphagus* Samuel and Joseph, *Indian J.Ent.*, **15** (1) : 31.

Material examined : From literature.

Diagnostic characters : Anterior lobe of the pronotum sculptured anteriorly, but impressed posteriorly, posterior lobe not impressed with some dark patches on its anterior margin; a darky shaped patch present on the dorsal side of the head just behind eyes, first joint of antennae shorter than anterior femur, colour ochraceous, but first and second joint of antennae, femora, tibiae, inner triangle of scutellum, clavus, whole abdomen except intersegmental portion, coxae, thorax orange red; last two segments of the antennae and tarsus brownish. *Length* : female : 17-18 mm; male : 15.50 mm.

Distribution : India : Delhi.

Remarks : The species was originally described from the material collected from Delhi. The types are deposited in the National Pusa Coll. (I.C.A.R), New Delhi. It is so far known only from Delhi.

100.****Rhinocoris lapidicola*** Samuel and Joseph

1953. *Rhinocoris lapidicola* Samuel and Joseph, *Indian J.Ent.*, **15** (1) : 29.

Material examined : From literature.

Diagnostic characters : Pronotum with anterior lobe shorter than posterior, medially sulcate with rounded elevation on either side, tubercles scattered all over, posterior lobe rugose except posteriorly with a feeble median line and two lateral depressions, scutellum triangular pointed apically with a `Y' shaped elevation, hemelytra extending just beyond the apex of the abdomen, antennae, head, pronotum, femora, clavas. corium connexivum and sometimes the last abdominal segment sanguineous whereas eyes, femora, scutellum, membrane and some times the whole abdomen except connexivum and pleura black. *Length* : female : 20-22 mm; male : 17-18.80 mm.

Distribution : India : Delhi.

Remarks : This species is originally described from Delhi. The types are deposited in the Pusa Collection (I.C.A.R), New Delhi.

SUMMARY

The present paper presents an account of 100 species belonging to 62 genera distributed over 17 families of Hemiptera from Delhi. Of these, 80 species belonging to 45 genera under 5 families are Homoptera and 20 species in 17 genera distributed over 6 families are Heteroptera.Two homopteran families *viz*, Cicadellidae and Aphididae and two heteropteran families *viz*., Coreidae and Reduvidae are relatively more dominant. 23 species belonging to 20 genera are reported for the first time from Delhi. Diagnostic characters of most of the species (except Cicadellidae) are given. Notes on the available geographical information wherever possible are also incorporated, besides references and distribution of the species (except those marked** of Cicadellidae) are provided. The paper is chiefly based on the collections made by Northern Regional Station, Zoological Survey of India, Dehra Dun.

LACUNAE IN THE KNOWLEDGE

Review of literature reveals that out of 77 hemipteran families represented in India, only 11 are so far known from Delhi area and that too the species known under each family are rather negligible. Also, total number of hemipteran species so far recorded from the area is only about 100 which is again meagre in view of about 6,500 known species of Hemiptera in India.

While over 700 species of Aphididae from India, and over 7,500 species from the world are on record, the occurrence of only 24 species from the area under study appears to be too little.

Hence, thorough surveys of various localities as well as crop wise surveys are essential in order to consolidate the hemipteran fauna and identify the economically important species for studying their damage symptoms, control and bioecology, etc.

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REFERENCES

Anand,R.K.1986. Records of Syrphids predating on aphids in Delhi. *Proc. 2nd Nat.Symp., Recent trends in Aphidological Studies*, Modinagar : 197-200.

Bhanotar, R.K and Ghosh, L.K. 1969. The oviparous morph of *Pentalonia nigronervosa* Coquerel (Aphididae : Homoptera) from West Bengal. *Bull. Ent.*, **10** : 79-99.

Behura, B.K. and Das, M.M. 1973. Studies on the Aphididae of India VI. Notes on the external morphology of *Aphis neril* Fonsc. collected on *Bryophyllum pinatum* from Bihar. *Prakruii Utkal Univ. J.Sc.*, **8** : 53-64 (1971).

Chakraborty, S.P. and Dutta, B.1977. On a collection of Pentatomidae (Insecta : Heteroptera) from Arunachal Pradesh, India. *Newsl. zool. surv. India*, **3** (4): 211-212.

Chakraborty, S.P., Ghosh, L.K. and Basu, R.C.1993. *"Insecta : Hemiptera : Pentatomoidea" Fauna of West Bengal, State Fauna Series*, **3** (in press).

Chakraborty, S.P., Ghosh, L,K.and Basi, R.C. 1994. On a collection of Hemiptera from Namdhapa Biosphere, India. *Rec. zool. surv. India*, occ. paper, **168** : 1-44.

David, S.K. 1975. A taxonomic review of *Macrosiphum* (Homoptera : Aphididae) in India. *Oriental Ins.*, **9** : 461 493.

Distant, W.L.1902. *The Fauna of British India, Rhynchota,* **1** : 1 438. Taylor & Francis, Ltd., London.

Distant, W.L. 1904. *The Fauna of British India, Rhynchota,* **20** : 1-503. Taylor & Francis, Ltd., London.

Distant, W.L. 1906. The *Fauna of British India, Rhynchota,* **3** : 1-503. Taylor & Francis, Ltd., London.

Distant, W.L. 1908. *The Fauna of British India, Rhynchota,* **4** : 1-501. Taylor & Francis, Ltd., London.

Distant, W.L. 1910. *The Fauna of British India, Rhynchota,* **5** : 1-362. Taylor & Francis, Ltd., London.

Dutta, B. and Ghosh, L.K. 1973. Three new species of Typhlocybinae (Homoptera : Cicadellidae). *Zool.Anz.* Leipzig, **191** (516) : 415-419.

Dworakowska, I. 1971. On some genera of Erythroneurini (Cicadellidae Typhlocybinae) from the oriental region. *Bull. Acad. Pol. Sci. Cl. II Ser. Sci. Biol.*, **19** (5) : 314- 350.

Dworakowska, I. 1972. On some oriental genera of Typhlocybinae (Auchenorrhyncha, Cicadellidae). *Bull. Acad. Pol. Sci. Cl. II Ser. Sci. Biol.* **20** (2) : 117- 125.

Dworakowska, I.1977. On some north Indian Typhlocybinae (Homoptera, Auchenorrhyncha, Cicadellidae). *Reichenbachia Mus. Tierk. Dresden,* **16** (29) : 283 346.

Dworkowska, I.1979. On some Typhlocybinae from India and adjoining areas (Homoptera, Auchenorrhyncha, Cicadellidae). *Reichenbachia Mus. Tierk, Dresden,* **17** (18) : 143-162.

Ghosh, A.K. and Raychaudhuri, D.N. 1962. A preliminary account of the bionomics and taxonomy of aphids from Assam. *J.Bombay nat. Hist. Soc.*, **59** : 238 -253.

Gulamullah, 1940. Studies on Indian Aphididae 1. The aphid fauna of Delhi. *Indian J. Ent.*. **2** :13-25

Mathur, R.N. 1975. Psyllidae of the Indian Subcontinent. ICAR. **1** : 1-429.

Menon M.G.R. and Pawar, J.G. 1958. Taxonomic study on Indian Aphididae 1. Additon to the aphid fauna of Delhi. *Proc. 45th Indian Sci. Congr.*, **3** : 348.

Menon, M.G.R. and Ghai, Swaraj, 1963. The oviparous form of *Rhopalosiphum maidis* (Fitch) (Homoptera). *Oriental Ins.*, **3** : 383 - 393.

Menon, M.G.R. 1967. A note on the occurrence of banana aphid *Pentalonia nigronervosa* Coq. in Delhi. *Indian J.Ent.*, **29** : 393.

Misra, S.D. and Kurl, S.P. 1978. Some new records of aphids (Homoptera : Aphididae) from Meerut, India. *Geobios*, **5** (2) : 83.

Pruthi, H.S.1940. Description of some new species of *Empoasca* Walsh(Eupterygidae : Jassoidea) from north India. *Indian J. Ent.*, **2** (1) : 1-10.

Ramakrishnan, U. and Menon, M.G.R. 1971. Studies on Indian Typhlocybinae (Homoptera, Cicadellidae) I : Five new genera and a new record of Dikraneuraini. *Orient. Insects*, **5** (4) : 455 - 468.

Ramakrishnan, U. and Menon, M.G.R. 1972. Studies on Indian Typhlocybinae (Homoptera. Cicadellidae) 2. Ten new species of Typhlocybinae. *Oriental Ins.*, **6** (1) : 111-129.

Ramakrishnan, U. and Menon, M.G.R. 1973. Studies on Indian Typhlocybinae (Homoptera, Cicadellidae) 4. Seven new genera with four new species of Typhlocybinae. *Oriental Ins.*, **7** (1) : 15 47.

Ramakrishnan, U. and Menon, M.G.R. 1974. Studies on Indian Typhlocybinae (Homoptera, Cicadellidae) 5. The tribe Erythroneurini. *Oriental Ins.*, **8** (4) : 433 - 455.

Samuel, C.K. and Joseph, M.P. 1953. On two new forms of Reduviidae collected from Delhi (India). *Indian J. Ent.*, **15** (1) : 24 - 32.

Young, W.R., Bhatia, S.K. and Phadke, K.G. 1971. Rice root aphid observed on Barley at Delhi. *Entomologists' News Letter*, **1** : 53.

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HEMIPTERA : WATER-BUGS

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INTRODUCTION

Our knowledge on the water-bugs of the order Hemiptera of India is limited to the preliminary taxonomic accounts contributed by Distant (1902, 1906, 1910), Paiva (1918, 1919). Dover (1928), Hafiz and Mathai (1938), Hafiz and Rebeiro (1939), Hafiz and Pradhan (1947), Hutchinson (1933, 1940), Brooks (1951), Lunsbury (1972), Lundblad (1934). Cheng and Fernando (1969) also rendered some valuable information on Indian, alongwith other exotic forms of water-bugs.

In the present paper, an attempt has been made to consolidate the taxonomic studies of water-bugs of the Order Hemiptera from Delhi. The paper deals with 21 species under 12 genera, distributed in seven families. The work is based upon the collections made by the Northern Regional Station of the Zoological Survey of India, during 1993-1995. Previously there was no faunal account on water-bugs from Delhi therefore, all the species inventorised are a new records from the state.

The water-bugs are of two major categories aquatic and semi-aquatic. The aquatic bugs collected from Delhi belong to five families, namely Corixidae, Nepidae, Belostomatidae, Pleidae and Notonectidae, while semi-aquatic bugs belong to two families, viz., Veliidae and Gerridae.

SYSTEMATIC ACCOUNT

Suborder : HETEROPTERA
Series : HYDROCORISAE
Family I : CORIXIDAE

1. Genus ***Micronecta*** Kirkaldy

1. *Micronecta (Basileonecta) scutellaris scutellaris* (Stal)

2. Genus ***Agraptocorixa*** Kirkaldy

2. *Agraptocorixa (Agraptocorixa) hyalinipennis* (Fabricius)

3. Genus ***Corixa*** Geoffroy

3. *Corixa (Tropocorixa) promontoria* Distant
4. *Corixa (Tropocorixa) distorta* Distant

Family II : NEPIDAE

4. Genus ***Ranatra*** Fabricius

5. *Ranatra elongata* Fabricius
6. *Ranatra filiformis* Fabricius
7. *Ranatra sordidula* Dohrn

5. Genus ***Cerocotmetus*** Amyot & Serville

8. *Cerocotmetus pilipes* (Dallas)

6. Genus ***Laccotrephes*** Stal

9. *Laccotrephes ruber* (Linnaeus)
10. *Laccotrephes griseus* (Guerin)

Family III : BELOSTOMATIDAE

7. Genus ***Lethocerus*** Mayr

11. *Lethocerus indicus* (Lepeletier & Serville)

8. Genus ***Diplonychus*** Laporte

12. *Diplonychus annulatus* (Fabricius)
13. *Diplonychus rusticus* (Fabricius)
14. *Diplonychus molestus* (Dufour)

Family IV : PLEIDAE

9. Genus ***Plea*** Leach

15. *Plea liturata* (Fieber)

Family V : NOTONECTIDAE

10. Genus ***Anisops*** Spinola

16. *Anisops batillifrons* Lundblad
17. *Anisops sardea* Herrich-Shaffer
18. *Anisops breddini* Kirkaldy

Series : AMPHIBICORISAE

Family VI : VELIIDAE

11. Genus ***Microvelia*** Westwood

19. *Microvelia diluta* Distant

Family VIII : GERRIDAE

12. Genus ***Limnogonus*** Stal

20. *Limnogonus (Limnogonus) fossarum* (Fabricius)

21. *Limnogonus (Limnogonus) nitidus* (Mayr)

Key to families

1. Antennae shorter than head, usually hidden in cavities beneath eyes and not visible from above (Aquatic and shore bugs) .....Series Hydrocorisae, 2
Antennae longer than head,inserted in front of eyes and clearly visible from above. (Semi-aquatic bugs) ....Series Amphibicorisae, 6

2. Rostrum very short and broad with not distinct segmentation; front tarsi spatulate and developed into comb like palae; base of head overlapping the anterior margin of pronotum.....Corixidae
Rostrum cylindrical or cone shaped, distinctly 3-4 segmented; front tarsi normal and not modified into palae; base of head inserted into pronotum.....3

3. Abdomen with a pair of long, slender, non-retractile posterior appendages; hind coxae short, free and rotatory.....Nepidae
Abdomen without paired long, slender posterior appendages or may have a pair of retractile small appendages; hind coxae broadly jointed to the thoracic pleura.....4

4. Body dorso-ventrally flattened and elongately suboval in shape; head more or less triangular in shape; adults large, 13-82 mm in length (Indian forms); hind legs with long swimming hairs and paired claws; abdomen with a pair of short, flat, retractile posterior appendages.....Belostomatidae
Body elongated and thick; head spherical; adult scarcely upto 17 mm in length; hind legs may or may not be fringed with long swimming hairs; abdomen without posteror appendages.....5

5. Adult minute, less than 3 mm in length; rostrum 3-segmented; hind legs normal and not fringed with swimming hairs; abdominal venter not narrowly keeled but rather elevated into variously formed carinae at the middle of each segment and without long hairs; pronotum and hemielytra coarsely punctured.....Pleidae
Adult moderate in size, varies from 6-17 mm; rostrum 4-segemented; hind legs very long and fringed with long swimming hairs; abdominal venter with median longitudinal narrow keel provided with long hairs; pronotum and hemielytra not puncutred.....Notonectidae

6. Rostrum 3-segmented; middle and hind legs not elongated; hind femora scarcely, if at all, surpassing the tip of abdomen; adult with lateral metathoracic scent gland openings.....Veliidae

Rostrum 4-segmented; middle and hind legs elongated; hind femora very long greatly exceeding the apex of abdomen; adult with median metasternal scent gland openings..... .....Gerridae

Series : HYDROCORISAE
Family I : CORIXIDAE

1. Genus ***Micronecta*** Kirkaldy

1897. *Micronecta* Kirkaldy, *Entomologist,* **30** : 260.

1. ***Micronecta (Basileonecta) scutellaris scutellaris*** (Stal.)

1858. *Sigara scutellaris* Stal. *Ofvers. K.Vet.- Akad. Forh.,* **15** : 339.
1910. *Micronecta dione* : Distant, *Fauna Brit. India, Rhynchota,* **5** : 348.
1989. *Micronecta (Basileonecta) scutellaris scutellaris* : Thirumalai, *Rec. zool. surv. India, occ. paper,* **118** : 15.

Material examined : Delhi; 10 ♂♂, 16♀♀, Auchandi, 30.x.1993, coll. N.K.Sinha & party.

Diagnostic characters : Adult insect about 4 mm in body length. It is the largest known *Micronecta* from India. In males, the pronotum is grey or greyish brown, paler margins and with obscurely marked elytra.

Distirbution : India : Delhi, Andhra Pradesh, Bihar, Karnataka, Kerala, Tamil Nadu, Uttar Pradesh, West Bengal. *Elsewhere* : Africa; China; Indonesia; Malaysia; Saudi Arabia; Sri Lanka; Vietnam.

2. Genus ***Agraptocorixa*** Kirkaldy

1906. *Agraptocorixa* Kirkaldy, *Trans. Amer. Ent. Soc.,* **32** : 152.

2. ***Agraptocorixa (Agraptocorixa) hyalinipennis*** (Fabricius)

1803. *Sigara hyalinipennis* Fabricius, *Syst. Rhyn.,* : 105.
1918. *Corixa unicolor* : Paiva, *Rec. Indian Mus.*, **14** : 30.
1922. *Corixa paivana* : Paiva & Dover, *Rec. Indian Mus.*, **24** : 333.
1989. *Agraptocorixa (Agraptocorixa) hyalinipennis* : Thirumali, *Rec. zool. surv. India, Occ. Pap.*, **118** : 11.

Material examined : Delhi; 2 ♂♂, Opposite Palam Airport, Gurgaon Rd., 9.ix.1994, coll. J.P.Sati & party; 2 ♂♂, 4♀♀, Mangal Mahadev, near Indira Gandhi International Air Port, Gurgaon Rd., 9.ix.1994, coll. J.P. Sati & party.

Diagnostic characters : Adult may be 6.5 8.00 mm in body length; pronotum and elytra

unicolorous, hyaline brown, incomplete pleural sutures well developed; strigil small (abdominal sixth dorsum bearing the strigil), composed of 5-6 combs and pala with at least 21 pegs in male.

Distribution : India : Delhi, Himachal Pradesh, Orissa, Punjab, Tamil Nadu. *Elsewhere* : Myanmar; Taiwan; Java; New Guinea; Pakistan.

3. Genus *Corixa* Geoffroy

1762. *Corixa* Geoffroy, *Hist. abreg. Ins.*, **1** : 477.

3. *Corixa (Tropocorixa) promontoria* Distant

1910. *Corixa promontoria* Distant, *Fauna Brit. India, Rhynchota,* **5** : 341.

1922. *Corixa ribeiroi* : Paiva & Dover, *Rec. Indian Mus.*, **24** : 333.

Material examined : Delhi; 3 ♀♀, 1 ♂, Bawana, 30.x.1993, coll. N.K. Sinha & party; 1 ♀, Lake Garden, Shakur Basti, 31.x.1993, coll. N.K.Sinha & party; 7 ♀♀, 7 ♂♂, Okhla Reservoir, 18.xii.1994, coll. A. Husain & party.

Diagnostic characters : Adults may reach upto 6.13 - 6.14 mm in body length; head fairly long, roundly produced in front of eyes, vertex with obscure puncture rows throughout the posterior half; pronotum black with six yellowish transverse lines; pala in male simple with a curved row of 34 pegs, of which distal 10 pegs slightly more elongate than others.

Distribution : India : Delhi, Karnataka, Uttar Pradesh.

4. *Corixa (Tropocorixa) distorta* Distant

1910. *Corixa distorta* Distant, *Fauna Brit. India, Rhynchota,* **5** : 343.

1910. *Corixa affinis* : Distant, *Fauna Brit. India, Rhynchota,* **5** : 341.

1910. *Corixa verecunda* : Distant, *Fauna Brit. India, Rhynchota* , **5** : 344.

1933. *Sigara (Sigara) distorta* : Hutchinson, *Rec. Indian Mus.*, **35** : 403.

Material examined : Delhi; 1 ♀, 2 ♂♂, River Yamuna, Nizamuddin Bridge, 11.v.1994, coll. A. Husain & party.

Diagnostic characters : Adults may reach upto 5.05 mm in body length; head yellowish and rather elongate, anterior margin of vertex evenly rounded, posterior margin with a blunt median carina between two rows of 5 punctures, also a few scattered punctures between this row and internal margin of each eye; pronotum black with six regular transeverse yellowish lines; pala in male with 38 pegs, the peg row is almost parallel with the flexor marign, distal 5 pegs rather elongate and more pointed.

Distribution : India : Delhi, Bihar, Himachal Pradesh, Maharashtra, Punjab. *Elsewhere* : China; Denmark; Nepal.

Family II : NEPIDAE

4. Genus *Ranatra* Fabricius

1790. *Ranatra* Fabricius, *Skr. nat. Selsk.*, 1(1) : 227.

5. *Ranatra elongata* Fabricius

1790. *Ranatra elongata* : Fabricius, *Skr. nat. Selsk.*, 1(1) : 228.
1906. *Ranatra elongata* : Distant, *Fauna Brit. India, Rhynchota*, 3 : 20.
1947. *Ranatra elongata* : Hafiz & Pradhan, *Rec. Indian Mus.*, 40 : 208.
1969. *Ranatra elongata* : Julka, *Entomologist Rec.*, 81 : 175.
1989. *Ranatra elongata* : Thirumalai, *Rec. zool. Surv. India, Occ. Paper*, 118 : 30.

Material examined : Delhi, 2 ♂♂, Auchandi, 30.x.1993, coll. N.K.Sinha & party; 1 ♂, Pond, Indira Gandhi Indoor Stadium Complex, 11.v.1994, coll. A.Husain & party; 4 ♀♀, Opposite Palam Air Port, Gurgaon Rd., 9.ix.1994, coll. J.P.Sati & party; 1♀, Asola Wildlife Sanctuary, 12.x.1994, coll. J.P.Sati & party; 1 ♀, Bhalsawa, Karnal Rd., 15.xii.1994, coll. A.Husain & party; 5 ♀♀, 3♂♂, Lodhi Garden, Lodhi Rd., 19.xii.1994, coll. A.Husain & party; 1 ♂, Bhalsawa Lake, 11.ii.1995, coll. J.P.Sati & party; 1♂, Jheel Park, Ranibag, 18.ii.1995, coll. J.P.Sati & party.

Diagnostic characters : Adults attain a length of about 40-45 mm and abdominal appendages may be 10 mm more longer than the body length; anterior femur provided with a large triangular tooth beyond the middle of its length and a pair of short teeth a little before the apex; metasternal process subtriangular and centrally longitudinally foveately sulcate.

Distribution : India : Delhi, Bihar, Jammu and Kahsmir, Kerala, Maharashtra, Orissa, Pondichery, Tamil Nadu, Uttar Pradesh, West Bengal. *Elsewhere* : Australia; Nepal; Sri Lanka.

6. *Ranatra filiformis* Fabricius

1790. *Ranatra filiformis* Fabricius, *Skr. nat. Selsk.*, 1(1) : 228.
1906. *Ranatra filiformis* : Distant, *Fauna Brit. India, Rhynchota*, 3 : 21.
1989. *Ranatra filiformis* : Thirumalai, *Rec. zool. Surv. India, occ. pap.*, 118 : 31.

Material examined : Delhi; 1♀, Water sports complex, Bhalsawa, 16.x.1993, coll. N.K.Sinha & party; 2 ♀♀, 5♂♂, Old Fort Lake, near Pragati Maidan, 10.v.1994, coll. A.Husain & party ; 2 ♀♀, River Yamuna, 14.v.1994, coll. A.Husain & party; 1 ♂, Gopalpur nala, near Wazirabad, 8.ix.1994, coll. J.P.Sati & party; 3 ♀♀, Indira Gandhi Indoor Stadium, 10.ix.1994, coll. J.P. Sati & party; 1♀, Bhalsawa, Karnal Rd., 15.xii.1994, coll. A.Husain & party; 1 ♀, 2 ♂, Nagli Sakraoti, near Sai Dham, 20.xii.1994, coll. A.Husain & party; 1♀, Jheel park, Ranibag, 18.ii.1995, coll. J.P.Sati & party.

Diagnostic characters : Adults attain a length about 27 mm, abdominal appendages about 23 mm long; both the teeth on anterior femur prominently spinulose; head may be provided with a distinct turbercle on the vertex; metasternal process posteriortly triangular with a distinct mid-

longitudinal ridge.

Distribution : India : Delhi, Assam, Kerala, Maharashtra, Orissa, Pondicherry, Punjab Tamil Nadu, Uttar Pradesh, West Bengal. *Elsewhere* : Nepal; Pakistan; Philippines; Sri Lanka.

7. *Ranatra sordidula* Dohrn

1860. *Ranatra sordidula* Dohrn, *Stettin. ent. Ztg.*, **21** : 409.

1906. *Ranatra sordidula* : Distant, *Fauna Brit. India, Rhynchota*, **3** : 22.

1994. *Ranatra sordidula* : Bal & Basu, *State Fauna Series* **3** : *Fauna of West Bengal*, **5** : 543.

Material examined : Delhi; 2 ♀♀, 4♂♂, Masudabad, 38 kms. from I.A.R.I., Najafgarh Road, 5.vi.1993. coll. V.Khanna & party; 7 ♀♀, 10 ♂♂, Pond, Saraswati Vihar, Ring Rd., 9.vi.1993, coll. V.Khanna & party; 5 ♀♀, 2♂♂, Water sports complex, Bhalsawa, 26.x.1993, coll. N.K.Sinha & party; 4 ♀♀, 1♂, Bawana, 30.x.1993, coll. N.K.Sinha & party; 9 ♀♀, 5 ♂♂, Old Fort Lake, near Pragati Maidan, 10.v.1994, coll. A.Husain & party.; 6 ♀♀, 3 ♂♂, River Yamuna, 14.v.1994, coll. A.Husain & party; 12 ♀♀, 8 ♂♂, Horse-shoe Lake, Jahangirpur, Bhalsawa, 16.v.1994, coll. A.Husain & party; 1 ♂, Pond, Indira Gandhi Indooor Stadium Complex, 11.v.1994, coll. A.Husain & party; 1 ♀, Gopalpur nala, near Wazirabad, 8.ix.1994, coll. J.P.Sati & party; 2 ♀♀, 2 ♂♂, Yamuna River, Ram Ghat, 17.xii.1994, coll. A.Husain & party; 1 ♂, Yamuna River, Ram Ghat, 17.xii.1994, coll. A.Husain & party; 2 ♀♀, 3 ♂, Okhla Reservoir, 18.xii.1994, coll. A.Husain & party; 3 ♀♀, 1 ♂, Pond, Nagli Sakraoti, near Sai Dham, 20.xii.1994, coll. A.Husain & party; 11 ♀ ♂, 4 ♂♂, Yamuna Barrage, Wazirabad, 11.ii.1995, coll. J.P.Sati and party; 4 ♀♀, 2 ♂♂, Bhalsawa lake, 11.ii.1995, coll. J.P.Sati & party.

Diagnostic characters : Adult insect may reach upto 23-24 mm long, abdominal appendages about 20 mm long; head without any tubercle on vertex; anterior femur not touching the inner tooth on the anterior femur; metasternal process posteriorly projectile and mid-longitudinally slightly carinated.

Distribution : India : Delhi, Meghalaya, Orissa, West Bengal. *Elsewhere* : Malay Peninsula; Sri Lanka; Thailand.

5. Genus *Cercotmetus* Amyot & Serville

1943. *Cercotmetus* Amyot & Serville, *Hem.*, : 441.

8. *Cercotmetus pilipes* (Dallas)

1849. *Ranatra pilipes* Dallas, *Trans. ent. Soc. London* : 2.

1906. *Cercotmetus pilipes* : Distant, *Fauna Brit. India, Rhynchota*, **3** : 23.

1918. *Cercotmetus pilipes* : Paiva, *Rec. Indian Mus.*, **14** : 26.

Material examined : Delhi; 1 ♂, Sabhaypur, Ghaziabad Rd., 17.xii.1994, coll. A.Husain & party.

Diagnostic characters : Body length of adults 41 mm, abdominal appendages about 9 mm in

length; head long with a tubercle on the vertex; elytra not reaching the apex of the abdomen; prosternum with two long deep longitudinal furrows extending to whole length; anterior femora considerably shorter than the pronotum; intermediate and posterior tibiae and tarsi furnished with a double row of long yellow hairs on the inner side.

Distribution : India : Delhi. *Elsewhere* : Bhutan.

6. Genus *Laccotrephes* Stal

1865. *Laccotrephes* Stal, *Hem. Africana,* **3** : 186.

9. *Laccotrephes ruber* (Linnaeus)

1764. *Nepa ruber* Linnaeus, *Mus. Lud. Ulr.*, : 165.
1864. *Laccotrephes ruber* : Stal, *Hem. Fabr.*, **1** : 135.
1906. *Laccotrephes ruber* : Distant, *Fauna Brit. India, Rhynchota,* **3** : 18.

Material examined : Delhi; 1 ♂, Ridge area near Dhaula Kuan, 23.x.1993, coll. N.K.Sinha & party; 1♀, 2 ♂♂, Auchandi, 30.x.1993, coll. N.K.Sinha & party; 1 ♀, opposite Palam Airport, Gurgaon Rd., 9.ix.1994, coll. J.P.Sati & party; 3 ♂♂, 1♀, Asola Wildlife Sanctuary, 12.ix.1994, coll. J.P.Sati & party; 1♀, Sabhaypur, Ghaziabad Rd., 17.xii.1994, coll. A.Husain & party.

Diagnostic characters : Adult insects 30-35 mm in length exlcuding abdominal appendages, breadth between posterior pronotal angles 7-9 mm; abdomen reddish-yellow above; prosternum convex at the middle provided with a small tuber at the anterior region; abdominal appendages distinctly longer than the body.

Distribution : India : Delhi, Bihar, Gujarat, Jammu & Kashmir, Kerala, Maharashtra, Meghalaya, Orissa, Tamil Nadu, Uttar Pradesh, West Bengal. *Elsewhere* : China; Taiwan; Japan; Nepal; Pakistan.

10. *Laccotrephes griseus* (Guerin)

1829. *Nepa griseus* Guerin, *Iconogr. Regne Anim. Ins.*, : 352.
1910. *Laccotrephes griseus* : Montandon, *Annali Mus. zool. Napoli,* **3** (10) : 3.
1910. *Laccotrephes griseus* : Distant, *Fauna Brit. India, Rhynchota,* **5** :314.

Material examined : 1 ♀, 1 ♂, Ring Road, near Vill. Naraina, 6.vi.1993, coll. V.Khanna & party; 3 ♀♀, 4 ♂♂, Pond, Saraswati Vihar, Ring Rd., 9.vi.1993, coll. V.Khanna & party; 2 ♀♀, 5 ♂♂, Dhaulakuan Ridge, Cantonment area, 10.vi.1993, coll. V.Khanna & party; 2 ♀♀, 3 ♂♂, Water sports complex, Bhalsawa, 26.x.1993, coll. N.K.Sinha & party; 4 ♀♀, 1 ♂, Bawana, 3.x.1993, coll. N.K.Sinha & party.; 1 ♀, Pond at Yamuna barrage, Okhla, 10.v.1994, coll. A.Husain & party; 4 ♀♀, 4 ♂♂, River Yamuna, near Nizamuddin Bridge, 11.v.1994, coll. A.Husain & party; 3 ♀♀, Pond, side of river Yamuna, Vikas Marg, 13.v.1994, coll. A.Husain & party; 3 ♀♀, 9 ♂♂, River Yamuna, 14.v.1994, coll. A.Husain & party; 3 ♀♀, 1 ♂, Okhla Dam,

15.v.1994, coll. A.Husain & party; 2 ♀♀, Horse-shoe Lake, Jahangirpur, Bhalsawa, 16.v.1994, coll. A.Husain & party; 5 ♀♀, 1 ♂, river Yamuna, I.S.B.T., 16.v.1994, coll. A.Husain & party; 6 ♀♀, 3 ♂♂, Gopalpur nala, Wazirabad, 8.ix.1994, coll. J.P.Sati & party; 2 ♂♂, Okhla Reservoir, 18.xii.1994, coll. A.Husain & party; 1 ♂, Jheel Park, Ranibag, 18.ii.1995, coll. J.P.Sati & party; 1 ♀, I.A.R.I., 19.ii.1995, coll. J.P.Sati & party.

Diagnostic characters : Adults 15-20 mm in body length excluding abdominal appendages which are distinctly shorter than the body; anterior area of prosternum provided with a strongly acute tubercle; base of the anterior femora characterised by a tooth which is obtusely rounded.

Distribution : India : Delhi, Andhra Pradesh, Bihar, Kerala, Maharashtra, Orissa, Pondicherry, Punjab, Tamil Nadu, Uttar Pradesh, West Bengal. *Elsewhere* : Myanmar; Malacca; Seychelles; Thailand; Sri Lanka.

Family III : BELOSTOMATIDAE

7. Genus *Lethocerus* Mayr

1853. *Lethocerus* Mayr, *Verh. zool. -bot. Ver. Wien.*, **2** (1852) : 17.

11. *Lethocerus indicus* (Lepeletier & Serville)

1825. *Belostoma indica* Lapeletier & Serville, *Encycl. Meth.*, : 272.

1909. *Lethocerus indicus* : Montardon, *Bull. Soc. Sci. Buc.*, **17** : 138.

Material examined : Delhi; 1 ♂, Auchandi, 30.x.1993, coll. N.K.Sinha & party; 1 ♂, Pond at Yamuna Barrage, Okhla, 10.v.1994, coll. A. Husain & party; 1 ♂, Okhla Dam, 15.v.1994, coll. A. Husain & party; 1 ♀, Horse-shoe Lake, Jahangirpur, Bhalsawa, 16.v.1994, coll. A.Husain & party; 1 ♂ Chhawla Bridge, Najafgarh, Bijwasan Rd., 10.ii.1994, coll. A.Husain & party; 2 ♀♀, 2 ♂♂, Jheel Park, Ranibag, 18.ii.1995, coll. J.P.Sati and party.

Diagnostic characters : This giant Indian water-bug may be 62-85 mm in body length; head between eyes with parallel sides; pronotum with a transverse fasciae at the basal end a fine mid-longitudinal carination; hemielytra with distinct membrane provided with longitudinal veins; posterior tibiae and tarsi completely compressed; intermediate and posterior legs provided with thick sets of swimming hairs on the ventral side.

Distribution : India : Delhi, Assam, Bihar, Kerala, Maharashtra, Meghalaya, Mizoram, Orissa, Uttar Pradesh, West Bengal. *Elsewhere* : Myanmar; China; Java; Malay Peninsula; Pakistan; Philippines; Sri Lanka; Sumatra.

8. Genus *Diplonychus* Laporte

1833. *Diplonychus* Laporte, *Guerin's Mag. Zool.*, **2** : 18.

12. *Diplonychus annulatus* (Fabricius)

1803. *Nepa annulatum* Fabricius, *Syst. Rhynchota* : 106.

1863. *Sphaerodema annulatum* : Dufour, *Ann. Soc. ent. Fr.*, **3** : 397.

1906. *Sphaerodema annulatum* : Distant, *Fauna Brit. India, Rhynchota*, **3** : 35.

Material examined : Delhi; 1 ♂, Bhalsawa, 16.x.1993, coll. N.K.Sinha & party; 1 ♀, Rawana, 30.x.1993, coll. N.K.Sinha & party; 2 ♀♀, 1 ♂, Swamp area, Wazirabad Bridge, 28.x.1993, coll. N.K.Sinha & party; 1 ♀, Pond at Yamuna barrage, Okhla, 10.v.1994, coll. A.Husain & party; 2 ♀♀, 1 ♂, Gopalpur nala, Wazirabad, 8.ix.1994, coll. J.P.Sati & party; 1 ♂, Okhla Reservoir, 18.xii.1994, coll. A.Husain & party; 1 ♂, 1 ♀, Yamuna barrage, Wazirabad, 11.ii.1995, coll. J.P.Sati & party; 1 ♀, Bhalsawa, 11.ii.1995, coll. J.P.Sati & party.

Diagnostic characters : Adults may attain body length upto 21-22 mm. Breadth is remarkably more than other two common species of *Diplonychus viz., rusticus* and *molestus;* head as long as the interocular space; antennae and tarsus with two joints; great expanse of hemielytra together almost equal to their length; hemielytra not provided with any shining spot beyond the middle of the inner margin; scutellum and corium thickly and very finely punctate.

Distribution : India : Delhi, Assam, Bihar, Orissa, West Bengal. *Elsewhere* : Bangladesh; Pakistan.

13. *Diplonychus rusticus* (Fabricius)

1803. *Nepa rustica* Fabricius, *Syst. Rhyngo*, : 106.

1906. *Sphaerodema rusticum* : Distant, *Fauna Brit. India, Rhynchota*, **3** : 36.

1979. *Diplonychus rusticus* : Polhemus, *Bull. Fish Res. Stn., Sri Lanka*, **29** : 91.

Material examined : Delhi; 7 ♀♀, 3 ♂♂, Pond, Saraswati Vihar on Ring Road, 9.vi.1993, coll. V.Khanna & party; 4 ♀♀, 1 ♂, Chhawla Bridge, Najafgarh, Bijwasan Road, 20.ii.1994, coll. A.Husain & party; 22, ♂♂, 36 ♀♀, River Yamuna, Barrage side, Okhla, 19.v.1994, coll. A.Husain & party; 1 ♀, River Yamuna, near Children Jail, 14.v.1994, coll. A.Husain & party; 2 ♂♂ Bhalsawa, Karnal Road, 15.ii.1994, coll. A.Husain & party; 1 ♂, Horse-shoe Lake, Jahangirpur, Bhalsawa, 16.v.1994, coll. A. Husain & party; 6 ♀♀, 4 ♂♂, Gopalpur nala, Wazirabad, 8.ix.1994, coll. J.P.Sati and party; 1 ♀, 1 ♂, Sabhaypur, Ghaziabad Road, 17.xii.1994, coll. A.Husain & party; 1 ♂, 1 ♀, Bhalsawa, 11.ii.1995, coll. J.P.Sati & party; 1 ♀♀, 6 ♂♂, Jheel Park, Ranibag, 18.ii.1995, coll. J.P.Sati & party.

Diagnostic characters : Body length of adults varying from 15-17 mm; a little narrower in width than *molestus;* anterior tarsal claws very minute; ventro-lateral stripe of fine hairs on the abdomen narrower.

Distribution : India : Delhi, Jammu & Kashmir, Kerala, Orissa, Maharashtra, West Bengal. *Elsewhere* : Australia; Myanmar; China; Taiwan; Japan; Java; Malay Peninsula; Philippines; Sri Lanka; Sumatra; Thailand; New Guinea; New Zealand.

14. ***Diplonychus molestus*** (Dufour)

1863. *Appasus molestum* Dufour, *Ann. soc. ent. Fr.*, : 395.

1906. *Sphaerodema molestum* : Distant, *Fauna Brit. India, Rhynchota*, **3** : 36.

Material examined : Delhi; 4 ♂♂, 2 ♀♀, Water sports complex, Bhalsawa, 26.x.1993, coll. N.K.Sinha & party; 3 ♂♂, 2 ♀♀, River Yamuna, Lok Nayak Bridge, 13.v.1994, coll. A.Husain & party; 2 ♀♀, Pond, side of River Yamuna, Vikas Marg, 13.v.1994, coll. A.Husain & party; 2 ♂♂, 2 ♀♀, River Yamuna, 14.v.1994, coll. A.Husain & party; 2 ♀♀, Okhla Dam, coll. A.Husain & party; 1 ♀, Horse-shoe Lake, Jahangirpur, Bhalsawa, 16.v.1994, coll. A.Husain & party; 2 ♂♂, Bhalsawa Lake, Karnal Road, 15.xii.1994, coll. A.Husain & party; 4 ♀♀, Lodhi Garden, Lodhi Road, 19.xii.1994, coll. A.Husain & party; 2 ♂♂, 2 ♀♀, Yamuna barrage, Wazirabad, 11.ii.1994, coll. J.P.Sati & party.

Diagnostic characters : Body length varying from 13.5 - 17.5 mm, a little broader in width than *rusticus;* posterior angles of pronotum a little more obtuse and less acute than those of *rusticus;* anterior tarsal claws modertely well developed and longer; ventrolateral stripe of fine hairs on the abdomen is broader.

Distirbution : India : Delhi, Jammu and Kashmir, Orissa, West Bengal. *Elsewhere :* Malacca; Sumatra.

Family IV : PLEIDAE

9. Genus ***Plea*** Leach

1817. *Plea Leach, Trans. Linn.soc. London*, **12** : 14.

15. ***Plea liturata*** (Fieber)

1854. *Plea liturata* Fieber, *Ent. Mongr. Leipzig*, (5) **3** : 296.

1910. *Plea metiadus* : Distant, *Fauna Brit. India, Rhynchota*, **5** : 337.

1992. *Plea liturata* : Bal and Basu, *Proc. zool. Soc. Calcutta*, **45** (Suppl. A) : 326.

Material examined : Delhi; 1 ♂, Auchandi, 30.x.1993, coll. N.K.Sinha & party.

Diagnostic characters : Body length upto 2 mm, dull yellowish grey in colour; elytra coarsely but prominently punctate; pronotum with fine punctures spread all over; abdominal keel prominent and not compact, moderately prominent spine like process on 4th, 5th and 6th abdominal sternite.

Distribution : India : Delhi, Tripura, West Bengal. *Elsewhere :* Indonesia; Malay Peninsula.

Family V : NOTONECTIDAE

10. Genus *Anisops* Spinola

1837. *Anisops* Spinola, *Ess. Ins. Hemipt.* : 58.

16. *Anisops batillifrons* Lundblad

1933. *Aisops batillifrons* Lundblad, *Ann. mag. nat. Hist.*, (10)**12** : 463.

1951. *Anisops batillifrons* : Brooks, *Kans. Univ. Sci. Bull.*, **34** (8) : 420.

Material examined : Delhi; 154 ♂♂, 178 ♀♀, Auchandi, 30.x.1993, coll. N.K.Sinha & party; 6 ♂♂, 1 ♀, Lake Garden, Shakur Basti, 31.x.1993, coll. N.K.Sinha & party; 2 ♂♂, 7 ♀♀, River Yamuna, Nizamuddin Bridge, 11.v.1994, coll. A.Husain & party; 22 ♂♂, 30 ♀♀, Okhla Reservoir, 18.xii.1994, coll. A.Husain & party.

Diagnostic characters : Body length : male 5.6-6.4 mm, female 5.4.-6.3 mm; greatest body width at about two-fifth of the body length; general body colour pale yellowish or greyish; head of male with short cephalic horn, frons excavate triangularly with rounded apex, bordered on each side by two carinae, the inner two carinae meet apically to form a median commissure; eyes not holoptic; stridulatory comb of male on the inner surface of anterior tibia composed of 13 teeth, basal 6 teeth much longer than the apical 7 teeth.

Distribution : India : Delhi, Assam, Tripura, West Bengal. *Elsewhere* : Myanmar; China; Taiwan; Japan; Philippines.

17. *Anisops sardea* Herrich-Shaffer

1850. *Anisops sardeus* Herrich-Shaffer, *Die Wanz. Ins.*, **9** : 41.

1906. *Anisops sardea* : Distant, *Fauna Brit. India, Rhynchota*, **3** ; 45.

Material examined : Delhi; 84 ♂♂, 83 ♀♀, Auchandi, 30.x.1993, coll. N.K.Sinha & party; 7 ♂♂, 6 ♀♀, Lake Garden, Shakur Basti, 31.x.1993, coll. N.K.Sinha & party; 1 ♂, 1 ♀, Okhla Reservoir, 18.xii.1994, coll. A.Husain & party.

Diagnostic characters : Males vary in length from 7.5-8.4 mm while females vary from 7.2-7.5 mm; greatest body width at about middle of the body length; general body colour pale yellow or brownish yellow; males with much prominent cephalic horn with frons excavate of its entire length and bordered laterally by two carinae; rostral prong(of male) slightly shorter than the 3rd rostral segment; stridulatory comb of male on the inner side of anterior tibia, gradually narrowed towards apex, composed of 18 teeth; each basal angle of labrum bearing a tuft of erect hairs with tips curved medianly and meet one another, forming a loop.

Distribution : India : Delhi; Bihar, Himachal Pradesh, Karnataka, Maharashtra, Tamil Nadu, Uttar Pradesh, West Bengal. *Elsewhere* : Afghanistan; Africa; Albania; Myanmar; Canary Islands; Syria; Turkey.

18. *Anisops breddini* Kirkaldy

1901. *Anisops breddini* Kirkaldy, *Entomologist*, **34** : 5-6.

1910. *Anisops breddini* : Distant, *Fauna Brit. India, Rhynchota*, **5** : 333.

Material examined : Delhi; 10 ♀♀, 1 ♂, Auchandi, 30.x.1993, coll. N.K.Sinha & party; 7 ♂♂, 7 ♀♀ Bhalsawa, 15.xii.1994, coll. A.Husain & party.

Diagnostic characters : Males 5.7-6.6 mm and females 5.4-5.7 mm in body length; general body colour pearlaceous; males with no cephalic horn; eyes holoptic; males with stridulatory comb irregular in shape, composed of 7 irregular teeth where 4th and 5th teeth largest and flattened.

Distribution : India : Delhi, Kerala, Orissa, Tripura, West Bengal. *Elsewhere* : Myanmar; Malay Peninsula; Sri Lanka.

Series : AMPHIBIOCORISAE
Family VI : VELIIDAE

11. Genus *Microvelia* Westwood

1834. *Microvelia* Westwood, *Ann. Soc. ent. France*, **3** : 647.

19. *Microvelia diluta* Distant

1909. *Microvelia diluta* Distant, *Ann. mag. nat. Hist.* (8) **3** : 500.

1910. *Microvelia diluta* : Distant, *Fauna Brit. India, Rhynchota*, **5** : 139.

Material examiend : Delhi; 3 ♂♂, (macropterous), 10 ♂♂, (apterous), 31 exs., (apterous), Auchandi, 30.x.1993, coll. N.K. Sinha & party.

Diagnostic characters : Body length about 2.5 mm; lateral angles of pronotum sub-equally prominent; pronotum with reddish-yellow anterior margin reaching the anterior angles; antennal 2nd segment distinctly shorter than the 3rd segment; hemielytra scarcely reaching the abdominal apex; presence of tibial comb both in the anterior and middle tibiae in males.

Distribution : India : Delhi; Bihar, Tamil Nadu, Tripura, West Bengal. *Elsewhere* : Bangladesh; Myanmar; Singapore; Sri Lanka; Sumatra.

Family VII : GERRIDAE

12. Genus *Limnogonus* Stal

1868. *Limnogonus* Stal, *K. svenska Vet.-Akad. Handb.*, **7** : 132.

20. *Limnogonus (Limnogonus) fossarum* (Fabricius)

1775. *Cimex fossarum* Fabricius, *Systema Entomologiae*, : 727.

1902. *Gerris fossarum* : Distant, *Fauna Brit. India, Rhynchota*, **2** : 178.

1989. *Limnogonus (Limnogonus) fossarum* , Thirumalai, *Rec. zool. Surv. India, occ. pap.*, **118** : 40.

Material examined : Delhi; 3 ♂♂ (apterous), 1 ♀ (apterous), Ridge area near Dhaulakuan. 23.x.1993, coll. N.K.Sinha & party; 1 ♂ (macropterous), Lake Garden, Shakur Basti, 31.x.1993, coll. N.K. Sinha & party; 1 ♀ (macropterous), 1 (apterous), Indira Gandhi Indoor Stadium, 10.ix.1994, coll. J.P. Sati & party.

Diagnostic characters : Adult insect may be 9.0-10.0 mm in body length; 1st antennal joint longest while rest are shorter and sub-equal in length; anterior part of pronotum with a pair of irregular yellowish patches; meso-and metanotum provided with pale or white median longitudinal line; hind margin of dorsal vesicle plate is concave; the females are characterised by small, median tooth on the posterior marign of 7th abdominal sternum.

Distribution : India : Delhi, Maharashtra, West Bengal, more or less found all over India. *Elsewhere* : Australia; Myanmar; China; Taiwan; Java; Malacca; Philippines; Sumatra; Thailand; Vietnam.

21. *Limnogonus (Limnogonus) nitidus* (Mayr)

1865. *Hydrometra nitida* Mayr, *Verh. zool.-bot. Ges. Wien.*, **15** : 443.

1902. *Gerris nitida* : Distant, *Fauna Brit. India, Rhynchota*, **2** : 178.

1989. *Limnogonus (Limnogonus) nitidus*, Thirumalai, *Rec. zool. Surv. Inida, occ. pap.*, **118** : 41.

Material examined : Delhi; 1 ♀ (apterous), Ridge, Dhaulakuan, 23.x.1993, coll. N.K.Sinha & party.

Diagnostic characters : Adult may be 6.0-8.0 mm in body length; posterior margin of dorsal vesicle plate is remarkably angular; 1st and 4th antennal segments longer and nearly sub-equal in length while 2nd and 3rd segments shortest and sub-equal in length; fairly prominent connexival spines present in both the sexes (on 7th abdominal segment).

Distribution : India : Delhi, Assam, Bihar, Kerala, Orissa, Tamil Nadu, Uttar Pradesh, West Bengal. *Elsewhere* : Bangladesh; Indonesia; Myanmar; Maldive Islands; Malaya; Nepal; Sri Lanka; Thailand; Vietnam.

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REFERENCES

Andersen, N.M. 1975. The *Limnogonus* and *Neogerris* of the Old world with character analysis and a classification of the Gerrinae (Hemiptera : Gerridae). *Ent. Scand. Suppl.*, **7** : 1-96.

Bal, Animesh and Basu, R.C. 1992. Water-bugs of economic improtance. *Proc. zool. Soc. Calcutta*, **45** (Suppl. A) : 321-329.

Bal, Animesh and Basu, R.C. 1994. Insecta : Hemiptera : Mesoveliidae, Hydrometridae, Vellidae and Gerridae. *State Fauna Series* 3 : *Fauna of West Bengal*. **5** : 511-534.

Bal, Animesh and Basu, R.C. 1994. Insecta. Hemiptera : Belostomatidae, Nepidae, Notonectidae and Pleidae. *State Fauna Series* 3 : *Fauna of West Benal*, part - **5** : 535-558.

Distant, W.L. 1902. *The Fauna of British India, including Ceylon and Burma, Rhynchota*, **2** : 1 -503.

Distant, W.L. 1909. Oriental Rhynchota, Heteroptera. *Ann. Mag. nat. Hist.*, **8** (3) : 491-507.

Distant, W.L. 1910. *The Fauna of British India, including Ceylon and Burma, Rhynchota*, **5** : 1 -362.

Hafiz, H.A. and Mathai, G. 1938. On a collection of aquatic Rhynchota from the Rajmahal Hills, Santal Parganas, Bihar. *Rec. Indian Mus.*, **40**(2) : 207 210.

Hafiz, H.A. and Pradhan, K.S. 1947. Notes on a collection of aquatic Rhynchota from the Patna State, Orissa, with descriptions of two new species. *Rec. Indian Mus.*, **45**(4) : 393-408.

Hafiz, H.A. and Riberio, S. 1939. On a further collection of aquatic Rhynchota from the Rajmahal Hills, Santal Parganas, Bihar, with description of *Microvelia santala* sp. nov. *Rec. Indian Mus.*, **41**(4) : 347-376.

Julka, J.M. 1969. Aquatic bugs of a fish pond. *Entomologist's Record*, **81** : 174-176.

Lansbury, I. 1972. A review of the Oriental Speceis of *Ranatra* Fabricius (Hemiptera : Hetroptera : Nepidae). *Trans. R. ent. Soc. London*, **124**(3) : 287 341.

Lundblad, V.O. 1934. Zur Kenntnis der aquatilen und semi-aquatilen Hemipteren von Sumatra, Java und Bali. *Arch. Hydrobiol. suppl.* **12** : 1-195, 263-489.

Polhemus, J.T. 1979. Aquatic and semi-acquatic Hemiptera of Sri Lanka from the Austrian Indo-pacific Expedition, 1970-71. *Bull. Fish Res. Stn. Sri Lanka*, **29** : 89-113.

Thirumalai, G. 1989. Aquatic and Semi-acquatic Hemiptera (Insecta) of Javadi Hills, Tamil Nadu. *Rec. zool. Surv. India, occ. pap.*, **118** : 1-63.

Usinger, R.L. 1956. *Aquatic Insects of California*. California : 1-508.

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HEMIPTERA : COCCOIDEA

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INTRODUCTION

So far no list of the coccids of Delhi has been published. Misra (1924) listed coccids in the Pusa Collection, which is housed in the Indian Agricultural Research Institute, New Delhi. However, it includes 84 species which were collected from different parts of India, besides 25 species from outside India. Borchsenius (1964) made collections in Delhi in March 1964 and published one new species from there. Takagi made collections of coccids in Delhi for a few days in October 1978, but perhaps nothing worth publishing was encountered. M.G. Ramdas Menon worked at I.A.R.I., New Delhi for a very long time, but has not published anything on the coccids of Delhi, although he described one new species from Palampur, Himachal Pradesh (Menon & Khan, 1963). The present paper is therefore first consolidated report on the coccids of Delhi.

Not only the 18 species of coccids (scale insects and mealybugs) reported in this paper, but at least twice more, can be safely assumed to be the number of coccid species occurring in Delhi. The reason is, many common species, which are widely distributed in the Indo-gangetic plains, have not been included here. Only those species have been included for which specifically Delhi has been mentioned in the range of occurrence.

All records included here are from the published literature. Catalogues by Hoy (1963), Borchsenius (1966), Ali (1969-74) and Ben-Dov (1993) have been referred to, besides data extracted from author's own earlier works (Varshney, 1985, 1992). Information on Lac insects has been taken from Varshney (1977).

SYSTEMATIC ACCOUNT

Superfamily : COCCOIDEA
I. Family : MONOPHLEBIDAE

Genus *Icerya* Signoret

1875. *Icerya* Signoret, *Anls. Soc. Ent. France*, (5) **5** : 350.
Type species : *Dorthesia seychellarum* Westwood.

1. ***Icerya pilosa*** Green

1896. *Icerya pilosa* Green, *Indian Mus. Notes,* **4** : 7.

1951. *Icerya pilosa* : Rao, *Indian J. Ent.*, **12** (2): 127.

1992. *Icerya pilosa* : Varshney, *Rec. Zool. Surv. India,* occ. paper, **139** : 15.

Host plants : Sugarcane and other wild grasses. Also on *Spinifex.*

Distribution : India : Delhi, Haryana, U.P., M.P., Bihar and southern India. *Elsewhere* : Pakistan; Sri Lanka.

Remarks : Rao (1951) has recorded this species from Delhi. It sometimes does great damage to seedlings of sugarcane which dry up due to its attack. Species is illustrated in Green (1922) and Rao (1951).

Genus ***Hemaspidoproctus*** Morrison

1927. *Hemaspidoproctus* Morrison, *Proc. Biol. Soc. Washington,* **40** : 104.

Type species : *Walkeriana cinerea* Green

2. ***Hemaspidoproctus cinereus*** (Green)

1908. *Walkeriana cinerea* Green, *Mem. Dept. Agr. India* (Ent.), **2** (2) : 18.

1922. *Aspidoproctus cinerea* : Green, Coccidae of Ceylon, Pt. **5** : 450.

1992. *Hemaspidoproctus cinereus* : Varshney, *Rec. zool. Surv. India,* occ. paper, **139** : 20.

Host plants : Polyphagous. Recorded on *Acacia, Psidium, Punica, Mangifera, Citrus, Terminalia, Thespesia, Achras, Santalum,* etc.

Distribution : India : Delhi, Rajasthan, Gujarat, Bihar and southern India. *Elsewhere* : Pakistan and Sri Lanka.

II. Family : TACHARDIIDAE

Genus ***Kerria*** Targ.

1884. *Kerria.* Targioni - Tozzetti, *Ann. di. Agr.* 1884, *Min. di. Agr. Indus. e. Com.,* Italy : 410.

Type species : *Coccus lacca* Kerr

3. ***Kerria fici fici*** (Green)
Ficus Lac insect

1903. *Tchardia fici* Green, *Indian Mus. Notes,* **5**(3) : 97.

1923. *Lakshadia ficii* (sic) : Mahdihassan, *J.Sci. Asso.*, Maharajah College Vizianagaram, **1** (2-3) : 57, 99.

1925. *Laccifer fici* : Chamberlin, *Bull. Ent. Res.*, **16**(1) : 36.

1977. *Kerria fici fici* : Varshney, *Oriental Ins. Suppl.*, **5** (1976) : 34.

Host plants : *Ficus, Samanea, Ziziphus, Butea* and *Litchi.*

Distribution : India : Delhi, Jammu & Kashmir, Rajasthan, U.P., Bihar, W.Bengal, M.P. and Tamil Nadu. *Elsewhere* : Pakistan.

Remarks : This species is recorded from Delhi by Mahdihassan (1937). It is one of the commonest lac insects of India. Varshney (1977) has illustrated it.

III. Family : DACTYLOPIIDAE

Genus ***Dactylopius*** Costa

1835. *Dactylopius* O.G. Costa, Fauna del Regondi Napoli, Farmiglia de Cocciniglifori, o de Gallinsetti : **2**, 15.

Type species : *Dactylopius coccus* Costa.

4. ***Dactylopius tomentosus*** (Lamarck)

1801. *Coccus tomentosus* Lamarck, *System des Animaux sans Vertebres* : 298.

1963. *Dactylopius tomentosus* : Hoy, *A Catalogue of the Eriococcidae of the World* : 61.

1992. *Dactylopius tomentosus* : Varshney, *Rec. zool. Surv. India*, occ. paper, **139** : 37.

Host plant : Prickly pear (*Opuntia*).

Distribution : India : Delhi, Maharashtra, Karanataka, Tamil Nadu and Orissa. *Elsewhere*: from north and south America; Europe; Madagascar; Mauritius; Indonesia; Australia; Sri Lanka.

Remarks : Beeson (1961) has reported that the Govt. of the then Ceylon imported this insect from America in 1924 for the control of prickly pear. From Sri Lanka it entered in India and by 1933 it had reached Delhi.

IV. Family : PSEUDOCOCCIDAE

Genus ***Birendracoccus*** Ali

1975. *Birendracoccus* Ali, *Dr. B.S. Chauhan Comm. Vol.* : 279.

Type species : *Dactylopius saccharifolii* Green.

5. ***Birendracoccus saccharifolii*** Green

1908. *Dactylopius saccharifolii* Green. *Mem. Dept. Agr. India* (Ent.), **2** (2): 23.

1970. *Phenacoccus saccharifolii* : Williams, *Bull. Ent. Res.*, **60** : 61.

1992. *Birendracoccus saccharifolii* : Varshney, *Rec. zool. Surv. India, Occ. Paper,* **139** : 39.

Host plants : Sugarcane. Also reported on sorghum.

Distribution : India : Delhi, Haryana, Uttar Pradesh, Bihar, W.Bengal and Andhra Pradesh. *Elsewhere* : Plains of Nepal.

Remarks : This species is the vector of spike disease on sugarcane. Williams (1970) has illustrated the species.

Genus *Nipaecoccus* Sulc

1945. *Nipaecoccus* Sulc, *Acta Soc. Sci. Nat. Morav.*, **17** (3) (Sign. F. 177) : 1

Type species : *Dactylopius nipae* Maskell.

6. *Nipaecoccus viridis* (Newstead)

Coconut Mealybug

1894. *Dactylopius viridis* Newstead, *Indian Mus. Notes,* **3** (5) : 25.

1895. *Dactylopius vastator* Maskell, *Trans. Proc. New Zealand Inst.*, **27** (1894) : 65 (syn.).

1992. *Nipaecoccus viridis* : Varshney, *Rec. zool. Surv. India,* Occ. Paper, **139** : 43.

Host plants : Polyphagous especially palms. Large number of host plants have been recorded by Varshney (1992) and others.

Distribution : India : Delhi, Himachal Pradesh, Uttar Pradesh, Bihar, W. Bengal, Orissa, NE India, Maharashtra, Goa and southern India. *Elsewhere* : Bangladesh; Sri Lanka and Pakistan.

Remarks : Subba Rao *et al.* (1965) while dealing with its parasites, reported it from Delhi on *Morus, Vitis, Citrus, Euphorbia* and *Dalbergia.*

Genus *Maconellicoccus* Ezzat

1958. *Maconellicoccus* Ezzat, *Soc. Ent. d'Egypte Bull.*, **42** : 380.

Type species : *Phenacoccus hirsutus* Green.

7. *Maconellicoccus hirsutus* (Green)

1908. *Phenacoccus hirsutus* Green, *Mem. Dept. Agr. India (Ent.)*, **2** (2) : 25.

1970. *Maconellicoccus hirsutus* : Williams, *Bull. Ent. Res.*, **60** : 149.

1992. *Maconellicoccus hirsutus* : Varshney, *Rec. zool. Surv. India,* Occ. Paper, **139** : 55.

Host plants : Polyphagous. *Ficus, Tectona, Morus, Psidium, Hibiscus, Annona, Vitis, Jasminum, Ziziphus*, etc.

Distribution : India : Delhi, Punjab, U.P, Bihar, W.Bengal, Orissa, southern India and Andaman Is. *Elsewhere* : Pakistan; Sri Lanka; Bangladesh; Taiwan; Thailand; Philippines and

throughout the Middle East.

Remarks : Williams (1970) has illustrated this species, although its record on sugarcane is doubtful.

Genus ***Saccharicoccus*** Ferris

1950. *Saccharicoccus* Ferris, Atlas of the scale insects of North America, **5** : 21, 216.
Type species : *Dactylopius sacchari* Cockerell.

8. ***Saccharicoccus sacchari*** (Cockerell)

1895. *Dactylopius sacchari* Cockerell, *J.Trinidad Field Nat. Club*, **2** : 195.
1970. *Saccharicoccus sacchari* : Williams, *Bull. Ent. Res.*, **60** : 171.
1992. *Saccharicoccus sacchari* : Varshney, *Rec. zool. Surv. India*, occ. paper, **139** : 61.
Host plants : Sugarcane *(Saccharum)*.
Distribution : India : Delhi, Haryana, Uttar Pradesh, Bihar, West Bengal, Madhya Pradesh, Orissa, Maharashtra and southern India. *Elsewhere* : Pakistan; Sri Lanka and Bangladesh.
Remarks : Williams (1970) has illustrated the species.

Genus ***Antonina*** Signoret

1875. *Antonina* Signoret, *Soc. Ent. de France Ann.*, (ser. 5) **5** : 24.
Type species : *Antonia purpurea* Signoret.

9. ***Antonina graminis*** (Maskell)
Rhodesgrass Mealybug

1897. *Sphaerococcus graminis* Maskell, *Ent. Mon. Mag.*, **33** : 244.
1953. *Antonina graminis :* Ferris, *Atlas of Scale insects of North America*, **6** : 294.
1992. *Antonina graminis :* Varshney, *Rec. zool. Surv. India, Occ. Paper*, **139** : 64.
Host plants : On base of stems, rhizomes and roots of *Bambusa, Cynodon* and *Saccharum*. Almost all belong to Gramineae.
Distribution : India : Delhi, U.P., Bihar, West Bengal, Orissa, Karnataka and Tamil Nadu. *Elsewhere* : Pakistan; Sri Lanka and Bangladesh in Indian region and widely upto Hong Kong and China in the east and north America in the west.
Remarks : Recorded by Pruthi & Rao (1943) from Delhi. McKenzie (1967) has described and illustrated the species.

V. Family : COCCIDAE

Genus *Ceroplastes* Gray

1828. *Ceroplastes* Gray, *Spicilegia Zoologica*, **1** : 7.
Type species : *Coccus (Ceroplastes) chilensis* Gray.

10. *Ceroplastes* sp.
Wax Scale

Host plants : *Psidium, Cocos, Prunus, Artocarpus, Anacardium, Ficus* and *Mangifera.*
Distribution : India : Delhi, Orissa, Tripura, etc.
Remarks : Varshney (1992) has reported 8 species of *Ceroplastes* from the Indian region. The above records are of material which could be identified upto genus level only. Gimpel *et al.* (1974) have revised and illustrated the species of this genus in U.S.A., many of which are known to occur in the Indian region as well.

11. *Ceroplastes pseudoceriferus* Green

1921. *Ceroplastes ceriferus* Green, *Ent. Mon. Mag.*, **57** : 259 (misidentification).
1935. *Ceroplastes pseudoceriferus* Green, *Stylops*, **4** : 180.
1992. *Ceroplastes pseudoceriferus* : Varshney, *Rec. zool. Surv. India*, Occ. Paper, **139** : 79.
1993. *Ceroplastes pseudoceriferus* : Ben-Dov, *A systematic catalogue of the soft scale insects of the world* : 46.

Host plants : Polyphagous, *Azadirachta, Diospyros, Artocarpus, Ficus, Psidium, Madhuca, Croton, Mangifera, Terminalia*, etc.
Distribution : India : Delhi, Uttar Pradesh, Bihar, Orissa. *Elsewhere* : Sri Lanka; Bangladesh; Taiwan; Tibet (China); Korea; Japan; New Zealand.
Remarks : Sankaran (1959) has described and illustrated its adult female and given its life history as well.

VI. Family : DIASPIDIDAE

Genus *Lopholeucaspis* Balachowsky

1953. *Lopholeucaspic* Balachowsky, *Actualites Sci. et Indus. Ent. Appl.* **1202** : 875.
Type species : *Leucaspis japonica* Cockerell.

12. *Lopholeucaspis menoni* Borchsenius
Menon Scale

1915. *Leucaspis japonica* Green (nec Cockerell), *Trans. Ent. Soc.*, London, 1914 : **460**, 466 (misidentification).

1964. *Lopholeucaspis menoni* Borchsenius, *Revue d'Ent. de l' URSS*, **43**(4) : 865 (In Russian).

1966. *Lopholeucaspis menoni* : Borchsenius, *A Catalogue of the Armoured Scale insects of the world* : 218.

1985. *Lopholeucaspis menoni :* Varshney, *Oriental Ins.*, **19** : 29.

Host plant : On bark of *Ficus religiosa.*

Distribution : India: Delhi, Uttar Pradesh and Rajasthan. Known from orginal record only.

Remarks : Borchsenius (1964) has described and illustrated it and recorded from Delhi. The species is named after Dr. M.G.K. Menon.

Genus *Parlatoria* Targ.

1868. *Parlatoria* Targioni - Tozzethi., *Soc. Ital. di sci. Nat. Atti*, **11** : 42.

Type species : *Aspidiotus proteus* Curtis

13. *Parlatoria crypta* McKenzie

1943. *Parlatoria crypta* McKenzie, *Bull. Dept. Agr. California*, **32** : 156.

1966. *Parlatoria crypta*: Borchsenius, *A Catalogue of the Armoured Scale insects of the world* :191.

1985. *Parlatoria crypta* : Varshney, *Oriental Ins.*, **19** : 31.

Host plants : Polyphagous. *Albizzia, Bauhinia, Clerodendron, Cassia, Eugenia, Ficus, Jasminum, Lagerstroemia, Laurus, Mangifera, Mallotus, Melia, Nerium, Rosa, Vitis, Ziziphus*, etc.

Distribution : India : Delhi, Punjab, U.P., and Maharashtra. *Elsewhere* : widely distributed in Pakistan.

Remarks : McKenzie (1952) has recorded this species from Delhi.

14. *Parlatoria marginalis* McKenzie

1945. *Parlatoria marginalis* McKenzie, *Microent.*, **10** : 67, 78.

1966. *Parlatoria marginalis :* Borchsenius, *A catalogue of the Armoured Scale insects of the world* :192.

1985. *Parlatoria marginalis* : Varshney, *Oriental Ins.*, **19** : 31.

Host plant : On jamun (*Eugenia*).

Distribution : India: Delhi. *Elsewhere* : Pakistan (Lahore).

Remarks : Borchsenius (1966) recorded it from Pakistan. However, Ali (1969) records Delhi as the type - locality.

15. *Parlatoria morrisoni* McKenzie

1943. *Parlatoria morrisoni* McKenzie, *Bull. Dept. Agr. California*, **32** : 157.
1966. *Parlatoria morrisoni* : Borchsenius, *A Catalogue of the Armoured Scale insects of the world* : 192.
1985. *Parlatoria morrisoni* : Varshney, *Oriental Ins.*, **19** : 31.
Host plant : On *Laurus*.
Distribution : India: Delhi. *Elsewhere* : Pakistan (Lahore). Known from these two places only.

Genus *Brainaspis* MacGillivray

1921. *Brainaspis* MacGillivray, *The Coccidae* : 390, 427.
Type species : *Aspidiotus kellyi* Brain.

16. *Brainaspis kellyi* (Brain)

1918. *Aspiliotus kellyi* Brain, *Bull. Ent. Res.*, **9** : 118, 122.
1966. *Temnaspidiotus kellyi* : Borchsenius, *A Catalogue of the Armoured Scale insects of the world* : 272.
1985. *Brainaspis kellyi* : Varshney, *Oriental Ins.*, **19** : 32.
Host plant : Sugarcane.
Distribution : India : Delhi. Known from Delhi only in the Indian region.
Remarks : Borchsenius (1966) treated this species under *Temnaspidiotus* and recorded on *Andropogon* (Graminae) from Peru.

Genus *Insulaspis* Mamet

1950. *Insulaspis* Mamet, *Inst. Sci. de Madagascar, Mem., ser.* A, **4** : 32.
Type species : *Lepidosaphes vermiculus* Mamet.

17. *Insulaspis citrina* Borchsenius

1963. *Insulaspis citrina* Borchsenius, *Zool. Zhur.*, **43**: 160, 168.
1966. *Insulaspis citrina :* Borchsenius, *A Catalogue of the Armoured Scale insects of the world* : 62.
1985. *Insulaspis citrina* : Varshney, *Oriental Ins.*, **19** : 35.
Host plant : On *Citrus* leaf.
Distribution : India : Delhi. Known from original record of Delhi only.

Genus *Melanaspis* Cockerell

1897. *Melanaspis* Cockerell *in Leonardi, Riv. di Patol. Veg.*, **5** : 375.
Type species : *Aspidiotus obscurus* Comstock.

18. ***Melanaspis glomerata*** (Green)

1903. *Aspidiotus (Targionia) glomeratus* Green, *Indian Mus. Notes*, **5** : 93.

1966. *Melanaspis glomerata* : Borchsenius, *A Catalogue of the Armoured Scale insects of the world* : 348.

1985. *Melanaspis glomerata* : Varshney, *Oriental Ins.*, **19** : 33.

Host plants : On the stalks under leaf sheaths of sugarcane. A major pest in Indian region.

Distribution : India: Delhi, Uttar Pradesh, Bihar, Gujarat, Andhra Pradesh and Tamil Nadu.

Remarks : Rao & Sankaran (1969) have reported it from Delhi and given detailed account of infestation, life cycle and parasites with figures.

SUMMARY

This is first consolidated report of the coccids recorded from Delhi. Altogether 18 species are included, belonging to 15 genera and 6 families. Four species are recorded from Delhi alone in India.

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REFERENCES

Ali, S.Mohammad, 1969 1974. A Catalogue of the Oriental Coccoidea, Parts I-V. *Indian Mus. Bull.*, Calcutta, 4 (1) : 67 83; 4(2) : 38 -73; 5(1) : 9-94; 5(2) : 71-150; 6(2) : 7-82.

Beeson, C.F.C., 1961. *The Ecology and Control of the Forest Insects of India and the neighbouring countries.* Forest Res. Instt., Dehra Dun (Reprint ed.) : 767 pp.

Ben-Dov. Y., 1993. *A Systematic Catalogue of the Soft scale insects of the world (Homoptera : Coccoidea : Coccidae).* Flora & Fauna Handbook No. 9; Sandhill Crane Press Inc., The Netherlands : 536 pp.

Borchsenius, N.S., 1964. Notes on the Coccoidea of India. I. A new genus and theee new species of Leucaspidini (Diaspididae). (In Russian). *Ent. Obozr.,Revue d'Ent. de* 1'URSS, **43**(4) : 864-872.

Borchsenius, N.S., 1966. *A Catalogue of the Armoured Scale insects (Diaspidoidea) of the world* (In Russian). Academy of Sciences of the U.S.S.R., Moskow : 449 pp.

Gimpel, W.F. Jr., Miller, D.R. & Davidson, J.A., 1974. A systematic revision of the Wax Scales genus *Ceroplastes* in the United States (Homoptera : Coccoidea : Coccidae). *Misc. Publ. Agric. expt. Stn. Univ. Md.,* U.S.A., **841** : 1-85.

Green, E.E, 1922. *The Coccidae of Ceylon*, Part V. Dulau & Co., London : 345-472.

Hoy, J.M., 1963. A Catalogue of the Eriococcidae (Homoptera : Coccoidea) of the world. *Bull. New Zealand Dept. Sci. Indus. Res.,* **150** : 1-260.

Mahdihassan, S., 1937. The Kashmir and Rajputana Lac insects. *Curr. Sci.,* Bangalore, **6** : 159.

McKenzie, H.L., 1952. New Parlatoriine scales from India and Egypt, and supplementary notes on other related species (Homoptera : Coccoidea : Diaspididae). Scale studies - Part IX. *Bull. California Dept. Agr.,* U.S.A., **41** : 9-18.

McKenzie, H.L., 1967. *Mealybugs of California, with taxonomy, biology and control of north American species (Homoptera : Coccoidea : Pseudococcidae).* University of California Press, Berkeley : 526 pp.

Menon, M.G.R. and Khan, M.S.H., 1963. Detailed description of diaspine scale insect *Chionaspis venui* Menon & Khan, 1961 (Diaspididae : Coccoidea). *J.Bombay Nat. Hist. Soc.,* Bombay, **60** : 280 - 282.

Misra, C.S., 1924. A list of Coccidae in the Pusa collection. *Report Proc. 5th Ent. Meeting, Pusa* 1923 : 345 - 351.

Pruthi, H.S. & Rao, V.P., 1943. Coccids attacking sugarcane in India. *Indian J. Ent., New Delhi,* **4** (1942) : 87-88.

Rao, V.P., 1951. Iceryine scale insects recorded from the Orient. *Indian J.Ent.*, New Delhi, **12** (1950) : 39-66; 127-158.

Rao, V.P. & Sankaran, T., 1969. The scale insects of sugarcane. In : *Pests of Sugarcane* (ed. J.R. Williams *(et al.)*. Elsevier Publ. Co., Amsterdam : 325 342.

Sankaran, T., 1959. The life history and biology of wax scale *Ceroplastes pseudoceriferus* Green (Coccidae : Homoptera). *J. Bombay Nat. Hist. Soc.*, Bombay, **56** (1) : 39 -59.

Subba Rao, B.R., Sangwan, H.S., Abbasri, Q.A., Singh Y. & Ksheersagar, A.M., 1965. New records of Hymenopterous parasites of *Nipaecoccus vastator* Maskell (Homoptera : Coccidae) a serious pest of *Citrus* spp. from India. *Indian J. Ent.*, New Delhi, **27**(1) : 109-110.

Varshney, R.K., 1977. Taxonomic studies on Lac insects of India (Homoptera : Techardiidae). *Oriental Ins. Suppl.*, **5** (1976) : 1-97.

Varshney, R.K., 1985. A review of Indian coccids (Homoptera : Coccoidea). *Oriental Ins.*, **19** : 1-101.

Varshney, R.K., 1992. A check-list of the Scale insects & Mealybugs of South Asia Part I. *Rec. zool. Surv. India, Occ. Pap.*, Calcutta. **139** : 153 pp.

Williams, D.J., 1970. The Mealybugs (Homoptera : Coccoidea : Pseudococcidae) of sugarcane, rice and sorghum. *Bull. Ent. Res.*, London, **60**(1) : 109 188.

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HEMIPTERA

Additional species known from Delhi

compiled by
VINOD KHANNA
Zoological Survey of India, Dehra Dun 248 195

1. *Moonia sancita sancita* Distant
2. *M.s. pomegrante* Rao & Ramakrishnan
3. *M.s albimaculata* Distant
4. *M.s immaculata* Rao & Ramakrishnan
5. *M.s. ixora* Rao & Ramakrishnan
6. *M.s. variabilis* Distant
7. *Agallia pseudorobusta* Rao & Ramakrishnan
8. *A. srinagarensis* Rao & Ramakrishnan
9. *A. delhiensis* Rao & Ramakrishnan
10. *Macropsis delhiensis* Rao & Ramakrishnan
11. *Rhopalosiphum maidis* (Fitch)
12. *Gompscoris delhiensis* Menon and Ghai
13. *Storthecoris longispinosus* Menon and Ghai

REFERENCES

Menon, M.G. Ramdass & Ghai, S., 1959. A new species of *Gampsocoris* Fuss (Hemiptera: Berytidae) from Delhi.*Proc. R. ent. soc.*, London, (B) : **28** : 109 113

Menon, M.G. Ramdass & Ghai S. 1959. A new species of *Storthecoris* (Hemiptera: Pentatomidae) *Indian J. Entomol.*, 21 (III). 161-162.

Menon, M.G. Ramdass & Ghai,S. 1969. The oviparouns form of *Rhopalosiphum maidis* (Fitch) (Homoptera). *Oriental Ins.*, **3** (4) : 383-388.

Rao, P.K & Ramakrishan, U., 1978. Studies on Indian Cicadelloidae (Homoptera). The genus Moonia.

Rao, P.K & Ramakrishnan, U. 1978 Studies on Indian Cicadelloidea (Homoptera): Three new species of *Agallia*. *Oriental Ins.*, **12** (2) : 235-242.

Rao, P.K. & Ramakrishnan, U. 1979. Two new species of *Macropsis* (Homoptera: Cicadelhidae : Macropsinae) from Northern India. *Oriental Ins.*, **13** (3-4) : 307-310.

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THYSANOPTERA

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The thrips, or Thysanoptera, are minute insects, ranging in size mostly from 0.6 to 2 mm in length. They escape the notice of the general collector because of their small size and often their conservative association with their preferred habitat, which may be a particular host plant, a particular part of the host, or other special habitat. Several species are polyphagous, living on a variety of host plants. One species is aquatic.

The Thysanopteran fauna of Delhi has been studied by the present author for more than 30 years now, although sporadically as time permitted from other activities, and not in a sustained systematic way. However, this study has yielded ample evidence of the richness of the thrips fauna of Delhi. My studies have encompassed mainly members of one order, the Terebrantia, which is reflected in the large number of species of this order given here.

The report of all species listed below from Delhi is based on collecting done by the present author, except three species, *Salpingothrips hoodi* and *Dichromothrips indicus* collected by Ananthakrishnan, and *Mycterothrips ricini* collected by Shumsher. Undoubtedly, the thrips fauna of Delhi is far more rich than indicated by this list, and many more species remain to be discovered by more systematic collecting so that the biodiversity of thrips of this area may be more fully understood. There are several species in my collection from Delhi which have still to be identified, there are others that are new to science but are still awaiting description.

The thrips fauna of Delhi is unique in several ways. It has a number of very remarkable species. One such species is *Indothrips bhushani*, which is associated with flowers of the neem tree. This species is remarkable in its sexual dimorphism, the males appearing so different from the females that they could easily be considered to belong to a different genus if the biology of the species were not known. The fungus spore feeding species *Idiothrips ficus* is strikingly similar to the South African species *bellus*, and indicates the faunal connection between Asia and Africa. One North American genus, *Kurtomathrips*, was discovered only in June 1996. An African genus *Paramystrothrips* was discovered in 1995. *Organothrips indicus* is the only species of Thysanoptera known to lead a completely aquatic life, passing its life cycle on completely submerged *Cryptocoryne* sp. in warmed aquaria in Germany without coming to the surface for uptake of oxygen (Titschack 1969). It has been suggested that oxygen is absorbed by the integument, through extensive bundles of very fine tracheal branches directly under the sternal integument. The habits of both species of *Organothrips* suggest the requirement of an aquatic environment for their existence.

A number of species are known only from Delhi, and are so far not known anywhere else in the world. These are *Eremiothrips varius*, *Exothrips ornus*, *E. poorva*, *Hydatothrips atactus*, *Psilothrips indicus*, *Rhamphothrips jasminae*, *Salpingothrips hoodi*, *Haplothrips pirus*, *Margaritothrips longus*, and *Paramystrothrips moundi*.

In order to give an idea of the habitat and biology of the insects, some notes are added with each species. I was unable to rediscover the species *Tenothrips alis* for almost 30 years, until I discovered its true host plant, *Launaea nudicaulis*, which is an inconspicuously growing small member of Asteraceae

(Compositae). Thereafter I could find numerous individuals of the species. When looking for a particular species one must know its preferred habitat and its seasonal occurrence.

It needs to be emphasized that in the case of a large number of species of Thysanoptera, it is practically impossible to find a particular species in nature unless one looks for the insect in its specific or preferred habitat, barring a stray individual which could be accidentally found. For instance, while I was giving final touches to this manuscript on my computer, it just occurred to me as to why *Diarthrothrips nimbus* should not occur in Delhi where its only known host plant is found in plenty, and the species has been collected on this plant at many other places. I then decided to try and find out. As I beat the leaves of the lower parts of *Lantana camara* plants growing just outside the Department of Zoology, I was able to collect 2 females and 2 larvae (27 July 1996) in a few minutes time. Earlier I had been collecting thrips from *Lantana* in Delhi for a long time, but unintentionally only from the upper parts of the plants.

91 species of Thysanoptera are now reported from Delhi, under 67 genera. Of these, 71 species in 49 genera and 2 families belong to Terebrantia, 20 species in 18 genera and 3 families belong to Tubulifera. Four species from Delhi are described as new to science : *Pseudodendrothrips albana*, *P. suvarna*, *Ajothrips medius*, and *Apterygothrips banyan*. The types of the new species are in the author's collection.

I thank Dr. A. K. Bhatnagar of the Botany Department, who kindly identified several plants, and provided much useful information.

Collection, Preparation, and Study of thrips

The study of Thysanoptera demands special technical procedures first in the collection of specimens in the field and then in the preparation of the material for study. The insects must be prepared as permanent mounts which involves careful processing through a long series of steps which require technical skill of a high order. Improperly prepared insects are unfit for serious study. The study of wings and genitalia often require special procedures for preparation.

A good research microscope, preferably with phase contrast and interference contrast, is required for study of the prepared insects, since the minute characters used in the taxonomy of these insects are not easily visible with the ordinary microscope.

Collection of thrips can be carried out in 10 to 20 % alcohol to which Triton X-100 (one in thousand parts of alcohol) has been added. Alternately 60 % alcohol with glacial acetic acid and glycerine (in the ratio of 10 : 1: 1) may be used. The ideal mounting medium for permanent preparation of specimens is the natural resinous medium Canada balsam dissolved in xylene. Some other mountants, such as water based mountants and synthetic mounting media have been used with disastrous results. Detailed technical procedures for collection and preparation of thrips have been provided by Hartwig (1952 : 345–362), Bailey (1957 : 143–144; collection only); Priesner (1964 : 7; 1965 : 1–6), Stannard (1968 : 234–237), Heming (1969 : 323–328), Mound & Pitkin (1972 : 121–125), Lewis (1973 : 288–289), Schliephake & Klimt (1979 : 63–68), Ananthakrishnan & Sen (1980 : 8–9), Mound & Walker (1982 : 21–23), Palmer & Mound (1990 : 241–242), and Mound & Marullo (1996 : 34–39).

Although light microscopic study is generally poor for studying the surface structure, a new method for enabling *light microscopic surface scanning* (LMSS) of the transparent, membranous wings of Tubulifera has been described by Bhatti (1991 : 29–31, etc.). This method tremendously heightens the contrast and provides a three dimensional view of the surface structures, emulating the results obtained from SEM. It enabled for the first time the recognition of the surface patterns of the tubuliferan wing, which has provided important new characters of taxonomic value. Minute microscopic details of the surface structures of other parts of the body are also clearly visible with this method, even in the case of very pale specimens.

Any method of preparation should aim at ensuring that there is *no distortion* in the shape of body parts as a result of mounting or the procedure of mounting, which alone can facilitate useful comparisons and thus reliable taxonomic work. And the preparations should be made in such a way that it should be possible to study the maximum number of characters. It will be useful to repeat with Mound & Walker (1982 : 21) that the importance of standardization and care in the collection, preparation, and preservation of specimens for microscopy for serious taxonomic work cannot be emphasized too strongly.

Superorder THYSANOPTERA

The thrips comprise the superorder Thysanoptera (Bhatti 1988, 1994) belonging to the Paraneoptera (Acercaria, Hemipteroid assemblage) (Kristensen 1992).

The Thysanoptera differ from other Paraneoptera in the following features : (1) *A single*, unpaired *left mandibular stylet* present, the right mandible lost or atrophied during embryogenesis. (2) *Mouth parts* of the *punching-sucking type*, the single mandibular stylet capable only of slight protrusion, this and the two maxillary stylets ensheathed by the distal part of labrum. (3) Pretarsus with a *large protrusible*, adhesive *arolium* and thick heavily sclerotized *unguitractor apodeme*. (4) *Locomotion* not plantigrade, but *on the tips of pretarsi*, i.e. on the expanded arolia. (5) *Pretarsal claws* in the adult *reduced to spoon-shaped laterally ensheathing plates*. (6) *Wings narrow*, mostly slender, *membranous*, with *long fringes*. (7) Panoistic ovarioles.

These insects have *suctorial mouth parts*, with the labrum, maxillae, and labium together forming a ventrally directed *proboscis* or *mouth cone*. The base of the proboscis actually occupies the anterior part of the venter of prothorax. The suction process in feeding is brought about by the strongly developed *cibarial pumping apparatus*. The mandible makes the initial probing thrusts and the penetrative stab so as to make a puncture in the surface of the food substrate. The two maxillary stylets are held together by an *interlocking ridge and groove system* and are capable of independent sliding movement, and enclose a *food channel* between them. The maxillary stylets enter the puncture for sucking the liquid food. In contrast with some Hemiptera, the mandibular stylet in thrips is not interlocked to maxillary stylets.

The *metamorphosis* of these insects involves development of *external wing pads*, and a *complete metamorphosis* with two or three non-feeding quiescent instars.

The plesiotypic features of Thysanoptera are (Bhatti 1994) : opisthognathous head, with the *proboscis* arising from its caudal part; 3 dorsal ocelli in fully winged adults, absent in larvae; *tentorium* π *shaped*, complete, with tentorial bridge and anterior and posterior arms; a *functional left mandibular stylet*, and absence of right mandible; maxilla with a maxillary stylet joined to the stipes by a *maxillary lever*; strongly developed cibarial pumping apparatus, with greatly enlarged cibarium for attachment of the large cibarial muscles; straight prothoracic *notopleural sutures*; lack of anapleural sutures on metathorax; *sternopleural sutures* on meso and metathorax; *2-segmented tarsi* in adults; *arolia protrusible*; wings narrow, elongate, membranous, with distinct clavus; *4 longitudinal veins* on fore wing; long, *socketed fringe hairs* arising from the anterior and posterior margin of wings; *hamulo-franate* type of wing coupling, the hamulate component comprising a ventral ridge on the hind margin of clavus of fore wing and a series of hamuli along the anterior margin at the base of hind wing; undivided abdominal tergum I; 2 ovaries each with 4 ovarioles; female with *gonapophysial ovipositor* made of 2 pairs of blade-like piercing valves; 2 pairs of thoracic spiracles, one along the mesopreepisternum and one on the metathorax; 2 pairs of abdominal spiracles, one on tergum I and one on VIII; sperm not differentiated into head, middle piece, and tail — with the nucleus, acrosome, mitochondrial derivative, and axoneme disposed side by side; life history involves *5 immature instars*, comprising 2 larval instars and 3 nonfeeding

semiquiescent pupal stages (propupa I, propupa II, and pupa); development *exopterygote, holometabolous*, with internal metamorphic changes taking place in the pupal stages.
Members of this group live in diverse habitats. Some are flower dwellers, many live on leaves, others cause galls on plants. Many live in habitats rich in fungus mycelia, such as under bark, in dead and decaying twigs, and in fallen leaf habitat rich in humus.

In the following account of the Thysanoptera of Delhi the characters of the orders and families are given. The genera and species are listed along with notes on the habitat of each species.
The superorder Thysanoptera is divided into two orders Terebrantia and Tubulifera (Bhatti 1988, 1994), which are customarily considered as suborders.

Order TEREBRANTIA

This group is characterized (Bhatti 1994) by the possession plesiotypically of a *gonapophysial ovipositor*; abdominal segment X of female ventrally forming a *broad membranous recess* for the reception of ovipositor valves in repose; maxillary stylets each with its lever articulating with the stipes; greatly enlarged *clypeolabral membrane*; fully developed tentorium, with a tentorial bridge (reduction of tentorium to small rudiments of anterior tentorial arms is an autapomorphy in 3 families); head without genal fissure; broad, transverse, *strap-shaped prospinasternum*; strongly developed *prosternal apophyses*; *metanotum without craspedum, divided into scutum and scutellum* in macropterous form, ; 2-segmented fore tarsi; tarsi lacking an incurved hamus on the outer ventral side; left and right wings at rest lying parallel to one another on the abdomen; wing surface covered with a *pubescence of microtrichia*; local surface pattern of wings not cellate-bossate; retinacular component of fore wing strongly developed, functional, hind wing with *frenular bristle*; fore wing with *4 lacunate* and *macrotrichiate longitudinal veins* (C, R, Cu, A, Am); plesiotypically 4 or more *cross veins* present (2 c-r, 1 r-cu, 2 cu-am); venation largely lacunate and macrotrichiate; fluting of wing at the veins largely obliterated; wing fringes movable, arising from sockets on the wing membrane; *posterior fringes collapsible*, held in open or closed position because of specialized *∞-shaped sockets*; first abdominal tergum undivided; segment XI represented by the dorsal *epiproct* and the lateral *paraprocts*; setae of segment XI much shorter than those of X; terga II to VIII occupying a little more than half the circumference of segment; female *sternum VIII* represented by two triangular *hemisternites* separated by the base of ovipositor; female sternum IX membranous, unsclerotized, forming a broad recess together with that of segment X; androsternal plate absent; parameres and *hypomere well developed* ; *sperm triflagellar*, without acrosome, with dynein arms and showing static motility; *spermatophore* formed; egg *operculate*; antennal segments III to VII of larvae with annulations and microtrichia rings; antennal III of larvae strongly constricted and thinned at base; cephalic musculature remains unaltered during metamorphosis from larva to adult; only *2 pupal instars* (propupa and pupa) in the life history (one pupal instar lost).

The most readily recognizable characters of this order in the adult instar are the gonapophysial ovipositor (except Uzelothripidae), the socketed wing fringes, the macrotrichiate wing veins, the ventrally membranous and recessed female abdominal segment X bearing long setae, strongly developed prosternal apophyses, maxillary stylets articulating with the stipes, the pubescent wing surface, the divided metanotum, and the usually strap-like prospinasternum. The plesiotypically fully developed tentorium is lost in the families Thripidae, Heterothripidae, and Hemithripidae, and only rudiments of the tentorium are left.

The Terebrantia are classified into 8 families (Bhatti 1979a). These are: Uzelothripidae (Uzelothripoidea); Merothripidae (Merothripoidea); Aeolothripidae and Stenurothripidae (Aeolothripoidea);

Thripidae, Hemithripidae, and Heterothripidae (Thripoidea). Later, another family Melanthripidae was added under Aeolothripoidea (Bhatti 1990a). Only two families are represented in Delhi. A catalogue of the genera and species of Indian Terebrantia has been provided by Bhatti (1990b), giving the synonymy and distribution of each species.

Family AEOLOTHRIPIDAE

The Aeolothripidae are characterized by a complete *tentorium*, an *upturned ovipositor*, and fairly *broad wings* which are *apically rounded*. The *mesopreepisternum is not separated* or is incompletely separated; the *mesothoracic spiracle is short*, not elongate, the eyes in *female* are ventrally usually narrowed and prolonged, the ventral facets in female are usually strikingly unequal, and the *fore tarsus* has an apical backwardly directed stout *hook apposed to a seta*. The abdominal tergum X has a pair of *trichobothria*.

1. ***Coleothrips*** Haliday 1836
1. ***Coleothrips collaris*** (Priesner 1919)

This species is common on *Brassica campestris* during the winter months, and on ornamental flowers, particularly *Centaurea cyanea*, during spring.

2. ***Indothrips*** Bhatti 1967
2. ***Indothrips bhushani*** Bhatti 1967

It is a rare species. It is found in Delhi on flowers of neem, *Azadirachta indica*, April–May; both adults and larvae are found. There is remarkable sexual dimorphism. There is also marked spanandry.

Family THRIPIDAE

There is *reduced tentorium* represented by small anterior tentorial arms, the posterior tentorial arms barely visible, and the tentorial bridge is absent. The antennal segments III and IV bear slender or stout *emergent sense cones* which may be simple or forked. The abdominal tergum X lacks trichobothria. There is usually a well developed ovipositor which is mostly downturned, rarely straight.
This family is divided into 4 subfamilies, Dendrothripinae, Panchaetothripinae, Sericothripinae, and Thripinae (Bhatti 1989 : 15).

Subfamily DENDROTHRIPINAE

3. ***Dendrothrips*** Uzel 1895
3. ***Dendrothrips cameroni*** Priesner 1965

The species is found during late Jan. to Feb. on leaves of *Grewia tenax* growing on the ridge. The only other record of the species is from Sudan, from where the original specimens come.

4. ***Dendrothrips punctatus*** zur Strassen 1968

It has been collected once in Delhi, subsequent to its description from specimens taken in Madras.

4. *Pseudodendrothrips* Schmutz 1913

The genus is recognizable by the long hind tarsus (Fig. 8), a longitudinal row of corpusculae (cor, Fig. 5) running on the ventral side through the mid line, abdominal terga on sides with short longitudinal lines connecting the transverse lines of sculpture (but no microtrichia), and 2-segmented maxillary palps. In the related genus *Leucothrips* the sides of abdominal terga bear rows of microtrichia and the maxillary palps are 3-segmented. The number of setae on antennal segments in *Pseudodendrothrips* is interesting, there being fewer setae than in other Thripidae (Table 1) (compare with *Ajothrips* below; segment VI in *Ajothrips* = VI+VII here).

Table 1. Number of setae on antennal segments in *Pseudodendrothrips*.

Segment	I	II	III	IV	V	VI	VII	VIII	IX
Setae	4(+5)	6(+1)	4	4	6	5	2	3	4

5. *Pseudodendrothrips albana* n. sp. (Fig. 1)

Female (macropterous). Body pale yellow, including legs. Interocular area in front of fore ocellus brown. Fore wings grayish in about second 1/4; otherwise unshaded. Antennal segments I and II light brown; III unshaded; IV light brown at apex, V in distal 1/3, VI in a little less than distal 1/2; VII to IX light brown. Setae hyaline, including those on wings.

Head with 2 pairs of anteocellar setae, dorsal postoculars absent; with a 22 µm long lateral postocular on either side. Eye with 6 ventral pigmented facets. Maxillary palp 2-segmented. Antenna 9-segmented; length (and width) of segments: I 20 (20), II 29 (24), III 28 (17), IV 30 (17), V 27 (14), VI 28 (9), VII 8 (6), VIII 17 (4.5), IX 14 (3) µm. Sense cone on VII and VIII (Fig. 1), each arising from an *elongate base*.

Setae on antennal segments : I 3 inner, 1 outer (+ 5 minor); II 6 (+ 1 minor); III 4; IV 4; V 6; VI 5; VII 2; VIII 3; IX 4. Segment I with only 4 setae, there being only 1 outer seta; middorsal seta basad of campaniform sensillum is lacking on II.

Pronotum with a strong transverse internal apodeme which is interrupted in the middle; surface covered with closely placed transverse lines, and *without* wrinkles among lines; posteroangular seta 39–42 µm long, with 3 pairs of setae inner to the major angulars.

Median pair of mesonotal setae placed along posterior margin, in line with the submedian pair. Median pair of metascutal setae placed close together a little ahead of the middle of sclerite or almost at middle; submedian pair along anterior margin. Mesonotum sculptured transversely, without wrinkles. Metascutum with fairly close longitudinal anastomosing striae along mid line, and with wrinkles among these lines; lateral to these, on either side, with large reticules, without wrinkles. Mesoanepimeron with a dense covering of microtrichia; katepimeron with 2 setae. Mesothoracic sternopleural sutures present. Mesospinula present apparently only in anterior half; metaspinula absent. Mesosternellum forming a narrow strip marked off from the metasternum by a suture.

Fore wing with 23–24 setae on costa; upper vein (R) with 3 setae in proximal third, thereafter with 3 to 4 setae in distal half; none in place of lower vein; clavus with 2 veinal setae (A) and one discal seta. Wing coupling on hind wing made of 3 upcurved hamuli and 1 frenular seta. Fore femur W 27 µm; hind tibia L 118 µm, with only 1 apical spur; hind tarsus 90 µm long (excluding pretarsus).

Abdominal tergum I with a pair of well developed setae at middle, these not so closely approximated as are those on succeeding terga; median part of tergum including these setae with longitudinal wrinkles and with a few reticules formed by oblique line; laterally unsculptured; surface mesad of these setae with about 6 widely spaced transverse anastomosing striae, and between adjacent lines having a few longitudinal lines similar to those seen on sides of intermediate abdominal terga. Terga II to VIII unsculptured medially; on the sides, laterad of seta S2, with transverse lines (about 8 along the length of segment V, near S3), and with longitudinal lines connecting adjacent transverse lines. Tergum IX with long and stout microtrichia in posterior half, arranged in about 3 rows; X with 2 rows of microtrichia in posterior 1/4 *across middle*. Segment IX with 5 pairs of thick and strong setae, all situated along posterior margin, three of these on either side dorsal and *tapering gradually* to apex, the other two ventrolateral in position; these 2 ventrolateral setae on either side uniformly thick through most of their length, and then *abruptly rounding off* to a point at apex; segment X with only one pair of strong setae, these dorsally placed and similar to the dorsal setae of the preceding segment. Segment X not split dorsally.

Tergum II apparently with 2 to 3 lateral setae.

Posterior margin of *terga V to VII* in middle with about 5–8 short, fine microtrichia; VIII with a complete posterior marginal comb of longer microtrichia.

Laterotergite and pleurite areas not marked out from the tergal area; pleurite areas apparently very weakly sclerotized. Sterna II to VII (also VIII in ♂) with all setae far ahead of posterior margin; II with 2 pairs of setae, III to VII each with 3 pairs of setae. Total body length (distended) 864 µm.
Male (macropterous) : Body pale whitish yellow, including legs and wings. Antennal segments I to III unshaded; IV to VI lightly shaded apically; VII to IX lightly shaded.

Sculpture and chaetotaxy of body mostly similar to female. Abdominal terga V to VII with median row of microtrichia along posterior margin; complete posterior marginal comb present on VIII. Tergum IX dorsally with 2 pairs of strong setae near posterior margin, none of the lateral setae strongly developed; other setae on terminal segments not accentuated; microtrichia absent on tergum IX, present on X in two transverse rows. Gland areas absent on sterna. Hypophallus simple. Phallus unarmed, without special processes; gonopore terminal. Total body length (distended) 606 µm.
Holotype ♀, Delhi: from leaves of mulberry, *Morus alba*, 4.v.1991, leg. J.S. Bhatti. **Paratypes** 1 ♀ 2 ♂, with the same data. The species is common in Delhi.

The new species can be compared with two yellow species from Japan found on mulberry, *mori* (Niwa) and *bhattii* Kudô. *P. mori* is a completely yellow species, with unshaded wings, and has 8-segmented antennae. *P. bhattii* has uniformly gray fore wing.

The antennal segments VI, VII, and VIII bear each a long sense cone, arising in each case nearly at the base. The length of these long sense cones on segments VII and VIII in relation with the terminal segments also seems to differ between *albana* and the Japanese species. However, Kudô (1984) in his account of the two Japanese species, did not show the long sense cone of (morphological) antennal segment VII in *mori* (his fig. 5-2 on p. 501) and that of segment VIII in *bhattii* (his fig. 6-2 on p. 503). It is also not known whether the sense cones on VII and VIII in the Japanese species arise from circular or elongate base.

6. *Pseudodendrothrips suvarna* n. sp. (Figs. 2–8)

Female (macropterous). Body bicoloured; head and thorax brown, abdomen pale yellowish. Antennal segments I to III dark brown, II darkest; IV to VI brown in about distal third, yellow proximally; VII to IX brown. Hind legs unshaded; other coxae, proximal 2/3 of femora, and second 1/4 of tibiae brown; unguitractor plate on all legs brown. Fore wings brown, including clavus; lighter to almost clear in proximal third, except base; also faded at apex. Ocellar crescents red. Setae hyaline, except those on wings, which are shaded.

Head (Fig. 4) with 2 pairs of anteocellar setae, dorsal postoculars absent; but a prominent lateral postocular present on either side. Eye with 6 ventral pigmented facets. Maxillary palp 2-segmented. Antenna (Figs. 2, 3) 8-segmented, but often with a partial ventral suture on segment VII; morphological segments VII and VIII (of the plesiotypic 9-segmented antenna) fused. Length (and width) of segments: I 24 (22), II 28–29 (26–27), III 28 (19), IV 26–27 (18), V 25 (14), VI 29–30 (11), VII 21–23 (7), VIII 12–15 (2.5) μm. Base of sense cones on VII (i.e. of morphological VII+VIII) not elongate (Fig. 2).

Setae on antennal segments : I 3 inner, 1 outer (+ 5 minor); II 6 (+ 1 minor); III 4; IV 4; V 6; VI 5; VII 5; VIII 4. Segment I with only 4 setae, there being only 1 outer seta; middorsal seta basad of campaniform sensillum is absent on II. Compared to *albana*, antennal VII (= morphological VII+VIII) has 5 setae, whereas in *albana* there are 3 setae on VII and 2 setae on VIII.
Pronotum with a strong transverse internal apodeme which is interrupted in the middle; surface covered with closely placed transverse lines, and with wrinkles between lines; posteroangular seta 32 μm long, with 3 pairs of setae inner to the major angulars.

Median pair of mesonotal setae placed along posterior margin, in line with the submedian pair. Median pair of metascutal setae placed close together a little ahead of the middle of sclerite or almost at middle; submedian pair along anterior margin. Mesonotum sculptured transversely, without wrinkles. Metascutum with fairly close longitudinal anastomosing striae along mid line, and with wrinkles among these lines; lateral to these, on either side, with large reticules, without wrinkles. Mesoanepimeron with a dense covering of microtrichia; katepimeron with 2 setae. Mesothoracic sternopleural sutures present. Mesospinula present; metaspinula absent. Mesosternellum forming a narrow strip marked off from the metasternum by a suture.

Fore wing with 26–27 setae on costa; upper vein (R) with 3 setae in proximal third, thereafter with 3 setae in distal half; none in place of lower vein; clavus with 2 veinal setae (A) and one discal seta. Wing coupling on hind wing made of 3 upcurved hamuli and 1 frenular seta. Fore femur W 28 μm; hind tibia L 103 μm, with only 1 apical spur; hind tarsus 71 μm long (excluding pretarsus).
Abdominal tergum I (Fig. 6) with a pair of well developed setae at middle, these not so closely approximated as are those on succeeding terga; surface mesad of these setae with about 6 widely spaced transverse anastomosing striae, and between adjacent lines having a few longitudinal lines similar to those on sides of intermediate abdominal terga. Terga II to VIII unsculptured medially; on the sides, laterad of seta S2, with transverse lines (about 11 along the length of segment V, near S3), and with longitudinal lines connecting adjacent transverse lines. Tergum IX with long and stout microtrichia in posterior half, arranged in about 3 rows; X with 2 rows of microtrichia (only one row in middle) in posterior 1/4.

Segment IX with 5 pairs of thick and strong setae, all situated along posterior margin, three of these on either side dorsal and *tapering gradually* to apex, the other two ventrolateral in position; the 2 ventrolateral setae on either side uniformly thick through most of their length, and then *abruptly rounding*

off to a point at apex; segment X with only one pair of strong setae, these dorsally placed and similar to the dorsal setae of the preceding segment. Segment X not split dorsally.

Tergum II with 3 lateral marginal setae. One of the setae, the anteriormost may be in line with the other two setae, or it may be ventrolaterally placed.

Posterior margin of *terga VI and VII* in middle with about 8–10 short, fine microtrichia; VIII with a complete posterior marginal comb of better developed microtrichia.
Laterotergite and pleurite areas not marked out from the tergal area; pleurite areas apparently very weakly sclerotized. Sterna II to VII (also VIII in ♂) with all setae far ahead of posterior margin (Fig. 7); II with 2 pairs of setae, III to VII each with 3 pairs of setae. Total body length (distended) 872 µm.

Male (macropterous) : Body pale whitish yellow, including legs and wings. Antennal segments I to III unshaded; IV to VI lightly shaded in about distal third; VII and VIII lightly shaded. Ocellar crescents orange.

Sculpture and chaetotaxy of body mostly similar to female. Abdominal tergum VII alone with median row of microtrichia along posterior margin; complete posterior marginal comb present only on VIII. Tergum IX dorsally with 3 pairs of strong setae near posterior margin, and with one strong seta on either side laterally; other setae on terminal segments not accentuated; microtrichia absent on tergum IX, present on X in a single transverse row. Gland areas absent on sterna. Hypophallus simple. Phallus unarmed, without special processes; gonopore terminal. Total body length (distended) 772 µm.

Holotype ♀, Maharashtra : Deolali, from leaves of *Ficus religiosa*, 3.vi.1966, leg. J.S. Bhatti. **Paratypes** 13 ♀ 1 ♂, with the same data. The species is common on the same host in Delhi, inhabiting chiefly the tender terminal leaves.

The new species resembles *ornatissimus* Schmutz, but the latter species is readily separated by the 9-segmented antennae and the greatly elongated segments VIII and IX.

Subfamily PANCHAETOTHRIPINAE

5. *Astrothrips* Karny 1921
7. *Astrothrips stannardi* Bhatti 1967

A highly polyphagous species found on a variety of plants. Originally found in large numbers on *Mirabilis jalapa* leaves in Delhi, it has also been collected on *Parthenium* and other weeds.

6. *Caliothrips* Daniel 1904
8. *Caliothrips graminicola* (Bagnall & Cameron 1932)

It is an uncommon species, of which the females are difficult to separate from *indicus*.

9. *Caliothrips indicus* (Bagnall 1913)

This a common leaf-feeding species on ornamentals like *Tegetes*, and on herbage.

10. ***Caliothrips luckmanni*** Wilson 1975

This species differs strikingly from the other two in the abdominal sculpture and wing coloration. Unlike the other two species, the larvae have red dots on the colourless pale whitish body.

7. ***Phibalothrips*** Hood 1918
11. ***Phibalothrips peringuyei*** (Faure 1925)

Occasionally found in grasses in Delhi.

8. ***Rhipiphorothrips*** Morgan 1913
12. ***Rhipiphorothrips cruentatus*** Hood 1919

This is a polyphagous species. It is occasionally heavily infests the leaves of rose, *Syzygium cuminii*, and *Terminalia*, especially on the underside of leaves, where immature stages are also found.

Subfamily SERICOTHRIPINAE

9. ***Hydatothrips*** Karny 1913
13. ***Hydatothrips atactus*** Bhatti 1973

An uncommon species, collected only from flowering *Alhagi pseudalhagi*, which grows before the monsoon.

14. ***Hydatothrips ramaswamiahi*** Priesner 1926

The subspecies *diversus* Bhatti 1973 was described from Delhi, based on a single male.

10. ***Neohydatothrips*** John 1929
15. ***Neohydatothrips raniae*** (Bhatti 1967)

The species is monophagous on flowers of the wild tree *Ehretia laevis*, which flowers during Feb.–March.

11. ***Pyrothrips*** Bhatti 1973
16. ***Pyrothrips boerhaaviae*** (Seshadri & Ananthakrishnan 1954)

It is a vividly bicoloured monophagous species almost always found wherever *Boerhaavia diffusa* is growing.

Subfamily THRIPINAE

12. *Agrostothrips* Hood 1954
17. *Agrostothrips meridionalis* (Bagnall 1927)

Commonly found on grasses in Delhi, but in small numbers. Recently it was collected in large numbers in grass in Lucknow (U.P.).

13. ***Ajothrips*** Bhatti 1967
18. ***Ajothrips medius*** **n. sp.** (Fig. 9–10)

Female (macropterous). Body bicoloured; head and thorax yellow, abdomen brown. Legs yellow. Antennae brown, with segments I to III slightly paler than the rest. Fore wing very faintly infumated with pale brownish; at first sight appearing unshaded. Setae lightly shaded on head and thorax, dark on abdomen and wings.

Head with 2 pairs of anteocellar setae. Interocellar setae placed on a tangent between outer margins of fore and hind ocelli, similarly developed as in other species. Postoculars I and II longest, II longer than I. Eyes without ventral pigmented facets. Maxillary palps 3-segmented.

Antennae 8-segmented; length (and width) of segments : I 19 (25), II 30–32 (24), III 39–42 (17), IV 42 (15), V 30 (15), VI 42 (15), VII 8 (7), VIII 13 (5) μm. Middorsal seta on II basad of campaniform sensillum positioned mesiad (as in the other species). Number of setae on segments : I 6 (+ 5 minor setae), II 7 (+ 1 minor seta), III 5, IV 5, V 6, VI 7, VII 3, VIII 6.

Pronotum with surface completely sculptured with transverse anastomosing striae; posteroangular setae short, inner ca. 37 μm long, outer 31 μm long; with 3 pairs of posteromarginal setae inner to the major angulars, innermost posteromarginal seta 21–25 μm long. Pronotal disc with a total of 46 setae, including those at posterior margin.

Mesoanepimeron with a pubescence of microtrichia; katepimeron with 2 setae. Metanotal sculpture (Fig. 9) at middle made of short transverse lines, not reticulate sublaterally. Metaepisternum without setae; epimeron with 2 setae.

Mesoeusternum with 27 setae; metasternum with 20 setae. Mesospinasternum with lateral seta 27–30 μm long, longer than lateral mesosternal setae. Metasternellum broadly rounded.
Fore wing setae: costa 25; upper vein (R) 3+6 proximal setae reaching the middle of wing, and 2 distal setae; lower vein (Cu) 9–10 setae; clavus with 4 setae on anal vein (A) and 1 discal seta. Hind wing coupling : 3 hamuli, and one frenular seta.

Abdominal tergum VII (Fig. 10) with rows of well developed microtrichia across middle. Terga VII and VIII at middle without transverse lines of sculpture. Setae on abdominal tergum IX : *md* 37 μm; S1, 49; S2, 61–66; S3, 67–69; S4, 41–42. On tergum X : S1, 53–54; S2, 57–61 μm long.
Sterna completely sculptured with transverse lines. Lines of sculpture on abdominal sternum V wide apart and few in number; sublaterally with only *4 transverse rows* of microtrichia. Ovipositor 172 μm long. Total body length 1030 μm.

Holotype ♀, Delhi : from grass clumps, 8.iv.1974, leg. J.S. Bhatti.

The new species differs from the two species *karma* Bhatti and *gara* Bhatti in *Ajothrips* (Bhatti 1967) by the following features : 1) antennal III about as broad as VI (vs. III much broader than VI); 2) short pronotal posteroangular setae, 31–37 μm long (vs. 42–73 μm long); 3) fore femur width 38 μm (vs. 64–66 μm); 4) metanotal sculpture at middle made of short transverse lines (vs. made of long transverse lines), and without reticules sublaterally (vs. distinctly reticulate sublaterally); 5) smaller number of setae on meso and metasternum, respectively 27 and 20 (vs. 43 and 26 respectively); 6) upper vein (R) with fewer (9) proximal setae (vs. 11–13 setae); 7) clavus with 4+1 setae (vs. 5+1 setae); 8) abdominal terga VII and VIII unsculptured at middle (vs. with distinct transverse lines of sculpture); 9) tergum VII with rows of microtrichia across middle (vs. without microtrichia at middle);

10) abdominal sternum V with lines of sculpture wide apart (vs. closer to each other) and sublateral transverse rows of microtrichia only 4 in number (vs. ca. 8 transverse rows of microtrichia sublaterally); 11) shorter setae S1 to S3 on tergum IX, 49–69 μm long (vs. longer, 74–108 μm long); 12) shorter setae on tergum X, 53–61 μm (vs. longer setae, 78–97 μm).

The most important distinguishing characters of *medius* are the short pronotal posteroangular setae, only 4 anal setae on fore wing, abdominal tergum VII with rows of microtrichia across middle, terga VII and VIII at middle without transverse lines of sculpture, the metanotal sculpture, fewer rows of microtrichia sublaterally on sternum V, and shorter setae on terminal abdominal segments.

14. ***Alathrips*** Bhatti 1970
19. ***Alathrips roonwali*** (Bhatti 1963)

This is a monophagous species, living on flowers of *Capparis aphylla*. The finding of this species coincides with the flowering of its host, twice a year, in May-June and around November.

15. ***Anaphothrips*** Uzel 1895
20. ***Anaphothrips sudanensis*** Trybom 1911

Found on all grasses throughout the year.

16. ***Anascirtothrips*** Bhatti 1961
21. ***Anascirtothrips arorai*** Bhatti 1961

It lives on the leaves of pipal, *Ficus religiosa*, especially on the tender fresh foliage. Specimens have also been collected from the tender leaves of banyan tree, *Ficus bengalensis*.

17. ***Ayyaria*** Karny 1926
22. ***Ayyaria chaetophora*** Karny 1926

Found in Delhi only after the monsoon, when there is copious vegetation. But then it can be taken in good numbers.

18. ***Bolacothrips*** Uzel 1895
23. ***Bolacothrips striatopennatus*** (Schmutz 1913)

It is not a common species in Delhi. 4 females were collected on wheat, iv.1970.

19. ***Bregmatothrips*** Hood 1912
24. ***Bregmatothrips brachycephalus*** (Shumsher 1946)

It has been collected on a few occasions on *Setaria* subsequent to the monsoon when this grass is found in abundance.

20. ***Ceratothripoides*** Bagnall 1918
25. ***Ceratothripoides claratris*** (Shumsher 1946)

This species was collected in Delhi only once, on herbage.

21. ***Chirothrips*** Haliday 1836
26. ***Chirothrips africanus*** Priesner 1932

It has been collected from *Cynodon dactylon* at a couple of localities in Delhi.

22. ***Craspedothrips*** zur Strassen 1966
27. ***Craspedothrips minor*** (Bagnall 1921)

Although the females are often found on castor, *Ricinus communis*, the males are extremely rare. Single males were collected twice, viii.1966 and 25.ix.1966, on *Mirabilis jalapa* growing under a castor shrub.

23. ***Dendrothripoides*** Bagnall 1923
28. ***Dendrothripoides innoxius*** (Karny 1914)

It is a common yellow species associated with *Ipomoea* leaves.

24. ***Diarthrothrips*** Williams 1915
29. ***Diarthrothrips nimbus*** (Ananthakrishnan 1965)

The species lives on the leaves of *Lantana camara*, on the lower parts of the plant, and I have collected specimens from many parts of India. I found individuals of this species, 2 ♀ and 2 pale orange coloured larvae II, in Delhi for the first time on 27.vii.1996, when out of curiosity I wondered as to why it should not occur here, and went out specifically to look for this species. In numerous collections over the years I never found *Diarthrothrips* in Delhi, presumably because I never tried the lower parts of the plant.

25. ***Dichromothrips*** Priesner 1932
30. ***Dichromothrips indicus*** Mound 1976

The record from Delhi is based on a female from grass, 30.vii.1966 (Ananthakrishnan coll.) doubtfully assigned to this species by Mound (1976). The holotype male originates from Kalimpong, from orchids, taken in quarantine at New York airport.

26. ***Eremiothrips*** Priesner 1949
31. ***Eremiothrips varius*** (Bhatti 1967)

This species is found on *Suaeda fruticosa*, on which it has been collected on several occasions.

27. ***Exothrips*** Priesner 1939
32. ***Exothrips cephalicus*** Bhatti 1975

It has been collected from grass clumps in Delhi, where it occurs in numbers.

33. ***Exothrips deemax*** Bhatti 1975

This species is based on a single female from grass in Delhi.

34. ***Exothrips hemavarna*** (Ramakrishna & Margabandhu 1931)

It is a widely distributed Indian species, collected occasionally from grasses in Delhi.

35. ***Exothrips ornus*** Bhatti 1975

Known only from a single female collected on wheat, *Triticum aestivum*, in Delhi.

36. ***Exothrips poorva*** Bhatti 1975

This species is based on two small series from grass clumps in Delhi.

37. ***Exothrips redox*** Bhatti 1975

It has been collected on *Setaria* in Delhi. The holotype and a long series of specimens originate from tall grass in Jammu.

28. ***Florithrips*** Bhatti 1970
38. ***Florithrips traegardhi*** (Trybom 1911)

This species is often found on flowers of *Prosopis spicigera*, but specimens have also been collected from other plants.

29. ***Foliothrips*** Bhatti 1972
39. ***Foliothrips oratus*** Bhatti 1972

Common on leaves of *Acacia leucophloea*, where it lives in large numbers.

30. ***Frankliniella*** Karny 1910
40. ***Frankliniella sulphurea*** Schmutz 1913

It is a highly polyphagous, common species. But the males are rarely found. It is a yellow species which should not be confused with the brown species *schultzei*, with which it bears strong structural similarity. Reports of *sulphurea* have been appearing in recent literature under the name *schultzei*, which has been considered its senior synonym.

31. ***Kurtomathrips*** Moulton 1927

The genus is being reported from India for the first time, being known so far from U.S.A., Mexico, Jamaica, and Hawaii.

41. ***Kurtomathrips morrilli*** Moulton 1927

This is undoubtedly an introduced species. It has now been found in India for the first time. It infests the common weed *Parthenium hysterophorus* L. Specimens were first found on the weed in Delhi University north campus in June 1996, where, subsequent to its discovery as a result of the interest aroused in it, large numbers of specimens were collected. Thereafter, in order to find its status in Delhi, collections were made from *Parthenium* growing in a widely separated locality, Janakpuri (in west Delhi,

ca. 15 km from Delhi University campus), where large breeding populations of the species were found. 86 adult females along with numerous larvae could be collected from a single small plant. At another location, Subhash Nagar, midway between the two, ca. 4 km from Janakpuri, in a large area populated with luxuriant growth of *Parthenium*, not even a single individual of *Kurtomathrips* could be collected even after concerted beating, although *Frankliniella sulphurea* was found on this plant as usual.

Collections of thrips were made from *Parthenium* in Delhi during the last couple of years, but *Kurtomathrips* was never found. It is therefore surprising that it has been found so well established now. It is possible that only small isolated populations did exist previously, but were not encountered. Dr. A.K. Bhatnagar of the Botany Department informs me that *Parthenium* was introduced into India from North America accidentally during the 1970s, presumably with shipments of wheat under PL480 programme. However, I have not been able to document this information. Although *Parthenium* has been found in Delhi for many years now, according to Umrao et al. (1983, p. 165) it is "a weed found in Poona". *P. hysterophorus* is known to be found on roadsides in Florida, Texas, Massachusetts, and Montana in U.S.A., naturalized from tropical America (Long & Laleka 1971 : 839).
All adult specimens collected in Delhi are females. These are as follows :

Delhi University campus : **17.vi.**1996 (1), 1 ♀ mac., 5 ♀ apt.; **17.vi.** (2), 2 ♀ macropterous , 19 ♀ apterous, immatures; **18.vi.** (1), 21 ♀ apt., 35 immatures; **18.vi.** (2), 2 ♀ mac., 3 ♀ apt., **18.vi.** (3), 27 ♀ apt., 20 immatures; **19.vi.**, 9 ♀ apt., 14 immatures; **20.vi.** (1), 2 ♀ apt.; **20.vi.** (2), 2 ♀ mac., 9 ♀ apt.; **21.vi.**1996, 1 ♀ mac., 34 ♀ apt. Several other lots have not been sorted and counted.
Janakpuri : **22.vi.**1996, from a single small plant: 5 ♀ mac., 86 ♀ apt., 52 L II, 1 L I. Specimens from several other lots collected from the same area have not been sorted and counted.

The macropterous morph in this genus is known to be extremely rare (Mound & Marullo 1996). The winged form in this genus is known only in the case of *morrilli* from Hawaii (Bianchi 1965) and one female macroptera is known from Arizona (Mound & Marullo 1996). In Hawaii, Bianchi collected 17 winged females, 4 of which were lost or destroyed in the process of mounting, and the 13 specimens left with him were collected on various occasions between 1954 and 1964, as follows : 1 ♀ m, iv.1954; 3 ♀ m, vi.1954; 1 ♀ m, vii.1954; 1 ♀ m, ii.1955; 2 ♀ m, ix.1955; 5 ♀ m, vii.1964. Bianchi apparently made the collections at irregular and sometimes very wide intervals of time. It seems from the collection data of the specimens from Delhi, as well as the data from Bianchi, that it is actually the ratio of macropterae to apterae that is very small. But the macropterae are really not so rare.

The collections in Delhi in 10 lots of the material over a span of just 6 days yielded 13 macropterae. The ratios of apterae to macropterae in these lots are: 86 : 5, 19 : 2, 9 : 2, 3 : 2, 5 : 1, 34 : 1; 2 : 0; 9 : 0; 21 : 0; 27 : 0. The mean ratio of macropterae : apterae is therefore less than 1 : 16. The ratio in the biggest lot (from Janakpuri) is more representative of the species.

That no males of the species have been found in Delhi, is another indication of the adventive nature of the species in India. However, the sex ratio in the species is not known, and the occurrence of male in U.S.A. has been mentioned only twice in literature, once by Bailey (1957 : 183) without indication of locality and then by Mound & Marullo (1996 : 164).

Hitherto *K. morrilli* is known from U.S.A. (Texas, Arizona, Nevada, California), Jamaica, and Hawaii (Mound & Marullo 1996 : 164). It has not been reported from *Parthenium* in U.S.A. But *Parthenium* is found in Arizona, which is also the type locality of *morrilli*, and where it was found causing serious damage to cotton. In California the species was found damaging *Chrysanthemum*. No apparent damage to *Parthenium* could be found in Delhi.

32. ***Megalurothrips*** Bagnall 1915
42. ***Megalurothrips peculiaris*** (Bagnall 1918)

The species was once collected in large numbers in flowers of *Erythrina indica*, but sporadically specimens have been found from other plants.

43. ***Megalurothrips usitatus*** (Bagnall 1913)

This is a common species on leguminous crops.

33. ***Microcephalothrips*** Bagnall 1926

Besides other characters, the genus is readily distinguished from *Thrips* and all related genera by the presence of several pairs of setae on the membranous basantra, which also has a pair of small weakly sclerotized plates in its anterior half (Bhatti 1990b : 241). This character has not been used by other workers, such as Nakahara (1994 : 12) in his key to the New World genera of Thripidae with ctenidia, nor by Mound & Marullo (1996 : 76, 165).

44. ***Microcephalothrips abdominalis*** (Crawford 1910)

The 'composite thrips' is abundant in flowers of *Tegetes erecta*. It is also common on *Parthenium* and other Asteraceae. However, no specimens were found on *Launaea* in numerous recent collections of *Tenothrips* on this plant.

34. ***Mycterothrips*** Trybom 1910
45. ***Mycterothrips ricini*** (Shumsher 1946)

This yellow species has been collected from Delhi only once, the original collection comprising one male and three females from *Ricinus communis*, based on which the species was described by Shumsher. His suggestion that the species is probably predator on eggs of whitefly (*Trialeurodes ricini*) is unsubstantiated and does not agree with the known phytophagous habits of its congeners. I have collected specimens from Himachal Pradesh, Madhya Pradesh, and Rajasthan. The location of Shumsher's types remains unknown to me, in spite of enquiries many years ago at the IARI.

35. ***Organothrips*** Hood 1940
46. ***Organothrips indicus*** Bhatti 1974

This beautiful little insect is the only *aquatic species* of Thysanoptera. It has been collected rarely. The holotype female is from Delhi. Subsequently it has been collected from Maharashtra, Bangladesh, and Thailand, and was earlier reported under the name *bianchii* from warmed aquaria on *Cryptocoryne* sp. in Munich and Hamburg (Titschack 1969). The respiration and underwater movement of the insect have been described by Titschack.

The biology of this species in Delhi is not known. The single specimen from Delhi was collected from herbage, obviously a stray specimen which had flown away from its habitat. But the location was close to a branch of the Najafgarh drain, which carries household waste and abounds in water hyacinth, *Eichhornia crassipes* (family Pontederiaceae). It is possible that the species lives on water hyacinth, since a small series of the species was once sent to me from Poona, collected on this plant.

The only other species in this genus, *bianchii* Hood, is semiaquatic, inhabiting wet taro (*Colocasia esculenta*) in Hawaii. The eggs, young, and adults are found only on stems of partially submerged wet taro, from water line to 3 or 4 inches above water, and often covered with a "sort of slime" which collects at the base of the stem. The thrips were not found in dry taro (not standing in water), or in taro growing in mud only recently covered with water (Hood 1940 : 427). It therefore appears that species of *Organothrips* have an obligatory requirement of aquatic environment and either breed in water (*indicus*) or just next to the water line in fully water-soaked condition of the substrate (*bianchii*) and often covered with slime.

36. ***Parexothrips*** Priesner 1965
47. ***Parexothrips tenellus*** (Priesner 1950)

This species has been collected once, in good numbers, in Delhi from grass clumps. It was originally described from Egypt.

37. ***Plutonothrips*** Priesner 1933
48. ***Plutonothrips cus*** (Bhatti 1967)

It is a monophagous species associated with the tender terminal leaves of banyan tree, *Ficus bengalensis*. It has been collected from several widely separated areas in India, always from the same host.

38. ***Priesneriola*** Ananthakrishnan 1964
49. ***Priesneriola oneillae*** Ananthakrishnan 1964

This is a common species found only during the post-monsoon season, on *Setaria glauca* which grows copiously after the monsoon and remains for several months thereafter. The males are extremely rare, one was collected ix–x.1966, and another ix.1995, in both cases among very numerous females.

39. ***Psilothrips*** Hood 1927
50. ***Psilothrips indicus*** Bhatti 1967

The species is known from the few original specimens collected from an unknown host in Badarpur, Delhi.

40. ***Ramaswamiahiella*** Karny 1927
51. ***Ramaswamiahiella subnudula*** Karny 1927

It is a polyphagous species, occasional specimens being found in collections, but large populations live on flowers of *Moringa oleifera*.

41. ***Rhamphothrips*** Karny 1913
52. ***Rhamphothrips jasminae*** (Bhatti 1977)

The species has been collected on *Jasminum officinale*. Only the original specimens are known.

53. ***Rhamphothrips parviceps*** (Hood 1919)

It is a widespread species living on *Ailanthus excelsa*. It undoubtedly lives on this plant in good numbers, since specimens have been occasionally found on plants growing nearby.

42. ***Salpingothrips*** Hood 1933
54. ***Salpingothrips hoodi*** Ananthakrishnan 1969

This species is rare in collections. Its true host plant is not known.

43. ***Scirtothrips*** Shull 1909
55. ***Scirtothrips dorsalis*** Hood 1919

A widely distributed species, it is common on leaves of *Ricinus communis*, and also lives on other host plants.

56. ***Scirtothrips oligochaetus*** (Karny 1927)

This is another widely distributed species, often occurring in association with *dorsalis*. I recently collected both sexes of the species on *Acacia* leaves, without any other associated thrips species.

57. ***Scirtothrips*** **sp.**

This is an undescribed species of *Scirtothrips* that has been known to me for many years, but still remains to be described.

44. ***Scolothrips*** Hinds 1902
58. ***Scolothrips asura*** Ramakrishna & Margabandhu 1931

It is a very rare and beautiful bicoloured species.

59. ***Scolothrips rhagebianus*** Priesner 1950

This is the common Indian species, known for a long time under the name *indicus*.

45. ***Sorghothrips*** Priesner 1936
60. ***Sorghothrips jonnaphilus*** (Ramakrishna 1928)

This species is associated with sorghum leaves in many parts of India, and can be collected from *Sorghum* brought from fields in Delhi to be used as fodder, July–Sept.

46. ***Stenchaetothrips*** Bagnall 1926
61. ***Stenchaetothrips biformis*** (Bagnall 1913)

It is the common 'rice thrips', sometimes found in grass (? rice) along bodies of water.

62. ***Stenchaetothrips faurei*** (Bhatti 1962)

This species appears to be monophagous, found on *Arundo donax*, which is a tall ornamental grass with thick stem. This bicoloured insect lives in the terminal rolled young leaves in good numbers.

63. ***Stenchaetothrips indicus*** (Ramakrishna & Margabandhu 1931)

This species is rare in collections, but has been collected from widely separated areas in India. In Delhi it has been collected twice, once on *Setaria* and once on another grass.

47. ***Tenothrips*** Bhatti 1967
64. ***Tenothrips alis*** (Bhatti 1967)

This species is common on the small yellow flowers of the weed *Launaea nudicaulis* Hook. f. (Asteraceae), growing around the campus in Delhi University. The host plant was found in May–June 1996, 30 years after the original specimens were collected. A single flower may contain as many as 10–26 adults. Incidentally this was the only species of thrips found on this plant in numerous recent collections.

48. ***Thrips*** Linnaeus 1758
65. ***Thrips apicatus*** Priesner 1934

It lives on the inflorescence of *Acacia leucophloea*, which is the only plant that can be considered its true host plant. It is found only during the flowering season of the host, Sept.–Oct. It is widespread in India.

66. ***Thrips flavus*** Schrank 1776

This species has been collected on many host plants in Delhi (Bhatti 1980 : 136), as well as in other parts of India.

67. ***Thrips hawaiiensis*** (Morgan 1913)

It is a highly polyphagous species which is likely to be found in almost any flowers. The females are dark brown and the males are completely yellow.

68. ***Thrips orientalis*** (Bagnall 1915)

This species lives in the flowers of the ornamental *Jasminum officinale*.

69. ***Thrips palmi*** Karny 1925

It is a widely distributed species found on many plants. Populations have been found on the cultivated ornamental *Malva sylvestrum* in Delhi. It is a pest species that has in recent years spread to Japan and Europe.

70. ***Thrips tabaci*** Lindemann 1889

The 'onion thrips' is found in large numbers on the flowers of onion, *Allium cepa*, where only females are found. The males are rare, and have been collected along with females only on host plants other than onion (Bhatti 1980 : 136).

49. ***Tusothrips*** Bhatti 1967
71. ***Tusothrips sumatrensis*** (Karny 1914)

This species is associated with *Malvastrum*, although specimens have been collected from other plants as well.

Order TUBULIFERA

The Tubulifera have the following plesiotypic features (Bhatti 1994): ovipositor of the *substitutional* type, a *chute ovipositor* attached at the posterior margin of sternum VIII; segment X in both sexes forms a uniformly sclerotized, complete *tube*; maxillary stylets in the adult not articulating with the stipes, the lever of the stylet articulating with a ventral cephalic apodeme, the *maxillary pillar*; insignificant or absent clypeolabral membrane; tentorium reduced to two small anterior tentorial arms, tentorial bridge absent; head with *genal fissure* (gf, Figs. 14, 15) in adults as well as larvae; a small ovoid prospinasternum; reduced prosternal apophyses; metanotum not divided into scutum and scutellum, and with a broad posterior *metanotal craspedum*; 1-segmented fore tarsi; all tarsi *ventrally* with an *outer apical incurved hamus* (Fig. 15); left and right wings at rest overlapping one another on the abdomen; wing surface glassy transparent, devoid of microtrichia; local surface pattern of wings *cellate-bossate* (Bhatti 1991), made of cellae reflected on the opposite surface by bossae; retinacular component of fore wing weakly developed, nonfunctional, hind wing base *lacking frenular bristle*; fore wing with only *a single lacunate* and *macrotrichiate longitudinal stem vein* (C+R), 2 long veins identifiable (R, Cu), although a single trachea is present in the wing during the pupal stage, this being withdrawn soon after emergence of the adult; venation largely alacunate and amacrotrichiate, except the stem vein C+R; only one cross vein present (r-cu), this greatly accentuated as the *median bulge* or hump (MB); *fluting of wing* at the veins recognizable in the plesiotypic condition; fringe hairs of the wing immovably *embedded* in the wing membrane, their bases traversing deep into the wing membrane; first abdominal tergum plesiotypically undivided (*apeltate*), but an autapomorphy exhibited by most tubuliferans is a division into 7 sclerites with a median pelta (peltate condition); *segment XI* modified into a complete annulus, a *semisclerotized ring* attached to the distal rim of the tubular 10th segment; setae of segment XI much longer than those of X; terga II to VIII each barely spanning the width of segment; *female sternum VIII with a broad posterior craspedum* forming the subgenital plate underlying the ovipositor, but essentially similar to the preceding sterna; *female sternum IX fully sclerotized*, comprising 2 ovoid *gynosternal plates* that are completely separated from each other; hypandrium distally with an *androsternal plate*; parameres short, *hypomere suppressed*; *sperm biflagellar*, with acrosome, without dynein arms and completely *nonmotile*; spermatophore not produced, the sperm transferred directly into the female spermathecal duct; egg without operculum; antennal segments III to VII of larvae without annulations and without microtrichia; antennal III of larvae not strongly constricted and thinned at base; during metamorphosis from larva to adult the cephalic musculature degenerates almost completely and then rebuilds; *3 pupal instars* (propupa I, propupa II, and pupa) in the life history.

The chute ovipositor and the androsternite are unique among insects. Adults of the order Tubulifera can be readily recognized by the tubular abdominal segment X, absence of gonapophysial ovipositor which is substituted by the chute ovipositor, the long setae on segment XI, the rudimentary prosternal apophyses, the maxillary stylets not articulating with the stipes, the glassy nonpubescent wing surface, the undivided metanotum provided with a craspedum, and the small, ovoid prospinasternum.
The Tubulifera are divided into 9 families (Bhatti 1992): Allidothripidae, Allothripidae, Andrethripidae, Hyidiothripidae, Lonchothripidae, Murphythripidae, Phlaeothripidae, Urothripidae, and Xaniothripidae. However, conservative viewpoint (Mound & Marullo 1996) accepts only a single family.

Family UROTHRIPIDAE

The Urothripidae are *apeltate* Tubulifera, the abdominal tergum I forming a single, undivided transverse sclerite. The tube or 10th abdominal segment has 4 to 6 long terminal setae, the longest of which are 2.5 to 4 times the length of tube, major postocular setae are absent, and the abdominal *tergum*

IX lacks long setae and is *more than twice as long as tergum VIII.* The prothorax lacks notopleural sutures. It includes mostly apterous species characteristic of leaf litter habitat.

50. ***Baenothrips*** Crawford 1948
72. ***Baenothrips indicus*** (Ananthakrishnan 1966)

A few specimens were collected from herbage, 27.x.1971, in Delhi. The known habitats of the species are dry grass and dry twigs (Ananthakrishnan 1973 : 73).

Family ALLOTHRIPIDAE

The Allothripidae is a *peltate* family, with a median pelta differentiated on abdominal tergum I. The maxillary and labial palps are 3-segmented, with *styliform terminal segment.* The prospinasternum is usually degenerate.

51. ***Allothrips*** Hood 1908
73. ***Allothrips* sp.**

Several specimens, all apterous, were collected in Delhi from leaf litter through a Berlese funnel. These have yet to be determined. One fully winged specimen was collected near the window on the first floor at a height of about 25 feet from ground, indicating the flight capability of the winged form. The winged forms in *Allothrips* are very uncommon, and those that have been reported in literature possess broken wings; the wings in this genus have never been described in literature. However the Delhi specimen has fully intact wings.

Family PHLAEOTHRIPIDAE

It is one of the *peltate* families of Tubulifera, where the abdominal tergum I is divided into 7 plates (Fig. 17), the median of which is the pelta. The abdominal sterna have only 3 pairs of posterior marginal setae. The wings are narrow to slender, and the fringe hairs are much longer than the width of wing. The hind femora are slender, and the abdominal segment IX is not longer than VIII. The major body setae are simple. The prothoracic notopleural sutures are present, diverging anteriorly. The maxillary and labial palps are 2-segmented. The prospinasternum is well developed.

The currently used classification of this family into the subfamilies Idolothripinae and Phlaeothripinae is phylogenetically unacceptable (Bhatti 1994). However, the names idolothripine and phlaeothripine may be used for taxonomic convenience. An early offshoot from the stem species of Phlaeothripidae would be Adurothripinae (Bhatti 1995), which could be considered sister group of Phlaeothripinae, including the rest of the Phlaeothripidae.

52. ***Alerothrips*** Bhatti 1995
74. ***Alerothrips indicus*** (Ananthakrishnan 1964)

The species lives on the prop roots of banyan tree, *Ficus bengalensis.*

53. ***Ananthakrishnana*** Bhatti 1967
75. ***Ananthakrishnana euphorbiae*** (Priesner 1931)

A monophagous species living on the common weed *Euphorbia hirta.*

54. *Apterygothrips* Priesner 1933
76. *Apterygothrips banyan* n. sp. (Figs. 11–17)

Female (apterous). Body bicoloured; head, prothorax, and distal 2/3 of tube dark brown, rest of the body yellow, except the brown mesonotum. Legs yellow. Antennal segments I to IV yellow; V to VIII dark brown, V paler at base. All setae hyaline, unshaded, except those on tube which are slightly shaded.

Head (Fig. 15) longer than broad, about 1.3 times as long as broad; surface unsculptured. Ocelli absent. Postocular seta expanded at apex (*capitate*), but *not fringed*, 34 µm long. Head longer than pronotum, L up to eyes 162 µm, total (median) length 179 µm; W at cheeks 126 µm. Maxillary bridge 31 (30–38) µm broad; 0.23–0.29 (mean 0.267) times the width of head (121–130 µm) in 5 females with shape of head not affected by coverslip pressure; compare with ♂ (Fig. 14).

Antenna (Figs. 11, 12) 8-segmented; length (and width) of segments: I 34 (32), II 42 (28), III 36 (23), IV 46 (28), V 38–41 (23), VI 38 (21), VII 39–40 (19), VIII 27 (11) µm. A moderately developed *basal shelf on segment III*. Sense cones : III 0—0, IV 2—2, V 1—1 (+ 1 dorsal), VI 1—1 (+ 1 dorsal), VII 1 dorsal, VIII 1 dorsal. The setae on antennal segments are as follows (for abbreviations used, see Bhatti 1986) :

I : 11 setae : 2*da* + 2*dm* + 1*m* + 2*vm* + 2*va* + 1*oa* + 1*op*.
II : 12 setae : 4*d* + 2*m* + 2*v* +1*va* + 2*o* + 1*mp*.
III : 10–11 setae : 3*da* + 4*va* (= 7 setae around apex; 2 of these *vatr*) + 3 to 4 at middle (1*d*+1 or 2*m*+1*o*).
IV : 12 setae : 3*da* + 3*va* (= 6 setae around apex; 2 of these *vatr*) + 6 at middle (4*d* + 2*v*).
V : 10 setae : 4*da* + 2*vatr* (= 6 setae around apex; 2 of these *vatr*) + 4 at middle (2*d* + 2*v*).
VI : 11 setae : 5*da* + 2*vatr* (= 7 setae around apex; 2 of these *vatr*) + 4 at middle (2*d* + 2*v*).
VII : 10 setae; including 3 distal setae ventrally forming a triangle.
VIII : 14 setae : 4*dlr* + 6*vlr* + 2*m* +2*o*.

Pronotum L 137 µm; surface unsculptured; *am* vestigial; other dorsal setae *capitate*, but not fringed at apex; *aa* 27–30, *ml* 30, *pa* 27–30, *ep* 35–37, *cx* 31 µm long. Notopleural sutures complete. Basantral plates (b, Fig. 16) transversely *reticulate*, except posteriorly. Fernal plates trapezoidal, very wide apart. Spinasternum transverse, broadest at middle, tapering laterally. *Preepisternum undivided.* Mesonotum transversely reticulate in anterior half, smooth in posterior half; *lateral seta capitate*, 21–23 µm long. Metanotum unsculptured; with a pair of *median pointed setae*, 15–27 µm long.

Mesopresternum (mpr, Fig. 13) very narrow at middle; anterior part largely membranized. Lateral mesosternal seta pointed, 66 µm long. Metasternum lacking sternopleural sutures.
Mesothoracic spiracle extending down almost to infrapreepisternum.

Fore tarsus with a sharp tooth at apex. Fore femur W 69 µm.

Wings completely lacking.

Pelta (p, Fig. 17) somewhat D-shaped; reticulate in anterior half.

Terga I and II each with one long, capitate, posterior lateral seta on either side.

Terga III to VI each with 2 long, capitate, posterior lateral setae; the inner longer than the outer, except on VI where the two may be subequal on one side.

Tergum VII with outer posterior lateral seta long and pointed, 103–105 µm long; the inner seta *capitate*, 46 µm long.

Tergum VIII with both posterior lateral setae capitate; outer 61, inner 44–48 µm long.

Setae on segment IX : S1 *capitate*, 63–65; S2 and S3 *pointed*, S2, 124–133; S3, 130–135 µm long. Anal setae 1.4–1.75 times as long as tube; S1, 156–164; S2, 190; S3, 190–200 µm long. Length of tergum VIII 93; IX 72 µm. Tube 114 µm long; 0.7 times as long as head. Gynosternal plate with 2 setae, a longer inner and shorter outer seta.

Total body length (distended) 1939 µm.

Male (apterous). Colour and structure similar to female.

Maxillary bridge (Fig. 14) relatively wider (37–39 µm) proportionate to the width of head; 0.33–0.34 times the width of head (112–114 µm); compare with ♀ (Fig. 15). Setae on abdominal tergum IX : S1 capitate, 51–57 µm long; S2 pointed, 25 µm; S3 pointed, 152 µm long. Pseudovirga (Fig. 13) nearly parallel-sided, but very slightly broadened in distal half, then narrowing to the pointed apex.

Total body length 1515 µm.

Holotype ♀, Delhi: from hanging prop roots of banyan tree, *Ficus bengalensis*, 14.iii.1988, leg. J.S. Bhatti. Paratypes 6 ♀ 2 ♂, with the same data. The species has been collected many times from the same habitat.

The new species shows interesting sexual dimorphism in the width of maxillary bridge. In the female (Fig. 15) it is 0.23–0.29 times (mean 0.267) the width of head, whereas in the male (Fig. 14) it is relatively broader, 0.33–0.34 times the width of head. The actual width in the female also seems to be slightly less, being 30–38 µm (mean 34), compared to 37–39 µm in male. A similar, but much more pronounced sexual dimorphism is known in another haplothripine genus *Ananthakrishnana* (Bhatti 1979b : 309), in which the female has a short maxillary bridge with the maxillary stylets close together in the head, whereas the male has a much broader maxillary bridge with the stylets farther apart from each other. Besides *Ananthakrishnana* and *Apterygothrips banyan*, such a sexual dimorphism has not been reported so far in any species of *Haplothrips* and related genera.

Apt. banyan can be compared only with *jogensis* (Ananthakrishnan & Jagadish 1969) because of the absence of sense cones on antennal segment III and 4 sense cones on antennal IV. However, *jogensis* is at once distinguished by the following characters : body brown with brown legs; seta S1 on abdominal tergum IX pointed or blunt; antennal IV with 2—2 (+ 1) sense cones (the additional minor sense cone lacking in *banyan*). Moreover, the figure of head given by Pitkin (1976) (his fig. 12 on p. 238) shows the presence of 2 ocelli on head, and very narrow maxillary bridge (only 0.15 times as broad as the width of head). Pitkin's fig. 23 of the antenna of *jogensis* shows well developed dorsal apical sense cone on V and VI and relatively stout sense cones on IV. In *banyan* the dorsal sense cone on V and VI is very short, and the sense cones on IV are very slender. Pitkin's figure does not show the structure of the base of antennal III, whereas the original description of the species does not have any illustration or description of this antennal segment. Other characters for comparison are not known for *jogensis*.

55. ***Ataliothrips*** Bhatti 1995

77. ***Ataliothrips reuteri*** (Bagnall 1913)

Found on the leaves of *Tamarix aphylla*, it seems to be monophagous.

56. ***Azaleothrips*** Ananthakrishnan 1964

78. ***Azaleothrips aspersus*** Bhatti 1995

This species is being reported from Delhi for the first time, taken on *Thevetia* branches, 4.v.1991. It was described from Bombay from prop roots of banyan, *Ficus bengalensis*.

57. ***Dolichothrips*** Karny 1912
79. ***Dolichothrips citripes*** (Bagnall 1921)

It lives exclusively on the common weed *Abutilon indicum*, where it is found on the leaves, flowers, and fruit.

58. ***Haplothrips*** Amyot & Serville 1843
80. ***Haplothrips clarisetis*** Priesner 1930

It is an uncommon species in Delhi, found on *Chenopodium* inflorescence.

81. ***Haplothrips mangiferae*** Priesner 1933

A highly polyphagous species, it is found on the flowers of many plants in Delhi, including *Parthenium*. Reports of *tenuipennis* from Delhi should be referred to this species (Bhatti 1995 : 105).

82. ***Haplothrips pirus*** Bhatti 1967

The species lives as an inquiline in dipteran leaf mines on jaman, *Syzygium cuminii*. It has been collected in Delhi along with *Mallothrips indicus*.

59. ***Idiothrips*** Faure 1933
83. ***Idiothrips ficus*** Bhatti 1967

This widespread species has been collected in Delhi from twigs of the hedge of *Lantana camara*.

60. ***Liothrips*** Uzel 1895
84. ***Liothrips interlocatus*** Uzel 1895

It lives on *Terminalia* leaves.

61. ***Mallothrips*** Ramakrishna 1928
85. ***Mallothrips indicus*** Ramakrishna 1928

It lives on the leaves of *Syzygium cuminii* as an inquiline in dipterous leaf mines, contrary to Ananthakrishnan & Sen (1980 : 159) who state that it lives in leaf galls.

62. ***Margaritothrips*** Priesner 1933
86. ***Margaritothrips longus*** Bhatti 1967

The species is known from a single female from herbage in Delhi.

63. ***Paramystrothrips*** Bournier 1971
87. ***Paramystrothrips moundi*** Bhatti 1995

Another interesting species, based on a unique female from Delhi. It is an unusual tubuliferan species, with two brownish cross bands on the wings.

64. ***Podothrips*** Hood 1913
88. ***Podothrips canizoi*** Bhatti 1978

It lives in grass clumps, and with favourable season, multiplies in good numbers.

65. ***Stictothrips*** Hood 1924
89. ***Stictothrips fimbriata*** (Ananthakrishnan 1953)

This is an uncommon species, found on dry twigs.

66. ***Thilakothrips*** Ramakrishna 1928
90. ***Thilakothrips babuli*** Ramakrishna 1928

It lives on *Acacia leucophloea*, on which it is stated to produce galls.

67. ***Xylaplothrips*** Priesner 1928
91. ***Xylaplothrips flavitibia*** Ananthakrishnan & Jagadish 1969

It has been collected on *Terminalia* leaves in Delhi, although Ananthakrishnan & Sen (1980 : 166) give plant galls as the habitat.

REFERENCES

Ananthakrishnan, T.N. 1973. Mycophagous Tubulifera of India. *Occasional Publication of Entomology Research Unit*, No. 2 : 144 pp. Loyola College: Madras.

Ananthakrishnan, T.N. and Sen, S. 1980. Taxonomy of Indian Thysanoptera. *Zoological Survey of India Handbook Series*, No. 1 : 234 pp. Zoological Survey of India: Calcutta.

Bailey, S.F. 1957. Thrips of California. Part I : Suborder Terebrantia. *Bulletin of the California Insect Survey*, 4 (5) : 143–220. University of California Press: Berkeley and Los Angeles.

Bhatti, J.S. 1967. New Indian Thysanoptera I. A new genus and two species belonging to the tribe Sericothripini (Family Thripidae). *Bulletin of Entomology*, 8 (1) : 58–63. Delhi.

Bhatti, J.S. 1979a. A revised classification of Thysanoptera. *Workshop on Advances in Insect Taxonomy in India and the Orient, Manali (H.P.), October 9–12, 1979*, pp. 46–48. Delhi.

Bhatti, J.S. 1979b. Studies in some haplothripine forms. (Insecta: Thysanoptera: Phlaeothripidae). *Nouvelle Revue de Entomologie*, 9 (4) : 305–311.

Bhatti, J.S. 1980. Species of the genus *Thrips* from India. *Systematic Entomology*, 5 : 106–166. London.

Bhatti, J.S. 1986. The importance of antennal chaetotaxy in tubuliferan taxonomy, illustrated by *Eugynothrips conocephali* (Karny) (Insecta: Tubulifera: Phlaeothripidae). *Zoology*, 1 (1) : 39–53. Delhi.

Bhatti, J.S. 1988. The Orders Terebrantia and Tubulifera of the Superorder Thysanoptera (Insecta). A critical appraisal. *Zoology*, 1 (2) : 167–240. Delhi.

Bhatti, J.S. 1989. The classification of Thysanoptera into families. *Zoology*, 2 (1) : 1–23. Delhi.

Bhatti, J.S. 1990a. Family group names in the Order Terebrantia (Insecta). *Zoology*, 2 (4) : 185–192. Delhi.

Bhatti, J.S. 1990b. Catalogue of insects of the Order Terebrantia from the Indian subregion. *Zoology*, 2 (4) : 205–352. Delhi.

Bhatti, J.S. 1991. Surface patterns of wings in the Order Tubulifera (Insecta). New structural features and a new simple technique for microscopic surface scanning of the transparent wing membrane. *Zoology*, 3 (1) : 1–95. Delhi.

Bhatti, J.S. 1992. The Order Tubulifera (Insecta) : Its characters and classification. *Zoology*, 3 (2) : 127–162. Delhi.

Bhatti, J.S. 1994. Phylogenetic relationships among Thysanoptera (Insecta) with particular reference to the families of the Order Tubulifera. *Zoology*, 4 : 93–130. Delhi.

Bhatti, J.S. 1995. Studies on some Phlaeothripidae (Insecta : Tubulifera). *Zoology*, 5 (1) : 97–110. Delhi.

Bianchi, F.A. 1965. *Kurtomathrips morrilli* has wings in Hawaii. *Proceedings of the Hawaiian Entomological Society*, 19 (1) : 69–71.

Kristensen, N.P. 1992. Phylogeny of Hexapod orders. Pp. 125–140. *In* : CSIRO (ed.), *The Insects of Australia*. Vol. 1. 560 pp. Melbourne University Press: Carlton.

Hartwig, E.K. 1952. Taxonomic studies of South African Thysanoptera, including genitalia, statistics and a revision of Trybom's types. *Department of Agriculture Union of South Africa, Entomology Memoirs*, 2 (11) : 339–499. Pretoria.

Heming, B.S. 1969. A modified technique for mounting Thysanoptera in canada balsam. *Entomological News*, 80 : 323–328.

Hood, J.D. 1940. *Organothrips bianchii*, a new Hawaiian thrips from taro. *Proceedings of the Hawaiian Entomological Society*, 10 (3) : 423–427.

Kudô, I. 1984. The Japanese Dendrothripini with descriptions of four new species (Thysanoptera : Thripidae). *Kontyû*, 52 (4) : 487–505. Tokyo.

Lewis, T. 1973. *Thrips, their Biology, Ecology and Economic Importance*. xv + 349 pp. Academic Press : London & New York.

Long, R.W. and Laleka, O. 1971. *A Flora of Tropical Florida.* 962 pp. University of Miami Press: Coral Gables (Florida).

Mound, L.A. 1976. Thysanoptera of the genus *Dichromothrips* of the Old World Orchidaceae. *Zoological Journal of the Linnean Society*, 8 (3) : 245–265. London.

Mound, L.A., Heming, B.S., and Palmer, J.M. 1980. Phylogenetic relationships between the families of recent Thysanoptera (Insecta). *Zoological Journal of the Linnean Society*, 69 (2) : 111–141. London.

Mound, L.A. and Marullo, R. 1996. The Thrips of Central and South America: An Introduction (Insecta: Thysanoptera). *Memoirs on Entomology, International*, 6 : 1–487. Associated Publishers: Gainesville (Florida).

Mound, L.A. and Pitkin, B.R. 1972. Microscopic whole mounts of thrips (Thysanoptera). *Entomologist's Gazette*, 23 : 121–125. London.

Mound, L.A. and Walker, A.K. 1982. Terebrantia (Insecta : Thysanoptera). *Fauna of New Zealand*, No. 10 : 1–140. Science Information Publishing Centre, DSIR Wellington.

Nakahara, S. 1994. The genus *Thrips* Linnaeus (Thysanoptera : Thripidae) of the New World. *U.S. Department of Agriculture, Technical Bulletin* (1993), No. 1822 : 183 pp. Washington, D.C.

Palmer, J.M. and Mound, L.A. 1990. Thysanoptera. Pp. 67–76, 241–242. *In* : Rosen, D. (editor), *The Armoured Scale Insects : Their Biology, Natural Enemies and Control.* Vol. B. Elsevier Science Publishers : Amsterdam.

Pitkin, B.R. 1976. A revision of the Indian species of *Haplothrips* and related genera (Thysanoptera : Phlaeothripidae). *Bulletin of the British Museum (Natural History), Entomology*, 34 (4) : 223–280. London.

Priesner, H. 1964. Ordnung Thysanoptera (Fransenflügler). *Bestimmungsbücher zur Bodenfauna Europas*, 2 : 1–242. Akademie-Verlag : Berlin.

Priesner, H. 1965. A monograph of the Thysanoptera of the Egyptian deserts. *Publications de l'Institut du Désert d'Egypte* (1960), No. 13, 549 pp. Heliopolis, Cairo.

Schliephake, G. and Klimt, K. 1979. Thysanoptera (Fransenflügler). *Die Tierwelt Deutschlands*, Part 66, 477 pp. Gustav Fischer Verlag : Jena.

Stannard, L.J. 1968. The Thrips, or Thysanoptera, of Illinois. *Illinois Natural History Survey Bulletin*, 29 (4) : 215–552. University of Illinois Press : Urbana.

Titschack, E. 1969. Der Tarothrips, ein neues Schadinsekt in Deutschland. Anzeiger für Schädlingskunde und Pflanzenschutz, 42 (1) : 1–6. [The taro thrips, a new injurious insect in Germany].

Umrao Singh, Wadhwani, A.M., and Johri, B.N. 1983. *Dictionary of Economic Plants in India.* 288 pp. ICAR: New Delhi.

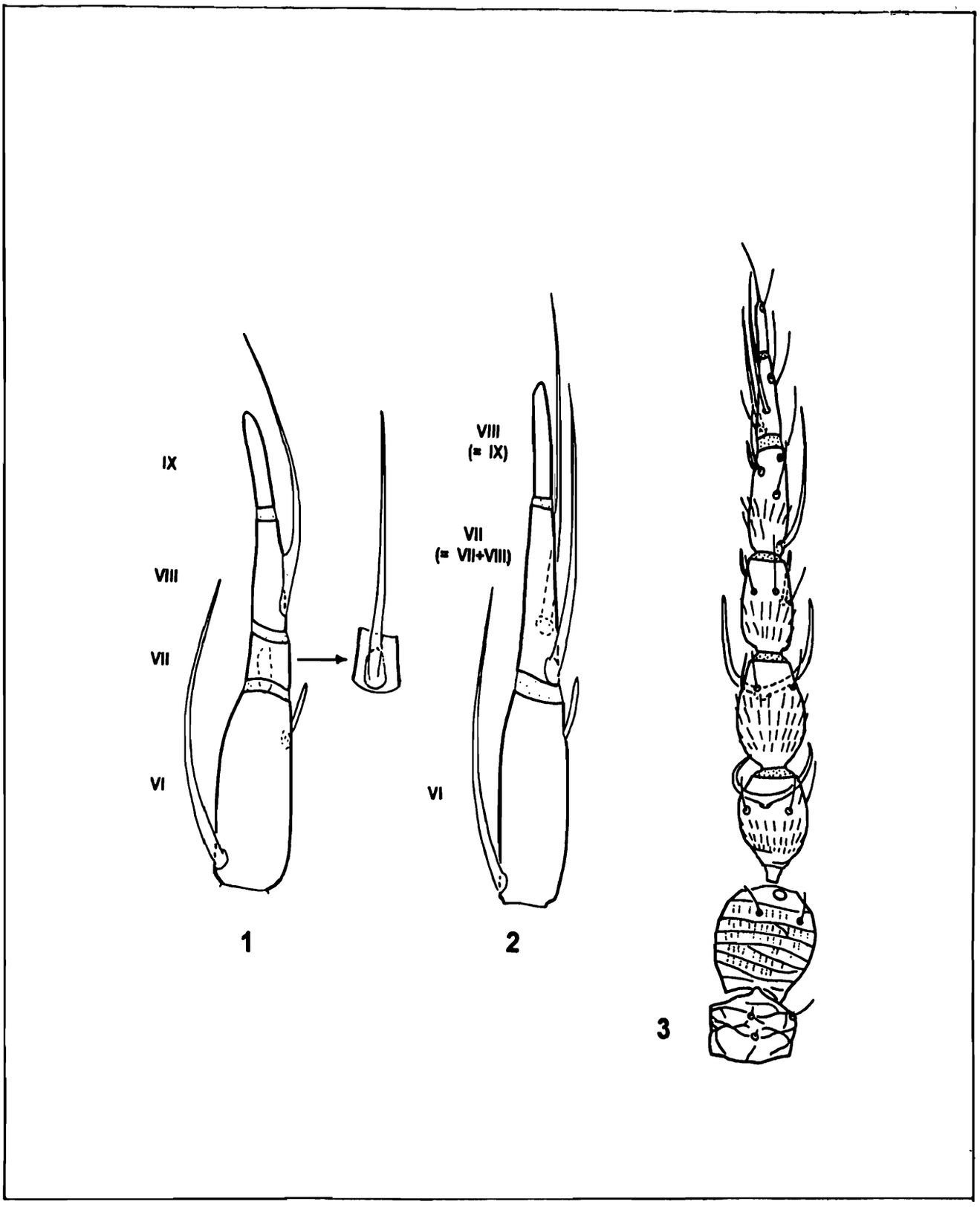


Fig. 1. *Pseudodendrothrips albana*, ♀, antennal segments VI–IX, dorsal, showing the sense cones. Ventral aspect of VII is shown by the arrow. Note the elongate sense cone on VII and VIII.

Figs. 2–3. *P. suvarna*, ♀. 2. Antennal segments VI–VIII, showing the sense cones. Note the round base of sense cones on VII (= VII + VIII). 3. Antenna, dorsal.

Setae and microtrichia omitted in Figs. 1 and 2.

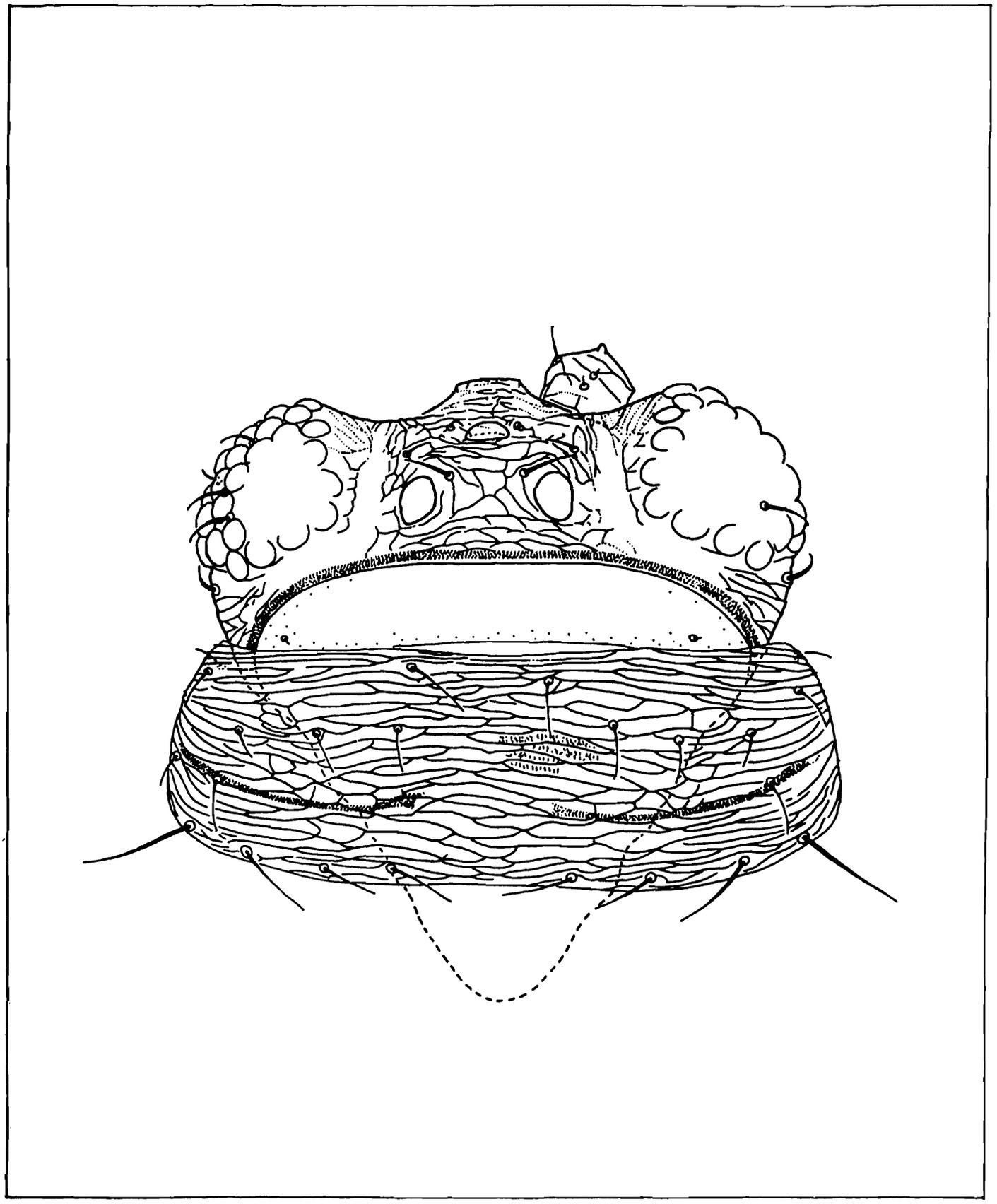
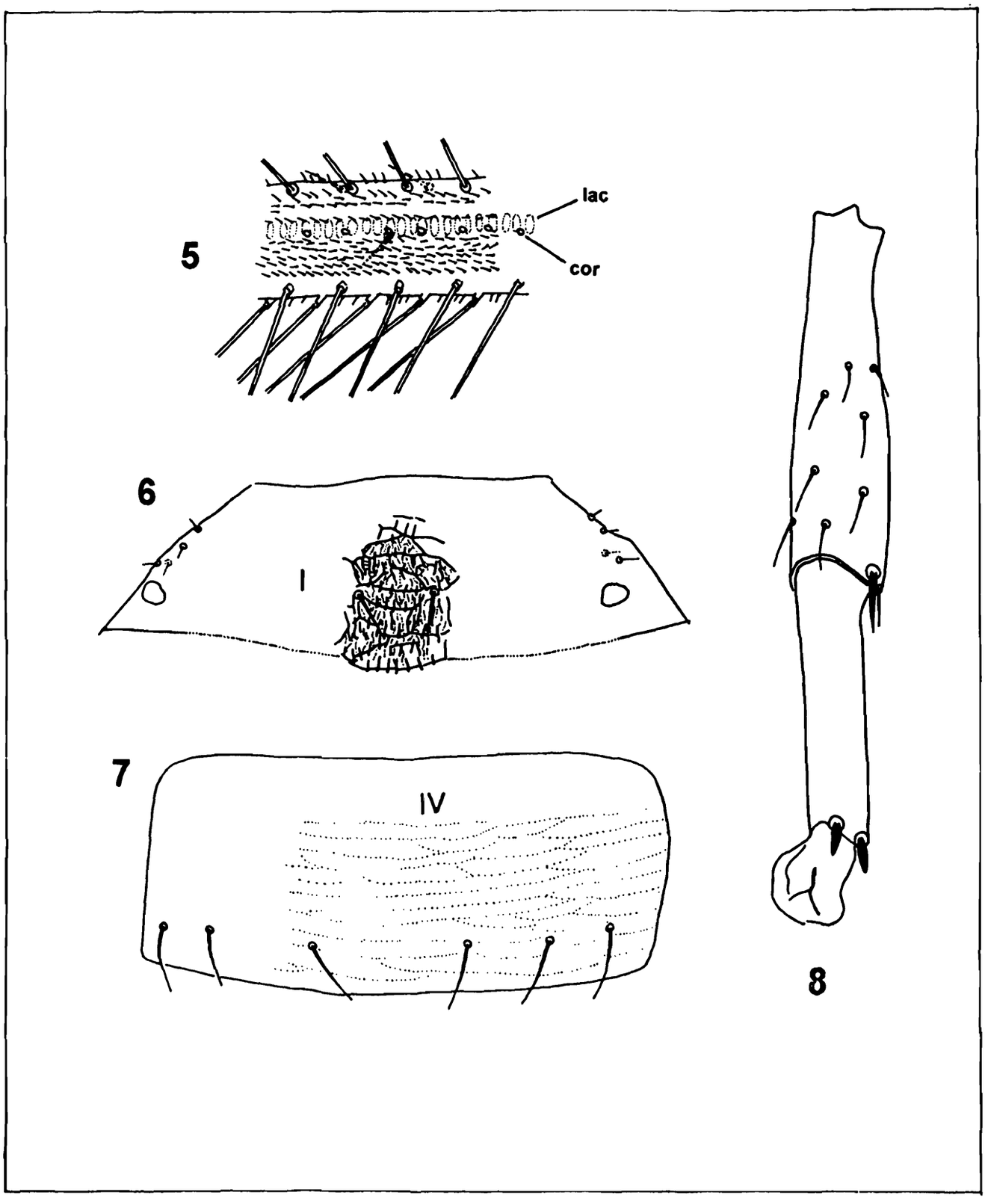
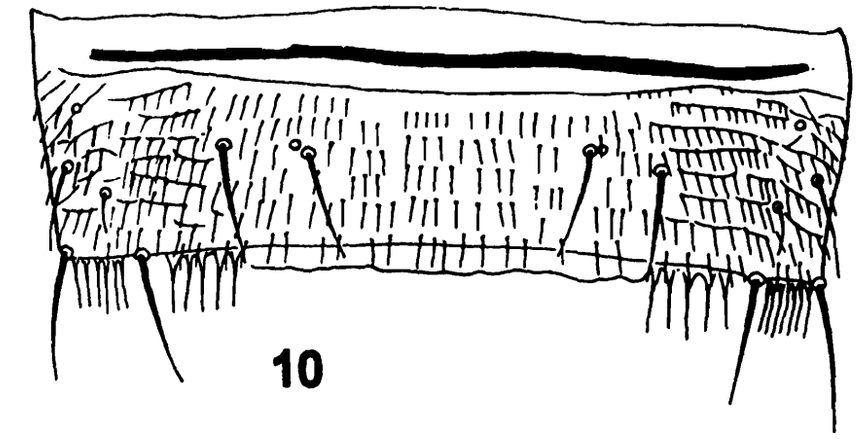


Fig. 4. *Pseudodendrothrips suvarna*, ♀. Head and pronotum.



Figs. 5–8. *Pseudodendrothrips suvarna*, ♀. 5. Ventral view of part of fore wing at about the middle. Note the ventral roundish dot-like corpusculae (cor) running through the middle of the wing and the series of lacunae (lac) in the wing membrane. 6. Abdominal tergum I. 7. Abdominal sternum IV. 8. Part of hind leg, ventral. Note the long tarsus.



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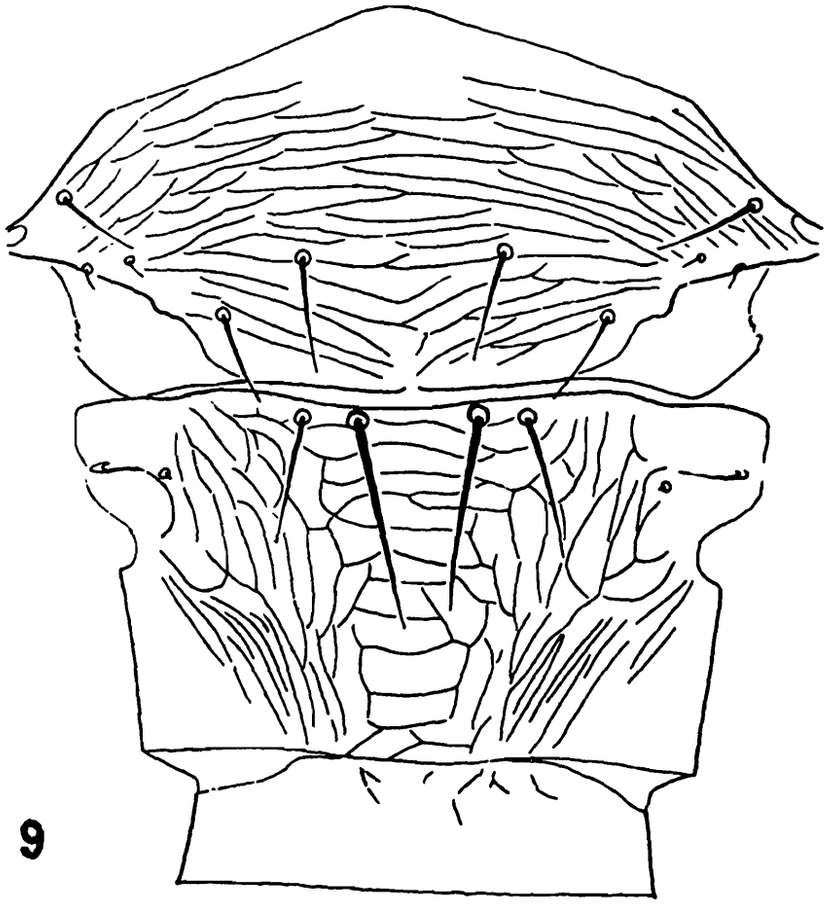

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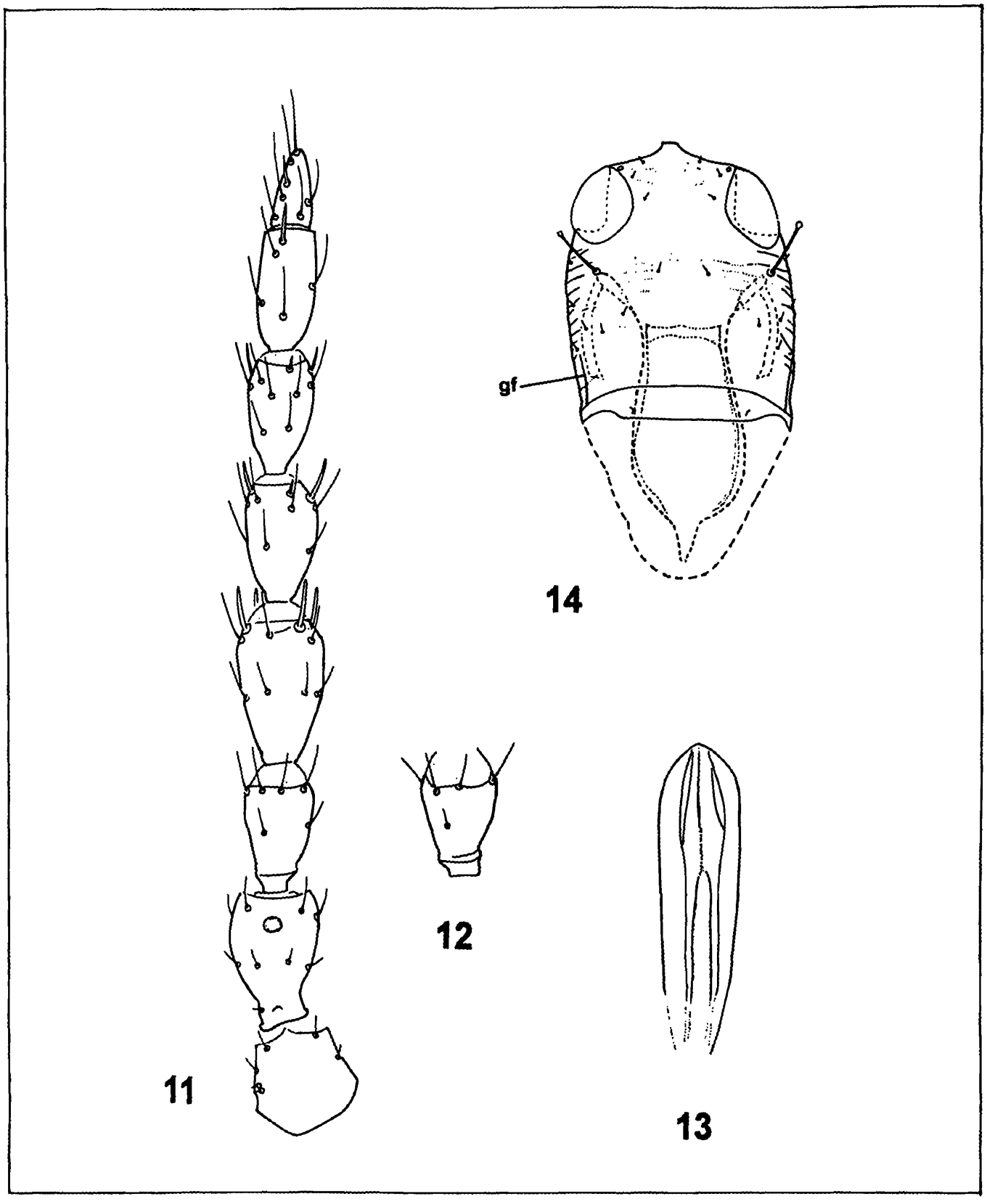
Figs. 9–10. *Ajothrips medius*, ♀. 9. Meso- and metanotum. 10. Abdominal tergum VII.



Figs. 11–14. *Apterygothrips banyan*. **11**. Antenna, dorsal, ♀. **12**. Right antenna, in outer lateral view, ♀.

13. Pseudovirga. **14**. Head, dorsal, ♂. **gf** genal fissure.

Compared to fig. 15 of ♀, the maxillary bridge is broader in proportion to the width of head at cheeks.

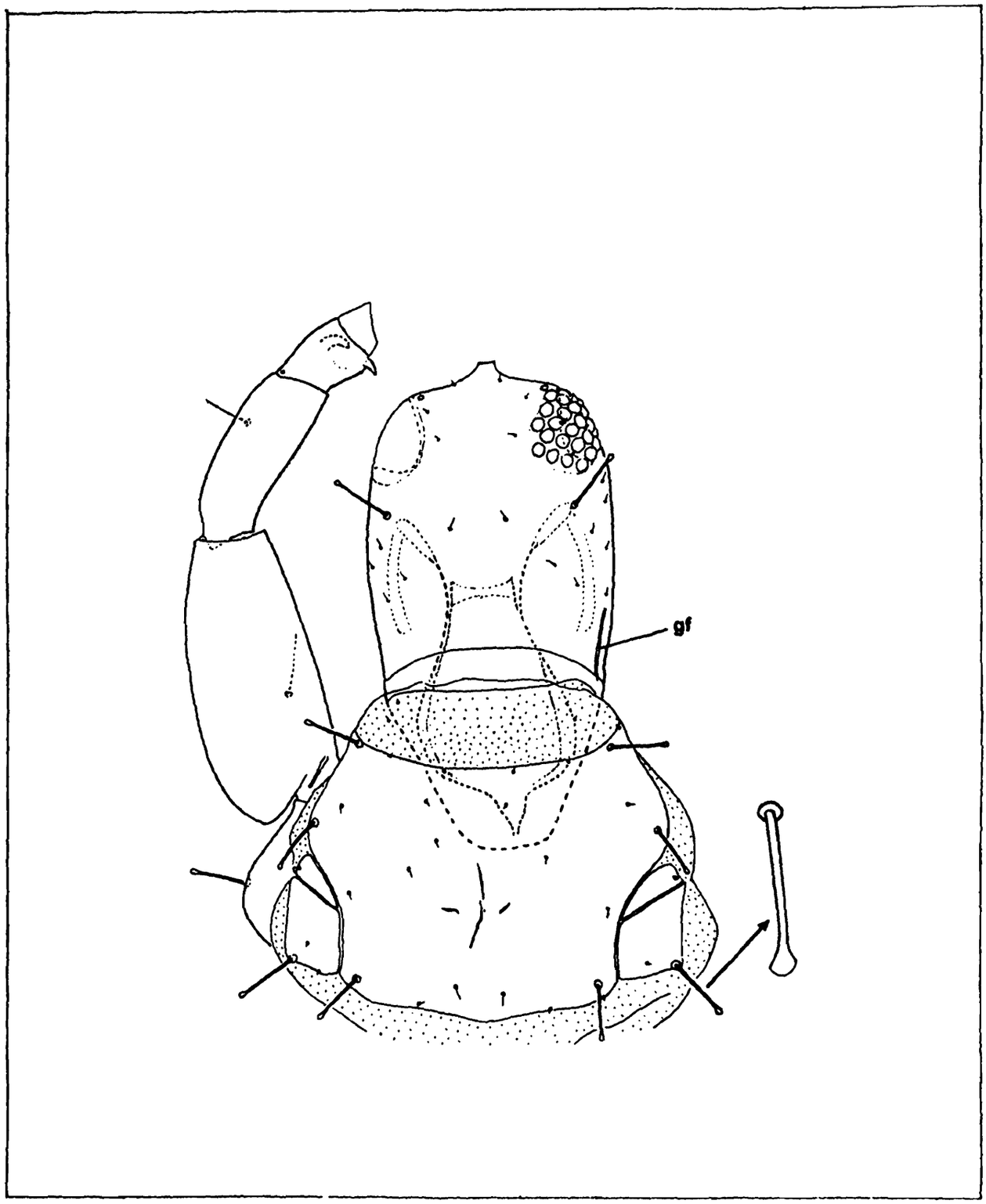
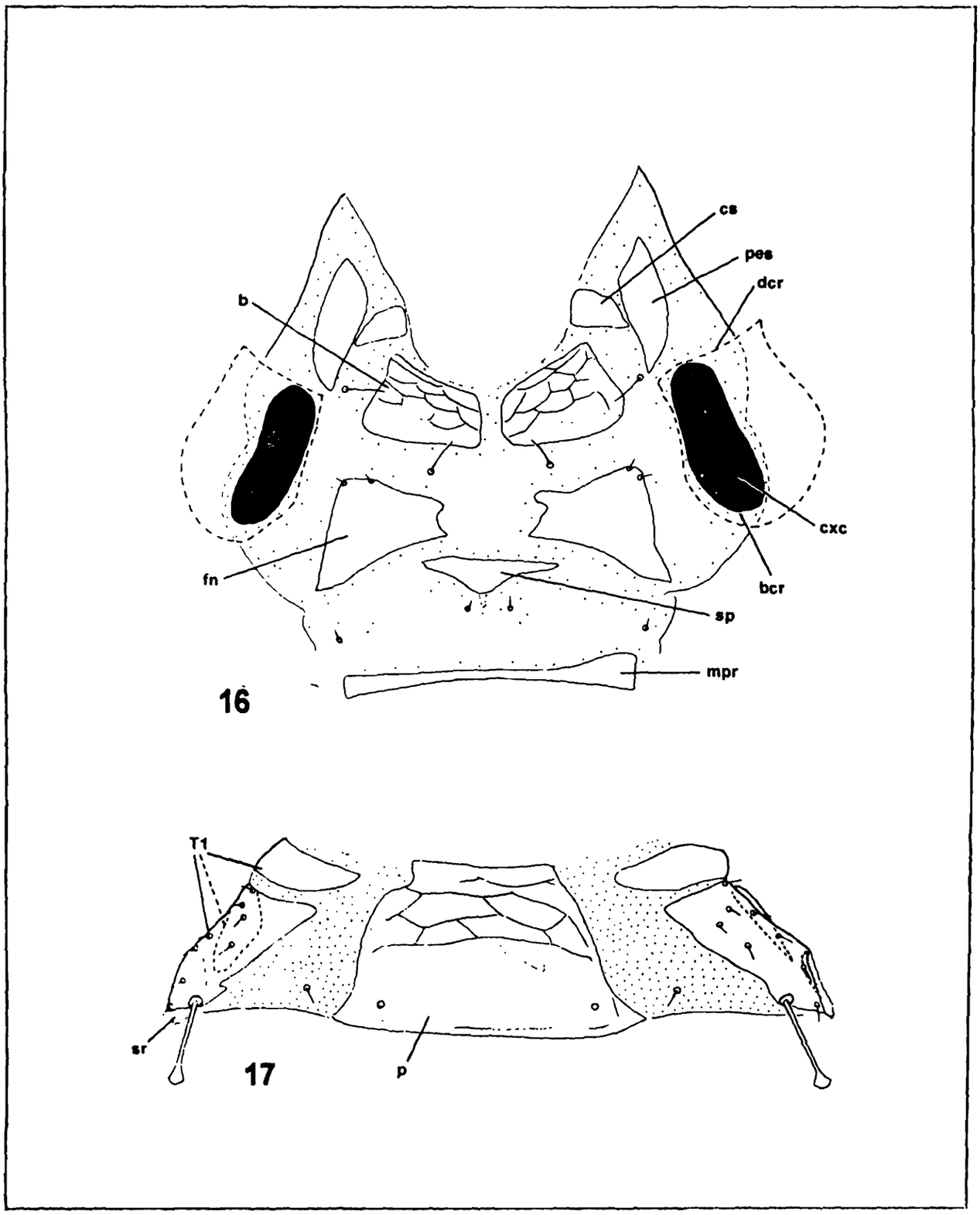


Fig. 15. *Apterygothrips banyan*, head and prothorax, dorsal, ♀. gf genal fissure.
The head and prothorax are very slightly tilted to the left.

Compared to fig. 14 of ♂, the maxillary bridge is narrower in proportion to the width of head at cheeks. Note the inwardly directed ventral hamus of fore tarsus, shown in dotted line (cf. characters of Tubulifera).



Figs. 16–17. *Apterygothrips banyan*, ♀.

16. Prothorax, ventral.
    b basantra; **bcr** basicoxal rim; **cs** cervical sclerite; **cxc** coxal cavity; **dcr** disticoxal rim; **fn** ferna; **mpr** mesopresternum; **pes** preepisternum; **sp** spinasternum.
17. Abdominal tergum I.
    p pelta; **sr** spiracle; **T1** lateral plates of tergum I.

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COLEOPTERA

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INTRODUCTION

Coleoptera, commonly known as beetle, is the largest group among the comparable taxa of the entire animal kingdom. They are enormous in numbers of both individuals and species and exhibits tremendous variations in size, form, structure, habitat, food and behaviour. These insects play a very important role in different ecosystems as well as in our national economy as some of these insects are extremely injurious to our agricultural crops, horticultural, floricultural and forests trees. Some of the species are serious pests of stored grains and stored products of both animal and plant origin. A group of species are also predators to various injurious insects.

Earlier informations on Coleopteran insects of Delhi is very little. Recently Arora (1977) and Pajni (1990) have published their monographic works on Indian Bruchidae and Curulionidae (in part) but only 5 species of Bruchidae* were reported from Delhi and not a single species of Curulionidae has been reported. Vats (1992 onwards), has contributed extensively to our knowledge of Elateridae of northern India, but no species has been recorded specifically from Delhi.

The present account of Coleoperan fauna of Delhi is based on the material collected by the Northern Regional Station. Dehra Dun over two years (1993-95) from different localities. Altogether 49 species belonging to 41 genera under 13 families have been studied.

Information regarding diversity, habitat, economic importance and general characteristic of the families included, have been given besides keys to the families, genera and species. Collection data on materials studied have been incoroprated. Distributional data of the species has been given from the published records as well as actual study of the specimens. First reference and recent valid names of each genus and species have been given.

**Note* : Five species of Bruchidae, namely (1) *Caryedon longuilus* Gyll., (2) *C. prosopides* Arora, (3) *C. serratus* (Ob), (4) *Callosobruchus cajanus* Arora and *Callosobruchus theofornae* (L.) recorded by Arora (1977) have not been included here as no material was studied.

SYSTEMATIC ACCOUNT

Family I : CARABIDAE

1. ***Pheropsophus*** Solier
1. *catoirei* Dejean
2. *hilaris* Fabricius
2. ***Chalaenius*** Bonelli
3. *pulcher* Niet.
4. *pretiosus* Chaudoi
3. ***Macrocheilus*** Hope
5. *impictus* Wied.
4. ***Trigonotoma*** Dejean
6. *indica* Brull

Family II : PAUSSIDAE

5. ***Platyrhopalus*** Westwood
6. *denticornis* (Donovan)

Family III : DYTISCIDAE

6. ***Hyphoporus*** Sharp
8. *elevatus* Sharp
7. ***Rhantus*** Stephens
9. *taprobanicus* Sharp
8. ***Eretes*** Castalnau
10. *sticticus* (Linnaeus)
9. ***Hydaticus*** Leach
11. *fabricii* Macleay
12. *luczonicus* Aube
10. ***Rhantaticus*** Sharp
13. *congestus* (Klug)
11. ***Cybister*** Curtis
14. *posticus* Aube
15. *tripuctatus asiaticus* Sharp

Family IV : GYRINIDAE

12. ***Dineutus*** Macleay
16. *unidentatus* (Aube)

Family V : HYDROPHILIDAE

13. ***Helochares*** Mulsant
17. *anchoralis* Sharp
14. ***Hydrophilus*** Muller
18. *senegalensis* Percheron
15. ***Sternolophus*** Solier
19. *ocufipes* (Fabricius)

Family VI : HISTERIDAE

16 ***Santalus*** Lewis
20. *parallelus* (Redtenbacher)
21. *Santalus sp.*

Family VII : STAPHYLINIDAE

17. ***Paederus*** Fabricius
22. *kuluensis* Bernhauer
23. *tamulus* Erichson
18. ***Platyprosopus*** Mannerheim
24. *indicus* Motschulsky
19. ***Philonthus*** Curtis
25. *castaneus* Gemm. et. Har.
20. ***Stephylinus*** Linnaeus
26. ***(Platydracus)*** *maculipennis* Kraatz
21. ***Zyras*** Stephens
27. ***(Glossacantha)*** *reversus* Cameron

Family VIII : SCARABAEIDAE

22. ***Oxycetonia*** Arrow
28. *versicolor* (Fabricius)
23. ***Chiloloba*** Burmeister
29. *acuta* (Wiedmann)
24. ***Anomala*** Samouella
30. *bengalensis* Blanchard
25. ***Gymnopleurus*** Illiger
31. *miliaris* (Fabricius)
32. *parvus* (Maciendayas)
26. ***Oniticellus*** Serville
33. *spinipes* Roth

Family IX : BUPRESTIDAE

27. ***Sternocera***
34. *chrysis* Fabricius

Family X : ELATERIDAE

28. ***Lanelater*** Arnett
35. *fuscipes* (Fabricius)
29. ***Agrypnus*** Eschscholtz
36. *sinensis* (Candaze)
30. ***Adelocera*** Latreille
37. *adspersus* (Candeze)

Family XI : COCCINELLIDAE

31. ***Brumus***
38. *suturalis* (Fabricius)
32. ***Adonia***
39. *variegata* (Goeze)
33 ***Coccinella***
40. *septempunctata* Linnaeus
41. *transversalis* Fabricius
34 ***Menochilus***
42. *sexmaculatus* (Fabricius)
35. ***Micraspis***
43. *allardi* (Mulsant)
36. ***Oenopia***
44. *luteopustulata* Mulsant

Family XII : MELOIDAE

37. ***Mylabris***
45. *phalerata* (Pall)
38. ***Aulacophora*** Chevrolat
46. *foveicollis* (Lucas)
39. ***Altica*** Fabricius
47. *cyanea* (Weber)
40. ***Aspidomorpha*** Hope
48. *miliaris* (Fabricius)
41. ***Sindia*** Weise
49. *clathrata* (Fabricius)

Key to families

1 (8) Hind coxae immovably fused to metasternum, completely dividng 1st visible abdominal sternite. Prothorax with notopleural suture distinct.

2 (5) Hind coxae not extending to the elytra ; metapleura and the first visible abdominal segment are in contact. First 2-4 antennal segments glabrous. Terrestrial insects.

3 (4) Front tibia with both spurs terminal. Front coxal cavities closed behind. Elytra with a notch or fold at sides posteriorly. Myrmicophilous in habit.....Paussidae

4 (3) If both front tibial spurs terminal, the fore coxae cavities open behind. Not myrmicophilous .....Carabidae

5 (2) Aquatic insects with the hind coxae extending to the elytra and dividing the metapleura from the first visible abdominal segment. All antennal segments with similar surface ornamentation.

6 (7) Eyes not completely divided. Antennae filiform. Mid and hind legs not very short and broad .....Dytiscidae

7 (6) Eyes completely divided into dorsal and ventral parts. Antennae short and thick, 2nd segment with a process. Mid and hind legs forming short, broad paddles ....Gyrinidae

8 (1) Hind coxae not immovably fused to metasternum. Prothorax never with distinct notopleural suture, wings never with oblongum.

9 (16) Pleural sclerites of the true 2nd abdominal sternite distinct from those of third, sternite represented by small lateral plates, rarely fully developed.

10 (11) Antennae usually 10 segmented, with 3-7 apical segments produced on one side to form a lamellate club. Species usually stout .....Scarabaeidae

11 (10) Antennae never with club of these type, species usually less stout. Wing venation of Staphylinidae type.

12 (13) Maxillary palpi longer than the antenna of which the first 3-5 segments are glabrous, the next segment cup-like, and the last one form a strong pubescent club. Habits normally aquatic .....Hydrophilidae

13 (12) Antennae not so constructed and not shorter than the maxillary palp. Habits rarely aquatic.

14 (15) Antennae with last 3 segments rarely forming a compact club ; if so 1st segment not elongate. Exoskeleton rarely very hard and shining,elytra truncate and usually leaving more than 2 abdominal segments exposed .....Staphylinidae

15 (14) Antennae geniculate with last 3 segments forming a compact club. Exoskeleton hard, black, shining, elytra truncate and leaving 1 or 2 abdominal segments exposed .....Histeridae

16 (9) Pleural sclerite of the true 2nd abdominal sternite almost always fused to that of 3rd. Sternite usually entirely membranous.

17 (2) Hind coxa almost always with a vertical posterior surface and with the posteroventral edge produced into a plate which partly covers the retracted femur.

18 (19) Metasternum nearly always with well marked transverse suture ; if not prosternum completely dividing mesosternum and its tip received in metasternum ....Buprestidae

19 (18) Metasternum never with distinct transverse suture ; prosternum with tip received in mesocoxal cavity never in metasternum .....Elateridae

20 (17) Hind coxa not with a posterior vertical posterior surface and with the posteroventral edge produced into a plate.

21 (22) Transverse suture of metasternum usually distinct laterally. Tarsi 5 segmented, 4th segment very small and concealed by the lobes of the third, 1st to 3rd with adhesive lobe beneath .....Chrysomelidae

22 (21) Transverse suture of metasternum not distinct laterally ; if the tarsi 5 segmented with the 4th segment very small, antennae have a marked three segmented club.

23 (24) Body elongated, tarsal formula 5-5-4 .....Meloidae

24 (23) Body rounded or oval, tarsal formula not 5-5-4 ....Coccinellidae

Family 1. : CARABIDAE

The family Carabidae includes the largest number of terrestrial Adephage. The members of the family are mainly predaceous, only a few species use vegetative material as their food. Some species of *Calsoma* Weber have been tested for biological control of insect pests in India.

Key to genera

1 (2) Procoxal cavities with a single opening inwards, the opening closed by the meeting of the epimeron with the intercoxal declivity .....*Trigonotoma*

2 (1) Procoxal cavities with two openings inwards.

3 (4) Mandibles with a fixed seta in scrobe ....*Pheropsophus*

4 (3) Mandibles without a fixed seta on scrobe.

5 (6) Elytra with a plica near sides on under surface .....*Macrocheilum*

6 (5) Elytra without a plice near sides on under surface ....*Macrocheilus*

Genus *Pheropsophus* Solier

1833. *Pheropsophus* Solier, *Ann. Mag. nat. Hist.*, : 461.

Key to species

1 (2) Elytra with brownish yellow spots on shoulder on either side ; median line of

pronotum fine .....*catorei* Dej.

2 (1) Elytra without brownish yellow spots on shoulder ; median line of pronotum deep .....*hileris* (F.)

1. ***Pheropsophus catoirei*** (Dej.)

1825. *Pheropsophus catoirei* Dej., *Species General Coleopteres* : 1.

1875. *Pheropsophus catoirei* : Putz, *Comot. Soc. Ent. Belgious* : 45.

1901. *Pheropsophus catoirei* : Arrow, *Trans. Ent. Soc. London* : 202.

Materiel examined : Delhi; 5 exs., Majnu Ka tila, Wazirabad, 15.xii.1994. coll. A. Husain & party.

Distribution : India : Throughout, westward to Kashmir. *Elsewhere* : Myanmar; Sri Lanka; Pakistan.

2. ***Pheropsophus hilaris*** (Fabr.)

1798.*Pheropsophus hilaris* Fabr., *Suppl. Ent. Syst.*:56.

1874.*Pheropsophus hilaris* : Schaum. *Stelt. Ent. Zeituna* : 49.

1921.*Pheropsophus hilaris* : Andrewes, *Trans. Ent. Soc. London* : 159.

Material examined : Delhi ; 3exs., Yamuna river, 17.xii. 1994, coll. A. Husain & party.

Distribution : India : throughout. *Elsewhere* : Myanmar; Pakistan.

Genus ***Macrocheilus*** Hope

1838. *Macrocheilus* Hope, *Col. Man.* **2** : 166.

3. ***Macrocheilus impictus*** (Wied.)

1823. *Macrocheilus impictus* Wied., *Zool. Mag.* **2** : 49.

1825. *Macrocheilus impictus* : Dej., *Species. Gen. Coleopteris*, **1** : 287.

1920. *Macrocheilus impictus* : Andrewes, *Ann. Mag. nat. History* (9) : 497.

Material examined : Delhi; 2 exs., Municipality nursery, Punjabi bagh, 14.ix. 1994, coll. J.P. Sati & party.

Distribution : India : Delhi, West Bengal, Uttar Pradesh, Karnataka, Kerala. *Elsewhere*: Java.

Genus ***Chlaenius*** Dejean

1826. *Chlaenius* Dejean, *Species. Generaldes Coleopteres*, **2** : 297.

Key to species

1 (2) Colour green, body elongate ; pronotum not much wider, distincly sinuate posteriorly and faintly punctate on dorsal surface ; elytra with pale marginal border .....*pulchar* Nictn.

2 (1) Colour blue-violet, body short and wide ; pronotum much wider not distincly sinuate posteriorly and coarsely punctate on dorsal surface ; elytra without pale marginal border .....*pretiosus Chaud.*

4. ***Chlaenius pretiosus*** Chaudoir

1856. *Chlaenius pretiosus* Chaud. *Bull. Soc. Imp., Nat. Moscou*, **2** : 288.

1920. *Chlaenus pretiosus* : Andrewes, *Ent. Month. Magazine* : 235.

Material examined : Delhi : 4exs., Asiad Village, 23.xii.1994, coll. A. Husain & party.

Distribution : India : Delhi, U.P., Rajasthan. *Elsewhere* : Sri Lanka; Pakistan.

Genus ***Trigontoma*** Dejean

1828. *Trigonotoma* Dejean, *Species General des Coleopteres*, **3** : 182.

5. ***Trigonotoma indica*** Brulle

1834. *Trigonotoma indica* Brulle, *Audouin et. Brulle. His. Nat. Insectes*, **4** : 333.

1886. *Trigonotoma indica* : Bato, *Ann. Mag. nat. History* (5) **17** : 145.

Material examined : Delhi; 3 exs., Humayun's Tomb. 14.xii. 1994, coll. A. Husain & party.

Distribution : India : Delhi, Assam, West Bengal, U.P., Maharashtra, Tamil Nadu. *Elsewheter* : Sri Lanka.

Family 2. : PAUSSIDAE

The members of the family Paussidae are known to be myrmicophilous in habit. About 60 species are known from India. Shape of antennae is characteristic of the family.

Genus ***Platyrhopalus*** Westwood

1833. *Platyrhopalus* Westwood, *Trans. Linn. Soc.* London, **16** : 654-657.

1930. *Platyrhopalus* : Ribeiro, *Rec. Ind. Mus.*, **32** (III) : 232.

6. *Platyrhopalus denticornis* (Donovan)

1800. *Paussus denticornis* Donovan, *Ins. Ind.*, **I**, pl. 5, fig. 1.
1930. *Platyrhopalus denticornis* : Ribeiro, *Rec. Ind. Mus.*, **32** (III) : 233.

Material examined : Delhi; 2 exs., Munirka, 13.ix.1994, coll. J.P. Sati & party; 6 exs., Tuglaqabad park, 12. ii. 1995, coll. J.P. Sati & party.

Distribution : India : Delhi : Assam, W.Bengal, Bihar, Maharashtra, Madhya Pradesh, Tamil Nadu, Punjab, Uttar Pradesh.

Family 3 : DYTISCIDAE

The members of the family are most perfectly adapted to the aquatic life and commonly known as predaceous diving beetles. Dytiscid beetles frequent both stagnant and running waters and form one of the main constituents of insect fauna of aquatic biota. The family is represented world over but is more characteristic of the palaearactic region. It contains about 400 species of which 223 have been recorded from India.

Key to subfamilies

1	(2)	Scutellum not visible	.Hydroporinae
2	(1)	Scutellum visible.	
3	(4)	Anterior border of the eyes excised	...Colymbatinae
4	(3)	Anterior border of the eys not excised	Dytiscinae

Subfamily : HYDROPORINAE
Genus *Hyphoporus* Sharp

1882. *Hyphoporus* Sharp, *Sci. Trans. R. Dublin Soc.*, **2** : 390, 859.
1977. *Hyphoporus*, Vazirani, *Cat. Orient. Dytiscidae* : 44.

7. *Hyphoporus elevatus* Sharp

1882. *Hyphoporus elevatus* Sharp, *Sci. Trans. R. Dublic Soc.*, **2** : 390.
1977. *Hyphoporus elevatus*, Vazirani, *Cat. Orient. Dytiscidae* : 45.

Material examined : Delhi ; 4exs., Yamuna River, 17.xii. 1994 ; 1ex., 16.v. 1994; 17exs., 14.v. 1994 ; 70exs., 14.v. 1994, coll. A. Husain & party.

Distribution : India : Delhi, Tripura, Bihar, Madhya Pradesh, Punjab, Uttar Pradesh. *Elsewhere* : Pakistan.

Subfamily : COLYMBATINAE

Genus ***Rhantus*** Stephens

1835. *Rhantus* Stephens, *Illustrated Brit. Ent. Mand.*, **5** : 395.
1977. *Rhantus* : Vazirani, *Cat. Orient. Dytiscidae* : 70.

8. ***Rahntus taprobanicus*** Vazirani

1890. *Rhantus taprobanicus* Sharp, *Trans. ent. Soc., London* : 346.
1977. *Rhantus taprobanicus* : Vazirani, *Cat. Orient. Dytiscidae* : 73.

Material examined : Delhi; 1 ex., Yamuna River, 16.v. 1994, coll. A. Husain & party.

Distribution : India : Delhi, Karnataka, Tamil Nadu, Pondicherry, Maharashtra, Rajasthan, Uttar Pradesh, Bihar, Meghalaya, West Bengal. *Elsewhere* : Pakistan ; Sri Lanka.

Subfamily : DYTISCINAE

Key to genera

1 (2) Hind margins of the four basal metatarsal segments not fringed with any ciliae ..... **Cybizter**

2 (1) Hind margins of the four basal metatarsal segments fringed with golden-yellow ciliae.

3 (4) Sides of pronotum rebordered. Lateral border of the elytra serrated in the posterior half ..... **Eretes**

4 (3) Sides of pronotum not rebordered. Lateral border of the elytra not serrated in the posterior half.

5 (6) Suture between the metapisternum and metasternal wing straight, apical spurs of hind tibiae simple, pointed ....**Hydaticus**

6 (5) Suture between the metapisternum and metasternal wing curved, apical spurs of hind tibiae blunt, more or less bifid ..... .**Rhantaticus**

Genus ***Eretes*** Castalnau

1833. *Eretes* Castelnau, *Ann. Soc. ent. Fr.*, **2** : 397.
1977. *Eretes*, Vazirani, *Cat. Orient. Dytiscidae* : 73.

9. ***Eretes sticticus*** (Linnaeus)

1767. *Dytiscus sticticus* Linnaeus, *Syst. Nat. ed.* **12** : 666.
1833. *Eretes sticticus* : Castalnau, *Ann. Soc. ent. Fr.*, **2** : 397.

Material examined : Delhi ; 2exs., Wazirabad, 11.ii. 1995, coll. J.P. Sati & party; 13 exs., Indira Market, 9.v. 1994, coll. A. Husain & party ; 12 exs, Asola WLS, 12.ix. 1994, coll. J.P. Sati & party ; 1 ex., Yamuna Bridge, 10.ix. 1994, coll. J.P. Sati & party.

Distribution : India : Delhi. *Elsewhere* : Cosmopolitan.

Genus ***Hydaticus*** Leach

1817. *Hydaticus* Leach, *Zool. Miscell.*, **3** : 69, 72.
1977. *Hydaticus* : Vazirani, *Cat. Orient. Dytiscidae* : 75.

Key to species

1 (2) Elytra brown or tawny ..... *H. fabricii*
2 (1) Elytra black ..... *H. luczonicus*

10. ***Hydaticus fabricii*** Macleay

1833. *Hydaticus fabricii* Macleay, *Annulosa Javanica* : 134.
1977. *Hydaticus fabricii* : Vazirani, *Cat. Orient. Dytiscidae* : 76.

Material examined : Delhi; 3 exs., Indira Gandhi Indoor Stadium Complex, 11.v.1994, coll. A. Husain & party ; 1 ex., Piggery Farm nala, 18.xii.1994, coll. A. Husain & party ; 1 ex., Ghaziabad Road, 13.v.1994, coll. A. Husain & party.

Distribution : India : Delhi, Andaman Is., Rajasthan, Goa, Tamil Nadu. *Elsewhere* : Indonesia ; Vietnam ; Philippines.

11. ***Hydaticus luczonicus*** Aube

1838. *Hydaticus luczonicus* Aube, in Dejean's Species Coleopteres, **6** : 179.
1977. *Hydaticus* luczonicus : Vazirani, *Cat. Orient. Dytiscidae* : 79.

Material examined : Delhi ; 1 ex., Asola WLS, 12.ix. 1994, coll. J.P. Sati & party.

Distribution : India : Delhi, Bihar, Gujarat, Rajasthan, Madhya Pradesh, Maharashtra, Orissa, Uttar Pradesh, W.Bengal, Tamil Nadu.

Genus ***Rhantaticus*** Sharp

1882. *Rhantaticus* Sharp, *Sci. Trans. R. Dublin Soc.*, **2** : 691, 911.
1977. *Rhantaticus* : Vazirani, *Cat. Orient. Dytiscidae* : 82-83.

12. ***Rhantaticus congestus*** (Klug)

1832. *Hydaticus congestus* Klug, *Symb. Physicae, Insectes Madagascar* **3** : 136.
1920. *Rhantaticus congestus* : Var., *rochazi*, Zimmermann, *Coleopt. Cat.*, **4** : 333.
1977. *Rhantaticus congestus* : Vazirani, *Cat. Orient. Dytiscidae* : 83.

Material examined : Delhi; 1 ex., Indira Market, 9.v.1994; 29 exs., Lodhi Garden, 19.xii.1994 ; 1 ex., Najafgarh, 20.xii. 1994, coll. A. Husain & party.

Distribution : India : Delhi; Andhra Pradesh, Bihar, Orissa, Rajasthan, W. Bengal, Maharashtra. *Elsewhere* : Nepal ; Taiwan ; Philippines ; New Guinea ; Australia ; Madagascar ; Africa.

Genus *Cybister* Curtis

1827. *Cybister* Curtis, *Brit. Ent.*, **4** : 151.
1977. *Cybister* : Vazirani, *Cat. Orient. Dytiscidae* : 86.

Key to species

1 (2) Elytra without yellow lateral strips ..... **posticus**
2 (1) Elytra with yellow lateral strips .....**tripunctatus**

13. *Cybister posticus* Aube

1838. *Cybister posticus* Aube, in *Dejean's Species Coleopteres*, **6** : 87.
1977. *Cybister posticus* : Vazirani, *Cat. Orient. Dytiscidae* : 88.

Material examined : Delhi ; 2 exs., Ranibag, 18.ii. 1994, coll. J.P. Sati & party ; 1 ex. Mehrauli, 12.v.1994, coll. A. Husain & party.

Distribution : India : Delhi, Assam, Manipur, Maharashtra, W.Bengal. *Elsewhere* : Bangladesh.

14. *Cybister tripunctatus asiaticus* Sharp

1882. *Cybister asiaticus* Sharp, *Sci. Trans. R. Dublin Soc.*, **2** : 731.
1899. *Cybister tripunctatus asiaticus* : Regimbart, *Ann. Soc. ent. Fr.*, **68** : 352.
1977. *Cybister tripunctatus asiaticus* : Vazirani, *Cat. Orient. Dytiscidae* : 92.

Distribution : India : Delhi, Andaman Is., Sikkim, Gujarat, Rajasthan, Tamil Nadu, Tripura. *Elsewehre* : Pakistan ; Sri Lanka; Myanmar; Nepal ;Bangladesh; Afganistan.

Family 4. : GYRINIDAE

The members of the family Gyrinidae are commonly known as whirling beetles because of their habit of swimming in groups on the surface of ponds and quiet streams. They are

predominantly scavangers, feeding upon live or dead insects trapped or floating on the water surface. 700 species are known from the world of which 56 species are known from India.

Genus ***Dineutus*** Macleay

1825. *Dineutus* Macleay, *Annulosa javanica*, ed. **1** : 30.
1984. *Dineutus* : Vazirani, *The Fauna of India* : 16.

15. ***Dineutus unidentatus*** (Aube)

1838. *Dineutus unidentatus* Aube, *Species Coleopteres*, **6** : 788.
1930. *Dineutus (Spinosodineutus) unidentatus* : Ochs, *Cat. Indian Ins.* : 12.
1958. *Dineutus unidentatus* : Vazirani, *Rec. Indian Mus.*, **53** : 161.

Material examined : Delhi ; 1 ex., Okhla Reservoir, 18.xii.94, coll. A. Husain & party.

Distribution : India : Delhi, U.P., Bihar, W.Bengal, Assam, Meghalaya, Orissa, Tamil Nadu. *Elsewhere* : Bangladesh ; Myanmar ; Thailand, Malaysia, Laos, Vietnam.

Family 5 : HYDROPHILIDAE

Members of the family Hydrophilidae are commonly known as water scavanger beetles. Majority of this group of insects are truely aquatic in habit and form an important constituent of fresh water ecosystem. The group is widely distributed and 2000 species are known from the world of which about 150 have been known from India.

Key to genera

1 (2) Meso and metasternal carina not reunited intimately ..... **Helochares**
2 (1) Meso and metasternal carina reunited intimately.
3 (4) All femora clothed at base with a silky procumbent and dense pubescence ..... **..Sternolophus**
4 (3) Anterior femora only are clothed with pubescence at base, wanting or very much reduced on middle and posterior femora ..... **Hydrophilus**

Genus ***Halochares*** Mulsant

1844. *Helochares* Mulsant. *Palp.* : 137
1924. *Helochares* Mulsant, *Col. Cat.*, **14** (79) : 192-199.

16. ***Helochares anchoralis*** Sharp

1890. *Helochares anchorallis* Sharp, *Trans. ent. Soc. Lond.* : 352.

Material examined : Delhi; 1 ex., Yamuna River, 14.v. 1995, coll. A. Husain & party ; 1 ex., Shakur Basti, 31.x. 1993, coll. N.K. Sinha & party ; 1ex., Auchandi, 30.x. 1993, coll. N.K. Sinha & party.

Distribution : India : Delhi, West Bengal. *Elsewhere* : Sri Lanka ; Indonesia ; Indo-china.

Genus ***Hydrophilus*** Muller

1764. *Hydrophilus* Muller, *Fauna Ins. Fridrichsdalina* : 16.

1980. *Hydrophilus* : Smetna, *Mem. ent. Soc.* Canada, **111** : 10-11.

17. ***Hydrophilus senegalensis*** Percheron

1835. *Hydrophilus senegalensis* Percheron, *Gen. d. Ins.* **3** : 5.

Material examined : Delhi ; 1ex., Yamuna River, 14. v. 1995, coll. A. Husain & party.

Distribution : India : Delhi, W. Bengal, Uttar Pradesh. *Elsewhere* : Africa.

Genus ***Sternolphus*** Solier

1834. *Sternolophus* Solier, *Ann. Soc. ent. Fr.*, **3** : 302, 310.

18. ***Sternolphus rufipes*** (Fabricius)

1792. *Hydrophilus rufipes* Fabricius, *Entom. Syst.*, **1** : 183.

1840. *Sternolophus rufipes*: Laporte, *Castelnau, Hist. Nat. Ins.*, **2** : 54.

Material examined : Delhi ; 6 exs., Indira Market, 9.v. 1994, coll. A. Husain & party ; 5 exs., Bhalsawa, 26.x. 1993, coll. N.K. Sinha & party ; 7 exs, Yamuna River, 15.v. 1994 ; 6 exs., 16.v. 1994 ; 2exs., Yamuna, Ghaziabad Rd., 13.v. 1994; 3 exs., Wazirabad Bridge, 28.x. 1993, coll. N.K. Sinha & party ; 6 exs., Okhla Dam, 15.v. 1994, ; 4 exs., Sabhyapur, Ghaziabad Rd., 17.xii. 1994 ; 2 exs., Piggery Farm Nala, 18.xii. 1994 ; 2 exs., Saraswati Vihar, 9.vi. 1993, coll. V. Khanna & party ; 1 ex., Yamuna River, 17. xii. 1994 ; 11 exs., Yamuna River, 14.v. 1994, Coll. A. Husain & party ; 2 exs. Okhla Reservoir, 14.ii. 1995, coll. J.P. Sati & party ; 3 exs., Dhaulakuan, 23.x. 1993, coll. N.K. Sinha & party ; 3 exs., Bhalsawa, 15.xii. 1994 ;1 ex., Najafgarh, 20.xii. 1994, coll. A. Husain & party ; 1 ex., Okhla, 18.xii. 1994, A. Husain & party ; 13 exs., Shakur basti, 31.x. 1993, coll. N.K. Sinha & party ; 5 exs., Auchandi, 30.x. 1993, coll. N.K. Sinha & party.

Distribution : India : Delhi, W.Bengal. *Elsewhere* : Tropical Asia ; East Asia ; Sunda Island.

Family 6 : HISTERIDAE

Members of the family are very small to medium in size, round, oval or elongated in shape, generally black and shining with hard exoskeleton. Antennae are geniculate and strongly clubbed. The elytra is truncated behind leaving the two apical segments exposed. They are predaceous in nature both in larval and adult stage. They occur in a variety of habitats namely in soil, dung of various animals, termite and ant nests and under bark. The family is widely distributed and contains 3,000 species under 200 genera in the world. In India 175 species under 34 genera have been recorded so far.

Genus *Santalus* Lewis

1906. *Santalus* Lewis. *Ann. Mag. nat. Hist.* (7) **17** : 341.

19. *Santalus parallelus* (Redtenbacher)

1848. *Hister parallelus* Redtenbacher, in *Hegel, Kaschmir,* IV, **2** : 514. (Type loc. : India).
1854. *Hister elongatulus* : Marseul, *Ann. Soc. Ent. Fr.*(3) **2** : 194-195.
1910. *Santalus parallelus (Redtenbacher)* : Bickardt., *Coleopterorum Catalogus*, Paris,**24**: 36.

Material examined : Delhi ; 1 ex., Buddha Jayanti Park, 4.vi. 1993 ; 1 ex., Dist. park, Pitampura, outer Ring Road, 9.vi. 1993, coll. V. Khanna & party. ; 1 ex., Kamala Nehru Ridge, Rajpur Road, 14.ix. 1994, coll. J.P. Sati & party.

Remarks : This is an endemic species in India, generally found in the plains. It is distinguished from other allied species by the internal pronotal stria running parallel to the external margin. Elytra with 4 complete dorsal striae, 5th shortened anteriorly and without any sutural stria.

Santalus sp.

Material examined : Delhi; 1 ex., Masudpur, 13.ix. 1994, coll. J.P. Sati & party.

Remarks : This is a very interesting species. The internal pronotal lateral stria not running parallel to the margin and elytra have 1-4 complete, 5 and 6 anteriorly shortened dorsal striae. Presence of 6 sutural stria has made this species interesting. More over the body surface is rough. We could not place this example to the known species. May be designated as new to science. But due to lack of material we keep it as *Santalus* sp.

Family 7 : STAPHYLINIDAE

Members of the family are commonly known as *'Rove Beetles'* This group is mainly characterised by elongate and narrow, occasionally oblong or subovate body with short elytra

concealing large well developed wings. Members of the family are found in decaying organic matter, including dung and dead animals while many are predaceous. The family is widely distributed and 30000 species under 1500 genera are known from the World. In India 2000 species under 265 genera are recorded.

Genus ***Paederus*** Fabricius

1775. *Paederus* Fabricius, *Syst. Ent.* : 268.

Key to species

1. Larger species (9.5mm). Head narrower, which is more strongly retracted behind. antennae black ....***kuluensis*** Bernhaver
   Smaller species (5.2 to 8.25 mm.). Head orbicular, but with the postocular region gently rounded. Antennae black, the first two segments reddish yellow ....***tamulus*** Erichson

20. ***Paederus kuluensis*** Bernhauer

1914. *Paederus kuluensis* Bernhauer, *W.Z.B.*, **64** : 99.
1931. *Paederus kuluensis* : Cameron, *Fauna British India,* **2** : 55.

Material examined : Delhi ; 34 exs., River Yamuna and vicinity, Temporary Bridge, 14.v. 1994, coll. A. Husain & party.

Disribution : India : Delhi, Himachal Pradesh.

Remarks : This species is recorded for the first time from Delhi.

21. ***Paederus tamulus*** Erichson

1839-40. *Paederus tamulus* Erichson, *Gen. Spec. Staph.* : 661.

Material examined : Delhi : 2 exs., Okhla Dam, 15.v. 1994, coll. A. Husain & party.

Distribution : India : Delhi, West Bengal. *Elsewhere* : Sri Lanka ; Myanmar; Sumatra ; Java; Singapore ; Tonkin ; China and southern Japan.

Remarks : This species is recorded for the first time from Delhi.

Subfamily : STAPHYLININAE

Genus ***Platyprosopus*** Mannerhem

1830. *Platyprosopus* Mannerheim, *Brachely* : 36.

22. *Platyprosopus indicus* Motschulsky

1858. *Platyprosopus indicus* Motschulsky, *Bull. Mosc.* **31** (3) : 212.

1932. *Platyprospus indicus* : Cameron, *Fauna British India*, **3** : 49.

Material examined : Delhi; 1 ex., Bhalsawa, 11.ii. 1995, coll. J.P. Sati & party.

Diagnostic characters : A large and robust species. Head oval, the post-ocular region and sides of head internal to the eyes coarsely punctured. Length 12.5 to 18 mm.

Distribution : India : Delhi, Uttar Pradesh, Bihar, W.Bengal.

Remarks : This species is recorded for the first time from Delhi.

Genus *Philonthus* Curtis

1825. *Philonthus* Curtis, *Brit. Ent.*, **8** : 610.

23. *Philonthus castaneus* Gamm. at. Har.

1868. *Philonthus castaneus* Gemm. at. Har., *Cat. Col.*,**2** : 56.

1858. *Philonthus badius* : Motschulsky, *Bull. Mosc.*, **31** (1) : 661.

1932. *Philonthus castaneus* : Cameron, *Fauna British India*, **3** : 99-100.

Material examined : Delhi ; 1ex., Bhalsawa Lake, Karnal Road, 15.ii. 1994, coll. A. Husain & party.

Diagnostic characters : Head, terminal segments of antennae and last segments of the abdomen blackish, thorax, elytra and margin of the abdominal segments brownish or yellowish. Thorax with dorsal row of four punctures. Length 5 mm.

Distribution : India : Delhi.

Remarks : Cameron (1932) mentioned locality data as India.

Genus *Staphylinus* Linn.

1758. *Staphylinus* Linn., *Syst. nat. ed.*, **10** : 421.

24. *Staphylinus (Platydracus) maculipennis* Kraatz

1859. *Staphylinus maculipennis* Kraatz, *Arch. Naturgesh.* **25** (1) : 77.

1932. *Staphylinus (Platydracus) maculipennis* : Cameron, *Fauna British India*, **3** : 196.

Material examined : Delhi ; 1ex., Humayun's Tomb, Mathura Road, 14.ii.1994, coll. A. Husain & party.

Diagnostic characters : Blackish, the head, thorax and elytra variegated with more or less obscure purple, the postero-external angles of the elytra with very distinct patch of dense, long, golden-yellow pubescence. Length 11-13 mm.

Distribution : India : Delhi, Uttar Pradesh, Bihar.

Remarks : This species is recorded for the first time from Delhi.

Subfamily : ALEOCHARINAE

Genus *Zyras* Stephens

1832. *Zyras* Stephens, III. *Bri. Ent. Mendib.* **5** : 430.

25. ***Zyras (Glossacantha) reversus*** (Cameron)

1939. *Zyras (Glossacantha) reversus* Cameron, *Fauna British India*, **4** (2) : 530 - 531.

Material examined : Delhi ; 2exs., south campus, Delhi University, 23.xii. 1994, coll. A. Husain & party.

Diagnostic characters : Shining, head black, thorax and elytra yellowish-red, abdomen reddish-brown, the last three segments pitchy-black. Antennae red. legs reddish-yellow. In male 3rd abdominal segment with three short equal spines, the external ones arising from the lateral margin itself. Length 6 mm.

Distribution : India : Delhi, Uttar Pradesh.

Remarks : This species is recorded for the first time from Delhi.

Family 8 : SCARABAEIDAE

Members of the family Scarabaeidae can easily be recognized by the form of the antennae, apical segments extend on one side forming a lamellate club. These beetles feed on vegetation, roots and dungs of various animals. Some of the species of this group are highly injurious to cultivated plants, forest and horticultural trees. They widely occur in different parts of the world. 25,000 species under 2000 genera are known from the world. In India 1,330 species under 312 genera have been reported so far.

Key to subfamilies

1 (4) Posterior spiracles situated in the dorsal part of the chitinous ventral segments.
2 (3) Labrum membranous, not exserted ..... **Cetoniinae**
3 (2) Labrum chitinous and visible externally ..... **Rutelinae**
4 (1) Posterior spiracles situated in the membrane between dorsal and ventral segments ..... **Coprinae**

Subfamily : CETONIINAE

Key to genera

1 (2) Clypeus flat, bilobed ..... *Oxycetonia*
2 (1) Clypeus keeled, with produced angles ..... *Chiloloba*

Genus ***Oxycetonia*** Arrow

1842. *Gemetis*, Burmeister, *Handb. Ent.*, **3** : 358.
1910. *Oxycetonia* Arrow, *Fauna Brit. India (Coleoptera : Lamell.)*, **1** : 163.

26. ***Oxycetonia versicolor*** (Fabricius)

1775. *Cetonia versicolor* Fabricius, *Syst. ent.*, **51**.
1910. *Oxycetonia versicolor* : Arrow, *Fauna Brit. India* (Coleoptera : Lamell), **1** : 164.
Distribution : India : West Bengal, Tamil Nadu, Karnataka, Haryana, Delhi. *Elsewhere* : Bangladesh ; Bhutan ; Sri Lanka.

Genus ***Chiloloba*** Burmeister

1842. *Chiloloba* Burmeister, *Hanb. Ent.* **3** : 501.
1910. *Chiloloba* : Arrow, *Fauna Brit. India (Coleoptera : Lamelli)* : **1** : 171.

27. ***Chiloloba acuta*** (Wiedman)

1823. *Cetonia acuta* Wiedmann, *Zool. Mag.* **2** : 87.
1842. *Chiloloba acuta* : Burmeister, *Fauna Brit. India (Coleoptera : Lamell.)* , **1** : 172.
Distribution : India : Uttar Pradesh, Madhya Pradesh, Maharashtra, Karnataka. *Elsewhere* : Pakistan.

Subfamily : BUTELINAE
Genus ***Anomala*** Samouella

1819. *Anomala* Samouella, *The Entomologist's useful Companion* : 191.
1917. *Anomala*, Arrow, *Fauna Brit. India (Coleoptera : Lamell.)* **2** : 126.

28. ***Anomala bengalensis*** Blanchard

1851. *Anomala bengalensis* Blanchard, *Cat. Coll. Ent. Mus. Paris* : 182.
1917. *Anomala bengalensis* : Arrow, *Fauna Brit. India (Coleoptera : Lamell.)*, **2** : 143.
Distribution : India : West Bengal, Bihar, Tamil Nadu, Karnataka. *Elsewhere* :

Myanmar.

Subfamily : COPRINAE

Key to genera

1 (2) Middle coxae not widely separated ; middle tibia with one terminal spur ..... *Gymnopleurus*

2 (1) Middle coxae widely separated, middle tibia with two terminal spurs ..... *Oniticellus*

Genus ***Gymnopleurus*** Illiger

1803. *Gymnopleurus* Illiger, *Mag. Ins.*, **2** : 199.

1931. *Gymnopleurus* : Arrow, *Fauna Brit. India (Coleoptera : Lamell.)*, **3** : 46.

Key to species

1 (2) Clypeus quadridentate ..... *G. miliaris*

2 (1) Clypeus bidentate ..... *G. parvus Maci*

29. ***Gymnopleurus miliaris*** (Fabricius)

1775. *Scarabaeus miliaris* Fabricius, *Syst. Ent.*, : 817.

1931. *Gymnopleurus miliaris* : Arrow, *Fauna Brit. India (Coleoptera : Lamell.)*, **3** : 50.

Distribution : India : Delhi, Maharashtra, Madhya Pradesh, Orissa, Karnataka, Uttar Pradesh, Tamil Nadu, Jammu & Kashmir. *Elsewhere* : Sri Lanka.

30. ***Gymnopleurus parvus*** (Maclendae)

1821. *Scarabaeus parvus* Maclendae, *Horae Ent.*, dt. : 517.

1931. *Gymnopleurus parvus* : Arrow, *Fauna Brit. India (Coleoptera : Lamell.)*, **3** : 52-53.

Distribution : India : Delhi, Bihar, Uttar Pradesh, Tamil Nadu. *Elsewhere* : Sri Lanka.

Genus ***Oniticellus*** Serville

1825. *Onticellus* Serville, *Encycl. Meth.*, **10** : 356.

1931. *Oniticellus* : Arrow, *Fauna Brit. India (Coleoptera : Lamell.)*, **3** : 375.

31. *Oniticellus spinipes* Roth

1851. *Oniticellus spinipes* Roth, *Arch. F. Nat.*, **17** (1) : 128.

1931. *Oniticellus spinipes* : Arrow, *Fauna Brit. India (Coleoptera : Lamell.)*, **3** : 378-379.

Distribution : India : Delhi, Uttar Pradesh, Madhya Pradesh, Maharashtra, Tamil Nadu. *Elsewhere*: E.W. Africa.

Family 9. : BUPRESTIDAE

Members of the family Buprestidae are among the most brilliantly coloured insects and owing to the splendour of their metallic lustre are used in embroidery and in jewellery. They are typical inhabitants of hot moist forests and are exceedingly active on wings. The larvae are characterised by great expansion of the prothorax and the slender hind body. The larvae usually gnaw broad flattened galleries in or beneath the bark of trees or in roots. Some are found in the stems of herbaceous plants and are leaf miners.

Genus *Sternocera* Eschscholtz

1829. *Sternocera*, Eschscholtz. *Zoologischer Atlas*, 129.

32. *Sternocera chrysis* (Fabricius)

1774. *Buprestis chrysis* Fabricius, *Systema Entomologica* : 218.

1837. *Sternocera chrysis* : Cast & Gory, *Monograph* : 7, Pl. II f.

Material examined : Delhi; 1 ex., Masudpur, 13.ix. 1994, coll. J.P. Sati & party.

Distribution : India : Delhi, Karnataka, Andhra Pradesh, Tamil Nadu, Orissa. *Elsewhere* : Myanmar ; Singapore.

Remarks : Beeson (1941) recorded that this species feeds on the leaves of *Acacia arabica*, *A. leucopholila* and *Inga dulches*.

Family 10. : ELATERIDAE

Members of the family Elateridae are commonly known as 'chick beetles' They are mostly elongated insects, sombre or blackish in colour. Size varies from a few cm. to about 5-6 cms. They frequent foliage and flowers. Some of the larvae are root feeders and extremely destructive to variouis crops. About 9000 species under 400 genera are recorded from the world and nearly 842 species under 103 genera are known from India.

Key to genera

1 (2) Mesaplisternum reaching the middle coxal cavities. Tibial spurs present. Vestiture setose, scales entirely absent ....*Lanelater*

2 (1) Mesapisternum not reaching the middle coxal cavity. Tibial spurs absent. Vestiture often scaly.

3 (4) Mesapimeron not forming part of margin of mesocoxal cavity ....*Agrypnus*

4 (3) Mesepimeron forming part of margin of mesocoxal cavity .....*Adelocera*

Genus *Lanelater* Arnett

1952. *Lanelater* Arnett, Wasmann *J. Biol.* **10** : 105.

33. *Lanelater fuscipes* (Fabricius)

1775. *Elater fuscipes* Fabricius, *Systema entomologiae* : 211.

1952. *Lanelater fuscipes* (Fabricius) : Arnett, *Wasmann J. Biol.* **10** : 105.

Material examined : Delhi ; 3 exs., Mehrauli, 12.v. 1994, coll. A. Husain & party.

Distribution : India : Delhi, Karnataka, Tamil Nadu, West Bengal, Uttar Pradesh.

Genus *Agrypnus* Eschscholotz

1829. *Agrypnus* Eschscholtz, *Entomologisches Archiv.*, **2** (I) : 32.

1973. *Agrypnus* : von. Hayak, *Bull. Br. Mus. nat. Hist.* (Ent.) suppl. **20** : 113.

34. *Agrypnus sinensis* (Candeze)

1857. *Lacon sinensis* Candeze, *Monographie des Elaterides*, **1** : 139.

1973. *Agrypnus sinensis* : von Hayak, Bull. *Br. Mus. nat. Hist.* (Ent.) suppl. **20** : 212.

Material examined : Delhi ; 3 exs., Lal Bag (Model Town). 8.vi. 1993, coll. V. Khanna & party.

Distribution : India : Delhi, Jammu & Kashmir, Madhya Pradesh, West Bengal, Uttar Pradesh. *Elsewhere* : China & Myanmar.

Genus *Adelocera* Latreille

1829. *Adelocera* Latreille, *Le regna animal Nouvella*, **4** : 451.

35. *Adelocera adspersus* (Candeze)

1857. *Lacon adspersus* Candèze, *Monographie des Elaterides*, 1 : 115.

1926. *Adelocera adspersus* : Fleutiaux, *Annls. Soc. Ent. Fr.* 95 : 96.

Material examined : Delhi; 2 exs., Lake Garden, 16.ii. 1995, coll. J.P. Sati & party ; 1 ex., Mehrauli ; 12.v. 94, coll. A. Husain & party.

Distribution : India : Delhi.

Family 11. : COCCINELLIDAE

Coccinellid beetles, commonly known as *ladybird beetles*, are well known insects because of their common occurrence, beautiful colouration and great economic importance. Majority of species are carnivorous and play an important role in checking the population of harmful soft bodied insects such as aphids, coccids, aleuryds and plant mites. A comparatively small group of phytophagous insects, and cause considerable damage to cultivated plants of the families Cucurbitacae, Solanacae and Papilionacae. These insects widely occur in different regions of the world and 4500 species under 500 genera are known globally. In India nearly 350 species under about 50 genera are recorded so far.

Subfamily : CHILOCORINAE

36. *Brumus suturalis* (Fabricius)

1798. *Coccinella suturalis* Fab., *Suppl. Ent. syst.* : 78.

1850. *Brumus suturalis* (Fab.) : Mulsant, *Ann. Soc. Agric. Lyon*, (92) 2 : 494.

1942. *Brumus suturalis* (Fab.) : Kapur, *Indian J. Ent.*, 4 (1) : 8.

Material examined : Delhi; 5 exs., IARI Campus, 3.vi. 1993, coll. V. Khanna & party ; 6exs., Kakraula nursery, near Najafgarh Road, 27.x. 1993, coll. N.K. Sinha & party.

Distribution : India : widely distributed. *Elsewhere* : Oriental region.

Remarks : It feeds on mites, psyllids, coccids and aphids. It is easily recognised by two lateral and one common suture black strip on straw-yellow elytra.

Subfamily II. COCCINELLIANE

37. *Adonia variegata* (Goeze)

1777. *Coccinella variegata* Goeze, *Entomologische Beytrage* 1 : 246.

1846. *Adonia variegata* (Goeze) : Mulsant, *Histoire naturelle de Coleopteres de France : Sulcicolles Securipalpes*, 4 : 39.

1957. *Adonia variegata* (Goeze) : Kapur, *Bull. Nat. Inst. Sci. India*, 9 : 269-273.

Material examined : Delhi; 1 ex., IARI Campus, 3.vi. 1993, coll. V. Khanna & party.

Distribution : India : Delhi, Kashmir, U.P., West Bengal.*Elsewhere* : Palaearctic,

Ethiopian and Oriental region.

Remarks : It is easily recognised by its elongate shape and the following colour pattern, Head base black, black strip between clypeus and frons, rest brownish yellow ; pronotum straw yellow, base marked with a black strip leaving testaceous spare on either side, four black strip rising from the basal strip towards the anterior margin but not touching ; elytra straw-yellow, scutellum black, triangular, each elytra with 7 black spots of varying size of which scutellar spot uniting with its counterpart from a pear shape spot. Legs are black.

38. *Coccinella septempunctata* Linnaeus

1758. *Coccinella 7-punctata* Linnaeus, *Systema Naturae,* (10th ed.) : 365.

1955. *Coccinella septempunctata* Linnaeus : Kapur, *Rec. Indian Mus.*, **53** : 328.

Material examined : Delhi ; 2 exs., Roadside forest, Karnal Road, 25.x. 1993, coll. N.K. Sinha & party ; 1 ex., Kakraula nursery, near Najafgarh Road, 27.x. 1993, coll. N.K. Sinha & party ; 1 ex., Masudpur, 13.ix. 1994, coll. J.P. Sati & party ; 4 exs., Humayun's Tomb, Mathura Road, 14.xii. 1994, coll. A. Husain & party ; 1 ex., Najafgarh, 20.xii. 1994. coll. A. Husain & party ; 1 ex., Pond Nagli Sakraoti, 20.xii. 1994, coll. A. Husain & party ; 2 exs., Aurobindo Marg, 21.xii. 1994, coll. A. Husain & party ; 1 ex., Asola Wildlife sanctuary, 12.ii. 1995, coll. J.P. Sati & party.

Distribution : India : Widely occurs in plains and foot hills of Himalaya. *Elsewhere* : Palaearctic.

Remarks : It has seven black spots on brownish-yellow elytra, 3 on each side and a common scutellar pear shaped spot.

39. *Coccinella transversalis* Fabricius

1781. *Coccinella transversalis* Fabricius, *Spec. Ins.* : 97.

1962. *Coccinella transversalis* Fabricius : Kapur, *Proc. Ist All-India Congr. Zool.* : 479.

Material examined : Delhi; 5 exs., Kakraula nursery, near Najafgarh Road, 27.x. 1993, coll. N.K. Sinha & party, 1 ex., Roadside forest, Karnal Road, 25.x. 1993, coll. N.K. Sinha & party; 1 ex., Fort, 12.ix. 1994, coll. J.P. Sati & party ; 1 ex., Humayun's Tomb, Mathura Road, 14.xii. 1994, coll. A. Husain & party ; 3 exs., Najafgarh, 20.xii. 1994, coll. A. Husain & party. ; 2ex., Tughlakabad Park, 12.ii. 1995, coll. J.P. Sati & party.

Distribution : India : Widely distributed in plains. *Elsewhere* : Japan to Australia.

Remarks : It is a medium sized beetle. General colour of the pronotum and elytra is bright red (in living condition) and yellow to dark-yellow (in dead specimens). Pronotal base black, and extending medially towards the anterior margin, each elytron with 3 almost wavy, transverse and thick black markings, a common pear shaped scutellar spot and black sutural line connecting the hind two transverse lines.

40. *Menochilus sexmaculatus* (Fabricius)

1781. *Coccinella sexmaculata* Fabricius, *Spec. Ins.* : 96.

1943. *Menochilus sexmaculatus* : Timberlake, *Bull. Hawaiian Sug. Pirs. Ass. Exp. Stn.* (Ent. Ser.) 22, **47** : 40.

1958. *Menochilus sexmaculatus* (Fabricius) : Kapur, *Rec. Indian Mus.* **53** : 333.

Material examined : Delhi ; 2 exs., Kakraula, near Najafgarh Road, 27.x. 1993, coll. N.K. Sinha & party, 1 ex., Priya Park, 13.ix. 1994, coll. J.P. Sati & party. ; 2exs., Majnu Ka Tila. Wazirabad, 15.xii. 1994, coll. A. Husain & party ; 2exs., Aurobindo Marg, 21. xii. 94, coll. A. Husain & party ; 1ex., Jahanpanah Park, 22.xii. 1994, coll. A. Husain & party ; 1ex., Asiad Village, 23.xii. 1994, coll. A. Husain & party.

Distribution : India : Widely distributed. *Elsewhere* : Indo-Malayan sub-region.

Remarks : Mainly feeds on aphids. Varies in size and colour pattern. Generally medium sized beetles. Pronotum and elytra yellowish, Pronotum with a narrow black band at the base and a small black "T" rising from the base, occupying the median line, each elytron with 2 anterior black wavy markings and a posterior oval black wavy marking, sutural margin black, widened below the scutellum and near the apex.

41. *Micraspis allardi* (Mulsant)

1866. *Lamnia allardi* Mulsant, *Mem. Acad. Lyon,* **17** : 28.

1874. *Vevania allardi* : Crotch, *Revision of the Coleopterous family Cocinellidae* : 177.

1965. *Micraspis allardi* : Kamiya, *Revision of Coccinellini of Japan and the Ryukus, Mem. Fac. Lib. Arts, Fukui Univ. Ser. II. Nat. Sci.* **15** (3) : 59-60.

Material examined : Delhi ; 1 ex., Naraina Village, Nala near Ring Road, 6. vi. 1993, coll. V. Khanna & party : 4 exs., Kakraula nursery, near Najafgarh Road, 9.x.1993, coll. N.K. Sinha & party.

Distribution : India : Widely distributed.

Remarks : Pronotum and elytra are reddish yellow in colour. Pronotum has two small black spots at the base ; each elytron have two large black spots. Spots generally vary in shape ; sutural line black.

42. *Oenopia luteospustulata* Mulsant

1850. *Oenopia luteopustulata* Mulsant, *Ann. Soc. Agric. Lyon.* **3** : 421.

Material examined : Delhi ; 1 ex., Kakraula nursery, near Najafgarh Road, 27.x.1993, coll. N.K. Sinha & party.

Distribution : India : Widely distributed.

Remarks : Its colour pattern is variable. The examples under study belong to the var. *pracuae* Weire. Pronotum and elytra yellow. Pronotum with black marking leaving only the

anterior angles yellow. Each elyton with two irregular medium spots connected to the black sutural line which is broadened anteriorly and at the apex. The elytral spots often become separated from the sturual margins.

Family 12. : MELOIDAE

This family is one of the most interesting group among Coleoptera due to remarkable life histories of its members and general occurrence of hypermetamorphosis. These insects are commonly known as *oil beetles* or Blister beetles.Pharmaceutical product cantheridine is a prepared from the dried insects of this group. It is widely distributed in the world except Newzealand and 3000 species under 120 genera are known. In India 107 species under 16 genera have been reported (Saha, 1979).

Genus *Mylabris* Fabricius

1775. *Mylabris* Fabricius, *Systema entomologiae*, **78** : 26.
1976. *Mylabris* : Saha, *Rec. Zool. Survey India*, **74** (1) : 50.

43. *Mylabris phalerata* (Pallas)

1781. *Melos phalerata* Pallas, *Lcones. Insectorum Ross. Sibir* : 78.
1798. *Mylabris sidae* : Fabricius, *Ent. Syst. Suppl.* : 120.
1872. *Mylabris phalerata* : Marseul. *Mem. Soc. Liege.* : 446.
1954. *Mylabris (Euzonabris) phalerata* : Kuzin. *Trudi. Ent. Obs.* **44** : 358.

Material examined : Delhi ; 3 exs., Asola WLS, 17.ix. 1994, coll. J.P. Sati & party.

Distribution : India : Delhi, Uttar Pradesh, Bihar, Orissa, Tamil Nadu, Madhya Pradesh, Karnataka, West Bengal. *Elsewehre* : Sri Lanka.

Family 13 : CHRYSOMELIDAE

Members of the family Chrysomelidae are commonly known as *leaf beetles*. This is one of the largest family of Coleoptera. These beetles usually feed on the foliage both in larval and adult stage. Some species are highly injurious to various cultivated plants as well as forest and horticultural trees. So far 35,000 species under 2,500 genera are known from the world of which about 1,500 species have been recorded from India.

Genus *Aulacophora* Chevrolat

1837. *Aulacophora* Chevrolat, In Dejean, *Cat. Col.*, **2** : 378.
1936. *Aulacophora* : Maulik, *Fauna Bri. India. Col., Chry.* (Gal.) : 167.

44. *Aulacophora foveicollis* (Lucas)

1849. *Galeruca foveicollis* Lucas, *Explor. Alger. Ent.* : 542.
1879. *Aulacophora foveicollis* : Baly, *Cist. Ent.*, **2** : 445.
1936. *Aulacophora foveicollis* : Maulik, *Fauna Brit. India, Col. Chry. (Gal.)* : 173.

Material examined : Delhi ; 1 ex., Palam Airport, 9.ix. 1992, coll. J.P. Sati & party.

Diagnostic characters : General colour brown ; metasternum and abdominal sternites entirely or largely black ; in the male humerus covered with erect hairs ; length 6-7 mm.

Distribution : India : Delhi; Arunachal Pradesh, Assam, Andaman Is., Bihar, Gujarat., Kerala, Maharashtra, Meghalaya, Orissa, Punjab, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal. *Elsewhere* : Bangladesh; Myanmar; Nepal; Sri Lanka and also in Europe.

Subfamily : ALTICINAE
Genus *Altica* Fabricius

1762. *Altica* Geoffrey, *Hist. Ins.* **1** : 244 (new name)
1775. *Altica* : Fabricius, *Spst. ent.* : 112.
1969. *Altica* : Scharer, *Pac. Ins. Monogr.*, **22** : 126.

45. *Altica cyanea* (Weber)

1801. *Galleruca cyanea* Weber, *Observ. Ent.*, **1** : 67.
1889. *Altica cyanea* : Jacoby, *Ann. Mus. Civ. Genova*, **7** (27) : 191.
1960. *Altica cyanea* : Ohno. *Tokyo Univ. Bull. Dept. Lib. Arts.*, **1** : 90.

Material examined : Delhi, 47 exs., Okhla Dam, 25.v.1994, coll. A. Husain & party.

Diagnostic characters : General colour dark blue ; antennae black with the basal segments brownish at apices ; scutellum blackish, length 5.0 mm.

Distribution : India : Delhi, Assam, Karnataka, Maharashtra, Punjab. *Elsewhere* : Sumatra; Brunei : Borneo ; Malaya : Vietnam.

Remarks : First record from Delhi.

Subfamily : CASSIDINAE
Genus *Aspidomorpha* Hope

1840. *Aspidomorpha* Hope, *Col. Man.*, **3** : 158.
1919. *Aspidomorpha* : Maulik, *Fauna Brit. India, Col., Chry, (Hisp. & Cass.)* : 324.

46. *Aspidomorpha miliaris* (Fabricius)

1775. *Cassida miliaris* Fabricius, *Ent. Syst.* : 91.

1854. *Aspidomorpha miliaris* : Boheman, *Mon. Cassid.*, 2 : 261.

1919. *Aspidomorpha miliaris* : Maulik, *Fauna Brit. India*, Chry, (*Hisp. & Cas.*) : 334.

Material examined : Delhi ; 1 ex., Humayun's Tomb, Mathura Road, 14.ii. 1994, coll. A. Husain & party.

Diagnostic characters : General colour yellowish brown, sometimes paler or darker ; elytra with variable black markings ; the explate margins with usual four black patches or spots ; underside entirely or partly or not at all black ; length 9.5 - 15.0 mm.

Material examined : Delhi ; 1 ex., Humayun's Tomb, Mathura Road, 14.ii. 1994, coll. A. Husain & party.

Distribution : India : Delhi, Andaman Is., Assam, Bihar, Karnataka, Meghalaya, Orissa, Tamil Nadu and West Bengal. *Elsewhere* : Myanmar, China, Indo-china ; Sri Lanka and Sunda Is.

Remarks : First record from Delhi.

47. Genus *Sindia* Weise

1897. *Sindia* Weise, *Deut. Ent. Zeits.* : 105.

1919. *Sindia* : Maulik, *Fauna Brit. India. Col., Chry, (Hisp. & Cass.)* : 340.

48. *Sindia clathrata* (Fabricius)

1798. *Cassida clathrata* Fabricius, *Ent. Syst. Suppl.* : 83.

1897. *Sindia clathrata* : Weise, *Deut. Ent. Zeits.* 105.

Material examined : Delhi; 1 ex., Cantonment area, 10.vi.1993, coll. V.Khanna & party.

Diagnostic characters : Colour varies from light brown to dark red-brown, with black markings on pronotum and elytra ; length 11.5 - 14.0 mm.

Distribution : India : Kerala, Maharashtra and West Bengal.

Remarks : First record from Delhi.

SUMMARY

The present paper deals with 49 species belonging to 41 genera under 13 families. Key to the families have been provided; key to the genera and species have also been given except where diagnostic characters are added. First reference and recent valid names of genera and species have been given. Distributional data of the species have been given from the published records as well as from actual study of the specimens.

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REFERENCES

Arora, G.L. 1977. Bruchidae of North-West India. *Oriental Insects* Suppl. **7** : 1-132.

Pajni, H.R. 1990. *Fauna of India and adjacent countries. Coleoptera : Curulionidae : Eremninae : Cyphicerinii.* Zoological Survey of India, Calcutta ; vi+1-568.

Vats, L.K. & S.L. Kashyap 1992. Seven new species of *Adelocera* Latreille from North-West India (Coleoptera : Elateridae). *J. ent. Res.* **16** (1) : 1-2.

Vats, L.K. & S.L. Kashyap 1992. Forty eight species of *Agrypnus* Eschuscholtz including forty new additions from North-West India (Coleoptera : Elateridae). *J. ent. Res.* **16** (2) : 87-154.

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COLEOPTERA

Additional species known from Delhi

compiled by
VINOD KHANNA
Zoological Survey of India, Dehra Dun 248 195

Family : MELOIDAE

1. *Epicaudata rouxi* (Laporte)
2. *Lyttini acteon* Laporte
3. *L. indica* Anand
4. *Cylindrothorax pictus* (Laporte)
5. *Lytta limbata* (Kollar and Redtenbacher)
6. *Mylabris delhiensis* Anand
7. *M. orientalis* Marseul
8. *M. thunbergi* Billberg
9. *Cyaneolytta indica* Anand

Family : SCARABAEDAE

10. *Cyphonoxia delhiensis* Anand
11. *Holotrichia consanguinea* Blanchard
12. *Hemiserica mayarami* Khan and Ghai
13. *Holotrichia serrata*
14. *Schizonycha rufficollis* (Fab.)
15. *S. impressa* Khan and Ghai

Family : CHRYSOMELIDAE

16. *Cryptocephalus suillus* Saffrain
17. *C. insubidus* Saffrain

Family : STAPHYLINIDAE

18. *Deinopsis puncturatus* Kem and Ghai
19. *Hypocryptus ricini* Kem and Ghai

Family : DYTISCIDAE

20. *Canthydrus* sp.
21. *Hydrocopius* sp.
22. *Hydrovatus* sp.
23. *Eretes* sp.

Family : HYDROPHILIDAE

24. *Berosus indicus*
25. *Halochares* sp.
26. *Regimberita* sp.
27. *Sternolophus* sp.

Family : GYRINIDAE

28. *Dineustes* sp.

Family : LEPTOCERIDAE

29. *Leptocerus* sp.

Family : CURCULIONIDAE

30. *Bogons* sp.
31 *Myllocerus viridanus*
32. *M. mayarami*
33 *M. evasus*
34. *M. delicatulus*
35. *M. lineatocollis*
36. *M. dorsatus*
37. *M. tnuiclavis*
38. *M. fabricii*
39. *M. spinicollis*
40. *M. laetivirens*
41. *M. delbergiae*
42. *M. rosae*
43. *M. neopinus*
44. *M. sabulosus*
45. *M. menoni*
46. *M. transmarinus*
47. *M. lefroyi*
48. *M. subfasciatus*
49. *M. dentifer*

REFERENCES

Anand, R.K. 1988. On Genus *Cyphonoxia* Reitter with description of a new species from India (Insecta : Coleoptera : Scarabaedae). *Reichenbachia,* **26**(4) : 15-18.

Anand, R.K. 1979. A new species of *Cyneolytta* Peringuey (Col : Meloidae) from India. *Ent. Mon. Mag.*,**115** : 227-228.

Anand, R.K. 1984. Two new species of *Mylabris* Fabricius (Coleptera : Meloidae) from India. *Bull. Entomol.*, **25** (2) : 131-134.

Anand, R.K. 1989. Indian Meloidae (Coleoptera) : A Taxonomic review. *Bull. Entomol.*, **30** (1) : 24-34.

Kem, T.R. and Ghai, S. 1977. A new species of Rove Beetle from India (Coleoptera : Staphylinidae). *J. Bombay nat. Hist. Soc.*, **74** (1) : 147 148.

Kem, T.R. and Ghai,S. 1976. A new species of Predatory Rove Beetle from India (Coleoptera : Staphylinidae). *Entomon*,**1** (2) : 201 202.

Khan, K,M. and Ghai, S., 1982. Taxonomic status of genus *Holotrichia* Hope (Melolonthini : Melolonthinae : Scarabaedae) with descriptions of five new species from India alongwith redescriptions of two poorly described species and a key to the species. *Bull. Entomol.*, **23** : 28-45.

Khan, K.M. and Ghai S. 1974. White grubs and their control in India. *Pesticides*, 19-25.

Khan, K,M. and Ghai, S. 1980. *Schizonycha impressa* A new species from India (Melolonthini : Melolonthinae : Scarabaedae) and redescription of two species. *Bull. Entomol.*, **21** : 33-39.

Khan, K.M. and Ghai, S. 1980 : Notes on the genus *Hemiserica* Brenske (Sericini : Melolonthini : Scarabaedae) with description of two new species from India and key to the species.*Bull. Entomol.*, **21** : 40-43.

Ramamurty, V.V., Butani, D.K. and Ghai, S. 1982. Occurrence of *Cryptocephalus* spp. on Mango leaves in India. *Indian J. ent.*, **44** (4) : 403 - 405.

Ramamurthy, V.V. & Ghai S. 1988. A study on the Genus *Myllocerus* (Coleoptera : Curculionidae). *Oriental Ins.*, **22** : 377-500.

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DIPTERA

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INTRODUCTION

The Diptera fauna of Delhi is little known. This report contains the specimens belonging to 53 species of families Culicidae, Tipulidae, Stratiomyidae, Asilidae, Syrphidae, Tephritidae, Otitidae, Sciomyzidae, Sepsidae, Chamaemyiidae, Agromyzidae, Muscidae, Calliphoridae, Sarcophagidae, Tachinidae and Gasterophilidae. The species recorded for the first time from Delhi are marked with asterisk. Species recorded from the area in the past by other workers have been included to make the present report a comprehensive account on the Dipteran fauna of Delhi. The Stratiomid and Syrphid flies, etc. are flower visitors and could be encountered from various agricultural crops and flower gardens. As Asilids are predaceous flies and feed on insects of various orders, they could be seen at places with prevalence of insects. Tephrit flies are pests of fruits of almost all types. Otitids are met on the vegetations. Sepsids predominantly seen on cow-dung and its vicinity. Sciomyzids are predatory on land and fresh-water snails and could be seen in the vicinity of water bodies. Chaemomyiids are predatory on Homoptera. The cereals and various other agricultural crops and wild plants fall victim to Agromyzid fllies. Muscid, Calliphorid and Sarcophagid flies favour various decaying matters inlcuding excrements. Tachinids parasitises larvae of other insects, including silk moth (and emerge on rearing such larvae or catterpillars), while adults often visit vegetations particularly flowers. The Gasterophilids casually seen on bare mountain tops and on top of trees.

The easiest way to collect all these flies is by insect net. They could be trapped by various baits fish, meat, sweets, fruits, etc. The flies are to be preserved dry. The ideal time for collection of diurnal flies is after sunrise and after the onset of evening for noctural flies.

SYSTEMATIC ACCOUNT

Family : TIPULIDAE
Subfamily : TIPULINAE

1. *Tipula (Schummelia) continuata* Brunetti

Family : CULICIDAE
Subfamily : ANOPHELINAE

2. *Anopheles (Anopheles) barbirostris* Van der Wulp
3. *Anopheles (Anopheles) nigerrimus* Giles

4. *Anopheles (Anopheles) peditaeniatus* (Leicester)
5. *Anopheles (Cellia) annularis* Van der Wulp
6. *Anopheles (Cellia) culicifacies* Giles
7. *Anopheles (Cellia) maculatus* Theobald
8. *Anopheles (Cellia) fluviatilis* James
9. *Anopheles (Cellia) pallidus* Theobald
10. *Anopheles (Cellia) pulcherrimus* Theobald
11. *Anopheles (Cellia) splendidus* Koidzumi
12. *Anopheles (Cellia) stephensi* Liston
13. *Anopheles (Cellia) subpictus* Grassi
14. *Anopheles (Cellia) turkhudi* Liston

Subfamily : CULICINAE

15. *Aedes (Aedimorphus) culicinus* Edwards
16. *Aedes (Aedimorphus) tacniorhynchoides* (Christophers)
17. *Aedes (Neomaeleaya) indicus* (Theobald)
18. *Aedes (Neomacleaya) yusufi* Barraud
19. *Culex (Culex) fuscocephalus* Theobald
20. *Culex (Culex) perplexus guinuefasciatus* Say
21. *Culex (Culex) vagans* Wiedemann
22. *Aedes (Stegomya) aegypti* (Linnaeus)
23. *Coguillettidia (Coguillettidea) crassipes* (van der Wulp)

Family : STRATIOMYIDAE
Subfamily : STRATIOMYINAE

24. *Adoxomyia heminopla* (Wiedemann)

Family : ASILIDAE
Subfamily : LAPHRIINAE

25. *Laxenecera albibarbis* Macquart

Subfamily : DASYPOGONINAE

26. *Michotamia aurata* (Fabricius)

Subfamily : ASILINAE

27. *Promachus duvaucelii* (Macquart)
28. *Promachus maculatus* (Fabricius)

Family : SYRPHIDAE
Subfamily : MILISIINAE

29. *Eristalinus (Eristalinus) aruorum* (Fabricius)
30. *Syritta pipiens* Linnaeus

Family : TEPHRITIDAE
Subfamily : DACINAE

31. *Dacus (Zeugodacus) cucurbitae* Coquillett

Family : OTITIDAE
Subfamily : ULIDIINAE

32. *Physiphora aenea* (Fabricius)

Family : SCIOMYZIDAE
Subfamily : SCIOMYZINAE

33. *Sepedon ferruginosa* Wiedemann
34 *Sepedon plumbella* Wiedemann

Family : SEPSIDAE
Subfamily : SEPSINAE

35. *Sepsis albopunctata* Lamb

Family : CHAMAEMYIIDAE
Subfamily : CHAMAEMYIINAE

36. *Leucopis (Indioleucopis) luteicornis* Malloch

Family : AGROMYZIDAE
Subfamily : AGROMYZINAE

37. *Agromyza hordei* Spencer
38. *Agromyza pennisetivora* Spencer
39 *Melanagromyza hibisci* Spencer
40. *Melanagromyza metallica* (Thomson)
41. *Melanagromyza obtusa* (Malloch)
42. *Melanagromyza nigrisquama* (Malloch)
43. *Ophiomyia beckeri* (Handel)
44. *Ophiomyia phaseoli* (Tryon)

Subfamily : PHYTOMYZINAE

45. *Liriomyza brassicae* (Reley)
46. *Liriomyza compositella* Spencer

Family : MUSCIDAE
Subfamily : MUSCINAE

47. *Musca (Musca) domestica* Linnaeus
48. *Orthellia lauta* (Widemann)

Family : CALLIPHORIDAE
Subfamily : RHYNIINAE

49. *Idiella mandarina* (Wiedemann)

Family : SARCOPHAGIDAE
Subfamily : SARCOPHAGINAE

50. *Parasarcophaga (Parasarcophaga) misera* (Walker)
51. *Pierretia calicifera* (Bolttcher)

Family : TACHNIDAE
Subfamily : PHASIINAE

52. *Euthera mannii* Mik

Family : GASTEROPHILIDAE
Subfamily : GASTEROPHILINAE

53. *Gasterophilus intestinalis* (De Geer)

Key to families*

1. Antenna with more than 5 segments 2
\- Antennal segments less than 5 3

2. Thorax with a V-shaped transverse suture; palpus whiplash-like.....Tipulidae
Thorax without such transverse suture ; palpus stiff, wing with scales .....Culicidae

3. Antennal segment 3 with annulations : discal cell more or less round-shaped
.....*Stratiomyidae*
\- Antennal segment 3 without annulations ; discal cell of various shape.....4

4. Third antennal segment with apical arista; vertex depressed between the eyes .....*Asilidae*
\- Third antennal segment with dorsal arista ; vertex not depressed.....5

**Key's to the families, subfamilies, genera and species refers to those occurring in Delhi only.*

5. Wing with vena spuria ..... *Syrphidae*
- Wing without vena spuria 6

6. Mouth parts vestigial ; fourth posterior cell straight .....*Gasterophilidae*
- Mouth parts normal ; fourth posterior cell not as above 7

7. Antennal segment 2 above without distinct external groove ; squamma small or vestigeal 8
- Antennal segment 2 above with a distinct external groove ; squamma well developed 11

8. Vibrissae present ; palpus reduced .....*Sepsidae*
- Vibrissae absent ; palpus normally developed 9

9. Tibiae with preapical bristles ; post verticals divergent ; peristomal bristles absent .....*Sciomyzidae*
- Tibiae without preapical bristles ; post verticals and peristomal bristles not as above 10

10. Cell Cu_2 pointed at apex, vein R_1 bristly above ..... *Otitidae*
- Cell Cu_2 not pointed at apex, vein R_1 bare above .....*Chaemomyiidae*

11. Subcosta ends parpendicularly to costa, wing usually punctured .....*Tephritidae*
- Subcosta ends to costa normally 12

12. Costa broken at the end of subcosta.....*Agromyzidae*
- Costa not broken 13

13. Hypopleuron without bristles below spiracle.....*Muscidae*
- Hypopleuron with a row of strong bristles below spiracle 14

14. Post scutellum nonconvex ; second abdominal sternite with sides visible above tergite ; abdomen thickly covered with macrochaetae .....*Tachinidae*
- Post scutellum convex ; second abdominal sternite entirely covered by tergite ;abdominal macrochaetae few or even absent 15

15. Arista plumose upto its middle and bare distally ; distal part of abdomen with few macrochaetae ; non metallic .....*Sarcophagidae*
- Arista plumosa almost upto its apex ; abdomen almost without macrochaetae ; usually metallic blue or green in colour .....*Calliphoridae*

Family : TIPULIDAE
Subfamily : TIPULINAE

Genus ***Tipula*** Linnaeus

1758. *Tipula Linnaeus, Syst. Nat.*, **10** : 585. Type-species : *Tipula oleracea* Linnaeus.

Diagnostic characters : Proboscis moderately long and broad which projects dorsally nose-like ; antenna with 13 joints, first segment elongate, second segment very short, all flageller joints with 4 verticillate hairs ; thorax produced into a conceal neck, abdomen eight segmented in both sexes; legs very long, tarsi generally longer than tibiae ; wing with one marginal, two submarginals and five posterior cells, auxiliary and first longitudinal vein ends at the tip of first and second veins respectively.

1. ****Tipula (Schummelia) continuata*** Brunetti

1912. *Tipula continuata* Brunetti, *Fauna Brit. India, Dipt., Nematocera* : 328.

Material examined : Delhi; 1 ♂, Safdarjung Tomb, 21.xii.1994, coll. A. Husain & party.

Diagnostic characters : Head yellow with a brown stripe from frons to vertex, first joint of antenna yellow, rest grey but yellowish at base along with a black ring at each flagellomera ; thorax yellowish with three longitudinal stripes, the middle one touches the anterior margin, pleura yellow, abdomen yellowish with a narrow black lateral stripe on each side, last three segments brown dorsally ; coxae yellow, rest of legs brownish-yellow to dark brown ; wings pale grey with scattered clear spaces.

Distribution : India : Delhi, West Bengal. *Elsewhere* : Pakistan.

Family : CULICIDAE

Key to subfamilies

1. Wing usually spotted ; palpi long and of about same length as the proboscis in female ; in the male, palpi with the two apical segments swollen and flattened to be shaped as the head of a golf-club ..... *.Anophelinae*
- Wing usually unspotted, palpi not as above .....*Culicinae*

Subfamily : ANOPHELINAE

Genus ***Anopheles*** Meigen

1818. *Anopheles* Meigen, *Syst. Beschr. europ. zweife insekt.*, **1** : 10. Type species : *Anopheles maculipensis* Meigen.

Diagnostic characters : Palpi of both sexes equal to the length of proboscis, only male with apical two segments club-shaped ; posterior edge of scutellum bar-shaped with hairs on it in a continuous series. Male with single claw in fore tarsi ; in female abdomen with scattered scales on tergites but rare on sternites.

Key to subgenera

1. Wing wholly dark or with maximum 3 dark infuscations covering both costa and first longitudinal vein; male coxite with 2 parabasal spines and 1 internal spine ..... *Anopheles*
- Wing with at least 4 infuscated areas on costa and first longitudinal vein; male coxite with 4 or 5 parabasal spines, internal spine absent ..... *Cellia*

Subgenus *Anopheles* Meigen

1915. *Anopheles* Meigen, *Indian J. Med. Res.*, **3** : 383.

Key to species

1. Palpi with definite pale marking 2
- Palpi without any pale marking, apex of wing with two milk-white spots ..... *barbirostris*

2. Remigium with a line of white scales along the anterior border ; no fringe spot on vein 5, 2 ..... *peditaeniatus*
- Remigium without a line of white scales along the anterior border ; fringe spots present on vein 5, 2 ..... *nigerrimus*

2. ***Anopheles barbirostris*** Van der Wulp

1884. *Anopheles barbirostris* Van der Wulp, *Notes Leyden Mus.*, **6** : 248.
Material examined : From literature.
Distribution : India. *Elsewhere* : Wide spread in Oriental region.

3. ***Anopheles nigerrimus*** Giles

1900. *Anopheles nigerrimus* Giles, *Handbook* : 162.
Material examined : From literature.
Distribution : India : Delhi. *Elsewhere* : Wide spread in Oriental region from south-east;

Afganistan to Indonesia.

4. *Anopheles peditaeniatus* (Leicester)

1908. *Myzonhynchus peditaeniatus* Leicester, *Cul. Malaya* : 31.

Material examined : From literature.

Distribution : India : Delhi, Assam, Bihar, Karnataka, Madhya Pradesh, Punjab, Tamil Nadu and West Bengal. *Elsewhere* : Bangladesh ; China ; Kalimantan ; Malaysia ; Myanmar ; Nepal ; Philippines ; Sri Lanka ; Sutlawesi ; Thailand ; Vietnam.

Subgenus *Cellia* Theobald

1902. *Cellia Theobald, J.trop. Med.* 5 : 183. Type species : *Anopheles pharoensis* Theobald.

Key to species

1. Tip of hind tarsi white 2
- Tip of hind tarsi not white 6
2. White area on hind tarsi involving not more than one segment.....*maculatus*
- White area on hind tarsi involving at least two terminal segments 3

3. Femora and tibiae speckled .....*splendidus*
- Femora and tibiae not speckled 4

4. Hind tarsi 3-1/4 segments continuously white ; abdomen heavily clothed with broad scales forming lateral tufts except on the last few segments .....*pulcherrimus*
- Hind tarsi 3-3/4 or less segments continuously white, abdomen with almost rather narrow scales not forming tufts except on last few segments 5

5. Vein 5 mainly black or with at least a dark spot about the middle near the origin of the branch .....*annularis*
- Vein 5 continuously pale except dark spot at base and apex .....*pallidus*

6. Tarsi of front legs with broad pale bands 7
- Tarsi of front legs unbanded or only with narrow bands 8

7. Femora and tibiae speckled, white scales on 2-4 flagellar segments .....*stephensi*
Femora and tibiae not speckled, first flagellar segment with white scales.....*subpictus*
8. Thorax with obvious scales .....*turkhudi*
Thorax with hairs or hair like scales 9

9. Fringe spots well marked at all veins except 6 ; some erect pale scales in front of thorax ; vein 1 pale in basal area ....*fluviatilis*
Fringe spots only on two veins except rarely; no pale scales or very few in front of thorax; vein 1 internal to inner dark costal spot with dark spot.....*culicifacies*

5. *Anopheles (Cellia) annularis* Van der Wulp

1884. *Anopheles annularis* Van der Wulp, *Notes Leyden Mus.*, **6** : 249.
Material examined : From literature.
Distribution : India : Delhi. *Elsewhere* : Wide spread in Oriental region, including lesser Sunda Islands.

6. *Anopheles (Cellia) culicifacies* Giles

1901. *Anopheles culicifacies* Giles, *Entom. month. Mag.*, (2) **12** :197.
Material examined : From literature.
Distribution : India : Delhi, wide spread usually above 1500 m. *Elsewhere* : Sri Lanka; Bangladesh; Myanmar; South China; Indo-china; Nepal; Pakistan; Thailand;Afghanistan; Bahrein; Iran; Trucial Oman.

7. *Anopheles (Cellia) fluviatilis* James

1902. *Anopheles fluviatilis* James, *Scient. Mem. Offrs med. sanit. Deps. India, n.s.*, **2** : 31.
Material examined : From literature.
Distribution : India; widespread specially in foothill areas and hilly or rocky tracts, Delhi. *Elsewhere* : Sri Lanka; Bangladesh; Myanmar; South China; Taiwan; Nepal; Pakistan; Thailand; Afghanistan; Bahrein; East and South Arabia; Indo-china; Iran; Iraq; Kazakh; USSR; Oman; Trucial Oman.

8. *Anopheles (Cellia) maculatus* Theobald

1901. *Anopheles maculatus* Theobald, *Monogr. Cul.*, **5** : 65.
Material examined : From literature.
Distribution : India: Delhi. *Elsewhere* : Widespread Oriental region from Pakistan to Indonesia including lesser Sunda Islands.

9. *Anopheles (Cellia) pallidus* Theobald

1901. *Anopheles fuliginosus* var. *pallida* Theobald, *Monogr.Cul.*, **1**: 34.
Material examined : From literature.

Distribution : India : Delhi; widespread except Rajasthan, Andamans and Lakshadweep. *Elsewhere* : Sri Lanka; Bangladesh; Nepal; Myanmar; Malaysia; Pakistan; Thainland; Indonesia.

10. *Anopheles (Cellia) pulcherrimus* Theobald

1902. *Anopheles pulcherrimus* Theobald, *Proc. R. Soc.*, **69** : 369.

Material examind : From literature..

Distribution : India : Delhi ; Punjab, Gujarat, Uttar Pradesh. *Elsewhere* : Pakistan; Afghanistan; USSR; Iran; Iraq; Saudi Arabia; Bahrain; Syria; Lebanon; Israel; Turkey.

11. *Anopheles (Cellia) splendidus* Koidzumi

1920. *Anopheles splendidus* Koidzumi, *Daiwan Kenkyujo Hokoku,* **8** : 23.

Material examined : From literature..

Distruibution : India : Delhi ; Punjab, Kashmir, Himachal Pradesh, West Bengal, Sikkim, Assam, Madhya Pradesh, Maharashtra, Gujarat, Karnataka, Andhra Pradesh, Kerala, Tamil Nadu, Goa. *Elsewhere* : Afghanistan, Sri Lanka; Nepal; Myanmar; Pakistan; Bangladesh; Thailand; Indo-china; China

12. *Anopheles (Cellia) stephensi* Liston

1901. *Anopheles stephensi* Liston, *Indian Med. Gaz.*, **36**: 441.

Material examined : From literature.

Distribution : India : Delhi, widespread. *Elsewhere* : Pakistan; Afghanistan; Iran; Iraq; Bahrain; Saudi Arabia; Oman; Trucial Oman; South China; Myanmar; Thailand.

13. *Anopheles (Cellia) subpictus* Grassi

1899. *Anopheles subpictus* Grassi, *Re. R. Acad. Lineei*, **8** : 101.

Material examined : From literature..

Distribution : India : Delhi, widespread. *Elsewhere* : Myanmar; Sri Lanka; China; Nepal; Indonesia; Malaya; Pakistan; Thailand; Afghanistan; Bismarck Islands; Iran: New Guinea.

14. *Anopheles (Cellia) turkhudi* Liston

1901. *Anopheles turkhudi* Liston, *Indian med. Gaz.*, **36** : 441.

Material examined : From literature.

Distribution : India : Delhi, Maharashtra, Gujarat, Karnataka, Madhya Pradesh, Rajasthan, Punjab. *Elsewhere* : Egypt (Sinai); Morocco; Israel; Saudi Arabia; Yeman; Aden;

Sudan; Somaliland; Eritrea; Ethiopia; Afghanistan; Pakistan.

Subfamily : CULICINAE

Key to genera

1. Pulvilli present; bucco-pharyngeal armature present in female .....*Culex*
- Pulvilli absent; bucco-pharyngeal armature absent in female, postspiracular bristles present 2
2. Wing scales unusually broad, and many asymmetrical; tergite viii of female with a row or patch of short tooth-like spines; apical segment of palpi of male minute; claws of female simple .....*Couillettidia*
- Wing scales not unusually broad and not asymmetrical; tergite viii of female without spines; apical segment of palpi of male usually of moderate length;.....*Aedes*

Genus ***Aedes*** Meigen

1818. *Aedes* Meigen, *Syst. Beschr. europ. Zweifl. Insekt.*, **1** : 13. Type species : *A.cinereus* Meigen.

Key to subgenera

1. Segment viii narrow and completely retractile; cerci long and narrow and projecting from ring of segment vii .....*Aedimorphus*
- Segment viii broader and not completely retractile; cerci shorter and broader 2

2. Black species with snow white markings and white basal bands on tarsi.....*Stegomyia*
- Black species with little or no ornamentation .....*Neomacleaya*

Subgenus ***Aedimorphus*** Theobald

1903. *Aedimorphus* Theobald, *Monogr. Cul.*, **3** : 290. Type species : *Uranotaenia domestica* Theobald.

Key to species

Hind tarsal segments marked with distinct basal pale rings.....*taeniorhynchoides*
Hind tarsi not ringed, or with only distinct traces of rings at bases of first three segments.....*culicinus*

15. *Aedes (Aedimorphus) culicinus* Edwards

1922. *Aedes culicinus* Edwards, *Indian J.med. Res.*, **10** : 271.
Material examined : From literature.
Distribution : India : Delhi and Punjab.

16. *Aedes (Aedimorphus) taeniorhynchoides* (Christophers)

1911. *Leslicomyia taeniorhynchoides* Christophers, *Paludism*, **2** : 68.
Material examined : From literaute.
Distribution : India : Delhi and Punjab.

Subgenus *Neomacleaya* Theobald

1907. *Neomacleaya* Theobald, *Monogr. cul.*, **4** : 238. Type species : *N. indica* Theobald.

Key to species

Female apn covered with silvery white scales ....*yusafi* Barraud
Female apn not so covered.....*indicus* (Theobald)

17. *Aedes (Neomacleaya) indicus* (Theobald)

1907. *Neomacleaya indicus* Theobald, *Monogr. Cul.*, **4** : 238.
Material examined : From literature.
Distribution : India : Delhi, Bihar, Punjab, Tamil Nadu and Uttar Pradesh. *Elsewhere* : Sri Lanka; Thailand.

18. *Aedes (Neomacleaya) yusafi* Barraud

1931. *Aedes yusafi* Barraud, *Indian J. med. Res.*, **19** : 612.
Material examined : From literature.
Distribution : India : Delhi and Punjab.

Subgenus *Stegomyia* Theobald

1901. *Stegomyia* Theobald, *Mosquitoes* : 235. Type species : *Culex fasceatus* Fabricius.

19. *Aedes (Stegomyia) aegypti* (Linnaeus)

1762. *Culex aegypti* Linnaeus, *in Hasselguist's Reise nach. Palastina* : 470.

Material examined : From literature.

Diagnostic characters : Vertex with silver-white flat scales in the middle; clypeus with two small silver-white dots; scutum with a pair of curved white stripes and a pair of submedian yellowish lines; mid femur anteriorly with a white longitudinal stripe almost up to apex from base; tibiae without any white ring; fore and mid tarsi with narrow basal white bands up to first three segments, tergites 2-6 with dull white bands, 7 with two silvery-white dots.

Distribution : India : Delhi, wide spread. *Elsewhere* : Pantropical.

Genus *Coguillettidia* Dyar

1905. *Coguillettida* Dyar, *Proc. ent. Soc. Wash.*, 7: 47 : Type species : *Culex perturbans Walker.*

Diagnostic characters : It resembles *Aedes* but differs in the absence of postspiracular bristles; yellow or yellowish-brown species of moderate size with palpus in male slightly longer than proboscis, pulvilli absent; tarsal claws in female simple, in male fore and mid tarsal claws large and toothed.

20. *Coguillettidia (Coguillettidia) crassipes* Van der Wulp

1881. *Culex crassipes* Van der Wulp, *Midden-Sumatra, Dipt.*, 4 : 9.

Material examind : From literature..

Diagnostic characters : In female antenna, proboscis and palpi brown, palpi nearly one-third of proboscis; scutum yellowish-brown, wing with purple, blue and green reflections; femora yellowish at basal half, purplish on apical half; 1-5 abdominal tergites with purple scales, terminal segments yellow scaled in male, palpi longer than proboscis.

Distribution : India : Delhi, Assam, Bihar, Punjab, Peninsula. *Elsewhere* : Bangladesh; China; Malaya; Myanmar; Philippines; Ryukyu Islands; Caledonia; New Guinea; New Hebrides.

Genus *Culex* Linnaeus

1758. *Culex* Linnaeus, *Syst. Nat.*, 10 : 602 ; Type species : *C. pipiens* Linnaeus.

Diagnostic characters : Median to large sized species, adjacent area of eye without broad scales; proboscis with a pale ring in the middle; metatarsus of hind leg as long as or longer than tibia.

Key to species

1. Fore and mid femora and all tibiae conspicuously striped in front, hind femur pale beneath from base to knee.....*vagans*
- Fore and mid femora all dark in front 2

2. Hind tibia dark except small pale spot at tip .....*quinquefasciatus*
Hind tibia with more or less distinct pale stripe on outer side.....*fuscocephalus*

21. ***Culex (Culex) fuscocephalus*** Theobald

1906. *Culex fuscocephalus* Theobald, *Monogr. Cul.*, **4** : 420.
Material examined : From literature..
Distribution : India : Delhi, widespread, Andaman Islands. *Elsewhere* : China; Indonesia; Kalimanta; Malaya; Myanmar; Nepal; Philippines; Sri Lnaka; Taiwan; Thailand.

22. ***Culex (Culex) perplexus quinquefasciatus*** Say

1823. *Culex perplexus quinquefasciatus* Say , *J.Acad. nat. Sci. Philad.*, **3** : 10.
Material examined : From literature.
Distribution : India : Delhi. *Elsewhere* : Cosmotropical

23. ***Culex (Culex) vagans*** Wiedemann

1828. *Culex (Culex) vagans* Wiedeman, *Aussereurop Zweifl. Insekt.*, **1** : 545.
Material examined : From literature..
Distribution : India : Delhi, Kashmir, Punjab. *Elsewhere* : China; Japan; Korea; Taiwan.

Family : STRATIOMYIDAE
Subfamily : STRATIOMYINAE

Genus ***Adoxomyia*** Bezzi

1908. *Adoxomyia* Bezzi, *Wien. ent. Ztg.*, **27** : 75 ; Type species : *Clitellaria dahlii* Meigen.
Diagnostic characters : Eyes densely pubescent in both sexes; holoptic in males, dicloptic in females; antennal segment 3, elongate, conical, with 4- annulations, with 2- jointed apical style; scutellum with 2 spines; wing with R forked; vein M with 3 endings; posterior cross-vein absent; abdomen 5-segmented.

24. **Adoxomyia heminopla* (Wiedemann)

1819. *Clitellaria heminopla* Wiedemann, *Zool. Mag.*, **1** : 30.

Material examined : Delhi; 1 ♀, IARI Campus, 11.ix.1994, coll, J.P. Sati & party.

Diagnostic characters : Antennal segments 1 and 2 black, 3 reddish brown to yellow, tip black; thorax without definite hair-stripes but square; abdomen generally black.

Disttribution : India : Delhi, Bihar, Madhya Pradesh, Punjab, Tamil Nadu and Uttar Pradesh.

Family : ASILIDAE

Key to subfamilies

1. Palpus one segmented, more or less robust, bristly flies; third antennal segment long and slender with short bristle bearing microsegment.....*Asilinae*
- Palpus two segmented; thirds antennal segment of different shape 2

2. Marginal cell open, third antennal segment spindle-shaped with apical microsegment, fourth posterior cell generally open or closed in the margin, females generally with circulet of spines on acanthophorites.....*Dasypogoninae*
- Marginal cell closed, third antennal segment rod-like or clavate with apical pit, fourth posterior cell generally closed and stalked.....*Laphriinae*

Subfamily : LAPHRIINAE
Tribe : LAPHRIINI

Genus *Laxenecera* Macquart

1838. *Laxenecera* Macquart, *Dipt. exot.* **1** (2) : 194. Type-species : *L. albibarbis* Macquart.

Diagnostic characters : Face strongly gibbous with numerous bristles; third antennal segment with numerous stout bristles; femora modrately thick and stout, specially the hind femur, all femora bare of bristles; marginal, first and fourth psoterior cells closed and stalked; male genitalia bowl-shaped.

25. **Laxenecera albibarbis* Macquart

1838. *Laxenecera albibarbis* Macquart, *Dipt. exot.*, **1** (2) : 195.

Material examined : Delhi, 1 ♂, 1 ♀, Ring road, Naraina, 6.vi.1993, coll. V. Khanna & party.

Distribution : India : Delhi, Andaman Islands, Bihar, Gujarat. Himachal Pradesh,

Maharashtra, Rajasthan, Uttar Pradesh and West Bengal.

Diagnostic characters : Mystax black above and pale yellow below, first antennal segment golden-yellow setate, second and third segments with black setae; scutellum with scattered pale yellow setae; fore and mid femora black, hind femur black except yellowish brown mark at base; male genitalia black with pale yellow and white setae.

Subfamily : DASYPOGONINAE
Tribe : STICHOPOGONINI

Genus ***Michotamia*** Macquart

1838. *Michotamia* Macquart, *Dipt. exot.*, **1** (2) : 72. Type species : *Michotamia analis* Macquart.

Diagnostic characters : Face distinctly widened below ; mystax consists of stout bristles covering lower third of face ; first and second antennal segments quite short, third segment very long; humeri with scattered long setae; all femora stout, only hind femur slightly narrowed basally; marginal cell and fourth posterior all closed and stalked; abdomen elongate, clavate, male genitalia with well developed epandrium.

26. ***Michotamia aurata*** (Fabricius)

1794. *Asilus aurata* Fabricius, *Ent. Syst.*, **4** : 387.

Material examined : Delhi; 1 ♂, Forest near Kedia nursery, Karnal Road, 25.x.1993, coll. N.K.Sinha & party.

Diagnostic characters : Mystax pale-yellow ; first and second antennal segments orange-yellow, third segment black ; thorax black with dense black stripe ; legs yellowish-brown and pale yellow ; basal half of wing pale yellow, rest infuscated ; tergites 1-4 yellowish-brown, remaining tergites black, male genitalia dark brown and yellowish-brown.

Subfamily : ASILINAE
Tribe : ASILINI

Genus ***Promachus*** Loew

1848. *Promachus* Loew, *Linn. Ent.*, **3** : 390. Type-Species : *Asilus machulatus* Loew.

Key to species

1. Legs wholly black, eighth sternite produced with short black bristles on its border, tergites 1-3 with reddish-yellow tufts of piles .....*duvaucelii*

- Hind femur red, eighth sternite not produced; abdomen with yellow bands accompanied by black spots ....*maculatus*

27. ***Promachus duvaucelii*** (Macquart)

1838. *Asilus duvaucelii* Macquart, *Dipt. exot.*, 1 (2) : 97.

Material examined : Delhi; 1 ♂, 2 ♀, I.A.R.I. Campus, 11.ix.1994, coll. J.P. Sati & party; 1 ♂, Asola WLS. 12.ix.1994, coll. J.P. Sati & party; 2 ♂, 3♀, Tughlaqabad forest nursery, 12.ix.1994, coll. J.P. Sati & party.

Distribution : India : Delhi, Andhra Pradesh, Goa, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal.

28. ***Promachus maculatus*** (Fabricius)

1775. *Asilus maculatus* Fabricius, *Syst. Ent.* : 794.

Material examined : Delhi; 1 ♀, Kakraula nursery, Najafgarh Road, 36 km. off I.A.R.I., 5.vi.1993, coll. V.Khanna & party; 1 ex., (tip of abdomen lost), Nala near Naraina, 6.vi.1993, coll. V.Khanna & party.

Distribution : India : Delhi, Bihar, Karnataka, Orissa, Tamil Nadu and Uttar Pradesh.

Family : SYRPHIDAE
Subfamily : MILISIINAE

Key to tribes

1. Hind femur usually not greatly swollen, and with a well developed anterior basal patch of setulae ; anterior portion of mesopleuron bare ; third vein usually forming a strong loop .....*Eristalini*
- Hind femur usually greatly swollen, without basal patch of setulae ; anterior portion of mesopleuron pilose ; third vein usually with a shallow loop .....*Milesini*

Tribe : ERISTILINI

Genus ***Eristalinus*** Rondani

1845. *Eristalinus* Rondani, *Nuovi Annali Sci. nat. Bologna,* **2** (2) : 453, Type species ; *Musca sepulchralis* Linnaeus.

Diagnostic characters : Eyes pilose, rather widely separated in male, antennal arista practically bare or may be microscopic pubescent at base ; wing with marginal cell closed.

29. **Eristalinus (Eristalinus) arvorum* (Fabricius)

1787. *Syrphus arvorum* Fabricius, *Mantisaa Insecta*, **2** : 335.

Material examined : Delhi, 2 ♀, Masudpur, 13.ix.1994, coll. J.P. Sati & party.

Diagnostic characters : Antenna bright orange, tip of third antennal segment darker ; scutum with four black stripes, scutellar disc bears dense yellow pubescence except centre with black pubescence ; abdomen black, first tergite pale yellow, second with two oblong yellow spots, third with a pair of oval spots, fourth with a curve yellow spot ; legs brownish-yellow or orange except certain portion of all tibiae blackish.

Distribution : India : Delhi, Arunachal Pradesh, Jammu & Kashmir, Meghalaya, Orissa, Sikkim, Tripura and West Bengal. *Elsewhere* : Common in South East Asia; Australia; Hawaii; Japan and Micronesia.

Tribe : MILESINI

Genus *Syritta* St. Fargeau and Serville

1825. *Syritta* St. Farg. and Serville, *Encycl. Meth.*, **10** : 888.

Diagnostic characters : Face with a central keel ; eyes bare ; antennal arista bare; scutellum blackish pubescent ; hind femur highly incrussate with spinous projections ; anterior cross vein at the middle of discal cell.

30. **Syritta pipiens* Linnaeus

1758. *Musca pipiens* Linnaeus, *Syst. Nat.*, **10** : 594.

Material examined : Delhi, 1♂, Lodhi Tomb Complex, Lodhi Garden, 19.xii.1994, coll. A. Husain & party.

Diagnostic characters : Front facets of eye larger than rest ; antenna orange, arista bare ; thorax blackish with humeri, sides of dorsum upto suture and pleura yellowish or whitish-grey ; abdomen blackish, at junction of first and second segment exists a fan-shaped bunch of white pile, second and third segment each with a pair of yellowish spots ; hind trochanter with tiny spines,hind femur strongly incrassate with serration ventrally.

Distribution : India : Delhi, Himachal Pradesh, Uttar Pradesh and West Bengal. *Elsewhere* : Widely distributed in Europe; Asia ; Africa ; Maderia and Canaris ; North America.

Family : TEPHRITIDAE
Subfamily : DACINAE

Genus ***Dacus*** Fabricius

1805. *Dacus* Fabricius, *Syst. Antliat.* : 272. Type-species : *Dacus armatus* Fabricius.

Diagnostic characters : Antenna comparatively short, second segment twice the length of first ; ocellar and postocellar bristles absent ; Cell M. short and broad, more than twice the length of width, fifth abdominal tergite with two glandular areas.

31. ***Dacus (Zeugodacus) cucurbitae*** Coquillett

1899. *Dacus cucurbitae* Coquillett, *Ent. News*, **10** : 129.

Material examined : Delhi; 1 ♀, Jahanpanah Park, Chirag Dilli, 22.xii.1994, coll. A. Husain & party.

Diagnostic characters : Face with black spots ; mesonotum with three postsutural yellow vittae, wing with brown marking along the m and r-m cross veins.

Distribution : India : very common. *Elsewhere* : Widely distributed in Oriental region; Japan ; Pacific ; New Guinea ; Solomon Islands, Bismarck Archipelago ; Darwin ; Australia ; Mauritius ; Africa.

Family : OTITIDAE
Subfamily : ULIDIINAE

Genus ***Physiphora*** Fallen

1810. *Physiphora* Fallen, *Sp. ent. nor. Dipt.* : 11. Type-species : *Chrysomyza splendida Fallen.*

Diagnostic characters : Head almost a little longer than high ; medifrons bare in upper part with four swellings, antennal segment 3 rounded apically; humeral bristles usually well develooped; wing with basal cell 2 closed by straight or zig-zag vein.

32. ***Physiphora aenea*** (Fabricius)

1794. *Musca aenea* Fabricius, *Ent. Syst.*, **4** : 335.

Material examined : Delhi; 1 ♀, Safdarjung Tomb, 21.xii.1994, coll. A. Husain & party.

Diagnostic characters : Epistome, proboscis and palpi black ; frontal stripe green or blue ; wing with petiolate posterior cell I ;abdomen unicolourous ; green or metallic blue ; hairs on anterior corners yellowish.

Distribution : India, Delhi, Orissa, West Bengal and probably Assam. *Elsewhere* : widespread from Seychelles to Samoa ; Hawaii to Australia ; North and South America.

Family : SCIOMYZIDAE
Subfamily : SCIOMYZINAE
Tribe : TETANOCERINI

Genus ***Sepedon*** Latereille

1804. *Sepedon* Latereille, *Nouv. Dict. Hist. nat.*, **24** : 196. Type species ; *Syrphus sphegells* Fabricius.

Diagnostic characters : Slender flies with practically immaculate wings, frons deeply excavated and ridged ; ocellar bristles microscopic or absent ; lunule prominent ; scutellum with only two approximated apical bristles ; hind tibia without preapicals ; antennal segment 2 elongate.

Key to species

1. Apical half of wing distincly darker : antenna black, abdomen black .....*plumbella*
- Wing slightly infuscated at apex ; antenna not wholly black ; abdomen reddish .....*ferruginosa*

33. ****Sepedon ferruginosa*** Wiedemann

1824. *Sepedon ferruginosa* Wiedemann, *Analecta Ent.* : 56.

Material examined : Delhi; 3 ♂♂, Yamuna Barage, Wazirabad, 11.ii.1995, coll. J.P. Sati & party.

Distribution : India : Delhi, Andhra Pradesh, Assam, Bihar, Tamil Nadu and West Bengal. *Elsewhere* : Myanmar ; Malaya ; Nepal ; Pakistan ; Phillippines ; Sri Lanka ; Taiwan and Thailand.

34. ****Sepedon plumbella*** Wiedemann

1830. *Sepedon plumbella* Wiedemann, *Aussereurop. zweifl. Insekt.*, **2**: 577.

Material examined : Delhi; 3 ♀, Nila Talab near Qutubuddin Idgah, Mehrauli, Chattarpur Road, 12.v.1994, coll. A. Husain & party.

Distribution : India : Delhi, Bihar, Himachal Pradesh, Tripura and West Bengal. *Elsewhere* : Java ; and many other parts of Oriental region ; Australia ; New Caledonia ; New Guinea and Solomon Islands.

Family : SEPSIDAE
Subfamily : SEPSINAE

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Genus ***Sepsis*** Fallen

1810. *Sepsis* Fallen, *Sp. Ent. nov. Dipt.* : 17. Type-species : *Musca cynipsea* Linnaeus.

Diagnostic characters : Thorax and abdomen usually shining ; wing with first and second basal cells distinct ; abdomen in both sexes with distinct macrochaetae ;epandrial process not bifurcated at the tip.

35. ***Sepsis albopunctata*** Lamb

1914. *Sepsis albopunctata* Lamb, *Trans. Linn. Soc.Lond.*, **2** (zool), **16** : 323.

Material examined : Delhi; 1 ♂, Jahanpanah Park, Chirag Dilli, 22.xii.1994, coll. A. Husain & party.

Diagnostic characters : Head yellow, antenna reddish-yellow ; scutum reddish-yellow with two faint blackish lateral stripes,dorsocentrals, scutellum brownish-yellow or black; abdomen reddish-yellow ; legs yellow, posterior tibia brownish, in male fore femur in the middle with a bump with three spines on it and adjacent to it a leaf-shaped structure with a spine ; fore tibia constricted at base and middle, basal half bears a few bristles.

Distribution : India : Delhi, Andhra Pradesh, Assam, Bihar, Kerala, Uttar Pradesh and W.Bengal. *Elsewhere* : Borneo; Bangladesh; Taiwan; Philippines; Australia; Ethiopia.

Family : CHAMAEMYIIDAE
Subfamily : CHAMAEMYIINAE

Genus ***Leucopis*** Meigen

1830. *Leucopis* Meigen, *Syst. Beschr. europ. zweifl. Insekt.* **6** : 133; Type-species *Anthomyza griscola* Fallen.

36. ***Leucopis (Indioleucopis)luteicornis*** Malloch

1924. *Leucopis luteicornis* Malloch, *Mem. Dep. Agric. India* (ent. Ser.) **8** (7) : 67.

Diagnostic characters : Antenna and palpus reddish, arista brown apically; scutum with two brown longitudinal stripes ending at its transverse suture, prescutellar acrostichal one pair, long, posterior dorsocentrals one pair, long, sternopleuron with one bristle and a few hairs ; first posterior cell narrower at apex than base, anterior cross vein before middle of discal cell.

Distribution : India, Delhi, Karnataka and Tamil Nadu. *Elsewhere* : Sri Lanka.

Family : AGROMYZIDAE

Key to subfamilies

1. Subcosta extending straight coalescing with R_1 before reaching costa .....*Agromyzinae*
Subcosta making a fold distally ends in costa seperately and based on R_1 ....*Phytomyzinae*

Subfamily : AGROMYZINAE

Key to genera

1. Dorsocentrals at least 3 pairs, prescutellar present; haltere other than black.....*Agromyza*
- Dorsocentrals 2 pairs, prescutellar lacking ; haltere black.....2

2. Scutum or abdomen with metallic lustre, costa extends up to vein M_{1+2} ;mid tibia with lateral bristles.....*Melanagromyza*
Wholly black species : costa usually extends up to vein R_{4+5} ; mid tibia without lateral bristles ....*Ophiomyia*

Genus *Agromyza* Fallen

1810. *Agromyza* Fallen, *Sp. Ent. nov. Dipt.* : 21. Type-species : *A. reptans* Fallen.

There is no mention of *Agromyza nana* Meigen in Singh and Ipe (1973), although Sasakawa (1977) has recorded it from Delhi. The species is not included in the paper.

Key to species

1. r-m at the middle of discal cell, last segment of M_{3+4} in the ratio of 1:2 with the penultimate ....*hordei*
- r-m beyond the middle of discal cell, last segment of M_{3+4} in the ration of 2 :3 with the penultimate..... .....*pennisetivora*

37. ***Agromyza hordei*** Spencer

1961. *Agromyza hordei* Spencer, *Trans. R. ent. Soc. Lond.*, **113** (4) : 61.
Material examined : From literature.
Distribution : India : Delhi and Uttar Pradesh.

38. ***Agromyza pennisetivora*** Spencer

1961. *Agromyza pennisetivora* Spencer, *Trans. R. ent. Soc. Lond.* **113** (4) : 63.

Material examined : From literature.
Distribution : India : Delhi.

Genus ***Melanagromyza*** Hendel

1920. *Melanagromyza* Hendel, *Arch. Naturgesch.* (A) **84** : 126. Type-species : *Agromyza aeneoventris* Fallen.

Sasakawa (1977) recorded *M. alysicarpi* Bezzi from Delhi but there is no mention of it in Singh & Ipe (1973). The species is not mentioned here.

Key to species

1. Squamal fringe white, r-m at middle of discal cell.....2
- Squamal fringe black, r-m before middle of discal cell.....3

2. Frons one and half times broader than width of eye, apex of ocellar triangle ends to upper orbitals.....*hibisci*
- Frons slightly broader than the width of eye, apex of ocellar trinangle ends at upper margin of lunule.....*obtusa*

3. Frons conspicuously projecting, lunule black rest of head.....*nigrisquama*
- Frons not projecting, lunule bluish-grey.....*metallica*

39. ***Melanagromyza hibisci*** Spencer

1961. *Melanagromyza hibisci* Spencer,*Trans.R. ent.Soc. Lond.*, **113** (4) : 73.
Material examined : From literature.
Distribution : India : Delhi.

40.***Melanagromyza metallica*** (Thomson)

1869. *Agromyza metallica* Thomson, *K. svenska Fregatten Eugenies Resa.zool. Dipt.*, : 609.
Material examined : From literature.
Distribution : India : Delhi, Bihar, Kerala, Maharashtra, Uttar Pradesh and West Bengal. *Elsewhere* : Flores Isl., Nepal; Philippines; Ryukyls Is., Thailand: Vietnam; Africa; Australia; Mauritius; Melanesia; Micronesia; New Guinea; Seychelles.

41. ***Melanagromya nigrisquama*** (Malloch)

1914. *Agromyza nigrisquama* Malloch, *Annls. hist. nat. Mus. natn. Hung.*, **12** : 332.

Material examined : From literature.
Distribution : India : Delhi. *Elsewhere* : Taiwan; Vietnam.

42. *Melanagromyza obtusa* (Malloch)

1914. *Agromyza obtusa* Malloch, *Annls. hist. nat. Mus. natn. Hung.*, **12** : 323.
Material examined : From literature.
Distribution : India : Delhi, Assam, Maharashtra and Uttar Pradesh. *Elsewhere* ; Flores Isl., Java; Malaya; Taiwan; Sri lanka.

Genus *Ophiomyia* Braschnikov

1897. *Ophiomyia* Braschnikov, *Ann. Inst. agron. Moscow,* **3** : 40. Type species : *Agromyza pulicaria* Meigen

Key to species

1. Squamal fringe black; r-m cross vein before middle of discal cell..... .....*phaseoli*
Squamal fringe pale brown ; r-m cross vein after middle of discal cell..,..... *beckeri*

43. *Ophiomyia beckeri* (Hendel)

1923. *Melanagromyza beckeri* Hendel, *Konowia*, **2** : 145.
Material examined : From literature.
Distribution : India : Delhi, Punjab and West Bengal. *Elsewhere* : Africa, Europe.

44. *Ophiomyia phaseoli* (Tryon)

1892. *Oscinis phaseoli* Tryon, *Trans. nat. Hist. Soc. Qd.*, **1** : 4.
Material examined : From literature..
Distribution : India : Delhi, Kerala, and Uttar Pradesh. *Elsewhere* : Flores Isl., Java; Malaya; Nepal; Philippines; Ryukyu Islands; Sri Lanka; Taiwan; Vietnam; Africa; Australia; Hawaii; Melanesia; Micronesia.

Subfamily : PHYTOMYZINAE

Genus *Liriomyza* Mik

1894. *Liriomyza* Mik, *Wien.ent.ztg.*, **13** : 289. Type species : *L.urophorina* Mik.
Diagnostic characters : Frons yellow, upper orbital 2, orbital setulae redinate; scutum

dark, scutellum yellow; vein M_{1+2} ends close to wing tip; epandrium scarcely with comb-like process, aedeagus normally pale.

Distribution : India : Delhi.

Key to species

1. r-m cross vein at middle of discal cell, costal segment 3 longer than segment 4, ultimate sector of M_{1+2} more than eight times the penultimate .....*compositella*
- r-m cross vein after middle of discal cell. costal segments 3 and 4 equal, ultimate sector of M_{1+2} three times the penultimate ....*brassicae*

45. ***Liriomyza brassicae*** (Riley)

1884. *Oscinis brassicae* Riley, *Rep. U.S. Dept. Agric.*, : 332.

Material examined : Recorded from literature.

Distribution : India : Delhi, Bihar, Maharashtra, Punjab, Rajasthan and Uttar Pradesh. *Elsewhere* : Philippines ; Ryukyus; Singapore; Sri Lanka; Taiwan; cosmopolitan.

46. ***Liriomyza compositella*** Spencer

1961. *Liriomyza compositella* Spencer, *Trans. R. ent. Soc. Lond.*, **113**: 87. new name for *Agromyza pusilla* Malloch 1914. *Ann. Mus. Nat. Hung.*, **12** : 314.

Material examined : From literature.

Distribution : India : Delhi, Maharashtra and Uttar Pradesh.

Family : MUSCIDAE
Subfamily : MUSCINAE

Key to genera

1. Black flies covered with greyish dust, vein m subangular; prostigmal absent; suprasquamal ridge bare.....*Musca*
- Metallic lustrous flies, bend of vein m angular, prostigmal present, suprasquamal ridge setulose.....*Orthellia*

Genus ***Musca*** Linnaeus

1758. *Musca* Linnaeus, *Syst. Nat.*, **10** : 596. Type-species : *M.domestica* Linnaeus.

47. ****Musca (Musca) domestica*** Linnaeus

1758. *Musca domestica* Linnaeus, *Syst.Nat.*, **10** : 596.

Material examined : Delhi; 1 ♂, 2 ♀♀, Safdarjung Tomb, 21.xii.1994, coll. A. Husain & party.

Diagnostic characters : Four black vittae on thorax, inner pair terminating at the posterior margin; propleural depression with fine setulose hairs; suprasquamal ridge without setulae; all posterior dc strong; mid tibia without av and ad seta.

Distribution : India : Delhi, Andaman Isl., Arunachal Pradesh, Assam, Bihar, Goa, Himachal Pradesh, Karnataka, Kashmir, Maharashtra, Punjab, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal. *Elsewhere* : cosmopolitan species.

Genus ***Orthellia*** Robineau-Desvoidy

1863. *Orthellia* Robineau-Desvoidy, *Hist. nat. Dipt. env. Paris.* **2** : 837. Type-species : *O.cornicina F.*

48. ***Orthellia lauta*** (Wiedemann)

1830. *Musca lauta* Wiedemann, *Ausseurop Zweifl. Insekt.*, **2** : 410.

Material examind : Delhi; 1 ♂, River Yamuna and vicinity, 14.v.1994, coll. A. Husain & party.

Diagnostic characters : Metallic blue, green or purple coloured flies; in male eye facets enlarged on upper inner part; palpi and antenna dull orange; presutural acrostichals and dorsocentrals absent, sternopleurals 1+2; tergite 4 with long, erect fine pile; discal cell bare of hairs, stem-vein with single setula, bend of m subangular and than a dip.

Distribution : India : Delhi, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Karnataka, Madhya Pradesh, Uttar Pradesh and West Bengal. *Elsewhere* : Borneo; China; Flores Isl; Myanmar; Sri Lanka; Taiwan; Java; Lombok; Malaya; Nepal; Pakistan; Philippines; Ryukyus Isl. Sumatra; Sumbawa; Thailand; Australia; Iran.

Family : CALLIPHORIDAE
Subfamily : RHYNIINAE

Genus ***Idiella*** Brauer & Bergenstanm

1889. *Idiella* Brauer and Bergenstanm, *Denkschr. Akad. Wiss. Wien.*, **56** : 154. Type-species: *Idia manadarina* Wiedemann.

Diagnostic characters : Body slender and equilateral : antennal arista with dorsal plumus; hind tibia without an conspicuous row of anterodorsal setae but with 2-3 setae; abdomen mostly testaceous.

49. **Idiella mandarina* (Wiedemann)

1830. *Idia mandarina* Wiedemann, *Aussereurop. zweifl. Insekt.*, **2** : 350.

Material examined : Delhi; 1 ♀, Safdarjung Tomb, 19.xii.1994, coll. A. Husain and party.

Diagnostic characters : Face and gena shining black, lower half of occiput thickly golden pilose; mid-tibia in males with dense soft black hairs ventro-apically, absent in females; tergites 1-2 usually orange or darkened, tip of abdomen blackish-green.

Distribution : India : Delhi, Assam, Bihar, Gujarat, Haryana, Kerala, Madhya Pradesh, Maharashtra, Orissa, Uttar Pradesh and West Bengal. *Elsewhere* : Bangladesh ; China; Indonesia; Key Isl., Malaysia (Kalimantan and Malay) : Myanmar; North Borneo; Sri Lanka; Taiwan; Thailand.

Family : SARCOPHAGIDAE
Subfamily : SARCOPHAGINAE

Key to genera

1. Post sutural dorsocentrals three; arista plumose along basal half; fourth sternite with numerous long hairs.....*Pierreta*
- Post sutural dorsocentrals five, arista plumose along basal two-thirds, fourth sternite with short sparse hairs.....*Parasarcophaga*

Genus *Parasrcophaga* Johnston and Tiegs

1921. *Parasarcophaga* Johnston and Tiegs, *Proc. R. Soc. Qd.*, **33** : 86. Type-species : *Sarcophaga omega* Johnston and Tiegs.

50. **Parasarcophaga (Parasarcophaga) misera* (Walker)

1849. *Sarcophaga misera* Walker, *List Dipt. Brit. Mus.*, **4** : 829.

Material exaimed: Delhi; 1 ♂, NZP, 7.vi. 1993, coll. V. Khanna & party.

Diagnostic characters : Lateral verticals absent; palpi usually yellow; propleura bare; costal segment iii longer than v; mid femur with comb and sparse basal fringe, hind femur with a row of long hair-like posteroventrally in apical part.

Distribution : India : Delhi, Andaman Islands, Andhra Pradesh, Assam, Bihar, Goa, Haryana, Himachal Pradesh, Karnataka, Kerala, Maharashtra, Mizoram, Orissa, Rajasthan, Tamil Nadu, Tripura, Sikkim, Uttar Pradesh and West Bengal. *Elsewhere* : Bangladesh; China; E. Malayasia;Hainan Isls., Java; Kalimantan, Myanmar; Philippines; Ryukyu Isls., Sri

Lanka; Taiwan; and Thailand. Wide spread in Pacific Islands to New Guinea and Australia.

Genus ***Pierretia*** Robineau-Desvoidy

1863. *Pierretia* Robineau-Desvoidy,*Hist. nat. Dipt. Paris,* **2** : 422. Type-species : *P. praecox Rob.-Desv.* = *Sarcophaga nigriventris* Meigen.

51. ****Pierretia calicifera*** (Boettcher)

1921. *Sarcophaga calicifera* Boettcher, *Ent. Mitt.,* **1** : 169.

Material examined : Delhi; 1 ♂, Jahanpanah Park, Chirag Dilli, 22.xii.1994, coll. A. Husain & party.

Diagnostic characters : Small sized flies ; face shining silvery, frons half of eye width; lateral verticals wanting; antenna and palpus black; propleura bare, presutural acrostichal absent, postsutural acrostichal 1, posterior dorsocentrals 3; vein R_{4+5} with setae extending upto r-m; fore femur with a row of pv setae, hind femur with a complete and an incomplete row of ad setae.

Distribution : India : Delhi, Bihar and Tamil Nadu. *Elsewhere* : Japan, Phlippines; Sri Lanka; Taiwan; Thailand.

Family : TACHINIDAE

Genus ***Euthera*** Loew

1866. *Euthera* Loew, *Berl. ent. Z.,* **10** : 46. Type-species : *Euthera tentatrix* Loew.

Diagnostic characters : Eyes bare; face produced into a broad swollen carina that extends from the antenna to the epistome and has a sharp median edge; arista bare; facial ridge bare but for three-four setulae near vibrissae; reclinate orbital setae undifferentiated. Prosternum bare; prst. ia seta absent; usually three post ia setae (if only two, the foremost closer to the hind one than to the transverse suture), four or five post dc setae, pteropleural setae absent or weak. Wings boldly patterned with two dark brown crossbands (broad submedian band and narrow subapical band) and with usually elongate blackish brown alula; all the wing veins bare.

52. ***Euthera mannii*** Mik

1889. *Euthera mannii Mik,* Wien. ent. Ztg., **8** : 129.

Diagnostic characters : Mouth border prominent; facial keel swollen and rounded in profile; parafacials distinctly pilose in their whole length; frontal bristles curved inwardly and all decussate; female with orbital bristles. Three pairs of dorsocentral and two pairs of acrostrichal bristles before the suture; small apical scutellar bristles diverging; wing base whitish hyaline and

costal cells blackish, third posterior cell partly infuscated; allula entirely black, calypters whitish hyaline; female with front tarsi flattened. Second abdominal segment with strong macrochaetae. Head in greater part black; frontal stripe dark reddish; female with frontal stripe considerably narrower than one of the parafrontalia, the latter very broad,shining black, not or slightly dusted; frontal stripe dark reddish; coxae black; allula black; calypters whitish hyaline; submarginal cell with hyaline spot.

Distribution : India : Delhi. *Elsewhere* : Turkey; S.Europe; S.W.Asia; E. Africa; Taiwan.

Family : GASTEROPHILIDAE
Subfamily : GASTEROPHILINAE

Genus ***Gasterophilus*** Leach

1817. *Gasterophilus* Leach, *Arrangement Oestrid. Ins.* : 2. Type-species : *G.equi* (Clark).

Diagnostic characters : Head semiglobular, eyes bare, ocelli distinct; first two antennal joints very small, third segment oval, arista bare; thorax oval, thoracal squamae long haired; abdomen oval or subconical;legs slender,pulvilli and empodium distinct, fourth vein straight, first posterior cell widely open, discal cell usually as long as the anterior basal cell.

53. ***Gasterophilus intestinalis*** (Degeer)

1776. *Oestrus intestinalis* Degeer, *Mem. serv. Hist. Ins.*, **6** : 292.

Material examined : From literature.

Diagnostic characters : Frons widen in lower half than upper half, with two broad pale or dark brown stripes covering most of the area; ocellar spot black with long, pale pubescence; antenna situated on a deep cavity divides into two halves by a narrow median ridge, first and second antennal joint yellowish, third joint brownish; scutum brownish covered with brownish yellow pubescence, humeri yellowish, scutellum concolourous with scutum; abdomen brownish yellow, all tergites except first with three dark spots at base of each segment; legs yellowish brown with short yellow pubescence, first and fifth tarsal joints longer than other segments; wings grey with a light smoky band across middle and two small roundish spots one at tip of first vein, other before tip of third vein.

Distribution : India : Delhi, West Bengal, Bihar, Kashmir, Punjab.

SUMMARY

Of the 16 Diptera families dealt with in the present communication family Culicidae covers maximun (22) number of species followed by Agromyzidae (10 species). Together, these two families account for nearly 60.4% of the entire Dipteran fauna of Delhi while rest of the

fauna (approximately 39.4%) is covered by remaining 14 families.

Only one species belonging to family Agromyzidae is endemic in Delhi. Occurrence of two apparently non-Indian species in the area, viz. *Melanoagromyza nigrisquamma* (Malloch)(Agromyzidae) and *Euthera manni* Mik (Tachinidae) is of special interest. Eight species pertaining to families Asilidae, Gasterophilidae, Stratiomyidae and Culicidae are noticed to be confined to India. These include three out ot total five *Aedes* spp. (Culicidae) which are confined to Delhi and Punjab alone. Only species representing each of the families Gasterophilidae and Stratiomyidae are similarly confined to northern India. However, the only species representing the family Chamaemyiidae is noticed to occur only in southern India and Sri Lanka. 43 species (81.1% of total) are however, widespread in Oriental region and of these 28 species have even a wider distribution in southern Asia, Australia and the Pacific islands. Two species, one each from family Asilidae and Culicidae are known from Africa. In all, Indo-Chinese element is found to be most predominent in the Dipteran fauna of Delhi.

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REFERENCES

Barraud, P.J. 1934. *The Fauna of British India including Ceylon and Burma,* Diptera, Culicidae, **5**, 463 pp. Taylor and Francis, London.

Bezzi, M. 1913. Indian Trypaneids (fruit flies) in the collection of the Indian Museum, Calcutta. *Mem. Indian Mus.*, **3** : 53-175.

Brunetti, E. 1910.New Oriental Sepsinae., *Rec. Indian Mus.*, **3** : 343 - 372.

Brunetti, E.1912. *The Fauna of British India including Ceylon and Burma,* Diptera, Nematocera, **1** (excluding Chironomidae and Culicidae). xxx + 581 pp. Taylor and Francis, London.

Brunetti,E.1920. *The Fauna of British India including Ceylon and Burma,* Diptera, Brachycera, **2** : ix +401 pp. Taylor and Francis, London.

Brunetti, E.1923. *The Fauna of British India icluding Ceylon and Burma,* Diptera, Pipunculidae, Syrphidae, Conopidae and Oestridae, **3** : xi + 424 pp. Taylor and Francis, London.

Christophers, S.R.1933. *The Fauna of British India including Ceylon and Burma,* Diptera, Culicidae, **4** : vi + 371. Taylor and Francis, London.

Crosskey, R.W. 1976.A taxonomic conspectus of the Tachinidae (Diptera) of the Oriental region. *Bull. Brit. Mus. (nat. Hist.) Ent.,* **26** (Suppl.) : 1-357.

Delfinado, M.D. and Hardy, D.E. (ed.), 1973. *A Catalog of Diptera of the Oriental Region,* Nematocera, **1** : 1-618, Univ. of Hawaii Press, Honolulu.

Delfinado, M.D. and Hardy, D.E. (ed.) 1975.*A Catalog of Diptera of the Oriental Region,* Brachycera, **2** : 1-459. Univ. of Hawaii Press, Honolulu.

Delfinado, M.D, and Hardy, D.E. (ed.) 1977. *A Catalog of Diptera of the Oriental Region,* Cyclorrhapha, **3** : 1 854. Univ. of Hawaii Press, Honolulu.

Rao, T. Ramachandra, 1984.*The Anophelines of India,* xvi + 518 pp. Malaria Research Centre (ICMR), New Delhi.

Senior-White, R.A.,.Aubertin.D. and Smart,J. 1940. *The Fauna of British India including rhe remainder of the Oriental Region,* Diptera, Calliphoridae, **6** : xii + 288 pp. Taylor and Francis, London.

Singh, S. and Ipe, M. Ipe, 1973. The Agromyzidae from India. *Memoires of the School of Entomology,* **1**, v + 286 pp.

Van Emden, F.I. 1965. *The Fauna of India and the adjacent countries,* Diptera, Muscidae, **7** : xiv + 647 pp.

Wiedeman, C.R.W. 1824. *Analecta entomologica ex Museo Reguio Hafniensi maxima congesta* : 66 pp. Kilieae.

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DIPTERA

Additional species known from Delhi

compiled by
VINOD KHANNA
Zoological Survey of India, Dehra Dun 248 195

Family : SARCOPHAGIDAE

1. *Parasarcophaga (P.) hiritipes* (Wiedermann)
2. *P.(P.) albiceps* (Meigen)
3. *P.(P.) knabi* (Parker)
4. *P. (P.) orchidea* (Boettcher)
5. *P. (Liopygia) ruficornis* (Fab.)
6. *Seniorwhitea krameri* (Boltcher)

Family : SYRPHIDAE

Subfamily : SYRPHINAE

7. *Syrphus balteatus* De Geer
8. *S.confrator* Wiedemann
9. *Sphaerophoria indiana* Bigot
10. *S. scutellaris* Fab.
11. *Ischioden scutellaris* Fab.
12. *Xanthogramа pruthi* Deoras
13. *Xanthogramа* sp.
14. *Lasiopticus seleneticus* Brunetti
15. *Baccha nigricosta* Brunetti

Subfamily : ERISTALINAE

16. *Eristalis taphicus* Wiedemann
17. *E. laetus* Wiedemann
18. *E. quinquelineatus* Fab.
19. *E. tabanoides* Jaennicke

Subfamily : MILESIINAE

20. *Syritta orientalis* Macquart

Family : TENDIPEDIDAE

21. *Tendipes* sp.

Family : HELEIDAE

22. *Probezzia* sp.

Family : STRATIOMYIDAE

23. *Stratiomys* sp.

Family : TABANIDAE

24. *Tabanus* sp.

Family : **MUSCIDAE**

25. *Limnophora* sp.

REFERENCES

Anand, R.K. 1986. Records of Syrphids predating on Aphids in Delhi. *Proc. IInd Nat. Symp. Recent trends in Aphidological studies*, Modinagar : 197-200.

Anand, R.K. Rai, S, and Sharma V.K. 1967 Notes on the Hoverflies (Diptera : Syrphidae) from Delhi and adjoining areas. *Indian J. Entomol.*, **29** : 307-308.

Mitra K. & Kumar K. 1988. Common insects of fresh water and their control. *Bull.* no. 54, CIFRI, ICAR.

Nandi, B.C. 1979. Flesh flies (Diptera : Sarcophagidae) in the Indian Agriculture Research Institute, New Delhi, India. *Oriental Ins.* , **13** (1-2) : 189- 200.

Narayanan, E.S. and Ghai S., 1960. A new record of India Tachinids. *Indian J. Ent.*, **22** (1) : 64-65.

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LEPIDOPTERA : PAPILIONOIDEA AND HESPERIOIDEA

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INTRODUCTION

This article present an account of 192 exs. of butterflies spread over 19 species, 13 genera and four families, viz., Papilionidae, Pieridae, Nymphalidae and Hesperiidae, of which first three belong to the superfamily Papilionoidea and the last to the Hesperioidea. The study, confirming the earlier records of elements, is based on the material collected from Delhi by the scientists of Northern Regional Station, Dehra Dun.

The butterflies, *inter-alia* moths, constitue the highly specialised group of scale winged insects of Lepidoptera, principally of tropical origin, are of great aesthetic and economic value and serve mainly as pollinators. There are, however, quite a few species, particularly of Hesperiidae and Satyrinae, that are rather ugly creatures. The butterflies, in general are found almost everywhere from mountains to mainland, coastal as well as insular areas in high seas of the globe, except the Antarctica where there is absolute dearth of natural vegetation. According to the existing ecosystem patterns, the population of a given species develops more or less a degree of adaptive radiation within its definitive range of geographical distribution. For instance, Donahue (1966) mentioned two well defined habitats in the Ridge, a low prolongation of the Aravalli hills and mesophytic urban nursery areas in parts of the Delhi and New Delhi, of which the latter is so heavily irrigated that they differ radically from the arid thorny habitats of the former. Such a difference of habitats accounts for the faunal diversity in the areas surveyed.

As many as 43 species of butterflies, inclusive of a dozen of the peripheral area, all belonging to the foregone families and subfamilies are known from Delhi of which the material now examined represent about 24% of the known species. Evidently the butterfly fauna of Delhi is much poor as compared to that of the montane and mesophytic habitats of western Ghats or the Himalaya. All the species under report are characteristic of the population of peninsula rather than of the adjacent Himalaya.

The pioneering work on the Delhi butterflies dates back to Longstaff (1912) who recorded a total of 14 species of Papilionidae, Pieridae, Danaidae, Nymphalidae and Hesperidae in addition to material of other families not included here. Subsequently Jandu (1941, 1942, 1943), Donahue (1966, 1967) and Ashton (1972) further contributed to the faunistic studies of the group from the metropolis. It was Donahue (loc. cit.) who exhaustively dealt upon the Delhi butterfly fauna incorporating their habitat preferences, population assessment, seasonality and other habits together

with climatological annotations of the state. Sevastopulo (1975) made a brief critical review of the earlier works of the Delhi butterfly fauna.

Several morphological characters like tibial spines, wing venation, genitalia, antennae, etc., from higher to lower taxonomical categories need not be repeated here, since these are already found in the works of Talbot (1939, 1947), Evans (1949), D'Abrera (1982, 1985), Hancock (1983), Ackery & Vane Wright (1984) and others. Salient features of facies of each species are only provided here.

Regarding the conservation status, there is, so far, no mention of threats to survival of the species under the Wildlife Protection Act 1972 (*Vide* Collins & Morris, 1985). Not withstanding the fact, in Delhi the natural vegetation has drastically changed through excessive human interference in very many ways. Ruthless trend of modern urbanised outlook together with activity of his domestic pets causes serious populaton depletion of many butterflies in the wild. Such practices should, therefore be legally curbed so as to upkeep the population threshold of the fauna through the process of sustained development.

Table 1 : Field data of butterflies examined from Delhi Faunistic Survey material :

Sl.No. of loc.	Localities surveyed	S.No of spp.	No. of exs. coll.	Date of colln.
I	I.A.R.I. : In and around campus	2	1	3.vi.1993
		10	2	3.vi.1993
		15	10	3.vi.93; 24.x.93 9.v.94; 11.ix.94
		8	2	5.vi.93
		1	1	24.x.93
	(A) : Nala nr. Kisan Bhawan	3	1	24.x.93
	Guest House	14	1	24.x.93
II	Dhaulakuan, Ridge	15	3	4.vi.93; 10.vi.93
		6	1	10.vi.1993
III	Masudabad, *ca.* 38 kms. from I.A.R.I.	10	4	5.vi.93
		15	1	5.vi.93
IV	Vill. Chhawala on Najafgarh	15	8	5.vi.93
V	Kakraula Nursery, Najafgarh	12	2	5.vi.93
	Road, *ca* 36 kms south of I.A.R.I.	1	1	27.ix.93
		9	1	
		10	1	27.ix.93

		15	11	27.ix.93
		18	3	27.ix.93
VI	Nala Ring Road nr. Naraina village	2	1	6.vi.93
VII	Lalbagh, Model Town	9	3	8.vi.93
VIII	District Park, Pitampura, Outer Ring Road	12	2	9.VI.93
IX	Ridge Area	2	1	
		5	5	23.x.93
		15	1	
		17	1	
X	Kedia Nursery, Karnal Rd.	15	25	25.x.93
		19	1	
XI	Bhalsawa	15	8	26.x.93
XII	Shyampur	15	2	28.x.93
XIII	Bawana	2	1	
		2	1	
		13	2	30.x.93
		15	7	
XIV	Wazirabad : Along R.Yamuna	4	1	30.x.94
	(A) : Gurjar Ghat,	15	5	14.v.,8.ix.94
	nr. Yamuna Bridge	15	1	8.ix.94
XV	Lake Garden, Shakur Basti	15	1	31.x.93
XVI	I.G.Indoor Stadium	10	3	11.v.94
XVII	Nala Talab Qutuhudin, Idgah, Mehrauli	15	1	12.v.94
XIX	Rock-climbing area, Lado sarai on Mehrauli Road	4	5	7.ix.94

XX	Gopalpur	12	4	8.ix.94
XXI	Majnu ka Tila nr. Wazirabad	10	2	8.ix.94
		15	1	14.xii.94
		3	1	15.xii.94
		4	3	15.xii.94
		12	3	17.xii.94
XXII.	Okhla Barrage	15	4	8.ix.94; 10.ix.94
XXIII	Opposite Runway, Palam Airport on Gurgaon Road	12	3	9.ix.94
XXIV	Delhi Zoo (NZP)	9	1	10.ix.94
XXIV	Tughlaqabad Forest Nursery	15	1	12.ix.94
XXVI	Delhi Municipality Nursery, Punjabi Bagh	3	1	14.ix.94
XXVII	Kamala Nehru Ridge area on Rajpur Road	16	2	14.ix.94
XXVIII	Humayun's Tomb, Mathura Road	9	3	14.ix.94
XXIX	Sabhaypur, Ghaziabad	11	1	17.xii.94
		15	11	
XXX	Yamuna Reservoir, Ramghat	15	1	17.xii.94
XXXI	Piggery Farm Nala	3	6	18.xii.94
		7	1	
XXXII	Pond Nagli Sakroti nr. Saidham	7	4	20.xii.94
XXXIII	Safdarjung Tomb complex, Aurobindo Marg	12	1	21.xii.94
		13	1	21.xii.94
XXXIV	Asola-Bhatti Wildlife sanctuary	13	1	21.xii.94
XXXV	Jahanpanah Park, Chirag Dilli	15	1	22.xii.94

XXXVI A.N.Jha Deer Park, Hauzkhas	15	2	27.xii.94 15.ii.95

SYSTEMATIC ACCOUNT

Order : LEPIDOPTERA
Supefamily : PAPILIONOIDEA
Family : PAPILIONIDAE
Subfamily : PAPILIONINAE

1. *Princeps polytes* (Linnaeus)
2. *Princeps demoleus* (Linnaeus)

Family : PIERIDAE
Subfamily : PIERINAE

3. *Anaphaeis aurota* (Fabricius)
4. *Cepora nerissa* (Fabricius)
5. *Ixias marianne* (Cremer)
6. *Colotis fausta* (Olivier)
7. *Colotis etrida* (Boisduval)
8. *Colotis calais* (Cramer)

Subamily : COLIADINAE

9. *Catopsilia pomona* (Fabricius)
10. *Catopsilia pyranthe* (Linnaeus)
11. *Catopsilia florella* (Febricius)
12. *Eurema hecabe* (Linnaeus)
13. *Eurema laeta* (Boisduval)

Family : NYMPHALIDAE
Subfamily : DANAINAE

14. *Tirumala limniace* (Cramer)
15. *Danaus chrysippus* (Linnaeus)
16. *Euploea core* (Cramer)

Superfamily : HESPERIOIDEA
Family : HESPERIIDAE
Subfamily : HESPERIINAE

19. *Parnara* sp.

Family : PAPILIONIDAE
Subfamily : PAPILIONINAE

1. ***Princeps polytes*** (Linnaeus)
The Common Mormon

1758. *Papilio polytes* Linnaeus, *Syst. Nat.*, (10th ed.) : 460.

Material examined : Delhi; 2 exs. : I.V. Wing expanse : 90 mm.

Distribution : India : Delhi; throughout the mainland, Andaman & Nicobar Islands, Lakshadweep (Mondal, 1991). *Elsewhere* : Oriental Region; Ryukyus.

Status : Common.

Remarks : The butterfly has been extensively studied earlier because of mimetic colour patterns of the female (Mondal, 1985, 1991, Ghosh *et al.*, 1993). This is a widespread and fast-flying tailed butterfly with black ground colour and a row of cream spots on margin of fore wing and across hind wing. It is rarely found on the Delhi Ridge. The most important point of the Delhi female forms is that the male-like *`cyrus'* form is rather common, probably due to lack of natural selection for other mimetic forms, *romulus* and *stichius*, while the models are uncommon (*Atrophaneua aristolochiae*) or absent (*A. hector)* in Delhi. The food plants are *Citrus* spp. Donahue (1966) reared the butterfly in Delhi. The specimens examined belong to ssp. *romulus* (Cramer) which, however, is not found in the Andaman and Nicobar Is. *Elsewhere*: Restricted to Sri Lanka, Myanmar and Malayan belt.

2. ***Princeps demoleus*** (Linnaeus)
The Lime Butterfly

1758. *Papiilio demoleus* Linnaeus, Syst. Nat. (10th ed.) : 464.

Material examined : Delhi; 4exs. : I,VI,XI,XII. *Wing expanse* : 7-85 mm.

Distribution : India : Delhi, throughout mainland. *Elsewhere* : China to Malay Peninsula; Lesser Sunda Islands to N.Australia and South New Guinea, extending to Iran, Arabaia and whole of Africa.

Status : Very common.

Remarks : The species is usually found in nurseries where its food plant (*Citrus*) is cultivated. The poor representation in the collection under study may be because the species is so common and easily recognised that it is not collected in plenty. This is like the preceding species in habits, but tail reduced to a tooth-like structure, body black - yellow. Only a few specimens were reared in Delhi by Donahue (1966). The specimens examined are referable to the nominate subspecies, the exotic distribution of which is limited to East Palaearctic, N.Myanmar and Sri Lanka.

Family : PIERIDAE
Subfamily : PIERINAE

3. ***Anaphaesis aurota*** (Fabricius)
The Pioneer

1783. *Papilio aurota* Fabricius, *Ent. Sys.*, **3** (1) : 197.

Material examined : Delhi; 10 exs : I(A) XIII, XXI, XXVI, XXXI. *Wing expanse* : 40-50 mm.

Distribution : India: Delhi; rest of the mainland except Assam, Andaman & Nicobar Is. (Nicobar). *Elsewhere* : Sri Lanka; extending to Middle East and Africa.

Status : Very Common.

Remarks : The butterfly occurs abundantly during March to May, particularly at flowers. It was bred by Donahue (1966) at Delhi and observed on *Azadirachta indica* (Neem). This is attracted to light and found all round the year in the swift flight. The species has a white ground colour with fore wing showing a prominet black discal spot and a black apical area, hind wing black, margin white spotted. Seasonal apical area are prominent in dry-season form. The specimens examined belong to the nominate subspecies which is absent from Sri Lanka.

4. ***Cepora nerissa*** (Fabricius)
The Common Gull

1820. *Papilio nerissa* Fabricius, *Syst. Eng.*: 471.

Material examined : Delhi; 9 exs. : XIV, XIX, XXI. *Wing expanse* : 45-52 mm.

Distribution : India : Delhi; Peninsula; east and north west Himalaya; Andaman and Nicobar Islands. Elsewhere : Pakistan; Nepal; Sri Lanka; Myanmar; north to Taiwan; south to Sumbawa.

Staus : Common.

Remarks : The butterfly occurs in all habitats almost round the year at Delhi, but most frequently found in the nurseries. Females are more frequent than males from December to May. The butterfly has white ground colour with fore wing marginal black border at apex, a black cubital spot separated from black border by a white spot; black markings being more extended and veins darkened in female. Both sexes of dry-season form have reduced black markings especially on hind wing. The specimen examined are referable to the ssp. *phryne* (Fabricius) which occurs throughout peninsular India as far west as Jodhpur and Lahore (Pakistan). Foodplants are capers.

5. ***Ixias marianne*** (Cramer)
The White Orange Tip

1979. *Papilio marianne* Cramer, *Pap. Exot.*, **3** : 41.

Material examined : Delhi ; 5 exs. : IX. *Wing expanse* : 47-57 mm.

Distribution : India : Delhi ; throughout the peninsula; west and north west Himalaya. *Elsewhere* : Sri Lanka; Pakistan; Nepal.

Status : Seasonally common.

Remarks : The butterfly is common during monsoon, rare in cold months. It is a beautiful species found only in the Indian sub-region. The butterfly has white ground colour with apical half of fore wing black enclosing a large orange patch which is narrower in females and with four black spots; hind wing margin black. The specimens examined are referable to the wet season form with wing more heavily marked than the d.s.f. This sun-loving butterfly feeds on capers.

6. *Colotis fausta* (Olivier)
The Large Salmon Arab

1801. *Papilio fausta* Olivier, *Voy. L'Emp. Oth. Atlas*, pl.33, figs. 4 a,b.

Material examined : Delhi ; One ex.: II. *Wing expanse :* 38 mm.

Distribution :India: Delhi; througout the peninsula. *Elsewhere* : Palestine to Arabia, Turkistan; Egypt; Somali land; Iran; Afghanistan; Pakistan; Sri Lanka; Turkey; Egypt.

Status : Locally common.

Remarks : The butterfly is the most striking of the Delhi *Colotis,* but restricted to the Ridge. Cold weather accounts for its much less frequency during December - January. The species is recognised by its salmon ground colour, fore wing black discal spot not connected with the dark coastal margin and broad black distal border enclosing salmon spots. Like the preceding species, this one also feed on plants of Capparidaceae. The specimen examined is referable to the ssp. *faustina* (C.&R. Felder) which is known from the Punjab to Sind in the north and Karwar in the south.

7. *Colotis etrida* (Boisduval)
The Little Orange Tip

1836. *Anthocharis etrida* Boisduval, *Spec. Gen. Lep.*, 1 : 576.

Material examined : Delhi; 5 exs. : XXXI, XXXII. *Wing expanse* : 28-39 mm.

Distribution : India : Delhi; throughout the mainland. *Elsewhere* : Pakistan; Sri Lanka.

Status : Common.

Remarks : This is the only *Colotis* species which is known to be found in all Delhi habitats possibly due to its preference for the hot and dry weather. Unlike the preceding species, it is one of the most feebly flying insect in India. The species has white ground colour with fore-wing bearing an apical orange patch which is edged with black on the inner side. The specimens examined belong to the nominate subspecies, these belong to the wet season form, being quite larger and darker than the d.s.f. and having black marginal spots on hind wing in males. Food plants belong to capparidaceae.

8. *Colotis calais* (Cramer)
The Small Salmon Arab

1775. *Papilio calais* Cramer, *Pap. Exot.*, 1 : 84.

Material examined : Delhi ; 2 exs : I. *Wing expanse* : 32-40 mm.

Distribution : India : Delhi; North-West to Peninsula. *Elsewhere* : Ethiopia; Arabia, Syria to Iran; Pakistan and Sri Lanka.

Remarks : Unlike *C.fausta*, this butterfly is almost exclusively found in the nurseries at Delhi. The hottest month of the year at Delhi may be dominant environmental factor affecting the appearance of this butterfly of which earlier there was no record during June (*Vide* Donahue, 1966). The species has a salmon-pink ground colour with fore wings dark coastal border reaching a prominent discal spot and hind wing with a broad outer black border bearing spots of the ground colour. The speciemens examined are referable to the ssp. *arnata* (Fabricius) recorded from Uttar Pradesh and Bombay to Pakistan. The unusual ditribution of seasonal forms do not correlate with precipitation pattern. Delhi appears to be near the north eastern edge of the range of this butterfly. It flies near the ground at bright day light and feeds on Capponidaceae.

Subfamily : COLIADINAE

9. ***Catopsilia pomona*** (Fabricius)
The Lemon Emigrant

1775. *Papilio pomona* Fabricius, *Syst. Ent.*, : 479.

Material examined : Delhi; 8 exs. : V, VII, XXXIV, XXVIII. *Wing expanse* : 45-60 mm.

Distribution : India : Delhi; rest of the mainland, Andaman and Nicobar Is. *Elsewhere* : Myanmar; Pakistan; Sri Lanka; South China to Australia and the Pacific.

Status : Common.

Remarks : The butterfly is present in good numbers during sw monsoon, after November the adults are scarce. It shows jerky and irregular flight and feeds on *Cassia* sp. The species can be easily recognised by the chalky white ground colour fore wing with a discal black spot, costal and terminal margin black and hind wing with marginal narrow black band. The butterfly is confined to the nurseries in Delhi.

11. ***Catopsilia florella*** (Fabricius)
The African Emigrant

1775. *Papilio florella* Fabricius, *Syst. Nat.* : 479.

Material examined : Delhi; one ex. : XXIX. *Wing expanse* : 42 mm.

Distribution : India: Delhi, rest of the mainland, Andaman & Nicobar Is. *Elsewhere* : Pakistan; Sri Lanka; Myanmar to Indo-China ; Hainan to South China; Africa to Arabia and Iran.

Status : Seasonally common.

Remarks : This butterfly is less common and more scattered throughout the year than

C. pyranthe. Further collection may produce specimens from May, June and August, the months for which there are no records so far. Very few specimens were earlier collected at Delhi during the monsoon, when *C. pyranthe* was most abundant (Donahue, 1966). From this it is evident that Talbot (1939) rightly assumed the fact that *C. florella* is a dry season form of *C. pyranthe*. The species is however, provisonally considered under the name of *florella* which can be distinguished by the wing with large discal spots prominently silver centred. Habitat are like those of *pyranthe*. The specimen examined belongs to the only known Indian subspecies *quoma (Fabricius)*.

12. *Terias hecabe* (Linnaeus)
The Common Grass Yellow

1758. *Papilio hecabe* Linnaeus, *Syst. Nat.* (10th ed.) : 470.

Material examined : Delhi; 15 exs. : V, VII, XX, XXI, XXIII, XXXIII.

Wing expanse : 32-47 mm.

Distribution : India : Delhi ; throughout the rest of the mainland, Andman and Nicobar Is., Lakshadweep (Mondal, 1991). *Elsewhere* : Throughout the Ethiopian and Indo-Australian region; Northwards to Korea and Japan.

Status : Very common.

Remarks` : The butterfly is commonest *Eurema* at Delhi, mostly found in the nurseries. It is apparently rare from January to June. Food plants belong to different species of *Cassia, Acacia, Caesalpinia, Albizzia,* etc. The species is a strong flier frequenting the open hot plains at Delhi. It has bright yellow ground colour with terminal black border very broad and excavated around middle on fore wing. The dry-season form, that flies from early November to late April, has prominent rusty markings on the underside of wings, while the wet-season form has the dogface pattern on the fore wing more produced than that of d.s.f. and poorly marked on the underside. The specimens examined are referable to the ssp. *simulata* (Moore) found in central to peninsular India and Sri Lanka. The generic name, *Terias* Swainson, with which this and the following species have been placed, replaces the hitherto used name, *Eurema* Auct. (nec Hubner) (Varshney, 1993).

13. *Terias laeta* Boisduval
The Spotless Grass Yellow

1836. *Terias laeta* Boisduval, *Spec. Gen. Lep.*, **1** : 674.

Material examined : Delhi; 4 exs. : XIII, XXXIII, XXXIV.. *Wing expanse.* : 30 mm.

Distribution : India : Delhi; throughout the plains and hills of the mainland. *Elsewhere :* Sri Lanka; Myanmar; north to China; Japan and Amur; also south to Hainan; Vietnam; Java; Philippines and Timor to Kei Islands.

Status : Seasonally common.

Remarks : The species, which was earlier known to be common on the Ridge in Delhi, is poorly represented in the collection under study. As is known, it disappears rather completely after

heavy rains. It feeds on plants of Leguminosae. The species is recognised by the bright yellow ground colour with apex of fore wing to the broadly black and male sex-brand, one each at cubital base on underside of fore wing and at radial base of hind wing. The specimens examined belong to the nominate subspecies from peninsula to western Himalaya and also Sri Lanka; these are referable to the cold weather dry-season form, *laeta*, which is quite pale with fore wing apex much pointed and occurs from October to April at Delhi.

Family : NYMPHALIADE
Subfaily : DANAINAE

14. *Tirumala limniace* (Cramer)
The Blue Tiger

1775. *Papilio limniace* Cramer, *Pap. Exot.*, **1** : 92.

Material examined : One ex. : I. Wing expanse : 90 mm.

Distribution : India : Delhi; throughout the rest of mainland, Andaman and Nicobar Islands, Lakshadweep (Mondal, 1991). *Elsewhere* : Widespread in the Oriental Region.

Status : Locally common.

Remarks : This is a migratory butterfly, often occurring in swarms in the plains of India. Recognised by its large black body with numerous white semitransparent spots, blotches and stripes. It shows flight which is leisurely to fairly fast. Food plants belong to different species of Asclepidaceae and Menispermaceae. The specimen examined belongs to the single known Indian subspecies, *leoparctus* (Butler). Donahue (1967) and Ashton (1972) also recorded the species from Delhi.

15. *Danaus chrysippus* (Linnaeus)
The Plain Tiger

1758. *Papilio chrysippus* Linnaeus, *Syst Nat.*, (10th ed.) : 471.

Material examined : Delhi; 107 exs. : I-V, IX-XV, XVII, XVIII, XXI, XXII, XXV, XXIX, XXX, XXXIV, XXXV. *Wing expanse* : 55-73 mm.

Distribution : India : Delhi, throughout the mainland. *Elsewhere* : Widespread in the Oriental, Palaearctic, Ethiopian and Australian regions.

Status : Very common.

Remarks : This is the most widely distributed species of all the Indian butterflies. It feeds on *Calotropis* sp. and also *Asclepias curassavica*. The butterfly is the strongest of all the danaines on wing. It occurs chiefly in the nurseries. A dry weather species in areas of heavy rainfall. It is a large tawny species with fore wing bearing white spotted black apex and male androconia on hind wing. The specimens examined belong to the only known nominate subspecies from India.

16. *Euploea core* (Crammer)
The Common Indian Crow

1780. *Papilio core* Crammer, *Pap. Exot.*, **3** : 133.

Material examined : Delhi ; 2 exs : XXVII. *Wing expanse* : 75 mm.

Distribution : India : Delhi; rest of peninsula and the Himalaya, Andaman and Nicobar Is., Lakshadweep (Mondal, 1991). *Elsewhere* : Pakistan; Nepal; Sri Lanka; Myanmar; Indo-China; Indonesia and eastwards.

Status : Common.

Remarks : Very few specimens of the species have been collected from the Ridge. It is mimicked by *Chilasa* (Papilioninae) and also by the female of *Hypolimnas bolina* (Linn.) (Nymphalidae). The species is highly polyphagous in habit and recognised by its black ground colour and elongate wings bearing 2 rows of white marginal spots; male fore wing with a short sex brand. It is a slow flier. The specimens examined belong to the nominate subspecies from the major parts of Indian subregion.

Subfamily : SATYRINAE

17. *Ypthima inica* Hewitson
The Lesser Threering

1865. *Yspthima* (sic) *inica* Hewitson, *Trans. ent. Soc. Lond.*, (3) **2** : 284.

Material examined : Delhi; one ex. IX. *Wing expanse* : 35 mm.

Distribution : India : Delhi; Punjab to West Bengal. *Elsewhere* : north-west Frontier (Talbot, 1947).

Status : Locally common.

Remarks : The butterfly has been taken in singleton from a nursery from where it was earlier reported by Donahue (1967). The species feeds on the grasses and is confined to the plains. It is recognised by the uniform dark brown ground colour with underside hind wing bearing one apical and two tornal non-linear ocelli, being reduced to a single cubital one on the upperside, male with sex-brand on the fore wing. The specimen examined is referable to the wet-season form *ariaspa* Moore, with underside of wings light grey, very evenly and closely striated, and hind wing ocelli smaller. The butterfly has no geogrphical form.

18. *Melanitis leda* (Linnnaeus)
The Common Evening Brown

1758. *Papilio leda* Linnaeus, *Syst. Nat.* **1** (2) : 773.

Material examined : Delhi ; 3exs. : V. *Wing expanse* : 70-74 mm.

Distribution : India : Delhi, throughout the rest of mainland, Andaman and Nicobar Is.,

Lakshadweep (Mondal, 1991). *Elsewhere* : southern Japan; Korea; South China; and whole of the Indo-Australian and Ethiopian Region.

Status : Common.

Remarks : This species is so common in certian areas that it becomes a nuisance around lights in the evening. Though, it has been collected in poor numbers from a nursery at Delhi. At day time it shelters in undergrowth or among bushes or even in verrandahs, anywhere where it gets refuge. It is vey fond of ripe fruits and toddy and commonly seen about tapped palm trees. The butterfly is dark brown, broad-winged and tooth-tailed, showing marked seasonal variations; fore-wing has white-pupilled black eye surrounded by tawny. It flies rapidly in a jerky manner at dusk. Only one specimen is of wet-season form with underside fine brown streaks and large prominent ocelli on wings, while the other two belong to d.s.f. showing rich brown ground colour with fore wing produced at mid-margin in male and falcate in female, and sharply defined ochraceous bar bordering a black white centred spot inner side. The material examined belong to the single known Indian subspecies *ismene* (Crammer).

Superfamily : HESPERIOIDEA
Family : HESPERIIDAE
Subfamily : HESPERIINAE

19. ***Parnara*** sp.

Material examined : Delhi ; one ex. : X. *Wing expanse* : 35 mm.

Remarks : The single specimen collected from a nursery at Delhi could not be identified upto the species level due to its damaged condition; on closer examination it seems to be nearer *P. naso* (Fabr.), which was earlier reported from Delhi.

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REFERENCES

Ackery, P.R. & Vane-Wright, R.I. 1984. Milkweed Butterflies Their cladistics and biology. *British Museum (Nat. Hist.)*, London ; 425 pp.

Ashton, R. 1972. Butterflies of New Delhi (Papilionidae). *J. Bombay nat. Hist. soc.*, **69** (3) : 502-507.

Collins, N. M. & Morris, M.G., 1985. *Threatened Swallowtail butterflies of the world.* The IUCN Red Data Book. IUCN, Cambridge & Gland : 401 pp.

D'Arbera, B., 1982. *Butterflies of the Oriental Region. Part I. Papilionidae, Pieridae & Danaidae.* Hill House, Victoria : 1-294.

D'Abrera B., 1985. *Butterflies of the Oriental Region. Part II. Nymphalidae, Satyridae & Amathusiidae.* Hill House, Victoria : 295-534.

Donahue, J.P. 1966. An annotated list of the Butterflies of Delhi, India. *J. Bombay nat. Hist. soc.*, **63** (2) : 235-260.

Donahue, J.P. 1967. An annotated list of the Butterflies of Delhi; India. *J.Bombay nat.Hist. soc.*, **64** (1) : 22-48.

Evans, W.H. 1949. *A catalogue of Hesperiidae from Europe, Asia and Australia in the British Museum (Nat. Hist.).* V-XIX + 502 pp. Printed by order of the Trustees of the British Museum, London.

Hancook, D.L., 1983. Classification of the Papilionidae (Lepidoptera) : A phylogenetic approach. *Smithersia*, **2** : 1-48.

Jandu, A.S. 1941. Some Butterflies from Delhi. *Indian J. Ent.*, **3** (2) : 336-337.

Jandu, A.S. 1942. *Indian J.Ent.*, **4** (2) : 201 - 214. (O.S.Unseen).

Jandu, A.S. 1943. *Indian J.Ent.*, **5** (1-2) : 223 - 41 (O.S. Unseen).

Longstaff, G.B. 1912. *Butterfly hunting in many lands.* Longmans, Green & Co., London.

Mondal, D.K. 1992. On a collection of Lepidoptera from the Neora Valley and vicinity, West Bengal, India. *Rec. zool. Survey India*, **92** (1-4) : 23-40.

Ghosh, S.K., Mondal, D.K. and Chaudhary, M. 1993. Butterflies and moths in Indian Tiger Reserves. *Zool. surv. India* : 1-12.

Sevastopulo, D.G. 1975. Butterflies of New Delhi (Papilionoidea). *J.Bombay nat. Hist. Soc.*, **72** (3) : 870-71.

Talbot, G. 1939. Butterflies I. *Fauna Brit. India including Ceylon and Burma, Lepidoptera.* Taylor & Francis, London ; 600 pp.

Talbot, G. 1947. Butterflies II. *Fauna Brit. India including Ceylon and Burma, Lepidoptera.* Taylor & Francis, London ; 506 pp.

Varshney, R.K. 1993. Index Rhopalocera Indica. Part III. Genera of butterflies from India and neighbouring countries. *Oriental Ins.*, **27** : 347-372.

Watson, E.Y. 1891. *Hesperiidae Indicae.* 1-161 p. + XV, Printed & Published by Vest and Company, Mount Road, Madras.

Note : While Gupta, I.J. (Lepidoptera : Nymphalidae) has dealt with nymphalids of Delhi, comprising 8 spp. belonging to eight genera. Ghorpade (vide Kalpavriksh, 1991) has listed 84 spp. of butterflies from Delhi. Combining the list of Donahue (1966, 1967), Ashton (1972), Ghorpade, Mondal et al., and Gupta, a total of 90 spp. of butterflies have been annotated separately in the present document.

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LEPIDOPTERA : NYMPHALIDAE

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INTRODUCTION

The present communication is the second part on the butterfly fauna of Delhi, dealing with family Nymphalidae. The collection studied includes 65 specimens representing eight species/subspp. belonging to four genera of the family Nymphalidae. Mondal et al. in the preceding chapter, have discussed in detail the earlier studies carried out on the butterfly fauna of Delhi and the possible impact of the vegetation loss in the area on the butterfly diversity.

SYSTEMATIC ACCOUNT

Family : NYMPHALIDAE

1. *Junonia lemonias persicaria* (Fruhstorfer)
The Lemon Pansy

1967. *Precis lemonias lemonias, Donahue, J.Bombay nat. Hist. Soc.*, **64** (1) : 36.

Material examined : Delhi; 2 exs., Ridge, 23.x.1993, coll. N.K.Sinha & party; 1 ex., Safdarjung Tomb, 30.x.1993, coll. N.K. Sinha & party; 1 ex., 21. xii.1994, coll. A.Husain & party.

Forewing length: 23.5 - 26.00 mm.

Remarks : Donahue (1967) reported that it is difficult to distinguish it as subspecies as done by Evans (1932), but examination of four specimens presently collected from Delhi indicate their close resemblance to subspecies *persicaria*, of which a good number of examples are available in the collections of ZSI. In *dry season form* the forewing is falcate at apex whereas in *wet season form*, wings have well-marked pattern with ocelli on underside, particularly on hindwing. It is known to be more abundant during and after monsoon, but solitary specimens are also often seen during winter and dry season. It is found upto an altitude of 2500 m in the hills, particularly abundant on flowers in gardens. It has been recorded throughout the year from Delhi except January and May which are the coldest and hottest months. Donahue (1967) recorded it from nurseries in Delhi.

Status : Common.

Distribution : India : Delhi, Kashmir to Kumaon, Assam, W.Bengal.

2. *Junonia hierta hierta* Fabricius
The Yellow Pansy

1967. *Precis hierta* Fab., Donahue, *J. Bombay nat. Hist. Soc.* **64**(1) : 35.

Material examined : Delhi : 1 ex., nala on Ring Road, near Naraina Village and around, 6.vi.1993, coll. N.K. Sinha & party; 4 exs., Ridge, 23.x.1993, Kedia nursery, coll. V.Khanna & party; 1 ex., Karnal Road, 25.x.1993, coll. N.K.Sinha & party; 1 ex., Shyampur, 28.x.1993, coll. N.K.Sinha & party; 1 ex., Lodi Garden, 31.x.1993, coll. N.K.Sinha & party 1 ex., Jahanpanah Park, Chirag Dilli, 22.xii.1994, coll. A.Husain & party.

Forewing length : 21-23.5 mm.

Remarks : Donahue (1967) collected it from a nursery at Tughlaqabad and on the ridge between July to September, November to January and in March and May. Present collections were made in June, October 1993 and December, 1994. Though it is found up to height of 3000 m in the hills, yet also abundant at low elevations and on the plains particularly in dry and arid regions; less common in forest and above 1500 m. The species has preference for hotter and sunnier places and especially fond of dry river beds, stony uncultivated ground and roads. The imagos are usually wary and difficult to collect except when settled on flowers in gardens. They generally fly all the year round on the plains, but only from spring to autumn at the higher elevations. One of the two prettiest spp. of the genus.

Status : Common.

Distribution : India : throughout. *Elsewhere* : Sri Lanka ; Myanmar.

3. *Precis almana almana* (Linnaeus)
The Peacock Pansy

1967. *Precis almana almana* Donahue, *J. Bombay nat. Hist. Soc.*, **64** (1) : 37.

Material examined : Delhi : 2 exs., Ring Road, 23.x.1993, coll. N.K.Sinha & party; 5 exs., Ridge near Dhaulakuan, 23.x.1993, coll. N.K.Sinha & party; 1 ex., Kedia nursery, Karnal Road, 25.x.1993, coll. N.K.Sinha & party; 1 exs., Shyampur, Wazirabad, 28.x.1993, coll. N.K.Sinha & party; 1 ex., Gopalpur Nala, Wazirabad 8.ix.1994, coll. J.P.Sati & party; 2 exs., I.A.R.I. Campus (no date) : 1 ex., Tuglakabad, Forest nursery, 12.ix.1994, coll. J.P.Sati & party; 1 ex., Yamuna Reservoir, Ram Ghat, 17.xii.1994, coll. A.Husain & party; 1 ex., Sabhay Pur, Ghaziabad Road, 17.xii.1994, coll. A.Husain & party; 1 ex., Asiad Village, Hawa Singh Road, 23.xii.1994, coll. A.Husain & party.

Forewing length : 22-31 mm.

Remarks : Donahue (1967) collected the imagos every month, during the year except February, in the nurseries in Delhi. It is most common during and after the monsoon, from mid-July through Decemeber; the seasonal forms are well defined. The **d.s.f.** display *dead leaf* pattern on underside, without ocelli on underside of hindwing; hindwing tornus produced and forewing apex falcate. On the other hand, **w.s.f.** has prominent ocelli on underside of hindwing,

the latter with tornus rounded and also forewing apex rounded. Donahue (loc. c.) further records that wet season form start flying before the beginning of wet season. On account of different shapes and markings on the undersides of extreme seasonal forms of this species for long time the seasonal forms were treated as distinct species, i.e., **w.s.f.** as *P.asteriae* and the **d.s.f.** as *P.almana*. It occurs up to an altitude of 2000 m in the hills, but very common at low elevations (around 1000m) especially in moist districts and in the ghats. It inhabits gardens and is very fond of flowers.

Status : Common.

Distribution : India : excluding Andaman & Nicobar Islands. *Elsewhere* : Sri Lanka ; Myanmar.

4. *Junonia orithya swinhoei* (Butler)
Blue Pansy

1967. *Precis orithya swinhoei,* Donahue, *J.Bombay nat. Hist. Soc.*, **64**(1) : 35-36.

Material examined : Delhi : 1 ex., Model Town, 8.vi.1993, coll. V.Khanna & party; 2 exs., Ridge area, 23.x.1993; coll. N.K.Sinha & party; 3 exs., Roadside Forest near Kedia nursery, Karnal Road, 25.x.1993, coll. N.K.Sinha & party; 2 exs., Bhalaswa, 26.x.1993, coll. N.K.Sinha & party; 2 exs., Bawana, 30.x.1993, coll. N.K.Sinha & party; 1 ex., Lake Garden, Shakur Basti, 31.x.1993, coll. N.K.Sinha & party; 3 exs., Yamuna River, Vikas Marg, 10.v.1994, coll. A.Husain & party; 1 ex., Opposite Runway, Palam Airport, 9.ix.1994, coll. J.P.Sati & party; 1 ex.,Okhla Bridge, 10.ix.1994, coll. J.P.Sati & party; 1 ex., Tughlaqabad Forest nursery near Air Force Station, 12.ix.1994, coll. J.P. Sati & party.

Forewing length: 21-25 mm.

Remarks: Donahue (1966) referred to the smallest specimens (collected by him) as small as or smaller than the recorded dwarf reported by Crawford (1930) with wing expanse of 36 mm. During the present surveys one specimen is collected for the first time in June, 1993, Donahue (1967), who collected the species widely in Delhi, mentioned that "It occurs in all habitats throughout the year, except in June and early July, for which there are no records" It is the second prettiest species of the genus.

Distribution : India : throughout. *Elsewhere* : Sri Lanka ; Myanmar.

5. *Phalanta phalantha phalantha* (Drury)
The Common Leopard

1967. *Phalanta phalantha phalantha,*Donahue, *J.Bombay nat. Hist. Soc.*, **64** (1) : 38-39.

Material examined : Delhi; 3 exs., Bhalsawa, 26.x.1993, coll. N.K.Sinha & party; 1 ex., Kakraula nursery near Najafgarh Road, 27.x.1993, coll. N.K.Sinha & party.

Forewing length : 29-30 mm.

Remarks : Donahue (1967) records it as never abundant in Delhi. He recorded it from Ridge and nurseries in the months of July, August and November. The present specimens have been collected in October. It avoids shady piaces and is found at the edge of jungle, on the plains and in gardens, flying during dry weather. It is not found in the wetter parts of India during the monsoon.It is extremely sharp and active in its movements and has a strong but not long-sustained flight. It is attracted towards flowers of *Lantana, Duranata* and *Thistles* on which it settles down with half open wings, quickly flitting (flirting) from blossom to blossom. It is often found drinking from damp patches and on wet roads in hot weather. The species completes its life history in extremely short period of three weeks. The food plants are of family *Pixaccae,* (genus *F. lacourtia, F.ramontchi* and *F.montana*). Ormiston records *Smilax* (a kind of Lily) and de Niceville adds *Salix* (Willow) as food plants of the species.In Himalaya, it occurs up to the height of 2500m and also at the top of hills in south India and Sri Lanka.

Status : Donahue (1967) records it common all over Delhi.

Distribution : India : all over including central Nicobar Isls. *Elsewhere* : Sri Lanka ; Myanmar ; Pakistan.

6. *Hypolimnas bolina* (Linnaeus)
The Great Eggfly

1967. *Hypolimnas bolina bolina,* Donahue, *J.Bombay nat. Hist. Soc.,* **64** (1) : 34-35.

Material examined : Delhi : 1 ex., Municipality nursery, Punjabi Bagh, 14.ix.1994, coll. J.P.Sati & party; 1 ex., opposite runway, Palam Airport, 9.ix.1994, coll. J.P. Sati & party.

Forewing length : Male : 40 mm, female : 42 mm.

Remarks : Donahue (1967) records its occurrence in Delhi. Contrary to his remarks that 'no males have ever seen by the author, either in Delhi or elsewhere in India', there is one male specimen collected from Delhi in the present surveys. This species is a mimic of danaid species, *Euploea core* (The common Indian Crow). It is less common than *H.misippus*. It is abundant in the wetter, well forested parts of India during rains. Widely distributed and found almost throughout the plains and upto an altitude of 1600 m in the hills with occasional stragglers upto 2000 m. The male displays striking appearance as it opens and closes the wings in the sunshine often high up on a tree. Being a most pungnacious insect it sallies forth and chase away any butterfly that comes close, nearly always returning again to the same perch, upon which it may be found day after day. Female flies more slowly than the male and keeps close to the ground among bushes, in forest or in gardens, in fact anywhere that she is likely to find her food plants (low growing species of *Urticaceae*). Female is often found in verandahs and houses to settle in dark corners. Both sexes are very variable in appearance.

Distribution : India : throughout. *Elsewhere* : Myanmar ; Sri Lanka ; Pakistan.

7. *Hypolimnas misippus* Donahue
The Danaid Eggfly

1967. *Hypolimnas misippus*, Donahue, *J.Bombay nat. Hist. Soc.*, **64**(1) : 34.

Material examined : Delhi; 1 ex., Asola Wildlife sanctuary, 12.ix.1994, coll. J.P. Sati & party; 1 ex., Kakraula nursery, 27.x.1993, coll. N.K.Sinha & party.

Forewing length : Male 34-35 mm ; female 40 mm.

Status : Common.

Remarks : Donahue (1967) recorded that the female mimics all three forms of *Danaus chrysippus* found in India, and he further commented that *`the typical female form'*, which is extremely difficult to distinguish from *D.chrysippus* in the field, is the only form which has been collected in Delhi. Donahue (1967) collected specimens of *H.misippus* from June to September and November, whereas the present collection has been made in September (1994) and October (1993). It has been recorded from all sides of Delhi, and is more common than *H.bolina bolina* in Delhi.It is a wonderful mimic of the `Plain Tiger' both in appearance and habits. But unlike the female of *H.bolina*, it is not seen nearly as frequently as male and keeps out of sight in scrub and jungle, nor is she found in houses. Wynter-Blyth (1957) stated it to be the commonest in regions of moderate rainfall and in fairly open country, especially during the monsoon months. It is abundant to an altitude of 2500 m in south India, not common above 1500 m in the north, but occasionally seen as high as 2500 m; food plant : *Portulaca oleracea* (Purslane) (Portulacaceae).

Distribution : India : throughout. *Elsewhere* : Sri Lanka ; Myanmar.

9. *Ariadne merione* (Moore)
The Common Castor

1967. *Ergolis merione tapestrina* Moore, *J.Bombay nat. Hist. Soc.*, **64**(1) : 39.

Material examined : Delhi; 4 exs., IARI Campus, 24.x.1993, coll. N.K.Sinha & party; 1 ex., Kakraula nursery, Najafgarh Road, 27.x.1993, coll. N.K.Sinha & party; 2 exs., Shyampur, Wazirabad bridge, coll. N.K.Sinha & party; 1 ex., 9.x.1994, IARI Campus, coll. N.K.Sinha & party; 1 ex., River Yamuna, Wazirabad, 14.v.1994, coll. A. Husain & party; 2 exs., Gurjar Ghat at Yamuna Bridge, Wazirabad, 8.ix.1994, coll. J.P.Sati & party; 2 exs., IARI Campus, (no date), coll. J.P.Sati & party.

Forewing length : 24-29 mm.

Remarks : Donahue (1967) did not collect any specimens of this species but referred to the only record of a single specimen from Delhi availabe in the IARI Collection and stated " the only record other than Delhi is from Lucknow, where de Rhe`-Philipe (1902) observed two specimens." During the present surveys as many as 13 specimens of the species have been collected. The species is widely distributed and also common, except in the more arid northern regions and above 2000 to 2500 m. in hills (lower in N.W.Himalaya). It is a weak flier and keeps to the immediate neighbourhood of its food plants. The species is found in castor fields and

around hedges and bushes, whereas, like *H.bolina* it often fly amidst the stems and branches.It resembles other two species, viz., *Apanera parisatis* (The Black Prince), and *Pseudergolis wedah* (The Tabby). Displays considerable seasonal variation.

Status : Common.

Distribution : India : except arid N. and NW regions. *Elsewhere* : Sri Lanka ; Myanmar.

REFERENCES

Ashton, R.1972. Butterflies of New Delhi (Paplionidae). *J.Bombay nat. Hist. Soc.*, **69** (3) : 502-509.

Donahue, J.P.1966. An annotated list of the butterflies of Delhi, India. *J.Bombay nat.Hist. Soc.*, **63** (2) : 235-268.

Donahue, J.P.1967. An annotated list of the butterflies of Delhi, India. *J.Bomay nat. Hist. Soc.*, **64** (2) : 22-48.

Jandu, A.S. 1941. Some butterflies from Delhi. *Indian J.Ent.*, **3**(2) : 336-37.

Varshney, R.K.1993. Index *Rhopalocera indica* Pt. III. Genera of butterflies from India and neighbouring countries. *Oriental Ins.*, **27** : 347-372.

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LEPIDOPTERA : RHOPALOCERA

Annotated list of species known from Delhi

compiled by
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Zoological Survey of India, Dehra Dun 248 195

Family : PAPILIONIDAE

1. *Papilio polytes* Linn. [=*Princeps polytes* (Linn.)]
2. *P. demoleus* Linn. [=*Princeps demoleus* (Linn.)]
3. *Pachliopta aristolochiae* Fabr.
4. *Pathysa nomius* Esper
5. *Chilasa clytia* Linn.

Family : PIERIDAE

6. *Belenois aurota* Fabr. [=*Anaphaeis aurota* (Fabr.)]
7. *Cepora nerissa* Fabr.
8. *Ixias marianne* Cramer
9. *Ixias pyrene* Linn.
10. *Colotis amata* Fabr. [=*Colotis calais* (Cramer)]
11. *C. vestalis* Butler
12. *C. danae* Fabr.
13. *C. etrida* Boisduval
14. *C. fausta* Olivier
15. *Appias albina* Boisduval
16. *A. libythea* Fabr.
17. *Colias fieldii* Menetries
18. *Delias eucharis* Drury
19. *Terias brigitta* Stoll (=*Eurema brigitta* Stoll)
20. *T. hecabe* Linn. [=*Eurema hecabe* (Linn.)]
21. *T. laeta* Boisduval [=*E. laeta* (Boisduval)]
22. *Leptosia nina* Fabr.
23. *Pieris canidia* Sparrman
24. *Catopsilia pomona* Fabr.
25. *C. pyranthe* Linn.
26. *C. florella* Fabr.

Family : DANAIDAE

27. *Tirumala limniace* Cramer
28. *Danaus chrysippus* Linn.

29. *D. genutia* Cramer
30. *Euploea core* Cramer

Family : NYMPHALIDAE

31. *Argynnis hyperbius hyperbius* (Johannsen)
32. *Ariadne merione tapestrina* (Moore)
33. *Charaxes solon* Fabr.
34. *C. fabius fabius* (Fabr.)
35. *Cynthia cardui* (Linn.)
36. *Hypolimnas bolina* (Linn.)
37. *H. misippus* (Linn.)
38. *Phalanta phalantha phalantha* (Drury)
39. *Precis almana almana* (Linn.) [=*Junonia almana almana* (Linn.)]
40. *P. atlites* Linn.
41. *P. hierta* Fabr. (=*Junonia h. hierta* Fabr.)
42. *P. orithya swinhoei* (Butler) [=*J.orithya swinhoei* (Butler)]
43. *P. lemonias lemonias* (Linn.) (=*J. lemonias persicaria* Fruhstorfer)
44. *Pseudergolis wedah* (Kollar)
45. *Symphaedra nais* (Forster)

Family : ACRAEIDAE

46. *Acraea violae* Fabr. [=*A. terpscicore* (Linn.)]

Family : RIODINIDAE

47. *Abisara echerius* (Stoll)

Family : HESPERIIDAE

48. *Badamia exclamationis* Fabr.
49. *Borbo cinnara* (Wallace)
50. *Erionnota thrax* Linn.
51. *Gangara thyrsis thyrsis* (Fabr.)
52. *Gegenes nostrodamus* (Fabr.)
53. *Hasora chromus chromus* (Cramer)
54. *H. vitta* Butler
55. *Matapa aria* Moore
56. *Parnara naso bada* (Moore)
57. *Pelopidas m. mathias* (Fabr.)
58 *P. t. thrax* (Hubner)
59. *Spialia g. galba* (Fabr.)
60. *Suastus g. gremius* (Fabr.)

61. *Telicota ancilia* Henrich- Schaffer
62. *T. colon colon* (Fabr.)
63. *T. angias* (Linn.)

Family : LYCAENIDAE

64. *Azanus ubaldus* (Cramer)
65. *A. uranus* Butler
66. *Catochrysops strabo strabo* (Fabr.)
67. *Chilades laius laius* (Cramer)
68. *Euchrysops cnejus* (Fabr.)
69. *E. parhasius parhasius* (Fabr.)
70. *Freyeria trochilus putli* (Kollar)
71. *Lampides boeticus* (Linn.)
72. *Prosotas nora ardates* (Moore)
73. *Rapala iarbus* (Fabr.)
74. *Spindasis ictis ictis* (Hewitson)
75. *S. vulcanus vulcanus* (Fabr.)
76. *Syntarucus jesous* Guerin- Meneville
77. *S. plinius* (Fabr.)
78. *Tarucus balkanica nigra* Bethune Baker
79. *T. callinara* Butler
80. *T. indica* Evans
81. *T. nara* Kollar
82. *Zizeeria knysna karsandra* (Moore)
83. *Z. maha maha* (Kollar)
84. *Zizina otis indica* (Murray)
85. *Zizula hylax* (Fabr.)
86. *Virachola isocrates* Fabr.

Family : SATYRIDAE

87. *Melanitis leda ismene* (Cramer)
88. *Mycalesis perseus tabitha* (Fabr.)
89. *Orsotrioena medus* Fabr.
90. *Ypthima inica* Hewitson

REFERENCES

Ashton, R. 1972. Butterflies of New Delhi (Papilionidae) *J. Bombay nat. Hist. Soc.*, **69** (3) : 502-507.

Donahue, J.P. 1966. An annotated list of the Butterflies of Delhi, India. *J. Bombay nat. Hist. Soc.*, **63** (2) : 235-260.

Donahue, J.P. 1967. An annotated list of the Butterflies of Delhi, India. *J. Bombay nat. Hist. Soc.*, **64** (1) : 22-48.

Ghorpade, K. 1991. An updated list of the Butterflies of the Delhi area. (Unpublished list with Kalpavriksh) m/ss 4 pp.

Gupta, I.J. 1996. Lepidoptera : Nymphalidae. *Zool. Surv. India, State Fauna Series 6 : Fauna of Delhi*; m/ss 6 pp. (in press).

Mondal, D.K. et al., 1996. Lepidoptera : Papilionoidea and Hesperioidea. *Zool. Surv. India, State Fauna Series 6 : Fauna of Delhi*; m/ss 15 pp. (in press).

Varshney, R.K. 1993. Index Rhopalocera Indica. Part III. Genera of Butterflies from India and neighbouring countries. *Oriental Ins.*, **27** : 347-372.

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LEPIDOPTERA : HETEROCERA

Species known from Delhi

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Family : SPHINGIDAE

1. *Herse convovuli convovuli* (Linn.)

Family : ZYGAENIDAE

2. *Campylotes histrionicus* Westwood

Family : LYMANTRIIDAE

3. *Euproctis lunata* Walker

Family : ARCTIIDAE

4. *Argina astrea* (Drury)

Family : NOCTUIDAE

5. *Earias insulana* Boisduval
6. *Agrotis flammatra* (Fabricius)
7. *Metachrostis badia* Swinhoe
8. *Chalciope hyppasia* (Cramer)

Family : GEOMETRIDAE

9. *Macaria fidoniata* Guenee
10. *Tephhrina disputaria* (Guenee)

Family : PYRALIDAE

11. *Nophoptoryx akbarella* (Rag.)

REFERENCES

Cotes, E.C. & Swinhoe, C., 1887-89. *Catalogue of Moths of India*, **1-6**, pp. 1-812. (sl. no. 2-4, 688).

Longstaff, G.B., 1912. *Butterfly hunting in many lands*. Longmans, Green & Co., London. (sl. no. 5, 7, 9-11).

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HYMENOPTERA : ACULEATA

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INTRODUCTION

Aculeate Hymenoptera contains narrow waisted insects, commonly known as Wasps, Bees and Ants, where the ovipositor is modified into a stinging apparatus. Many species live close to human habitations and visit houses frequently, where they make nests in open varandahs or inside. While many are seen in the parks, gardens, agricultural fields or forested areas visiting flowers for nector or searching for the host larvae to parasitize.

There is no comprehensive data available on aculeate Hymenoptera of Delhi. Bingham (1897) in his first volume of *Fauna of British India* recorded, for the first time, seven species belonging to the families, Mutillidae (1 sp.), Eumenidae (2 spp.), Vespidae (1 sp.), Pompilidae (1 sp.), Sphecidae (1 sp.) and Apidae (1 sp.) from Delhi. Subsequently in his second volume of Fauna of British India, Bingham (1903) recorded six more species belonging to the families, Formicidae (1 sp.) and Chrysididae (5 spp.) from Delhi.

Pruthi & Mani (1942) recorded two species belonging to the families Dryinidae and Bethylidae. Kurian (1955) described four species of Bethylidae from Delhi. While, Ram (1969) described one more species from same area. Williams (1983) recorded one species of Vespidae. Das & Gupta (1986) in a monograph on "The Social Wasps of India and adjacent countries" recorded a total of thirteen species from Delhi. Recently, Jha & Farooqi (1995) added one more species of the family Sphecidae from Delhi.

The present communication is based on the study of the material of aculeate Hymenoptera collected recently by the scientists of Zoological Survey of India, Dehra Dun. In addition, some material collected by Prof. V.K. Gupta and his students, particularly from Delhi University ridge area, was also available for study. As a result identification details and diagnostic characters of 35 species belonging to five families namely Tiphiidae, Scoliidae, Eumenidae, Pompilidae and Sphecidae are given here. Out of these 30 species are being recorded for the first time from Delhi, which have been marked with an asterisk in the text.

The following annotated list contains a total of 62 species, belonging to 11 families of aculeate Hymenoptera except family Formicidae, which has been dealt separately.

An annotated list of species

Family DRYINIDAE

1. *Lestodryinus pyrillae* Kieffer

Family BETHYLIDAE

2. *Scleroderma delhiensis* Kurian
3. *Epyris delhiensis* Kurian
4. *Goniozus chowdhari* Kurian
5. *Goniozus delhiensis* Ram
6. *Goniozus indicus* Ashmead
7. *Neoclystopsenella luffae* Kurian

Family CHRYSIDIDAE

8. *Chrysis scioensis* Gribodo
9. *Chrysis gujaratica* Nurse
10. *Chrysis thalia* Nurse
11. *Chrysis orientalis* (Guerin)
12. *Hedychrum timidum* Dahlbom

Family TIPHIIDAE

*13. *Poecilotiphia albomaculata* Cameron
*14. *Mesa dimidiata* (Guerin)
*15. *Mesa petiolata* (Smith)
*16. *Tiphia (Tiphia) hirsuta* Smith

Family SCOLIIDAE

*17. *Campsomeriella (C.) collaris collaris* (Fabricius)
*18. *Megacampsomeris reticulata* (Cameron)
*19. *Scolia (Discolia) affinis* Guerin
*20 *Scolia (Discolia) aureipenniformis* Betrem
*21 *Scolia (Discolia) binotata binotata* Fabricius
*22 *Scolia (Discolia) cruenta* Klug
*23 *Scolia (Discolia) dunensis* Betrem
*24 *Scolia (Discolia) fichteli* Betrem

Family MUTILLIDAE

25. *Mutilla analis* Lepeletier

Family POMPILIDAE

*26. *Tachypompilus analis* (Fabricius)
*27. *Pompilus dehliensis* Cameron

Family EUMENIDAE

*28. *Eumenes dimidiatipennis* Saussure
*29. *Eumenes esuriens* (Fabricius)
30. *Odynerus bipustulatus* Saussure
31. *Odynerus punctatipennis* Saussure

Family VESPIDAE

32. *Polistes (Megapolistes) wattii* Cameron
33. *Polistes (M.) rothneyi rothneyi* Cameron
34. *Polistes (Stenopolistes) delhiensis* Das & Gupta
35. *Polistes (Polistella) adustus* Bingham
36. *Polistes (P.) stigma tamula* (Fabricius)
37. *Polistes (P.) striogosus atratus* Das & Gupta
38. *Polistes (P.) sagittarius* Saussure
39. *Ropalidia (Anthreneida) brevita* Das & Gupta
40. *Ropalidia (A.) variegata variegata* (Smith)
41. *Ropalidia (A.) jacobsoni jacobsoni* (Buysson)
42. *Parapolybia varia* (Fabricius)
43. *Parapolybia nodosa* van der Vecht
44. *Vespa orientalis* Linnaeus

Family SPHECIDAE

*45. *Ampulex dissector* (Thunberg)
*46. *Dolichurus taprobanae* Smith
*47. *Chalybion bengalense* (Dahlbom)
*48. *Sceliophron (S.) madraspatanum* (Fabricius)
49. *Sceliophron (Prosceliophron) coromandelicum* (Lepeletier)
50. *Sceliophron (P.) neobilineatum* Jha & Farooqi
*51. *Sphex (Sphex) fumicatus* Christ
*52. *Sphex (S.) vicinus* Lepeletier
*53. *Parapsammophila erythrocephalus* (Fabricius)
*54. *Ammophila atripes* Smith
*55. *Ammophila laevigata* Smith
*56. *Liris haemorrhoidalis* (Fabricius)
*57. *Liris subtessellata* (Smith)
58. *Tachytes nitidulus* (Fabricius)

*59. *Dasyproctus buddha* (Cameron)
*60. *Stizus biclipeatus* (Christ)
*61. *Stizus vespiformis* (Fabricius)

Family APIDAE

62. *Anthophora violacea* Lepeletier

SYSTEMATIC ACCOUNT

Family : TIPHIIDAE
Subfamily : MYZININAE
Genus ***Poecilotiphia*** Cameron

*1. *Poecilotiphia albomaculata* Cameron

1902. *Poecilotiphia albomaculata* Cameron, *J. Bombay nat. Hist. Soc.*, **14** : 274, fig. 6; ♂, Deesa.

1981. *Poecilotiphia albomaculata* Cameron : Gorbatovsky, *Ent. Obozr.*, **60** : 386.

Material examined : Delhi; Vikas Marg, nr. Lok Nayak Bridge ; 1 ♂, 13.v. 1994, coll. A. Husain & party.

Diagnostic characters : *Male* : Black ; head, thorax and abdomen with whitish maculations. Vestiture predominantly white. Wings clear hyaline. First abdominal segment almost as long as broad, not nodose at apex. Length 9-10 mm.

Distribution : India : Gujarat, Delhi.

Remarks : This rare species is, hitherto, known by its types from Deesa (Gujarat).

Genus ***Mesa*** Saussure

*2. *Mesa dimidiata* (Guerin)

1837. *Myzine dimidiata* Guerin, *Des. pitt. His. nat.*, **5** : 585, ♂, Bombay (India).

1982. *Mesa dimidiata* (Guerin) : Krombein, *Smithsonian Contr. Zool.*, No. 374 : 73-74. ♀, ♂, Sri Lanka.

Material examined : Delhi; Village Badli, 1 ♂, 23.viii. 1968, coll. Renuka.

Diagnostic characters : *Female* : Black, apex of first abdominal segment and second to fourth segments entirely red. Wings strongly infumated except base of hindwing. Length : 16-19 mm. *Male* : Abdominal integument entirely black. Apical two-third of forewing infumated, basal third clear. Genitalia : Inner surface of cuspis with a mixture of long, flattened setae and shorter capitate setae. Length 14-17 mm.

Distribution : India : Delhi, Tamil Nadu, Karnataka, Maharashtra, Bihar, Uttar Pradesh,

Elsewhere : Sri Lanka.

Remarks : This widely distributed species is not rare in India.

*3. *Mesa petiolata* (Smith)

1855. *Myzine petiolata* Smith, *Cat. Hym. British Mus.*, **3** : 72; ♂, India (type in British Museum).

1982. *Mesa petiolata* (Smith) : Krombein, *Smithsonian contr. Zool.*, No. 374 : 79-80; ♀, ♂, Sri Lanka.

1994. *Mesa petiolata* (Smith) : Gupta, *Fauna conser. area*, **5**, *Rajaji Natn. Park, Zool. Surv. India* : 301-302; ♀, ♂, India, Uttar Pradesh.

Material examined : Delhi; Delhi University ridge, 1 ♀, 14.ix.1969, coll. Sushil.

Diagnostic characters : *Female* : Black, mandible except apex and tegula dark red. Forewing strongly infuscated on apical two-third , strongly yellow on basal third. Length : 7-11 mm. *Male* : Fore coxa black ; front and propodeal dorsum coarsely pitted. Genitalia : caspis on apical third without very long setae, elsewhere with strongly flattened, sparser setae. Length : 10-14 mm.

Distribution : India : Kerala, Tamil Nadu, Karnataka, Maharashtra, Bihar, West Bengal, Uttar Pradesh. *Elsewhere* : Sri Lanka.

Subfamily : TIPHIINAE

Genus *Tiphia* Fabricius

*4. *Tiphia (Tiphia) hirsuta* Smith

1855. *Tiphia hirsuta* Smith, *Cat. Hym. British Mus.*, **3** : 83; ♂, Northern India (type in British Museum).

1975. *Tiphia (Tiphia) hirsuta* Smith : Allen, *U.S. Dept. Agricul., Tech. Bull.*, No. 1509 : 33, ♂, Nepal.

1982. *Tiphia (Tiphia) hirsuta* Smith : Krombein, *Smithsonian Contr. Zool.*, **374** : 46-49, figures 53, 56, 60; ♀ ♂, Sri Lanka.

Material examined : Delhi; Delhi University Ridge, 1 ♀, 4.ix.1976, coll. S. Ahuja.

Diagnostic characters : *Female* : Black except mandibles, scape and flagellum beneath, posterior margin of pronotal disc and tegula being medium red. Vestiture white, long and dense on abdominal segments. Wings strongly yellowish. Hind basitarsus without groove on inner surface. Lateral propodeal surface completely rugulose. Length 10-13 mm. *Male* : Clypeus and lower front with dense white vestiture ; sixth abdominal sternite with a tuft of dense, suberect setae; posterolateral process of fifth sternite high and overlying an invagination along inner edge. Length 6-11 mm.

Distribution : India : West Bengal, Uttar Pradesh, Delhi, Karnataka, Tamil Nadu.

Elsewhere : Sri Lanka; Nepal.

Family : SCOLIIDAE
Subfamily : SCOLIINAE
Genus ***Campsomeriella*** Betrem

*5. ***Compsomeriella (C.) collaris collaris*** (Fabricius)

1775. *Tiphia collaris* Fabricius, *Syst. Ent.*, : 354 ♀, coast of Malabar, India (type in Copenhagen Museum).

1967. *Campsomeriella (C.) collaris collaris* (Fabricius) : Betrem, *Ent. Ber*, **27** : 29.

1994. *Campsomeriella (C.) collaris collaris* (Fabricius) : Gupta, *Fauna Conserv. area*, **5**, *Rajaji Natn. Park, Zool. Surv. India* : 304. ♀ ♂, India : U.P.

Material examined : Delhi; 10 ♀, 28 ♂ : Delhi University campus, 1 ♂, 17.x.1954, S. Puri coll., 1 ♂, 24.x. 1960, 2 ♂, 13-19. viii. 1961, Usha & E.S.K. coll., 1 ♂, 13 viii. 1962, Sneh coll., 1 ♀, 3 ♂, 10-29. x. 1962, Student's coll., 1 ♀, 2 ♂, 3.ix. - 14.xi.1964, M.Singh coll., 1 ♂, 17.vii. 1964, 1 ♂, 26. viii. 1971, V.K. Gupta coll., 2 ♂, 4-16. vii. 1969, Geeta & Shashi coll., 1 ♂, 23.x.1970, Gulati coll., 4 ♀, 3 ♂, 20.viii-10.xii.1975, 2 ♀, 7 ♂, 23.viii-27.ix.1976, 1 ♂, 28.ix.1976, 1♀, 15.xi.1977, Student's coll. ; Najafgarh Road, Kakraula nursery, 1 ♀, 1 ♂, 27.x. 1993, coll. N.K. Sinha & party; Kamla Nehru Ridge, Rajpur Rd., 1 ♂, 14.ix.1994, coll. J.P. Sati & party.

Diagnostic characters : *Female* : Integument black ; wings very dark with strong blue reflections ; occiput and pronotum with a very conspicuous ruff of erect white setae. Length : 14-27 mm. *Male* : Extensive yellow maculations on the abdomen, usually covering almost entire dorsum of first tergite, apical two-thirds of the second, third and fourth tergites with narrow apical bands ; the sixth sternum is clothed with dense, erect white or black setae. Length : 11-19 mm.

Distribution : The typical subspecies is distributed throughout Indian subcontinent. Other subspecies ranges eastwards to China, Indonesia and Philippines.

Remarks : It is one of the most abundant Indian scoliid and occurs in all ecosystems.

Genus ***Megacampsomeris*** Betrem

*6. ***Megacampsomeris reticulata*** (Cameron)

1892. *Elis (Dielis) reticulata* Cameron, *Mem. Proc. Manch. Lit. Phil. Soc.*, (4) **5** : 109; ♂, Poona, India (type in Univ. Museum, Oxford).

1928. *Campsomeris (Megacampsomeris) reticulata* (Cameron) : Betrem, *Treubia*, **9** (Suppl.) : 157. ♀, ♂, India.

1972. *Megacampsomeris reticulata* (Cameron) : Betrem *in* Betrem & Bradley, *Mon. Ned. Ent. Ver.*, **6** : 164.

Material examined : Delhi; 2 ♀ : 1 ♀, 20.viii. 1953, coll. Gangrade, 1 ♀, 6.iv.1958, coll. M. Ramachandra.

Diagnostic characters : Integument and vestiture entirely black in both the sexes ; forewing with two recurrent veins. Length : *Female* : 22-30 mm. *Male* : 20-24 mm.

Distribution : India : Delhi, Tamil Nadu, Karnataka, Maharashtra, Orissa, Bihar, Haryana, Rajasthan, Himachal Pradesh.

Genus *Scolia* Fabricius

*7. *Scolia (Discolia) affinis* Guerin

1838. *Scolia affinis* Guerin, *Voy. Coq. Zool.* : 254, ♀, ♂. Senegal (type species in Paris Museum).

1978. *Scolia (Discolia) affinis* Guerin : Krombein, *Smithsonian contr. Zool.*, 283 : 31-33 ♀, ♂, Sri Lanka.

1994. *Scolia (Discolia) affinis* Guerin : Gupta, *Fauna Conserv. area* **5**, *Rajaji Natn. Park, Zool. Surv. India* : 305, India : U.P.

Material examined : Delhi; 2 ♀, 5 ♂ : Delhi University Ridge, 1 ♂, 14.ix.1976, Sudhir coll., 1 ♂, 14.ix.1977, S. Jakati coll., 1 ♀, 26.x.1976, Puri coll., 1 ♂, 20.ix.1966, coll. Douli Ram; Kamla Nehru Ridge, 1 ♂, 28.7.1995, coll. J.P. Sati & party.

Diagnostic characters : *Female* : Antennal flagellum orange red, rest of the integument black ; metanotum and propodeal dorsum entirely smooth. Length : 17-25 m. *Male* : Antennal flagellum orange red entirely to at least beneath, rest of the integument black ; propodeal dorsum with sparse and shallow punctures. Genitalia : apex of the volsella with capitate bristles. Length 13-21 mm.

Distribution : India : throughout subcontinent. *Elsewhere* : Southeast Asia.

Remarks : It is one of the abundant scoliids.

*8. *Scolia (Discolia) aureipenniformis* Betrem

1928. *Scolia (Scolia) aureipenniformis* Betrem, *Treubia*, **9** (Suppl.) : 301-302, ♂, ♀. India, Ceylon (holotype ♂ in Leiden Museum).

1978. *Scolia (Discolia) aureipenniformis* Betrem : Krombein, *Smithsonian Contr. Zool.*, **283** : 35-38.

Material examined : Delhi; 10 ♂ : Delhi University campus, 1 ♂, - viii. 1960, 1 ♂, 8.ix. 1962, 1 ♂, 12.x.1971, 7 ♂, 23.viii.1977, Student's coll.

Diagnostic characters : *Female* : Antennal flagellum except basal segment, orange red, rest of the integument black ; metanotum and propodeal dorsum with shallow, mostly

subcontiguous punctures. *Male* : Black, flagellum orange red entirely to only last two segments ; propodeal dorsum with coarse, contiguous to subcontiguous punctures. Length : *Male* 14-18 mm.

Distribution : India : Delhi, Kerala, Karnataka, Pondicherry. *Elsewhere* : Sri Lanka.

Remarks : This species is very close to *Scolia bilunata* Saussure.

9. Scolia (Discolia) binotata binotata Fabricius

1804. *Scolia binotata* Fabricius,*Syst. Piez.* : 244. ♂, Tranquebar, India (type in Copenhagen Museum).

1978. *Scolia (Discolia) binotata binotata* (Fabricius) : Krombein, *Smithsonian Contr. Zool.*, **283** : 41-43. ♀, ♂, Sri Lanka.

Material examined : Delhi; 3 ♀, 1 ♂ : Delhi University Ridge, 1 ♀, 23. vii. 1971, coll. V.K. Gupta, 1 ♀, 30. xii. 1973, coll. V. Khanna & party, 1 ♀, 2.vii. 1976, coll. Sheila; Road side Forest nr. Kedia nursery, Karnal Road, 1 ♂, 25.x.1993, coll. N.K. Sinha & party.

Diagnostic characters : *Female* : Black, third and fourth abdominal tergites with paired, large rounded, light red spots ; vestiture black except being white on occiput ; front impunctate ; scapula, posterior half of mesoscutum and metanotum very sparsely punctate. Length : 14-20 mm. *Male* : Black, usually light red spots on third and fourth abdominal tergites; antennal flagelllum clavate towards apex. Length 11-17 mm.

Distribution : India : West Bengal, Bihar, Orissa, Uttar Pradesh, Delhi. *Elsewhere* : Sri Lanka.

Remarks : This widely distributed polytypic taxon ranges from Indian subcontinent to Japan ; China ; Taiwan ; East Indies and Southeast Asia. Typical subspecies is confined to Indian subcontinent.

10 Scolia (Discolia) cruenta Klug

1805. *Scolia analis* Klug, *Beitr. Naturk*, **1** : 36, ♀, Poona, India (Holotype in Berlin Museum).

1810. *Scolia cruenta* Klug, *Beitr. Naturk.*, **2** : 168 (new name).

1964. *Scolia (Discolia) cruenta* Klug : Betrem & Bradley, *Zool. Meded*, **40** : 93 (new subgeneric assignment).

Material examined : Delhi; 2 ♀, 1 ♂ : Delhi University Ridge, 1 ♀, 23.viii. 1975, Anita coll., 1 ♂, 29. viii. 1977, coll. Neelam; I.A.R.I., Campus, 1 ♀, 3. viii. 1955, coll. Kankralli.

Diagnostic characters : *Female* : Black, third to fifth abdominal tergites almost entirely reddish yellow, paired large reddish yellow spots on second tergite ; anterior margin of clypeus truncate in the middle. Length 16-23 mm. *Male* : Black, third to fifth abdominal tergites with paired, lateral, reddish yellow spots. Length : 12-18 mm.

Distribution : India : West Bengal, Bihar, Orissa, Madhya Pradesh, Uttar Pradesh, Delhi, Maharashtra, Karnataka, Tamil Nadu.

*11. *Scolia (Discolia) dunensis* Betrem

1928. *Scolia (Scolia) dunensis* Betrem, 1928 *Treubia*, **9** (suppl.) : 270. ♂, Dehradun, India.

1994. *Scolia (Discolia) dunensis* Betrem : Gupta, *Fauna conser. area* 5, *Rajaji National Park, Zool. Surv. India* : 306, Chilla, Pauri dist., U.P., India.

Material examined : Delhi; 1 ♀, 10 ♂ : Delhi University ridge, 1 ♂, 15.ix.1960, coll. P.Singh; 1 ♂, 29.viii. 1973, coll. V.Khanna; 1 ♂, 23.viii. 1975, coll. Mohan, 1 ♂, 4.viii. 1977, 1 ♂, 4.viii. 1977, 1 ♂, 10.ix.1977, coll. Neelam; 1 ♂, 28.x.1977, coll. Anita; New Delhi, 1 ♀, 3 ♂, 20-23. x.1978, IARI Campus, 1 ♂, 14.x.1993, coll. N.K. Sinha & party.

Diagnostic characters : *Female* : Black, abdomen with faint blue reflections, third abdominal tergite with a red band ; vestiture black ; wings dark brown. Length - 20 mm. *Male* : Integument and vestiture entirely black ; wings light brown, rosaceous in appearence, forewing dark anteriorly ; genitalia with massive volsella whose base and apex are not divided. Length 12 -15 mm.

Distribution : India : Delhi, Uttar Pradesh.

Remarks : This species resembles *Scolia fasciatopunctata* Guerin, known from southern India and Sri Lanka, in having similar punctation and male genitalia with unique massive volsella. It seems to be northern counterpart of that species.

*12. *Scolia (Discolia) fichteli* Betrem

1928. *Scolia (Scolia) fichteli* Betrem, *Treubia*, **9** (Suppl.) : 313-314. ♀, ♂, Malabar, India (types in Vienna and Paris Museums).

1964. *Scolia (Discolia) fichteli* Betrem : Betrem & Bradley, *Zool.Meded*, **40** : 93.

Material examined : Delhi; 1 ♀, 24.iii. 1971, coll. Suman.

Diagnostic characters : *Female* : Black, antennal flagellum brown beneath, third and fourth abdominal tergites with large, paired, lateral reddish spots ; vestiture black but lighter on maculated parts and on occiput, mesoscutum almost entirely punctate, upper plate of metapleurum impunctate except being very narrowly punctate along upper margin. Length 16-18 mm. *Male* : Black, third and fourth abdominal tergites with paired, lateral red marks ; vestiture black except being white on maculated parts and white mixed with brownish on head, pronotum and mesothorax ; antennal flagellum not clavate towards apex ; upper plate of metapleurum impunctate except being narrowly punctate above along upper margin as in female. Length : 14-16 mm.

Distribution : India : Kerala (Malabar coast), Delhi.

Remarks : This species is hitherto known by its types from Mahe, Malabar coast, Kerala and from an unknown locality.

Family : EUMENIDAE

Genus ***Eumenes*** Latreille

*13. *Eumenes dimidiatipennis* Saussure

1852. *Eumenes dimidiatipennis* Saussure, *Mon. Guep. Sol.* : 51,♀, ♂.

1897. *Eumenes dimidiatipennis* Saussure : Bingham, *Fauna British India, Hym.*, **1**:342, ♀, ♂, India.

Material examined : Delhi; Masudpur, Vasan Kunj, 1 ♀, 1 ♂, 13.ix.1994, coll. J.P. Sati & party.

Diagnostic characters : Obscure dull red, the following black : mesonotum, basal portion of petiole, apical half of second and the following abdominal segments entirely. Wings yellowish ferruginous with less than apical half being fuscous having purple effulgence. Length : *Female* 24-27 mm. ; *Male* : 22-25 mm.

Distribution : India : Maharashtra, Gujarat, Delhi, Punjab, Uttar Pradesh. *Elsewhere* : Pakistan; Arabia and Africa.

*14. *Eumenes esuriens* (Fabricius)

1787. *Vespa esuriens* Fabricius, *Mant. Ins.*, **1** : 293.

1804. *Eumenes esuriens* Fabricius, *Syst. Piez.* : 286.

1897. *Eumenes esuriens* (Fabricius) : Bingham, *Fauna British India, Hym.* : **1** : 342-343.

Material examined : Delhi; Priya Park, Vasant Vihar, 2 ♀, 13.ix.1994, coll. J.P. Sati & party.

Diagnostic characters : The following yellow : Head except for a broad band between eyes on vertex posteriarly being black, pronotum, mesopleurae, metanotum, petiole at apex and apical half of the second and the following abdominal segments, rest of the integument mainly light reddish except the following being black : a narrow subapical band at petiole and a band in the middle of second abdominal segment anterior to yellow band. Wings flavo-hyaline, forewing with a dark fuscous narrow subapical spot. Length : *Female* ; 18-20 mm ; *Male* : 16-18 mm.

Distribution : India : widely distributed. *Elsewhere* : Oriental Region, where it ranges from the Indian subcontinent eastward through Myanmar, Thailand, Borneo and Java to Philippines; and also extends to Iraq and Iran into southeastern part of the Palaearctic Region.

Genus *Odynerus* Latreille

15. *Odynerus bipustulatus* Saussure

1854. *Odynerus bipustulatus* Saussure, *Mon. Guep. Sol.* (Suppl.) **3** : 277, ♀, ♂, p. xii.-fig. 10.

1897. *Odynerus bipustulatus* Saussure : Bingham, *Fauna British India, Hym.* **1** : 369. ♀, ♂,

Diagnostic characters : Black, second abdominal segment with lateral round yellow spots at the base, apical margins of first and second abdominal segments only with complete transverse yellow bands above. First abdominal segment not narrowed, broader than long ; head, thorax and

abdomen with fine punctures ; wings hyaline, forewing narrowly dark fuscous. Length : 6-7.5 mm.

Distribution : India : Delhi, U.P. (Allahabad), West Bengal. *Elsewhere* : Myanmar.

Remarks : Bingham (1897) recorded this species for the first time from Delhi. The above diagnostic characters are based on Bingham's re-description.

16. *Odynerus punctatipennis* Saussure

1852. *Odynerus punctatipennis* Sasussure, *Mon. Guep. Sol.* : 210, ♀.

1897. *Odynerus punctatipennis* Sasussure : Bingham, *Fauna British India, Hym.* **1** : 365, ♀, ♂.

Diagnostic characters : *Female* : Ferruginous brown except head and antennae being more or less orange yellow, the following yellow : pronotum anteriorly, tegulae, post-scutellum, legs and second to third abdominal segments ; the second segment black at base. Wings flavo-hyaline, forewing with a large subapical cloud. Head and thorax coarsely punctate. Length : *Female* 11-13 mm. : *Male* 9 mm.

Distribution : India : Delhi, Sikkim, Uttar Pradesh, Maharashtra.

Remarks : The diagnostic characters are based on Bingham (1897).

Family : POMPILIDAE
Subfamily : POMPILINAE
Genus *Tachypompilus* Ashmead

*17. *Tachypompilus analis* (Fabricius)

1793. *Sphex analis* Fabricius, *Ent. Syst.*, **2** : 188.

1991. *Tachypompilus analis* (Fabricius) : Krombein, *Smithsonian Contr. Zool.*, **515** : 34. Sri Lanka (Prey record).

Material examined : Delhi; 1 ♀ : Road side Forest, near Kedia Nursery, Karnal Road, 1 ♀, 25.x.1993, coll. N.K. Sinha & party.

Diagnostic characters : Integument black, except third to last abdominal segments being red. Wings hyaline. Length : *Female* 14-21 mm. ; *Male* : 12-15 mm.

Distribution : India : throughout. *Elsewhere* : Eastward through Myanmar; southeast Asia and China to Sulawesi ; Philippines ; Taiwan ; Japan.

Genus *Pompilus* Fabricius

18. *Pompilus dehliensis* Cameron

1891. *Pompilus dehliensis* Cameron, *Mem. Proc. Manch. Lit. & Phil. Soc.*, (4) **4** : 458, 465. ♀, plate iii, fig. ii.

1897. *Pompilus dehliensis* Cameron : Bingham, *Fauna British India, Hym.*, **1** : 156. ♀, Delhi.

Diagnostic characters : *Female* : Black with glittering silvery pile. Wings flavo-hyaline, forewing with a subapical fuscous fascia occupying the radial, second and third cubital and upper part of second discoidal cells. Length : 9 mm.

Distribution : India : Delhi.

Remarks : This species is so far known from Delhi only. The above mentioned diagnostic characters are adopted from Bingham (1897).

Family : SPHECIDAE
Subfamily : AMPULICINAE
Genus ***Ampulex*** Jurine

*19. ***Ampulex dissector*** (Thunberg)

1822. *Ichneumon dissector* Thunberg, *Mem. lacol. inp. ins. Petersburg*, **8** : 341 ♀, Japan.

1976. *Ampulex dissector* (Thunberg) : Krombein, *Smithsonian Contr. zool.*, **298** : 8; ♀, ♂ Sri Lanka.

Material examined : Delhi; NZP, 1 ♀, 10.ii. 1995, coll. J.P. Sati & party.

Diagnostic characters : Body and legs shining metallic blue except antennae and mandibles being black and hind femur red. Pronotal disc with transverse rugulae interrupted by a shallow median groove, not tuberculate. Forewing with two submarginal cells. Length : *Female* : 13-15 mm. ; *Male* : 9 - 12 mm.

Distribution : India : Delhi, Uttar Pradesh, West Bengal. *Elsewhere* : Sri Lanka ; Hong Kong ; China ; Japan ; Taiwan.

Genus ***Dolichurus*** Latreille

*20. ***Dolichurus taprobanae*** Smith

1869. *Dolichurus taprobanae* Smith, *Trans. ent. Soc. London* : 304 ; ♀, Ceylon.

1897. *Dolichurus taprobanae* Smith : Bingham, *Fauna British India, Hym.*, **1** : 260.

Material examined : Delhi; Safdarjung Tomb, Lodhi Garden, 1 ♂, 21. xii. 1994, coll. A. Husain & party.

Diagnostic characters : Female : Vertex with relatively few, larger, scattered punctures; mesopleuron below with sternaulus running from omalus to mid coxa ; apex of first abdominal tergum with two rows of tiny, close punctures, succeeding terga with only scattered short setae except laterally on second through fourth. Length : 7-10 mm. Male : Vertex with tiny scattered punctures ; mesopleuron smooth and glossy except for scattered tiny punctures ; posterior surface of propodeum margined above and laterally by a strong ridge that ends in a blunt tooth halfway

down the side ; flagellar segments 3-10 slightly swollen in middle on inner surface, bearing erect long setae. Length : 6-8 mm.

Distribution : India : Delhi, Uttar Pradesh, Bihar, West Bengal, Assam Sikkim. *Elsewhere* : Sri Lanka ; Myanmar.

Subfamily : SPHECINAE

Genus ***Chalybion*** Dahlbom

*21. ***Chalybion (Chalybion) bengalense*** (Dahlbom)

1845. *Pelopoeus bengalense* Dahlbom, *Hym. Europoea*, **1** : 433.

1897. *Sceliophron violaceum* (Dahlbom) : Bingham, *Fauna British India, Hym.*, **1** : 240.

1976. *Chalybion (Chalybion) bengalense* (Dahlbom) : Bohart & Menke, *Sphecid Wasps of the World*, Univ. of Callifornia Press : 102.

Material examined : Delhi; 5 ♀, 10 ♂ : Indira Gandhi Indoor Stadium, 2 ♂, 10.ix.1994, I.A.R.I. Campus, 1 ♂, 11.ix.1994, Priya Park, Vasant Vihar, 3 ♀, 13.ix.94, Lodhi Garden, 2 ♀, 15.ix.1994, Humayun's Tomb, 7 ♂, 28.vii-1995, coll. J.P. Sati & party.

Diagnostic characters : Integument deep glistening cobalt blue except most of apical anntenal joints being black. Vestiture silvery white. Wings hyaline at the basal one-third and dark fusco-violaceous on apical half to two-thirds. Length : *Female* : 15-19 mm. ; *Male* : 11-16 mm.

Distribution : India : Throughout. *Elsewhere* : Oriental Region ; Mozambique, Seychelles ; Socotra ; Mauritius ; Australia ; Johnston ; Gilberts ; Marianae ; Solomons ; Hawaii.

Genus ***Sceliophron*** Klug

*22. ***Sceliophron (Sceliophron) madraspatanum*** (Fabricius)

1781. *Sphex madraspatanum* Fabricius, *Syst. Ent.*, **2** : 204.

1897. *Sceliophron madraspatanum* (Fabricius) : Bingham, *Fauna British India, Hym.*, **1** : 237.

1976. *Sceliophron (Sceliophron) madraspatanum* (Fabricius) : Bohart & Menke, *Sphecid wasps of the World*, Univ. of California Press : 106.

Material examined : Delhi; 8 ♀, 3 ♂ ; Majnu-Ka-Tila, 1 ♂, 8.ix.1994, Dhaulakuan Forest Ridge, 3 ♀, 9.ix.1994, I.A.R.I. campus, 1 ♀, 11.x.1994, Vasant Kunj, Masudpur, 1 ♀, 13.ix.1994, Lodhi Garden, 4 ♀, 2 ♂, 15.x.1994, coll. J.P. Sati & party.

Diagnostic characters : Black, the following yellow : scapus beneath, pronotum dorsally, tegulae, scutellum and post-scutellum, dorsal and posterior surfaces of propodeum largely, a large spot below tegulae on mesopleurum, femur (apical three-fourths), tibiae and first tarsal segment of fore and mid legs ; trochanter and basal one third of femur and tibia, two basal segments of tarsi of hind legs ; abdominal petiole. Wing yellowish hyaline with infumation

apically. Length : *Male* : 16-18 mm. ; *Female* : 20-22 mm.

Distribution : India (throughout). *Elsewhere* : Sri Lanka; Maldives; Indonesia, Vietnam.

*23. *Sceliophron (Prosceliophron) coromandelicum* (Lepeletier)

1845. *Pelpoeus coromandelicus* Lepeletier, *Hist. nat. Ins.* Hym., **3** : 306. ♀.

1897. *Sceliophron coromandelicum* (Lepeletier) : Bingham, *Fauna British India, Hym.*, **1** :238.

1976. *Sceliophron (Prosceliophron) coromandelicum* (Lepeletier) : Bohart & Menke, *Sphecid Wasps of the World*, Univ. of California Press : 106.

Material examined : Delhi; 1 ♂, Dhaulakuan, 1 ♂, 10.vi. 1993, coll. V. Khanna & party.

Diagnostic characters : Black except the scapus beneath being yellowish, the following are ferrugenous yellow : pronotum above, tegulae, apical two-thirds of fore and mid femora, hind femur almost entirely, tibiae and tarsi almost entirely and petiole. Vestiture black except for silvery pile on face. Wings light flavo-hyaline.

Distribution : India : Central and Southern India, Delhi. *Elsewhere* : Myanmar.

24. *Sceliophron (Prosceliophron) neobilineatum* Jha & Farooqi

1995. *Sceliophron (Prosceliophron) neobilineatum* Jha & Farooqi; *Shashpa,***2** (i) : 15-17. ♀, ♂; India : Delhi, Punjab, Bihar. Pakistan.

Diagnostic characters : Black except legs and abdomen being chestnut brown, the following are yellow : three spots on clypeus, scapus, first three antennal segments above, pronotal collar, scutellum, metanotum, tegulae, postspiracular ridge, a patch anterior to propodeal spiracle, posterior half of propodeum except a median longitudinal line, about apical two-thirds of femora, fore and mid tibiae, tarsi, petiole at anterior half, first abdominal segment sub-apically and sub-basally. Vestiture predominantly white. Wings flavo-hyaline with apices being infuscated. Length : *Female* : 16-21 mm; *Male* : 15-18 mm.

Distribution : India : Bihar, Haryana, Delhi, Punjab. *Elsewhere* : Pakistan ; Iran.

Remarks : Diagnostic characters based on Jha & Farooqi (1995).

Genus *Sphex* Linnaeus

*25. *Sphex (Sphex) fumicatus* Christ

1791. *Sphex fumicatus* Christ, *Naturg. Ins.* : 293.

1897. *Sphex umbrosus* : Bingham, *Fauna British India, Hym.*, **1** : 250,♀, ♂.

1976. *Sphex (Sphex) fumicatus* (Christ) : Bohart & Menke, *Sphecid wasps of the World*, Univ. California Press : 114.

Material examined : Delhi; 2 ♀, 2 ♂ : Road side Forest nr. Kedia Nursery, Karnal Road, 1 ♀, 1 ♂, 25.x.1993, coll. N.K. Sinha & party; Dhaulakuan forest ridge, 1 ♀, 1 ♂, 9.ix.1994, coll. J.P. Sati & party.

Diagnostic characters : Black. Clypeus and face at sides with a dense silvery pubescence; thorax and petiole with thin and hairy white pubescence. Wings clear hyaline, lightly and broadly fuscous at apex. Length : *Female* : 27-30 mm ; *Male* : 24-28 mm.

Distribution : India : throughout. *Elsewhere* : Sri Lanka ; Transcontinental Africa ; Cyprus ; east Mediterranean area ; Socotra ; Pembas ; Egypt.

*26. *Sphex (Sphex) vicinus* Lepeletier

1845. *Sphex vicinus* Lepeletier, *Hist. nat. Ins.*, **3** : 343.

1897. *Sphex vicinus* (Lepeletier) : Bingham, *Fauna British India, Hym.*, **1** : 245-246. ♀, India : Mussoorie (U.P.).

Material examined : Delhi; Road side forest, nr. Kedia Nursery, Karnal Road, 1 ♀, 25.x.1993, coll. N.K. Sinha & party.

Diagnosis : Black, the following red : legs except coxae, first and second abdominal segments. Vestiture white to silvery white. Wings hyaline, forewing slightly fuscous apically. Propodeum with coarse, broad and transverse striations. Length : *Female* : 18-22 mm.

Distribution : India : Uttar Pradesh, Delhi. *Elsewhere* : Myanmar.

Genus *Parapsammophila* Taschenberg

*27. *Parapsammophila erythrocephalus* (Fabricius)

1781. *Sphex erythrocephala* Fabricius, *Ent. Syst.* : 204.

1897. *Ammophila erythrocephala* (Fabricius) : Bingham, *Fauna British India, Hym.*, **1** : 235.

1976. *Parapsammophila erythrocephalus* (Fabricius) : Bohart & Menke, *Sphecid Wasps of the World*, Univ. California Press : 139. India.

Material examined : Delhi; Asola Wildlife sanctuary, 1 ♂, 12.ix.1994, coll. J.P. Sati & party.

Diagnostic characters : Black, the head, pronotum, tegulae, legs, petiole of the abdomen, scapus and basal half of the first antennal segment red ; wings fuscous with purple effulgence. Head and pronotum smooth and shining ; scutellum and metanotum longitudinally striate ; propodeum coarsely reticulate above in the middle, and transversely striate on sides. Length : *Female* : 32-34 mm.; *Male* : 29-31 mm.

Distribution : India : Throughout.

Genus ***Ammophila*** Kirby

*28. ***Ammophila atripes*** Smith

1852. *Ammophila atripes* Smith, *Ann. Mag. Nat. Hist.*, (2) **9** : 46.

1897. *Ammophila atripes* Smith : Bingham, *Fauna British India, Hym.*, **1** : 229-230. ♀, ♂.

1976. *Ammophila atripes* Smith : Bohart & Menke, *Sphecid Wasps of the World*, Univ. of California Press : 151.

Material examined : Delhi; Kakraula Nursery, Najafgarh Road, 2 ♀, 27.x.1993, coll. N.K. Sinha & party.

Diagnostic characters : Black, the femora, tibiae, basal two segments of tarsi, the petiole and first abdominal segment being red. Wings light fusco-hyaline. Pronotum, mesoscutum and propodeum striated. Length : *Female* : 18-30 mm. ; *Male* : 23-27 mm.

Distribution : India : Throughout. *Elsewhere* : Asia mainland of Oriental Region.

*29. ***Ammophila laevigata*** Smith

1856. *Ammophila laevigata* Smith, *Cat. Hym. British Mus.*, 4 : 215,♂.

1897. *Ammophila laevigata* Smith : Bingham, *Fauna British India, Hym.*,**1** : 231-232. ♀, ♂. India ; Sri Lanka.

1976. *Ammophila laevigata* Smith : Bohart & Menke,*Sphecid Wasps of the World*, Univ. of California Press : 152.

Material examined : Delhi; 4 ♀, 1 ♂ : Road side Forest Nr. Kedia nursery, Karnal Road, 1 ♂, 25.x.1993, Kakraula nursery, Najafgarh Road, 1 ♀, 27.x.1993, coll. N.K. Sinha & party; Patparganj area nr. Yamuna Bridge, 3 ♀, 10.ix.1994, coll. J.P. Sati & party.

Diagnostic characters : Black, the legs, petiole and first abdominal segment and basal two third of second segment red, except posterior tibiae and tarsi being black. Wings hyaline with a yellowish tinge. Pronotum and mesonotum punctured ; propodeum striate. Length : *Female* : 18-20 mm. ; *Male* : 15-16 mm.

Distribution : India : Tamil Nadu, Karnataka, Gujarat, Uttar Pradesh, Delhi. *Elsewhere* : Sri Lanka.

Subfamily : LARRINAE

Genus ***Liris*** Fabricius

*30. ***Liris haemorrhoidalis*** (Fabricius)

1804. *Pompilus haemorrhoidalis* Fabricius, *Syst. Piez. : 198.*

1897. *Liris haemorrhoidalis* Fabricius : Bingham, *Fauna British India, Hym.*, **1** : 207.

1976. *Liris haemorrhoidalis* Fabricius: Bohart & Menke, *Sphecid wasps of the World*, Univ. of California Press : 245.

Material examined : Delhi; 2 ♀ : Sabhyapur, Ghaziabad Rd., 1 ♀, 17.xii.1994, coll. A. Hussain & party; I.A.R.I. campus, 1 ♀, 10.ii. 1995, coll. J.P. Sati & party.

Diagnostic characters : Black, the following reddish : mandibles at base, scapus and two to three basal segments of antennal flagellum, the tegulae, legs except coxae and trochanters and apical margins of third to last abdominal segments. Vestiture silky golden. Wings flavo-hyaline with apical margins being fuscescent. Head and thorax covered with dense short silky pile. Propodeum obscurely transversely striate dorsally, at sides with fine and oblique striations. Length : *Female* 17-24 mm. ; *Male* 15-29 mm.

Distribution : India : Punjab, Delhi, Uttar Pradesh ; *Elsewhere* : Sri Lanka ; Mediterranean region, Africa, Middle east.

*31. *Liris subtessellata* (Smith)

1856. *Larrada subtessellata* Smith, *Cat. Hym.*, **4** : 277.

1897. *Notogonia subtessellata* (Smith) : Bingham, *Fauna British India, Hym.*, **1** : 202-203.

1976. *Liris subtessellata* (Smith) : Bohart & Menke, 1976. *Sphecid Wasps of the world*, Univ. California Press : 248.

Material examined : Delhi; 1 ♀, 1 ♂ : Sabhaypur, Ghaziabad Road, 1 ♀, 7.xii.1994, Piggery Farm nala, URI enclave, 1 ♂, 18.xii. 1994, coll. A. Husain & party.

Diagnostic characters : Black except the posterior femora being blood-red ; vestiture predominantly white ; wings subhyaline. Length : *Female* 11-14 mm.; *Male* : 8-10 mm.

Distribution : India : Delhi, Uttar Pradesh, Bihar, West Bengal, Maharashtra. *Elsewhere* : Sri Lanka ; Myanmar.

Genus *Tachytes* Panzer

32. *Tachytes nitidulus* (Fabricius)

1793. *Crabro nitidulus* Fabricius, *Syst. Ent.*, **2** : 294.

1897. *Tachytes nitidula* (Fabricius) : Bingham, *Fauna British India, Hym.*, **1** : 190-191. ♀, ♂; India, Myanmar, Tenasserim.

1976. *Tachytes nitidulus* (Fabricius) : Bohart & Menke, 1976. *Sphecid wasps of the World*, Univ. of California Press : 266.

Diagnostic characters : Integument black ; vestiture silvery except on pygidial area being black, dense silvery pubescent bands on apical margins of first to fourth abdominal tergites. Wings hyaline with very light yellowish tinge ; nervures and tegulae testaceous. Length : *Male* : 12-14 mm.

Distribution : India : Punjab, Delhi, Uttar Pradesh (Allahabad), West Bengal

(Barrackpore), Tamil Nadu (Madras). *Elsewhere* : Myanmar.

Remarks : Diagnostic characters based on Bingham (1897).

Subfamily : CRABRONINAE

Genus ***Dasyproctus*** Lepeletier & Brulle

*33. ***Dasyproctus buddha*** Cameron

1889. *Rhopalum buddha* Cameron, *Mem. Proc. Manch. Lit. Phil. Soc.*, (4) **2** : 18.

1897. *Carbro buddha* (Cameron) : Bingham, *Fauna British India, Hym.*, **1** : 323-324. ♀, ♂, India.

1976. *Dasyproctus buddha* (Cameron) : Bohart & Menke, *Sphecid wasps* of *the World*, Univ. California Press : 420.

Material examined : Delhi; 2 ♀, 1 ♂ : Hawa Singh Road, Asiad Vill., 1 ♀, 23.xii.1994, Vikas Marg nr. Lok Nayak Bridge, Ghaziabad Road, 1 ♀, 1 ♂, 13.v.1994, coll. A. Husain & party.

Diagnostic characters : Integument black, marked with yellow on the head, thorax and abdomen. Enclosed space at the base of median segment coarsely reticulate. Abdominal petiole long, linear and nodose at apex. Length : *Female* 8-12 mm. ; *Male* : 7-10 mm.

Distribution : India : West Bengal, Maharashtra, Tamil Nadu, Delhi, Uttar Pradesh. *Elsewhere* : Sri Lanka.

Subfamily : NYSSONINAE

Genus ***Stizus*** Latreille

* 34. ***Stizus biclipeatus*** (Christ)

1791. *Vespa biclipeatus* Christ, *Natur. Ins.*, 223, ♀. India.

1897. *Stizus biclipeatus* (Christ) : Bingham, *Fauna British India, Hym.*, **1** : 279. ♀, ♂. India : Punjab ; Gujarat ; Uttar Pradesh, Burma.

1976. *Stizus biclipeatus* (Christ) : Bohart & Menke, *Sphecid wasps of the World,* Univ. California Press : 526.

Materiel examined : Delhi; Vasantkunj, Masudpur, 1 ♀, 13.ix.1994, coll. J.P. Sati & party.

Diagnostic characters : Ferruginous, the following yellow : clypeus and most of the front, pronotum, legs partly ; paired lateral marks on first tergite and second to apical abdominal segments almost entirely. Wings fulvohyaline, forewing with a fuscous mark occupying the radial cell entirely and upper one-third of second and third submarginal cells. Length : *Female* : 14-18 mm.; *Male* : 13-17 mm.

Distribution : India : Punjab, Delhi, Uttar Pradesh, Gujarat, Madras. *Elsewhere* :

Myanmar.

*35. ***Stizus vespiformis*** (Fabricius)

1775. *Sphex vespiformis* Fabricius, *Spec. Ins.*, **1** : 447.

1897. *Stizus vespiformis* (Fabricius) : Bingham, *Fauna British India, Hym.*, **1** : 277-278. ♀, ♂.

1976. *Stizus vespiformis* (Fabricius) : Bohart & Menke, *Sphecid wasps of the world*, Univ. California Press : 527.

Materieal examined : Delhi; Asola-Bhatti WLS, 1 ♀, 12.ix.1994, coll. J.P. Sati & party.

Diagnostic characters : Black except head, forelegs, pronotum and second to fifth abdominal segments being red. Wings fuscous with purple effulgence. Length : *Female* : 20-25 mm. ; *Male* : 17-20 mm.

Distribution : India : Punjab, Delhi, Madras. *Elsewhere* : Sri Lanka ; Pakistan; Mauritius.

REFERENCES

Allen, H.W. 1975. The genus *Tiphia* of the Indian subcontinent. *U.S. Dept. of Agricul., Tech. Bull.* **1509** : 1-96, 6 plates.

Betrem, J.G. 1928. Monographie der Indo-Australischen Scoliiden mit Zoogeographischen Betrachtungen. *Treubia*, **9** (Suppl.) : 1-388, 5 plates.

Bingham, C.T. 1897. *The Fauna of British India, including Ceylon and Burma, Hym.*, **1** : xxix + 1-579, 4 plates. Taylor & Francis, London.

Bingham, C.T. 1903. *The Fauna of British India, including Ceylon and Burma, Hym.*, **2** : xix +1 - 506, 1 plate. Taylor & Francis, London.

Bohart, R.M. and A.S. Menke, 1976. *Sphecid wasps of the World - A generic revision.* Univ. of California Press ; 695 pp.

Cameron, P. 1902. Description of new genera and species of Hymenoptera collected by Major C.S. Nurse at Deesa, Simla and Ferozepur. *J. Bombay nat. Hist. Soc.*, **14** : 267-275.

Das, B.P. and V.K. Gupta, 1989. The Social wasps of India and adjacent countries (Hymenoptera : Vespidae). *Oriental Ins. Mon.*, **11** : 292 pp, figures 45, maps 45.

Gorbatovskij, V.V. 1981. On systematics of Palaearctic Myzininae (Hymenoptera : Tiphiidae). *Entomologicheskoe obozr.*, **60** (2) : 380-394 (Translated in *Entomological Rev. Wash.* : 105-122).

Gupta, S.K. 1994. Hymenoptera (Insecta). *Fauna of conservation area* 5 : Rajaji National Park. *Zool. Surv. India* : 301-307.

Jha, B.S. and Farooqi, S.I. 1995. Four new species of *Sceliophron* Klug (Sphecoidea : Sphecidae) from India. *Shashpa*, **2** (1) : 12-22.

Krombein, K.V. 1978. Biosystematic studies of Ceylonese wasps, II : A monograph of Scoliidae (Hymenoptera : Scolioidea). *Smithsonian contr. zool.*, **283** : 1-56.

Krombein, K.V. 1979. Biosystematic studies of Ceylonese wasps, V : A monograph of the Ampulicidae (Hymenoptera : Sphecoidea). *Smithsonian contr. zool.*, **298** : 1-29.

Krombein, K.V. 1982. Biosystematic studies of Ceylonese wasps, IX : A monograph of the Tiphiidae (Hymenoptera : Vespoidea). *Smithsonian contr. zool.*, **374** : 1-120, 64; 8 figures.

Krombein, K.V. 1991. Biosystematic studies of Ceylonese wasps, XIX : Natural History notes in several families (Hymenoptera : Eumenidae, Vespidae, Pompilidae and Crabronidae). *Smithsonian contr. zool.*, **515** : 1-41.

Kurian, C. 1955. Bethyloidea (Hymenoptera) from India. *Agra Univ. J. Res.*, **4** : 67-154, 255 figures.

Pruthi, H.S. and M.S. Mani, 1942. Distribution, hosts and habits of the Indian Serphoidea and Bethyloidea. *Mem. Indian Mus.*, **13** : 405-444.

Ram, A. 1969. Description of *Goniozus delhiensis*, n. sp.'(Bethylidae : Hymenoptera), a primary larval parasite of *Dicherocis punctiferalis* (Guen.) (Pyralidae : Lepidoptera). *Bull. Ent. Soc., India*, **10** (1) : 68-70, 6 figs.

Williams, P.H. 1983. Social wasps (Hym., Vespidae) from North West India. *Ent. Monthly Mag.*, **119** : 193-197.

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HYMENOPTERA : FORMICIDAE

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The present work is based on the specimens of ants (Formicidae) collected from Delhi by Zoological Survey of India, Dehra Dun.

So far only one species, viz., *Camponotus rufoglaucus* (Jerdon) was recorded from Delhi. The present study includes 19 species and eight genera under four subfamilies; of these 18 species are reported for the first time from Delhi. Key to subfamilies, genera and species have been provided which is mostly based on ♀♀.

List of species

Family : FORMICIDAE

I. Subfamily : DORYLINAE Forel

1. Genus *Dorylus* Fabricius

Subgenus *Typhlopone* Westwood

1. *Dorylus (Typhlopone) labiatus* Shuckard

Subgenus *Alaopone* Emery

2. *Dorylus (Alaopone) orientalis* Westwood

II. Subfamily : PONERINAE Lepeletier

2. Genus *Anochetus* Mayr

3. *Anochetus* sp. 1
4. *Anochetus* sp. 2

III. Subfamily : MYRMICINAE Lepeletier

3. Genus *Pheidole* Westwood

Subgenus *Pheidole* s. str.

5. *Pheidole (Pheidole) spathifera* Forel
6. *Pheidole (Pheidole) lamellinoda* Forel

4. Genus *Crematogaster* Lund

7. *Crematogaster contemta* Mayr
8. *Crematogaster buddhae* Forel
9. *Crematogaster hodgsoni* Forel

5. Genus ***Meranoplus*** Smith

10. *Meranoplus bicolor* (Guerin)

6. Genus ***Messor*** Forel

11. *Messor barbarus* (Linnaeus)

IV. Subfamily : FORMICINAE Lepeletier

7. Genus ***Myrmecocystus*** Wesmael

12. *Myrmecocystus setipes* Forel

8. Genus ***Camponotus*** Mayr

13. *Camponotus angusticollis* (Jerdon)
14. *Camponotus compressus* (Fabricius)
15. *Camponotus dichrous* Forel
16 *Camponotus festinus* (Smith)
17. *Camponotus invidus* Forel
18. *Camponotus* sp.
19. *Camponotus rufoglaucus* (Jerdon)

SYSTEMATIC ACCOUNT

Key to subfamilies

1. Pedicel of the abdomen one-jointed.....2
   Pedicel of the abdomen two-jointed.....Myrmicinae

2. A more or less marked constriction between basal two abdominal segments.....Ponerinae
   No constriction between basal two abdominal segments.....3

3. Opening at posterior end of gaster (acidopore) transverse, slit like.....Dorylinae
   Opening at posterior end of gaster (acidopore) terminal, circular and usually surrounded by a fringe of hairs.....Formicinae

1. Genus ***Dorylus*** Fabricius

1. ***Dorylus (Typhlopone) labiatus*** Shuckard

1940. *Dorylus labiatus* Shuckard. *Ann. Mag. nat. Hist.*, **5** : 319, ♂.

1994. *Dorylus (Typhlopone) labiatus* : Tiwari *et al., State Fauna Series*, 3 : *Fauna of West Bengal,* part 8 : 232 (In press).

Material examined : Delhi; 28 ☿☿ (maj. & minor), Okhla Reservoir, Okhla, 18.ii.1995, coll. A. Husain & party.

Distribution : India : Delhi, West Bengal. *Elsewhere* : Indian subcontinent.

Remarks : Wilson (1964) also reported this species along with synonyms from Delhi, Calcutta and Ahmedabad.

Subgenus ***Alaopone*** Emery

2. ***Dorylus (Alaopone) orientalis*** Westwood

1835. *Dorylus orientalis* Westwood, *Proc. Zool. Soc. Lond.*, 32 : 72, ♂.

1994. *Dorylus (Alaopon) orientalis* : Tiwari et al., *State Fauna Series* 3 : *Fauna of West Bengal* part 8 : 232 (In press).

Material examined : Delhi; 2 ☿☿ maj., NZP, 10.ii.1995, coll. J.P. Sati & party.

Distribution : India : Delhi, West Bengal, Orissa, Maharashtra, Tamil Nadu. *Elsewhere* : Myanmar; China; Malaya peninsula; Nepal; Sri Lanka; Indonesia.

Remarks : Wilson (1964) also reported this species along with the synonyms from West Bengal, Orissa, Madras and Poona.

II. Subfamily : PONERINAE Lepeletier

2. Genus ***Anochetus*** Mayr

3. ***Anochetus*** sp. 1

Material examined : Delhi; 5 ☿☿, NZP, 10.ii.1995, coll. J.P. Sati & party.

Diagnostic characters : ☿, TL 2 mm. Nearer to *A. yerburi* Forel but it differs in punctations of pro and mesonotum and is very small in size. Mandibles, antennae and thorax of dark reddish colour; the head a shade lighter.

4. ***Anochetus*** sp. 2

Material examined : Delhi; 10 ☿☿, Asola-Bhatti WLS, 21.xii.1994, coll. A. Husain & party.

III. Subfamily : MYRMICINAE

Key to genera

1. Antennae with less than 12 joints.....2
   Antennae 12-jointed.....3
2. Antennae 11-jointed.....*Crematogaster* Lund
\- Antennae 9-jointed.....*Meranoplus* Smith

3. Flagellum of antennae scarcely thickened towards apex, without distinct club..*Messor* Forel
   Flagellum of antennae with distinct club.....*Pheidole* Westwood

3. Genus *Pheidole* Westwood
Subgenus *Pheidole* Westwood

Key to species
(Soldier)

1. Body covered with abundant short red hairs, opaque; mandibles not dentate, smooth along the masticatory margin; antennal grooves as long as the scape; metanotal spines clavate and obtuse towards apex; the lower and anterior-lateral and the upper lateral angles of 1st node of pedicel dentate.....*spathifera* Forel
   Body smooth, polished and shining with very short and sparse pubescence; masticatory margin of mandibles with two blunt teeth at apex; no antennal groove; metanotal spines erect and more or less acute at apex; 1st node of pedicel not dentate.....*lamellinoda* Forel

5. *Pheidole (Pheidole) spathifera* Forel

1902. *Pheidole spathifera* Forel, *Rev. Suisse Zool.*,**10** : 168, 187; ☿, ♀ and ♂.
1994. *Pheidole (Pheidole) spathifera* : Tiwari *et al.*, *State Fauna Series* **3**, *Fauna of West Bengal*, part **8** : 265 (In press).
Material examined : Delhi; 244 exs. ; NZP, 10.ii.1995, coll. J.P. Sati & party.
Distribution : India : Delhi, West Bengal, Assam, western India. *Elsewhere* : Myanmar; Sri Lanka.

6. *Pheidole (Pheidole) lamellinoda* Forel

1902. *Pheidole lamellinoda* Forel, *Rev. Suisse Zool.*, **10** : 166, 186. 10 ☿, ♀ and ♂.
1951. *Pheidole (Pheidole) lamellinoda* : Chapman & Capco, *Monogr. Inst. Sci. Tech.*, *Manila* (Check List Ants Asia), **1** : 144.
Material examined : Delhi; 844 exs., Humayun's tomb, 12.ii.1995, coll. J.P. Sati & party.
Distribution : Recorded so far from central and western India.

4. Genus *Crematogaster* Lund

1831. *Cremastogaster* Lund, *Ann. Sci. Nat.*, **23** : 132.
Type species : *Formica scutellaris* Oliv., 1971, from Europe and north Africa.

Key to species
(♀♀)

1. Pronotum flat above; scape of antennae reaching a little beyond the top of the head.....*hodgsoni* Forel
- Pronotum convex above; scape of antennae not extending up to the top of the head.....2

2. Head broader than long; lateral angles of pronotum prominent; metanotal spines stout, acute, longer; 1st node of pedicel with a small rounded tubercle at apex above .....
.....*contemta* Mayr
- Head longer than broad; lateral angles of pronotum not prominent; metanotal spines very short; 1st node of pedicel with no such tubercle.....*buddhae* Forel

7. *Crematogaster contemta* Mayr

1878. *Crematogaster contemta* Mayr, *Verh. Zool. -bot. Ges. Wien.*, **28** : 680, 682, ☿.
1994. *Crematogaster contemta* : Tiwari et al., *State Fauna Series* **3** : *Fauna of West Bengal*, part **8** : 255 (In press).
Material examined : Delhi; 1 ☿, NZP, 10.ii.1995, coll. J.P. Sati & party; 50 ♀♀, Lok Nayak Bridge, Vikas Marg, river Yamuna, 13.v.1994, coll. A. Husain & party.
Distribution : India : Delhi, West Bengal, western India. *Elsewhere :* Sri Lanka.

8. *Crematogaster buddhae* Forel

1902. *Crematogaster buddhae* Forel, *Rev. Suisse Zool.*, **10** : 206, ☿.
1994. *Crematogaster buddhae* : Tiwari et al., *State Fauna Series* **3** : *Fauna of West Bengal*, part **8** : 255 (In press).
Material examined : Delhi; 75 ☿☿, Piggery Farm near Dhaulakuan, 16.ii.1995, coll. J.P.Sati & party.
Distribution : India : Delhi, West Bengal, Sikkim, north west Himalaya.

9. *Crematogaster hodgsoni* Forel

1902. *Crematogaster hodgsoni* Forel, *Rev. Suisse Zool.*, **10** : 204, ♀.

1951. *Crematogaster hodgsoni* : Chapman & Capco, *Monogr. Inst. Sci. Tech.*, Manila (Check List Ants Asia), **1** : 91.
Material examined : Delhi; 150 ☿☿, NZP, 10.ii.1995, coll. J.P.Sati & party.
Distribution : India : Delhi, Meghalaya (E. Khasi Hills). *Elsewhere* : Myanmar.

5. Genus *Meranoplus* Smith

1845. *Cryptocerus (part)* Guer., *Iconogor. Regne, Anim. Insecta*, **7** : 4.
1853. *Meranoplus (part)* : Smith, *Trans. Ent. Soc. Lond.*, (2) **2** : 224.
1865. *Meranoplus* : Mayr, *Novara Reise. Formicid* : 26.
Type species : *Cryptocerus bicolor* Guerin from India.

10. *Meranoplus bicolor* (Guerin)

1845. *Cryptocerus bicolor* Guerin, *Iconoger. Regne. Anim. Insect*, **7** : 425.
1853. *Meranoplus bicolor* : Smith, *Trans. Ent. Soc. Lond.*, (2) **2** : 224.
1994. *Meranoplus bicolor* : Tiwari et al., *State Fauna Series* **3** : *Fauna of West Bengal*, part **8** : 258 (In press).
Material examined : Delhi; 26 ☿☿, Humayun's tomb, 12.ii.1995, coll. J.P.Sati & party.
Diagnostic characters : ☿, head trapezoidal, broader posteriorly than in front; presence of antennal groove; mandibles stout, the masticatory margin armed with 4 teeth; clypeus with median portion broad, frontal area triangular, depressed; antennal carinae short, antennae moderate and 9 jointed, club distinct, formed of apical three joints; eyes oval, prominent. thorax more or less square in form, the pro- and mesonotum with no vestige, more or less armed laterally and posteriorly with spines or teeth; metanotum depressed beneath the over hanging posterior portion of the promesonotal sheild, armed at its upper or anterior angles with two backwardly pointing spines; pedicel short, nodes large, sessile or only shortly petiolate; abdomen cordate.
Distribution : India : Delhi, West Bengal. *Elsewhere* : Myanmar.

6. Genus *Messor* Forel

1890. *Aphaenogaster*, subgenus Messor Forel, *Ann. Soc. Ent. Belg.*, **34** : 68.
1903. *Messor* : Bingham, *Fauna Brit. India Hymn.*, **2** : 277:
Type species : *Formica barbara* Linnaeus from south Europe.

11. *Messor barbarus* (Linnaeus)

1767. *Formica barbara* Linn., *Syst. Nat.* (12th ed.), **1** : 962.
1903. *Messor barbarus* var. *instabilis*, Bingham, *Fauna Brit. India, Hymn.*, **2** : 278.

1994. *Messor barbarus* : Tiwari et al., *State Fauna Series* 3 : *Fauna of West Bengal*, Part 8 : 259 (In press).

Material examined : Delhi; 3 ☿☿, Asiad village, Hawa Singh road, 23.xii.1994, coll. A. Husain & party; 26 ☿☿, Asola WLS, 21.xii.1994, coll. A. Husain & party.

Distribution : India : Delhi, recorded so far from north west Himalaya and Kerala.

IV. Subfamily : FORMICINAE Lepeletier

Key to genera

1. Antennae inserted at a perceptible distance from posterior margin of clypeus..... .....*Camponotus* Mayr
- Antennae inserted immediately above posterior margin of clypeus, almost touching it..... .....*Myrmecocystus* Wesmael

7. Genus *Myrmecocystus* Wesmael

1838. *Myrmecocystus* Wesmael, *Bull. Acad. Sc. Brux.*, 5 : 770.

Type species : *M. melligera* Llave, from America.

12. *Myrmecocystus setipes* Forel

1894. *Myrmecocystus viaticus* race *setipes* Forel, *J. Bombay nat. Hist. Soc.*, 8 : 401, ☿.

1903. *Myrmecocystus setipes* : Bingham, *Fauna Brit. India, Hymn.*, 2 : 312, ♀.

1994. *Myrmecocystus setipes* : Tiwari et al., *State Fauna Series* 3 : *Fauna of West Bengal*, Part 8 : 278.

Material examined : Delhi; 4 ☿☿, Kamala Nehru Ridge, 17.ii.1995, coll. J.P.Sati & party; 1 ☿, Lok Nayak Bridge, Vikas marg, river Yamuna, 13.v.1994, coll. A. Husain & party; 3 ☿☿, Tughlaqabad Forest Nursery, near Air Force Station and fort, 12.ix.1994, coll. J.P. Sati & party; 1 ☿, Lodhi Garden, 15.ix.1994, coll. J.P.Sati & party.

Diagnostic characters : ☿. TL 10-12 mm. Head, thorax, legs and node of pedical dark red; abdomen black. Pilosity on head, thorax and abdomen sparse, confined to a few scattered erect hairs, most numerous on the underside of the abdomen. Legs densely setose and spinous; pubescence extremely minute and fine with a silvery glint, giving the head, thorax and abdomen a dull subopaque appearence. Head without mandibles quadrangular; mandible comparatively large, maxillary palpi 6-jointed; antennae 12-jointed. Thorax viewed from the side constricted in the middle, saddle shaped, the sutures well marked. Pedicel one jointed, node rounded; abdomen some what short and oval.

Distribution : India : Delhi, West Bengal, Punjab, central India. *Elsewhere* : Iran.

8. Genus *Camponotus* Mayr

1861. *Camponotus* Mayr. *Europ. Formicid.* : 35.
Type species : *C. ligniperdus* Latr., from Europe.

Key to species
(☿☿)

1. Head, thorax and abdomen entirely pale yellow.....*invidus* Forel
- Head, thorax and abdomen differently coloured.....2

2. Head, thorax and abdomen black.....3
- Head, thorax and abdomen never all black or all yelow.....4

3. ♀ maj. with 7 teeth on the mandible; length 11-16 mm, ♀ min. with head posteriorly narrow but not constricted to form a collar.....*compressus* (Fabr.)
- ♀ maj. with 6 teeth on the mandible; length 17-21 mm, ♀ min. with the head posteriorly constricted so as to form a collar.....*angusticollis* (Jerdon)

4. Body covered with very fine, dense, silky pubescence; lateral occipital angles of head not very prominent.....*rufoglaucus* (Jerdon)
- Pubescence on the body very sparse.....5

5. Head, thorax and abdomen dark castaneous brown, nearly black; median portion of clypeus not produced; thorax anteriorly not forming a collar.....*festinus* (Smith)
- Head and 3rd and following segments of abdomen pitch-black; thorax and basal two abdomonial segments yellow; median portion of clypeus anteriorly produced into a rectangular lobe; thorax anteriorly narrowed into a collar.....*dichrous* Forel

13. *Camponotus angusticollis* (Jerdon)

1851. *Formica angusticollis* Jerdon, *Madras Journ. Lit. Sci.*, **17** : 120, ♀,☌,☿ maj.
1903. *Camponotus angusticollis* : Bingham, *Fauna Brit. India, Hymn.*, **2** : 357, ☿.
1994. *Camponotus angusticollis* : Tiwari et al., *State Fauna Series* **3**, *Fauna of West Bengal*, Part **8** : 272 (In press).

Material examined : Delhi; 1 ☿, Lodhi garden, 13.ii.1995, coll. J.P.Sati & party; 15 ☿☿ (minor), I.A.R.I. Campus, 3.vi.1993, coll. V.Khanna & party; 5 ☿☿ (minor), Humayun's tomb, Mathura road, 12.xii.1995, coll. A. Husain & party.

Distribution : India : Delhi, West Bengal, Assam, central and western India. *Elsewhere* : Myanmar.

14. *Camponotus compressus* (Fabricius)

1787. *Formica compressus* Fabricius, *Manl. Insect.*, **1** : 307, ☿.

1903. *Camponotus compressus* : Bingham, *Fauna Brit. India, Hymn.*, **2** : 351, ☿, ♀ and ♂.

1994. *Camponotus compressus* : Tiwari et al., *State Fauna Series* **3**, *Fauna of West Bengal*, Part **8** : 273.

Material examined : Delhi; 13 ☿☿ (maj. & minor), Kamala Nehru Ridge, 17.ii.1995, coll. J.P.Sati & party; 34 ☿☿ (maj. & minor), Hauz Khas Park, 15.ii.1995, coll. J.P.Sati & party; 52 ☿☿ (maj. & minor), Budha Jayanti Park, 15.ii.1995, coll. J.P.Sati & party; 105 ☿☿ (maj. & minor), Jahapanah Res. Forest, 18.ii.1995, coll. J.P.Sati & party; 46 ☿☿, Humayun's tomb, 14.ii.1995, coll. J.P.Sati & party; 16 ♀♀ (minor), Asola WLS, 12.ii.1995, coll. J.P.Sati & party; 180 ☿☿, lake Garden, Dhaulakuan, 16.ii.1995, coll. J.P.Sati & party; 149 ☿☿ (minor), Tughlaqabad Park, 12.ii.1995; 2 ☿☿ (maj.), Dhaulakuan, Lake Garden, 10.vi.1993, coll. V. Khanna & party; 6 ☿☿ (maj. & minor), Tughlaqabad Forest and nursery near Airforce Station, 12.vi.1994, coll. J.P.Sati & party; 7 ☿☿ (minor), Road side Forest, near Kedia nursery, Karnal road, 25.x.1993, coll. N.K.Sinha & party; 4 ☿☿ (maj. & minor), Najafgarh, 27.x.1993, coll. N.K.Sinha & party; 6 ☿☿ (maj. & minor), Jahanpanah Park, Chirag Dilli, 22.xi.1994, coll. A. Husain & party; 7 ☿☿ (maj. & minor), Yamuna Reservoir, Ram ghat; 17.xii.1994, coll. A. Husain & party.

Distribution : India : Delhi, West Bengal, Assam. *Elsewhere* : Myanmar; Sri Lanka; extending through Russia and Arabia into Africa, and on the east to the Malayan sub-region.

Remarks : They prey upon membracid bug, *Leptocentrus taurus*.

15. *Camponotus dichrous* Forel

1897. *Camponotus maculatus* Fabr. race *dichrous* Forel, *Bulll. Soc. Vaud. Sci. Nat.*, **16** : 65, ☿,

1903. *Camponotus dichrous* : Bingham, *Fauna Brit. India, Hymn.*, **2** : 356, ☿.

1994. *Componotus dichrous*, Tiwari et al., *State Fauna Series* **3** : *Fauna of West Bengal*, part **8** : 273 (In press).

Material examined : Delhi; 9 ☿☿ (maj. & minor), Pond, Nangli Sakraoti near Saidham, 20.xii.1994, coll. A. Husain & party.

Distribution : India : Delhi, West Bengal, Orissa.

16. *Camponotus festinus* (Smith)

1857. *Formica festinus* Smith, *Proc. Linn. Soc.*, **2** : 53, ♀.

1892. *Camponotus festinus* : Forel, *J. Bombay nat. Hist. Soc.*, **7** : 228.

1903. *Camponotus festinus* : Bingham, *Fauna Brit. India, Hymn.*, **2** : 362.

1951. *Camponotus (Tanaemyrmex) festinus* : Chapman & Capco , *Mongr. Inst. Sci. Tech.*, Manila (Check List of Ants), **1** : 245.

Material examined : Delhi; 6 ☿☿ (maj. & minor), NZP, 10.ii.1995, coll. J.P. Sati & party.

Distribution : India : Delhi. *Elsewhere* : Borneo; China and Java.

17. *Camponotus invidus* Forel

1892. *Camponotus invidus* Forel, *J. Bombay nat. Hist. Soc.*, **7** : 225, ☿.

1994. *Camponotus invidus* : Tiwari et al., *State Fauna Series* **3** : *Fauna of West Bengal*, Part **8** : 273 (In press).

Material examined : Delhi; 11 ☿☿ (maj. & minor), Tughlaqabad Park, 12.ii.1995, coll. J.P.Sati & party.

Distribution : India : Delhi, West Bengal and Orissa.

18. *Camponotus* sp.

Material examined : India : Delhi; 2 ☿☿, Okhla Reservoir, Okhla, 18.xii.1994, coll. A. Husain & party.

Diagnostic characters : ☿. TL 5-6 mm. It comes nearer to *C. serecius* (Fabr.), but differs in having following characters. Head reddish ferruginous; scape of antennae, tibiae and tarsi reddish; rest of the body dark black in colour. Pedicel antero-posteriorly compressed, transverse.

19. *Camponotus rufoglaucus* (Jerdon)

1851. *Formica rufoglauca* Jerdon, *Madras Journ. List. Sci.*, **17** : 124, ☿.

1903. *Camponotus rufoglaucus* : Bingham, *Fauna Brit. India, Hymn.*, **2** : 363.

1951. *Camponotus rufoglaucus* : Chapman & Capco, *Monogr. Inst. Sci. Tech.*, Manila (Check List Ants Asia), **1** : 238.

Material examined : From literature.

Distribution : India : Delhi, Assam, central India, Deccan. *Elsewhere* : Sri Lanka and Myanmar.

Remarks : The material of this speceis could not be collected during the present study. However, Bingham (1903) reported the species from Delhi.

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REFERENCES

Bingham, C.T. 1903. *The Fauna of British India, including Ceylon and Burma,* Hymenoptera, Formicidae, **2** : 1-414. Taylor & Francis, London.

Bolton, B. 1995. A taxonomic and zoogeographical census of the extant ant taxa (Hymenoptera : Fromicidae). *Journ. nat. Hist.*, **29** : 1037-1056.

Chapman, J.W. & Capco, S.R. 1951. Check List of the Ants (Hymenoptera : Formicidae) of Asia. *Monogr. Inst. Sci. Tech., Manila*, **1** : 1-327, 1 map.

Forel, A. 1900a. Les Formicides de l'Empire des Indes et de Ceylan. Part VI. *J. Bombay nat. Hist. Soc.* **13** : 52.

Forel, A. 1900b. Les Formicides de l'Empire des Indes et de Ceylan. Part VII. *J. Bomaby nat. Hist. Soc.*, **13** : 303-332.

Forel, A. 1900c. Les Formicides de l'Empire des Indes et de Ceylan. Part VIII. *J. Bombay nat. Hist. Soc.*, **13** : 462-477.

Rothney, G.A.J. 1889. Notes on Indian ants. *Trans. Ent. Soc.* (1889) : 347-374.

Tiwari, R.N. Kundu, B.G., Roychowdhury, S. & Ghosh, S.N. 1993. Insecta : Hymenoptera : Formicidae. *State Fauna Series* **3** : *Fauna of West Bengal,* Part **8** : 209-288 (In press).

Wilson, E.O. 1964. The true Army Ants of the Indo-Australian area (Hymenoptera : Formicidae : Dorylinae). *Pacific Ins.*, **6** (3) : 427-483, key, figs., des.

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HYMENOPTERA : ICHNEUMONIDAE

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INTRODUCTION

The family Ichneumonidae of the Order Hymenoptera is one of the largest of all animal groups and constitutes 5-8% of all the species of insects known from the world. They are parasitic in cocoons, usually of Lepidoptera, but also parasitize cocoons of Symphyta, Braconidae, Ichneumonidae, Neuroptera, Diptera and spiders.

There are about 1200 species/subspecies of this family known from India. Very little is known about the fauna of this family from Delhi; which being small in area with very little forest cover, except the remains of Aravalli hills, agricultural fields and orchards, the insect population is very low.

In total 24 species/subspecies have been recorded under 14 genera and 7 subfamilies from Delhi. A check-list of the taxa is as follows :

1. Subfamily : PIMPLINAE

1. *Scambus (Scambus) laccae* Gupta & Tikar

2. Subfamily : TRYPHONINAE

2. *Netelia (Netelia) corrugata* Kaur & Jonathan
3. *Netelia (Netelia) kashmirensis* (Cameron)
   = *Paniscus montanus* Cameron
   = *Paniscus kashmirensis* Cameron
4. *Netelia (Netelia) striata* Nikam

3. Subfamily : BANCHINAE

5. *Syzeuctus zanthorius* (Cameron)
   = *Lissonota zanthoria* Cameron
   = *Paratanera indica* Rao

4. Subfamily : PORIZONTINAE

6. *Casinaria formosana bharata* Maheshwary & Gupta
7. *Campoletis chlorideae* Uchida
8. *Xanthocampoplex nigromaculatus* (Cameron)
   =*Zachresta nigromaculata* Cameron

=*Xanthocampoplex orientalis* Morley

5. Subfamily : OPHIONINAE

9. *Enicospilus erythrocerus* (Cameron)
= *Pleuroneurophion erythrocerus* Cameron
= *Allocamptus orientalis* Uchida
= *Enicospilus hirayamai* Uchida

10. *Enicospilus insinuator* (Smith)
= *Ophion insinuator* Smith
= *Enicospilus zyzzus* Chiu

11. *Enicospilus javanus* (Szepligeti)
= *Henicospilus javanus* Szepligeti
= *Enicospilus fulacorensis* Brues
= *Enicospilus gephyrus* Chiu
= *Enicospilus (Bicorniata) diurnus* Nikam

12. *Enicospilus laqueatus* (Enderlein)
= *Henicospilus laqueatus* Enderlein
= *Enicospilus leetoni* Chiu

13. *Enicospilus melanocarpus* Cameron
= *Enicospilus reticulatus* Cameron
= *Eniscospilus melanocarpus* Cameron
= *Henicospilus nigrinervis* Szepligeti
= *Ophion (Henicospilus) nocturnus* Kohl
= *Henicospilus batavianus* Szepligeti
= *Henicospilus turneri* Morley
= *Henicospilus uncivena* Enderlein
= *Henicospilus crassivena* Enderlein
= *Henicospilus nigrivenalis* Cushman

14. *Enicospilus shinkanus* (Uchida)
= *Henicospilus shinkanus* Uchida
= *Henicospilus pankumensis* Cheesman
= *Enicospilus relictus* Chiu
= *Enicospilus (Unicorniata) bindus* Nikam

6. Subfamily : DIPLAZONTINAE

15. *Diplazon laetatorius* (Fabricius)
= *Ichneumon laetatorius* Fabricius
= *Scolobates varipes* Smith
= *Bassus generosus* Cameron

16. *Diplazon tetragonus delhius* Diller

7. Subfamily : MESOSTENINAE

17. *Gotra marginata* (Brulle)
= *Mesostenus marginatus* Brulle
= *Mesostenus himalayensis* Cameron
= *Mesostenoideus octozonatus* Ashmead
= *Mesostenus clarinervis* Cameron
= *Stenaraeus rufipes* Szepligeti

18. *Menaforia indica* Gupta & Sexena
= *Menaforia nigrominiata* Gupta & Saxena

19. *Goryphus cinctipes* (Cameron)
= *Melcha maculiceps* Cameron
= *Melcha cinctipes* Cameron
20. *Goryphus flavorbitalis flavorbitalis* Jonathan & Gupta
21. *Goryphus nursei* (Cameron)
= *Melcha nursei* Cameron
22. *Gambroides javensis* (Rohwer)
= *Eripternimorpha javensis* Rohwer
23. *Isotima pusilla* (Szepligeti)
= *Neomesostenus pusillus* Szepligeti
= *Neomesostenus minutus* Szepligeti
= *Neomesostenus persimilis* Szepligeti
24. *Acromia punctata* Kamath

REFERENCES

Gauld, I.D.1976. The classification of the Anomoloninae (Hymenoptera : Ichneumonidae). *Bull. Brit. Mus. Nat. Hist. (Ent.)*, 33 : 1-135.

Gauld, I.D. & Mitchell, P.A. 1981. *The taxonomy, distribution and host preferences of Indo-Papuan Parasitic Wasps of the Subfamily Ophioninae.* CAB : Slough. Commonwealth Institute of Entomology, London. Pp 1-1611.

Gupta, Virendra, 1987. Catalogue of the Indo-Australian Ichneumonidae. Part 1 & 2. *Mem. Amer. Ent. Inst.*, **41** : 1-1210.

Gupta, Santosh & Gupta, Virendra, 1983. Ichneumonologia Orientalis, Part IX. *Oriental Ins. Monogr.*, **10** : 1-313.

Gupta, V.K. & Maheshwary, S. 1977. Ichneumonologia Orientalis, Part IV. The tribe Porizontini (=Campoplegini) (Hymenoptera : Ichneumonidae). *Oriental Ins. Monogr.*, **5** : 1-265.

Gupta, V.K. & Tikar, D.T. 1976. Ichneumonologia Orientalis, Part 1. The tribe Pimplini (Hymenoptera: Ichneumonidae). *Oriental Ins. Monogr.*, **1** : 1-313.

Jonathan.J.K.1980. The Isotima-Complex. *Rec. zool. Surv.*, Occ. Paper, **17** : 1-146.

Jonathan.J.K. & Gupta, V.K. 1973. Ichneumonologia Orientalis, Part III. The *Goryphus*-Complex (Hymenoptera : Ichneumonidae). *Oriental Ins. Monogr.*, **3** : 1-203.

Kamath, M.K. & Gupta, V.K. 1972. Ichneumonologia Orientalis, Part II. The tribe Rhyssini (Hymenoptera : Ichneumonidae). *Oriental Ins. Monogr.*, **2** : 1-300.

Kaur, Raminder & Jonathan, J.K. 1979. Ichneumonologia Orientalis, part VIII. The tribe Phytodictini from India (Hymenoptera : Ichneumonidae). *Oriental Ins. Monogr.*, **9** : 1-276.

Morley, C. 1913. *The Fauna of British India, including Ceylon and Burma, Hymenoptera,* **3** Ichneumonidae. Taylor & Francis, London : 1-531.

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HYMENOPTERA : CHALCIDOIDEA

Species known from Delhi

compiled by
VINOD KHANNA
Zoological Survey of India, Dehra Dun 248 195

Family : CHALCIDIDAE

1. *Palachia indica* Farooqui, Husain & Ghai,
2. *P. turneri* Boucek
3. *Brachymeria (B.) neomegaspila* Farooqui, Husain & Ghai
4. *B. (B.) rossicorporis* Farooqui, Husain & Ghai
5. *B. (B.) bengalensis delhiensis* Farooqui, Husain & Ghai
6. *B. (B.) bengalensis pulchellae* Joseph, Narendran & Joy
7. *B. (B.) euploeae* (Westwood)
8. *Diplazon lactatrius*
9. *Diplazon* sp.
10. *Anthrocephalus brevidentata* Roy & Farooqui
11. *A. delhiatus* Roy & Farooqui
12. *A. longidentata* Roy & Farooqui
13. *A. mitys* (Walker)
14. *Stomatoceras sulcatiscutellum* Narendran = (*A, renalis* Waterson)
15. *A. varipilosus* Cameron
16. *A. naduganiensis* (Mani & Dubey)
17. *A. nepalensis* (Mani & Dubey)
18. *Eucepsis brevispinosa* Roy & Farooqui
19. *E. longigaster* Roy & Farooqui
20. *E. mansues* (Nikolskaya)
21. *Eugastrochalcis breviceps* Masi
22. *Haltichella delhensis* Roy & Farooqui
23. *H. macroclava* Roy & Farooqui
24. *H. nigroclava* Roy & Farooqui
25. *Hockeria aligarhensis* Roy & Farooqui
26. *H. atra* Masi
27. *H. amamioshinensis* Habu
28. *Oxycoryphus pilosellus* Cameron
29. *Tanycorynhus micans* Steffan
30. *Temnata maculipennis* Cameron
31. *Boucekia differens* (Boucek)
32. *Euchalcidia crassicornis* Masi

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33. *E. emarginata* Roy & Farooqui
34. *E. reticulata* Roy & Farooqui
35. *E.ricini* Roy & Farooqui
36. *Hyperchalcidia soundaensis* Steffan
37. *Indoinvreia bouceki* Roy & Farooqui
38. *T.menoni* Roy & Farooqui
39. *Inrevia cliqvistica* Masi
40. *I.subarmata* (Foerster)
41. *Lasiochalcidia dragelassi* (Latrelle)
42. *Peltochalcidia indica* Mani & Dubey
43. *Phaenocarpa antisukata* Bhat

Family : PTEROMELIDAE

44. *Austroterobia* sp.
45. *Catolaccus crassiceps* (Masi)
46. *Cephaleta bruniventris* Motschulsky
47. *Chlorocytus xanthopus* (Cameron)
48. *Coruna clavata* Walker
49. *Dinarmus basalis* (Rondani)
50. *D. colemani* (Crawford)
51. *Haltiicoptera propinqua* (Waterson)
52. *Ischyroptyx* sp.
53. *Miscogaster* sp.
54. *Oedavle stringifrons* Waterson
55. *Oxysychus coimbatorensis* (Ferriere)
56. *O. sphenopterae* (Ferreire)
57. *Pachyneuron aeneum* Masi
58. *P. ahlaense* Mani & Saraswat
59. *P. aphidis* (Boucek)
60. *P. groenlandicum* (Holmgren)
61. *Pteromalus sequester* Walker
62. *Spalangia cameroni* Perkins
63. *S. nigroaenea* Curtis
64. *Sphegigaster stepicola* Boucek
65. *Syntomopus* sp.
66. *Systasis cenchrivora* Farooqui & Menon
67. *Thinodytes cyzicus* (Walker)

Family : EUCHARITIDAE

68. *Indosema indica* Husain & Agarwal

Family : ENCYRTIDAE

69. *Anagyrus swezeyi* Timberlake
70. *A. saccharicola* Timberlake
71. *A. mirzai* Agarwal
72. *Compariella bifasciata* Howard
73. *C. aspidiophaga* Subba Rao

REFERENCES

Bhat, S. 1979 The genus *Phaenocarpa* Foerster (Hymenoptera : Braconidae, Alysiinae). *Oriental Ins.*, **13** (1-2) : 1-27.

Boucek, Z. & Subba Rao, B.R. 1978. A preliminary review of *Pteromelidae* (Hymenoptera) of India and adjacent countrics. *Oriental Ins.*, **12** (4) : 433 468.

Farooqui, S.I., Husain, T., & Ghai S. 1990a. Description of a new species and record of an already known species of *Palachia* Boucek. (Torymidae : Chalcidoidea) from India. *Hexapoda*,**2** : 5-8.

Farooqui, S.I., Husain, T. and Ghai, S. 1990b. Description and new record of the male of *Indosema indica* Husain & Agarwal (Hymenoptera : Eucharitidae) from India. *Hexapoda*, **2** : 1-2.

Farooqui, S.I., Husain, T. and Ghai, S. 1991. Description of four new species, two new subspecies and new host records of the genus *Brachymeria* Westwood (Hymenoptera : Chalcididae) from India. *Ann. Entomol.*, **9** (2) : 11-24.

Farooqui, S.I., Menon, M.G. Ramdas, 1972, A new phytophagus species of *Systasis* Walker (Hymenoptera : Pteromalidae) infesting seeds of *Cenchurus* sp. *Mushi*, **46** (9) : 111-114.

Hayat, M. 1979. Indian species of *Anagyrus* (Hym:Encyrtidae). *Oriental Ins.*, **13** (1-2) : 167-188.

Jha, B.S. and Farooqui, S.I. 1995 ,Four new species of *Sceliophron* Klug (Sphecoidea : Sphecidae) from India. *Shashpa*, **2** (1) : 12-22.

Joseph, K.J., Narendran. T.C. & Joy, P.J. 1972. New species of *Brachymeria* Westwood (Hymenoptera : Chalcididae) in the collection of Indian Agriculture Research Institute, New Delhi. *Oriental Ins.*,**6** (4) : 419-424.

Kundu, G.G., Anand, R.K., Sharma, V.K. & Rai, S. New records of some Hymenopterous Parasites. *Ent.*, **5** (2) : 1-2.

Roy C.S. and Farooqui, S.I. 1984. Taxonomy of Indian Haltichellinae (Chalcididae : Hymenoptera) at National Pusa Collection, IARI, New Delhi. *Ent. Soc. India.* **10** : 1-59.

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DIPLOPODA

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INTRODUCTION

Millipedes are multi-segmented, mutilegged Arthropods having two pairs of legs on each body segment, and hence grouped under the class Diplopoda.

Scanty information is available on the millipede fauna of Delhi in particular and India in general. The state of Delhi was surveyed by the scientists of Zoological survey of India, Northern Regional Station, Dehradun to collect the fauna. Millipedes are generally found in good number during and soon after the rains in the wet and secluded places. The present communication deals with four species belonging to four genera under three families. All the species reported here are new from Delhi and it is very likely that more species of the class may be found in Delhi. The classification followed is after Hoffman (1982).

SYSTEMATIC ACCOUNT

Subclass : PENTOZONIA
Order : SPHAEROTHERIIDA
Family : SPHAEROTHERIIDAE
Genus ***Arthrosphaera*** Pocock

1. ***Arthrosphaera magna*** Attems

1936. *Arthrosphaera magna* Attems, *Memoirs. Ind. Mus.*, **11** (4) : 160-161.

Material examined : Delhi; 6 exs., Lalbag, Model Town, 8.vi.1993, coll. V.Khanna & party.

Diagnostic characters : Head collum and second segment bright chestnut, yellowish brown, olive - brown or olive-green, other tergites dark brown, posterior border of tergites yellowish, forming a narrow stripe. Length 63 mm; width 18.5- 34 mm. Head sparsely punctate, clypeus also not densely punctate. 6th joint of antenna of ♂ strongly expnaded laterally (Fig. 1a), terminal disc narrow, oval and oblique. In ♀ 6th joint only weakly expanded, collum without anterior edge or sulcus, with an anterior row of setiferous punctures and a similar row near the posterior border; surface not punctate. Second segment polished like a mirror, not punctate, marginal groove vanishing near eyes, anterior zone in the middle of dorsum not punctuate or with few scattered punctures, each puncture with or without a hair, lateral part of groove with scattered fine yellow hairs. Marginal thickening equally thick; Anterior edge of tergite with small granules,

behind the furrow no zone of bristles; anterior half of the tergite densely punctate and hairy, posterior half smooth and shining, with only few punctures near the posterior margin, especially visible on the 12th segment. Marginal bristles not extending over the border. Entire pygidium densely punctate, punctures fine or coarse, sometimes several punctures united to form common shallow depressions; hairs visible only in the anterior zone, which is more densely punctate. Pygidium lightly expanded like a bell, not marginated. 2 ridges on the underside Lateral notch distinct.Coxae of legs with a small or strong tooth; claw sigmoid, curved (Fig 1b). Femoral process (Fp) of anterior telopods (Fig 1c,d) short and blunt, situated behind tibiotarsus, not forming pincers with the latter ; tibia and tarsus distinctly separated, tibia with a superior rounded lobe, tarsus with a smaller lobe, narrowed, cylindrical, with long bristles at the apex. On the posterior side a small knob and a small spine present. Posterior telopod (Fig 1e) like those of related species; coxal horns large, thick at the base, dense and short hairs on the medial side, apex with a rounded, dark-coloured claw; femoral process longer than tibia, with numerous rounded tubercles, situated beside the tibia with 2 short broadly rounded lappets, posterior edge with numerous rounded lappets and tubercles. Vulva (Fig 1f) resembling that of *A. hemdersoni* but the operculum larger and broader. Coxae of 2nd leg of ♀ with a small lateral cone.

Distribution : India : Delhi, Maharashtra, Tamil Nadu and Andhra Pradesh.

Remarks : First record from Delhi.

Subclass : HELMINTHOMORPHA
Order : SPIROBOLIDA
Family : SPIROBOLIDAE
Genus ***Physobolus*** Attems

2. *Physobolus olivaceus* Attems

1936 *Physobolus olivaceus*, Attems, *Memoirs Ind. Mus.*,**11** (4) : 301 - 302.

Material examined : Delhi; 1 ex., Humayun's Tomb, 14.ii 1995, coll. J.P.Sati & party.

Diagnostic characters : Head and oral valves brownish olivaceous, prozonites blackish olivaceous, metazonites greenish black, antenna and legs testaceous; width 4.3-4.5mm; male female 44 segmetned. Labral sinus broad, 3 labral teeth, 3+3 supralabral foveolal, lateral ones smaller than the others; a fine median sulcus reaching upto the antennae. Mandibular cheeks with triangular process.Second segment without lateral edges. Prozonites dorsally with irregular longitudinal striae; below the pores the striae are more regular and the striae of the metazonites and prozonites are continuous, curving obliquely dorsally on the prozonite. Anterior zone of prozonite smooth. Transverse suture somewhat indistinct, curving obliquely dorsally on the prozonite. No scobina; sternites transversely striate margins smooth in the middle. Anal segment with a short triangular tail, a little longer than the valves, latter vaulted, without marginal thickening, borders sinking into the depth of a narrow channel; anal scale broadly rounded; Coxae of 3rd to 5th legs with a dark coloured process, its length increasing from the 3rd to the 5th pair. Ist to 5th joints with one bristle,

6th with several bristles. No tarsal pads (Fig 2a). Sternite of anterior gonopods (Fig 2b) with a short buckle, coalesced completly with the modified tracheal stalks, and weakly sinuate in the middle. Anterior gonopod consisting of two distally narrowed lamellae, coxite somewhat longer than telopodite. Posterior gonopod (Fig. 2 c) distinctly two-jointed; in the basal joint a large ovoid bladder filled with dark granules and opening by a broad canal on a short cylindrical process; margin of the opening irregular and finely dentate; from the bladder a canal runs to the second joint. No prostate gland in the male.

Distribution : India : Delhi, eastern Himalaya (Pashok?).

Subclass III : HELMINTHOMORPHA
Order : SPIROSTREPTIDA
Family : HARPAGOPHORIDAE
Genus ***Stenurostreptus*** Carl.

3. ***Stenurostreptus crenulatus*** Attems

1936 *Stenurostreptus crenulatus* Attems. *Memoirs Ind. Mus.*, **22** (4) : 296-297.

Material examined : Delhi; 16 exs., N.Zoological Park, 10.ii.1995, coll. J.P.Sati & party.

Diagnostic Characters : Light brown, a broad anterior stripe of head dark brown; antennae dark brown, legs testaceous, witdth 4 mm; 68 segments.Anterior part of clypeus finely punctate and longitudinally wrinkled, wrinkles very rough in the middle; 2+2 supralabral foveolae, vertex smooth and shining; vertical sulcus deep, interocular line very fine; median angle of eyes not projecting beyond the antennal socket. Basal joint of mandible with a triangular acute process. Anterior border of collum distinctly sinuate, rounded anterior corners, therefore, more or less protruding lateral marginal thickening narrow; one strong furrow behind the margin. Anterior half of prozonites with few; Ca 6, finely punctuate, irregular but not anastomosing transverse striae, posterior half smooth. Matazonites below the pores striat, each stria ending anteriorly with a little edge; these edges alone are continued over the whole dorsum; the rest of the metazonites finely punctuate dorsally, smooth and shining. Pores beginning in 6th segment, behind and near the transverse suture. Suture curving away before the pores of 6th segment, not distinctly curving away on the succeeding segments. No transparent punctures. Sternites smooth. Stigmal grooves short, triangular only slightly longer than half the coxa. Dorsal border of anal ring bluntly angled, reaching to the base of marginal thickening of valves; valves vaulted, densely punctate; marginal thickening low and scale free. Coxa of the posterior legs of each segment with a low rounded knob. Tibia of all legs from the third pair with a large pad; pad of post femur vanishing on some of the last legs. Proximal part of the gonocoel opening on anterior side of the coxa, distal part on the posterior side. Lateral (L) lamella (Fig 3 a) limiting the gonocoel, much shorter than medial lamella (M) with a curved tooth. No lateral knob at the base of the coxa. Femoral spine rising (Fd); fibio-tarsus describing three quarters of a circle, tip enlarged with a triangular lappet and a slender canal branch; distal stripe squamous; no spines (Fig 3 b).

Distribution: India : Delhi, Maharastra, Madhya Pradesh, Kerala.
Remarks : First record from Delhi.

Genus ***Jonespeltis*** Verhoeff

4. ***Jonespeltis splendidus*** Verhoeff

1936. *Jonespeltis splendidus* Verhoeff, *Rec. Indian Mus.*, **38** : 103-123.
Material examined : Delhi : 2 exs., Rajpur road, 14.ix.1994, coll.N.K.Sinha & party.
Diagnostic characters : Body brownish black with lateral yellow dots, which are protruding thick and rounded ones without sharpening. No grooves on the mouth of the pores. The pores of defensive scent glands are not situated in the grooves or in cavities. The leg movement sturdy; femur upto 8th pairs of legs as long as coxa and prefemur. The tibiotarsus of gonopode (Fig 4 a,b) plain at the end, without lobes. The femur straight and not as long as prefemur; the post femoral branch is separated into two appendages (Fig 4 a, b, H1,H2). Pores on 3,7,9,10,12,13,15-18 (19) diplosomite. The side yellow dot on 19th trunk segment is only with small tubercles. The entire back is shiny with a couple of fine wrinkles here and there. The lateral dots of the collum are rounded, triangular at intervals from lateral margin with curved wrinkle; lateral wrinkles of metatergite quite prominent. Lateral ridges of the lateral spots accompanied by prominent wrinkles are arched from front to the inside and do not reach the joint. Dorsally the lateral dots are round at the front and at the back (behind) all the more becoming narrow. There are wrinkles on the sides under the lateral dots. This area is less shining. Telson is just like that of *Prinopeltis*; 1-3 B of ♂ simple with tubercles. Between the coxa of 4 B a slanting plate projects down and surpasses. Femur at the 5-7 B ♂ bent down, hunch backed coxae and with a tuft of hair. These distinctions are very prominent at 7 B. The gonopodes (Fig 4 a,b) resembles those of *Prionopeltis* but at the post femoral appendix the basal arm (fore leg) (H_2) is so small that it can be overlooked. The base of the terminal arm H_1 is at the post femoral appendix before the middle of the tibiotarsus (X in Fig 4 b) never near its base. The tibiotarsus forms a simple point running upto solanophore sickle in which the groove for the solanomerit through longitudinal band (x in Fig 4 b) is noticed. The femur segment proceeds straight and does not possess any hump in it at the end.
Distribution : India : Delhi, Tamil Nadu and Kerala.

REFERENCES

Attems, C. 1936, Diplopoda of India. *Mem. Ind. Mus.* **11** : 133-323, 94 text figs.

Verhoeff, K.W. 1936, Ueber einige Indische chilognathen gesammelt von Herrn S. Jones, Madras. *Rec.Indian Mus.*, **38** : 103-123.

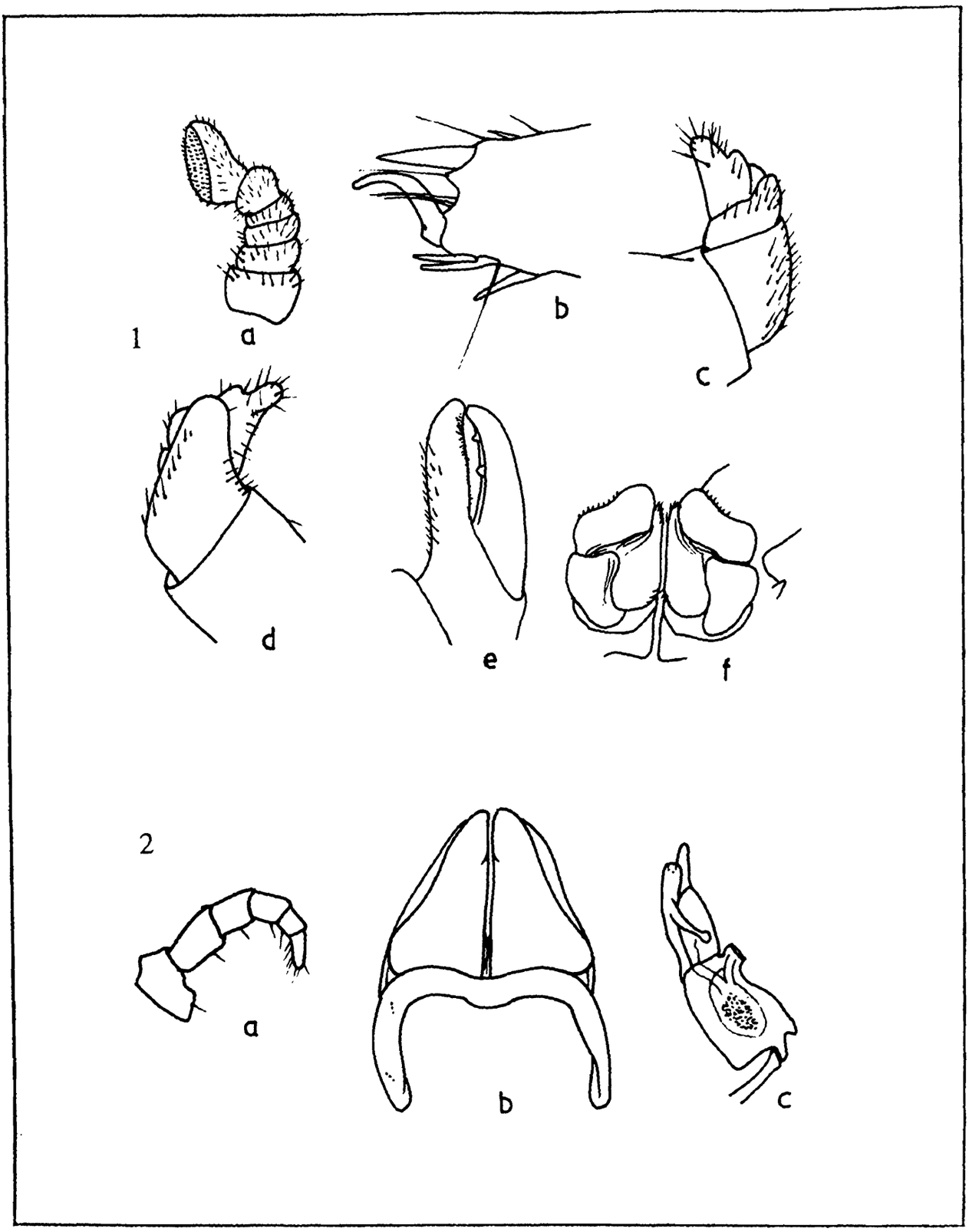

Fig. 1. *Arthrosphaera magna* Attems. a antenna of ♂ b. tarsus and claw of anterior leg; C, d. anterior telopod (anterior and posterior views); F. femoral process; e. posterior telopod; F. vulva.

Fig. 2. *Physobolus olivaceus*, Attems. a. ♂ 5th leg; b. anterior gonopod; C. posterior gonopod.

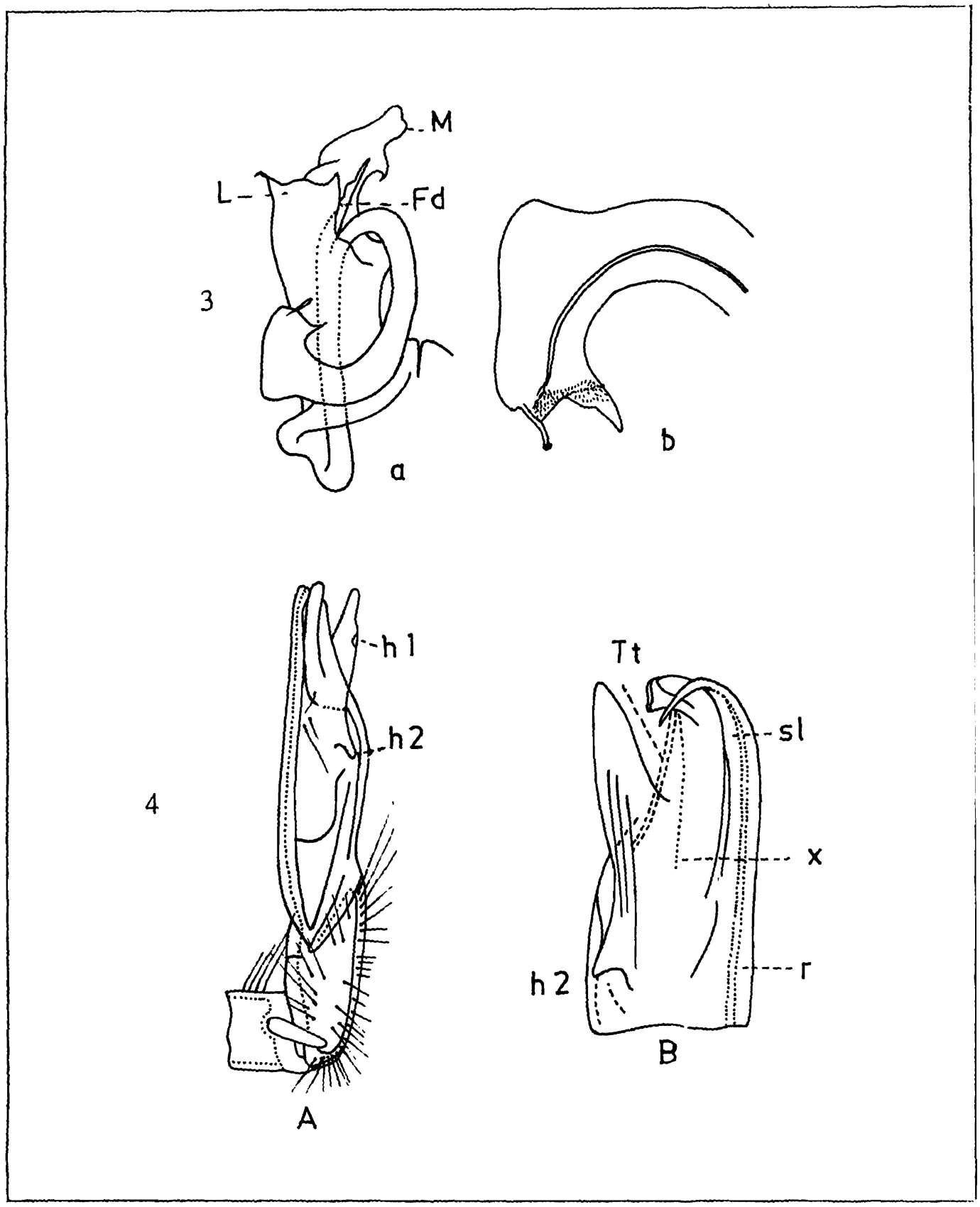

Fig. 3. *Stenurostreptus crenulatus*, Attems a.b. gonopod, Fd. femoral spine; L.Lateral lamella, m.medial lamella, Fd.femoral spine, H.lateral or posterior lamella, X.limit between praefemur and femur.

Fig. 4 *Jonespeltis splendidus*, Verhoeff A. Gonopod; h1, h2 Bifurcated postfemoral appendix. B. Endpart of telopodit. Tt Tibiotarsus h1, h2 - Bifurcated postfemoral appendix S1 - Solanomerit.

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CHILOPODA
(SCOLOPENDRIDAE AND CRYPTOPIDAE)

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INTRODUCTION

The earliest known reference on the centipede fauna of Delhi is by Gravely (1910), which contains the mere mention of occurrence of *Scolopendra morsitans* Linn. only, which was later recorded from Delhi by Jangi & Dass (1977). Jangi & Dass (1978, 1980 a) described one new species each of Cryptopid centipede, *viz Paracryptops spinosus* Jangi & Dass and Scolopendrid centipede *Trachycormocephalus nudus* Jangi & Dass respectively, besides recording *Cormocephalus dentipes* Pocock (Jangi & Dass, 1975, 1980 b) from Delhi.

Since the genus *Trachycormocephalus* Kraepelin has been relegated as a junior synonym of *Scolopendra* Linn. by Lewis (1986), Khanna (1987) and Khanna & Yadav (in press) accordingly treated the Indian species of the genus *Trachycormocephalus* under the genus *Scolopendra* and also provided a combined key to the identification of the Indian species of the genus. The review of the available references reveal the occurrence of only four species of the scolopendromorph centipedes from Delhi.

Recently, during field surveys undertaken by the Zoological Survey of India, during 1993-1995 in different ecological zones and during different seasons, a total of 229 exs. of the Scolpendrid centipedes belonging to two families, five genra and ten species have been collected. Thus raising the total of known species from four to eleven from the environs of Delhi.

SYSTEMATIC ACCOUNT

Class : CHILOPODA
Order : SCOLOPENDROMORPHA
Family 1. : CRYPTOPIDAE

1. ***Paracryptops spinosus*** Jangi & Dass

1978. *Paracryptops spinosus* Jangi & Dass, *Zool. J. Linn. Soc.*, **64** : 327 -330 (Type Locality : Hillside Road, IARI campus, Delhi).
Material examined : From literature.
Distribution : India : Delhi.

Remarks : In India the genus *Paracryptops* Pocock is represented by only two species, including the one described by Jangi & Dass (1978) from Delhi. The other species *P. indicus* Silvestri is a cavernicolus form reported only from Siju Caves, Assam by Silvestri (1924). In the present surveys, the author has not come across even a single specimen of the species from Delhi.

Family 2. : SCOLOPENDRIDAE
Subfamily : OTOSTIGMINAE
Tribe : OTOSTIGMINI

2. ***Rhysida nuda immarginata*** Porath

1878. *Branchiostoma immarginatum* Porath, *Bih. Svenska Akad.*, 4(7) : 24.
1903. *Rhysida immarginata* : Kraepelin, *Mitt. Mus.*, Hamburg, 20 : 143.

Material examined : Delhi; 5 exs., Pitampura Distt. Park, 9.vi.1993; 1 ex., Lalbagh, Model Town, 8.vi.1993, coll. V. Khanna & party; 2 exs., Yamuna Barrage, Wazirabad, 11.ii.1995; 1 ex., Piggery Farm, Dhaula Kuan, 16.ii.1995; 1 ex., Tughlakabad, 12.ii.1995; coll. J.P.Sati & party.

Diagnostic characters : Since the specimens studied by various authors lack detailed descriptions and illustrations it is felt appropriate to provide detailed description alongwith the illustrations of the subspecies.

Colour : Cephalic plate and tergite olive green to brownish; sternites and legs yellow (Preserved in 70% alcohol); *Body length* : 45 mm, including antennae and anal legs; Antennae 19 (or 20) segmented with its 3 basal segment glabrous, when reflexed reaching back to the middle of 5th tergite vs. 6th tergite, Attems (1.c.). *Head* : Cephalic plate wider than long, smooth, anteriorly with a median notch (Fig. 1) *Coxosternum* : Dental plate of the maxillipede with 4+4 teeth, the 2 on the inner side being larger in size than the outer and giving a clubbed appearence; post dental spur not visible; prefemoral process unidentate (Fig. 2). *Tergites* : Smooth; feeble but complete paramedian longitudinal furrows visible from 4th tergal segment, partly visible on 12th and 13th segment; only endtergite laterally emarginate, without median furrow; endtergite rectangular in shape having its lateral margins almost parallel and posterior margin more or less truncate (Fig. 2); Ist tergite almost equal in length to the IIIrd, whereas the IInd less than 1/2 of the first (Fig. 1); 20th tergite almost goblet shaped with its sides convexed (Fig. 4). *Sternites* : Sternites smooth; none with paramedian longitudinal furrows (vs. incomplete paramedian longitudinal furrows) (Attems, 1.c.) ; endsternite almost equal in length and width (Fig. 3) with its posterior margins slightly incurved. *Coxopleura* : The process of coxopleura densely punctate with 3 very small and curved apical spines; without dorsal or lateral spines; lateral margins of the porose area incurved almost near the middle (Fig. 3).*Legs* : 2-18 pair of legs with 2 spurs to the Ist tarsal segment; 19th with 1 and 20th without such spur; all legs with two spurs to the terminal claws. *Anal legs :* Prefemur of the anal legs about two and a half times longer than wide, basally with 2, femur ventrally with a transverse furrow (Fig. 5); pretarsus is roughly double the length of distal tarsus and smaller than

tibial segment; prefemoral process absent.

Distribution : India : Uttar Pradesh, Delhi, throughout Himalaya, West Bengal, Madhya Pradesh, Assam, Gujarat, Andaman & Nicobar Islands. *Elsewhere* : Sunda Islands; Myanmar; Venezuella; Philippines; Guatemala; Australia; Zaire; Bangladesh; Nepal; Malaya & South America.

Remarks : It is a widely distributed species occurring throughout in the Himalayan ecosystem and plains of Uttar Pradesh. First record from Delhi. Jangi & Dass (1984) in their key to the identification of the genus *Rhysida* Wood, have refrained from the subspecific treatment of the species *R.nuda*, viz. *R.nuda nuda* and *R.nuda immarginata* apprehending them to be two good species and not as subspecies, basing their main idea on the emargination of tergite, which is restircted either to the end tergite or only a couple of the preceding segments. Attems (1930) key treats the specimens with only end tergite emerginate under *nuda* complex; *R.nuda immarginata* with 3 apical spines on the coxopleura while *R. nuda nuda* with 2 apical spines. On the basis of the vast material of *R.nuda immarginata* and *R.nuda nuda* studied by the author no major morphological characters of taxonomic importance has been noticed so as to merit them the rank of a separate species.

3. ***Rhysida longipes longipes*** (Newport)

1845. *Branchiostoma longipes,* Newport, *Trans. Linn. Soc.*, London, **19** : 411 (by original designation).

1903. *Rhysida longipes longipes*, Kraepelin, *Mitt. Mus.* Hamburg, **20** : 148 (by subsequent designation).

Material examined : Delhi; 2 exs., Bhalsawa lake and around, 11.ii.1995, coll. J.P.Sati & party.

Diagnostic characters : Tergites, except anterior segments, with a pair of paramedian longitudinal furrows; emargination of tergites begining from 15th segment; process of coxopleura with a lateral spine; prefemur of anal legs with a process (Eckdorn); 1-12 pair of walking legs with 2 spurs to the Ist tarsal segment.

Distribution : India : Delhi, Uttar Pradesh, Himachal Pradesh, West Bengal, Maharashtra, Madhya Pradesh, Karnataka, Aruncahal Pradesh and Andaman & Nicobar Islands. *Elsewhere* : Cosmopolitan species occurring in all tropical zones, Australia; east & west Africa; Madagascar; Seychelles; Mexico; Central and South America; Nepal; Sri Lanka; Lower Myanmar; Malaya Peninsula and Mauritius.

Remarks : First record from Delhi.

4. ***Rhysida longipes simplicior*** Chamberlin

1920. *Rhysida simlicior* Chamberlin, *Univ. Calif. Pub.*, **19** : 391 (Type locality : Coonoor, Tamil Nadu).

Material examined : Delhi; 20 exs., Municipality nursery, Punjabi Bagh, 14.ix.1994, coll. J.P.Sati & party.

Diagnostic characters : Prefemur of the anal legs without eckdorn; 1-5 pair of walking legs with two spurs to the Ist tarsal segment. 16-20th tergal segment feebly and 21st strongly emarginate.

Distribution : India : Delhi, Tamil Nadu.

Remarks : This is the first record of the species from northern India, Delhi.

5. ***Rhysida afra cuprea*** Kraepelin

1903. *Rhysida cuprea,* Kraepelin, *Mitt. Mus.*, Hamburg, **20** : 154.

1930. *Rhysida afra cuprea* Kraepelin : Attems, *Das Tierr., Scolopendromorpha,* **54** (2) : 197 (Type Locality : Bhutan).

Material examined : Delhi; 3 exs., Majnu-Ka-Tila, Wazirabad, 15.xii.1994, coll. A.Husain & party.

Diagnostic characters : All tergal segments without paramedian longitudinal furrows; 1-19th pair of legs with two tarsal spurs to Ist tarsal segment; only very small paramedian longitudinal furrows visible on anterior sternal segments.

Distribution : India : Delhi, West Bengal, Assam, Uttar Pradesh, Himachal Pradesh, Arunachal Pradesh and Meghalaya. *Elsewhere* : Bangladesh; Bhutan; China.

Remarks : First record from Delhi.

6. ***Rhysida lithobioides shivalikensis*** Khanna

1994. *Rhysida lithobioides shivalikensis* Khanna, *Fauna Cons. Areas 5 : Rajaji Nat. Park, U.P., Zool. Surv. India* : 312-314 (Type Locality : India : Motichur, Dehra Dun, U.P).

Material examined : Delhi; 1 ex., Gopalpur Nala, Wazirabad, 8.ix.1994; 2 exs., Gurjar Ghat, Yamuna Bridge, Wazirabad, 8.ix.1994, coll. J.P.Sati & party.

Distribution : India : Delhi, Uttar Pradesh.

Remarks : First record from Delhi.

7. ***Otostigmus politus politus*** Karsch

1881. *Otostigmus politus politus* Karsch, *Berlin ent. Z.*, **25** : 219.

1903. *Otostigmus politus* : Kraepelin *Mitt. Mus.*, Hamburg **20** : 109.

1930. *O.politus politus* Attems, *Das Tierr., Scolopendromorpha,* **54**(2) : 150 (Type Locality : China, Beizing).

Material examined : Delhi; 1 ex., I.A.R.I. Campus, 24.x.1993, coll. N.K.Sinha & party.

Diagnostic characters : 4-5 to 20th sternal segments with two distinct paramedian longtudinal furrows; prefemur of the coxosternum without hooks on the tooth; 1-5 or 6 pair of legs

with two spurs to the first tarsal segment; emargination of tergites begins from 11th segment.

Distribution : India : Delhi, Himachal Pradesh, Assam, West Bengal, Orissa, Maharashtra, Meghalaya. *Elsewhere* : Nepal; New Guinea; China; Myanmar; Sumatra; Australia.

Remarks : First record from Delhi.

Subfamily : SCOLOPENDRINAE
Tribe : SCOLOPENDRINI

8. ***Scolopendra morsitans*** Linn.

1758. *Scolopendra morsitans* Linnaeus, *Syst. nat.*, **10** : 638.

Material examined : Delhi; 1 exs., Brass Coir Nala, Naraina, 9.ix.1994; 1 ex., Asola-Bhatti WLS, 12.xii.1994, coll. J.P.Sati & party; 1 ex., Qutub Minar complex, 21.xii.1994; 3 exs., Asola-Bhatti WLS, 21.xii.1994; 1 ex ., Humayun's Tomb complex, 14.xii.1994; 10 exs., Qutubuddin Idgah, Mehrauli, 14.xii.1994; coll. A.Husain & party; 1 ex., Hauz Khas, 15.ii.1995; 1 ex., Humayun's Tomb, 14.ii.1995; 1 ex., Budha Jayanti Park, 15.ii.1995; 2 exs., Jahanpanah Park, 15.ii.1995; 1 ex., Kamala Nehru Ridge, 17.ii.1995; 7 exs., Asola-Bhatti WLS, 12.ii.1995; 3 exs., Tughlaqabad park, 12.ii.1995; 6 exs., 25.vii.1995; 4 exs., Jahanpanah Park, 23.vii.1995; 2 exs., Humayun's Tomb, 28.vii.1995; 7 exs., Asola-Bhatti WLS, 26.vii.1995, coll. J.P.Sati & party.

Distribution : India : Delhi, Assam, Andhra Pradesh, Arunachal Pradesh, Andaman & Nicobar Islands, Bihar, West Bengal, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Manipur, Meghalaya, Mizoram, Maharshtra, Madhya Pradesh, Nagaland,Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh. *Elsewhere* : Cosmopolitan species occurring globally.

Remarks : The earliest known record of this species from Delhi was made by Gravely (1910) followd by Jangi & Dass (1977). The species occurs in various colour forms, shapes and sizes and as such a number of new species were described which could not withstand the test of time and were subsequently placed under the synonymies of *Scolpendra morsitans* (Khanna, 1987), and the species has been redescribed combining the characters of the variant forms, *vis-a-vis* the study of vast material of this species from various parts of India.

9. ***Scolopendra nudus*** (Jangi & Dass)

1980. *Trachycormocephalus nudus* Jangi & Dass, *J. Sci. & Inds. Res.*, **43**(2) : 27-54. (Type Locality : India, Delhi Univ. Ridge)

1987. *Scolpendra nudus* : Khanna, *D.Phil Thesis, Univ. of Garhwal,* Srinagar, U.P. : 1-243.

1995. *Scolopendra nudus* : Khanna & Yadav, *Rec. zool. Surv. India,* mss : 1-11 (In press).

Material examined : Delhi; 3 exs., Rock Climbing area, Ladu Sarai, 7.ix.1994; 1 ex., Priya Park, Vasant Vihar, 13.ix.1994; 1 ex., Masudpur, Vasant Kunj, 13.ix.1994, coll. J.P.Sati & party; 3 exs., Jahanpanah Park, Chirag Dilli, 22.xii.1994, coll. A.Husain & party; 3 exs.,

Zoological Park, 10.ii.1995; 8 exs., Asola-Bhatti WLS, 12.ii.1995; 7 exs., Tughlaqabad Park, 12.ii.1995; 2 exs., Humayun's Tomb, 14.ii.1995; 1 ex., Okhla Reservoir and around, 14.ii.1995; 8 exs., Hauz Khas Park, 15.ii.1995; 9 exs., Budha Jayanti Park, 15.ii.1995; 11 exs., Jahanpanah Park, 15.ii.1995; 4 exs., 23.vii.1995; 11 exs., Lake Garden, Dhaulakuan, 16.ii.1995; 3 exs., Piggery Farm, Dhaulakuan, 16.ii.1995; 2 exs., Kamala Nehru Ridge, 17.ii.1995; 10 exs., I.A.R.I. Campus, 19.ii.1995; 2 exs., Tughlaqabad Park, 25.vii.1995; 14 exs., Asola-Bhatti WLS, 26.vii.1995; 14 exs., Humayun's Tomb, 28.vii.1995, coll. J.P.Sati & party.

Distribution : India : Delhi.

Diagnostic characters : Cephalic plate opposed to or overlaid by 1st tergite; 2nd 20th tergal segment with paramedian furrows; cephalic plate also with small paramedian furrows.

Remarks : On the basis of 9 exs., (one Holotype, one allotype and seven paratypes) collected from Delhi University Ridge, Jangi & Dass (1980) described a new species under the genus *Trachycormocephalus* Kraepelin. Lewis (1986) since relegated the genus *Trachycormocephalus* as a junior synonym of the genus *Scolopendra* Linn., Khanna (1987) treated all the known Indian species of the genus *Trachycormocephalus* under the genus *Scolopendra* and subsequently Khanna & Yadav (in press) provided a revised combined key to the Indian species of the genus *Scolopendra*. The species *Scolopendra nudus* has been collected in large numbers from all the ecological zones of Delhi during the recent surveys undertaken by Zoological Survey of India.

10. *Cormocephalus dentipes* Pocock

1891. *Cormocephalus dentipes* Pocock, *Ann. nat. Hist.*, **6**(7) : 66 (Type Locality : Bengal ?).

1930. *C. (Cormocephalus) dentipes* : Attems, *Das Tierr., Scolopendromorpha*, **54** (2) : 96.

1984. *Cormocephalus pseudonudipes* : Jangi & Dass, *J. Sci. Indl. Res., 43* : 36-37.

Material examined : Delhi; 15 exs., Municipality nursery, Punjabi Bagh, 14.ix.1994, coll. J.P.Sati & party; 12 exs., A.N.Jha Deer Park, 22.xii.1994, coll. A.Husain & party; 2 exs., Humayun's Tomb, 14.ii.1995; 2 exs., Lodhi Garden, 13.ii.1995; 1 ex., Lake Garden, Dhaulakuan, 16.ii.1995; 1 ex., Zoological Park, 10.ii.1995; 1 ex., Lodhi Garden, 25.vii.1995; 1 ex., Tughlaqabad Park, 27.vii.1995; 1 ex., Humayun's Tomb, 28.vii.1995, coll. J.P.Sati & party.

Tribe : ASANADINI

11. *Asanada indica* Jangi & Dass

1984. *Asanada indica*, Jangi & Dass, *J.Scient. indl. Res.*,**43** : 38 (Type Locality : Urilikanchan, Pune).

Material examined: Delhi; 1 ex., Asola-Bhatti WLS, 21.xii.1994, coll. A.Husain & party; 1 ex., 26.vii.1995, coll. J.P.Sati & party.

Diagnostic characters : Anal legs short and thick; paired paramedian longitudinal furrows always complete on 20th tergal segment; 21st tergal and sternal segments nearly twice broader than long; while according to the orginal description the longitudinal median groove is present only on the posterior half of the anal legs femur and prefemur, Khanna (in press) has studied the material from various states, including from Delhi and found that these grooves are not restricted to posterior half only but throughout the length of prefemur and femur of the anal legs and on the basis of some other variations and additional characters of taxonomic importance the species has been redescribed and illustrated.

Distribution : India : Maharashtra, Kerala, Uttar Pradesh, Rajasthan, Gujarat, Haryana, Delhi.

Remarks : This is the first record of the species from Delhi.

SUMMARY

Eleven species belonging to two families, three tribes, and six genera have been recorded from the study area. Detailed distributional records, original references, synonymies and type localities have been provided, besides diagnostic characters of the species dealtwith. *Rhysida nuda immarginata* Porath has been redescribed and illustrated to supplement the original description and to remove the anomalies and confusions existing hitherto.

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REFERENCES

Attems, C. 1930. Die Scolopendromorpha. *Das Tierr.*, **54** (2) 1-308.

Ahmed, S. 1980. On a collection of centipedes (Scolopendromorpha : Scolopendridae and Cryptopidae) from Andaman and Nicobar Island. *Rec. zool. Surv. India*, **77** : 25-30.

Gravely, F.H. 1910. The distribution of Oriental Scolopendridae. *Rec. Indian Mus.*, **5** (1) : 161-172.

Jangi, B.S. & Dass, C.M.S. 1975 A new form of "Sexual dimorphism" in the Indian Centipede *Cormocephalus (Cormocephalus) dentipes* Pocock *(Scolopendridae)* and its bearing on the taxonomy of the species. *J. zool. Soc.*, **27**(1&2) : 113-116.

Jangi, B.S. & Dass, C.M.S. 1978. Identity and redescription of the Indian Centipede *Pseudocryptops agharkari* Gravely (Chilopoda : Scolopendromorpha : Scolopendridae). *J. nat. Hist.*, **12** : 423-426.

Jangi, B.S. & Dass, C.M.S. 1980 a. A new species of *Trachycormocephalus* Kraepelin (Chilopoda : Scolopendridae) from India. *Ent. Mon. Mag.*, **116** : 67-70.

Jangi, B.S. & Dass, C.M.S. 1980 b. Revisional notes on the taxonomy of *Cormocephalus dentipes* Pocock, with redefinition of the species (Chilopoda : Scolopendromorpha : Scolopendridae). *J. nat. Hist.*, **14** : 49-53.

Jangi, B.S. & Dass, C.M.S. 1984. Scolopendridae of Deccan. *J.Scient. Indl. Res.*, **43** : 27-54.

Khanna, V. 1987. Taxonomic and ecological studies on the centipedes (Chilopoda : Scolopendromorpha : Scolopendridae) from Western Himalaya, Uttar Pradesh, India. *D.Phil. Thesis Univ. of Garhwal,* Srinagar, U.P. : 1-243.

Khanna, V. (1995) Chilopoda : Scolopendridae : in *Fauna of Conservation Areas 5 : Rajaji National Park. Zool. Surv. India* : 309-316.

Khanna, V. (in press) On a small collection of Centipedes (Chilopoda : Scolopendromorpha : Scolopendridae) from Dudhwa National Park, U.P., India. *Fauna of Conservation Areas : Dudhwa National Park, U.P. Zool. Surv. India* , mss. : 1-7.

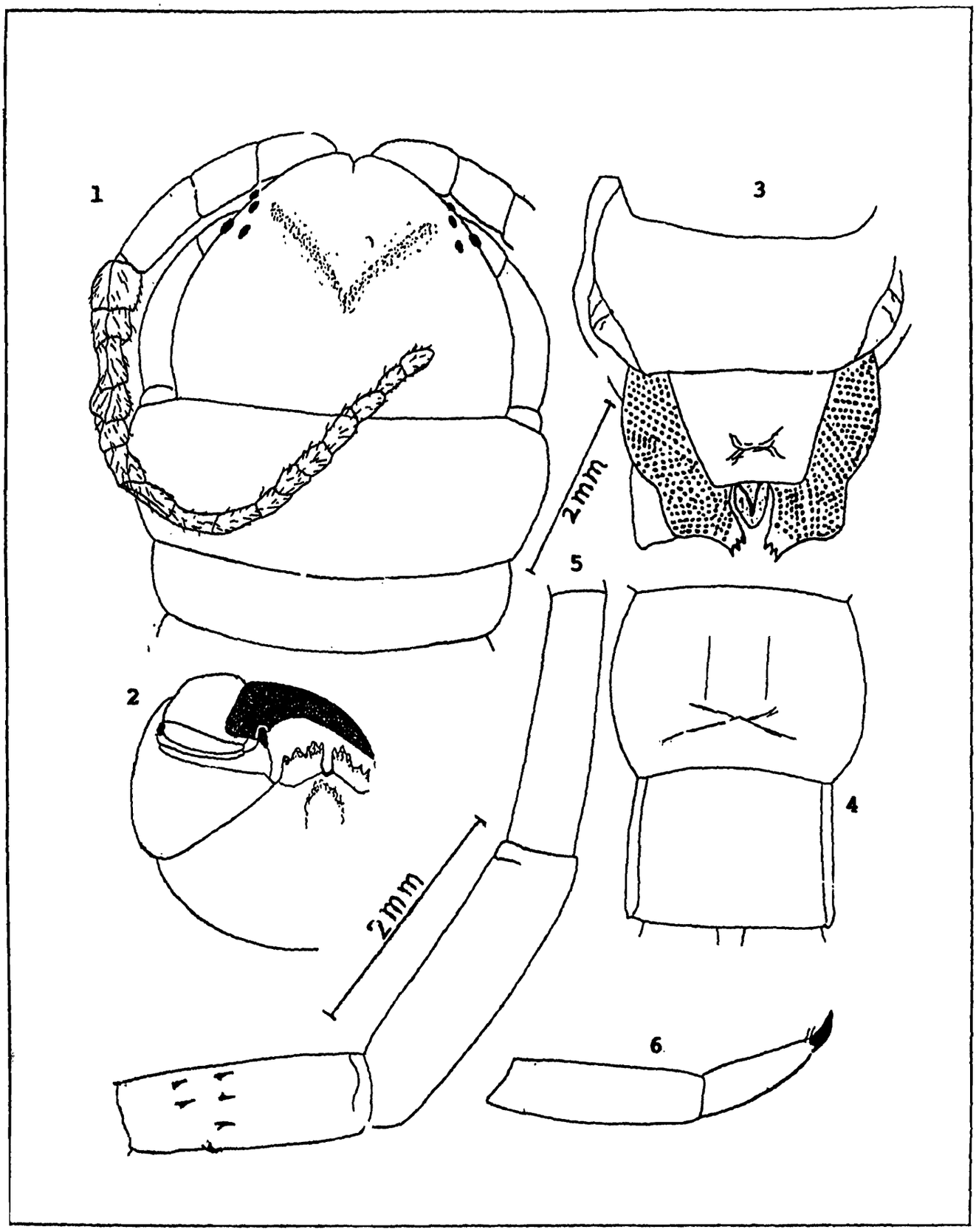
Khanna, V. & Tripathi, J.C. 1984. Observations on the seasonal incidence within the centipede genus *Cormocephalus* (Chilopoda : Scolopendridae). *Uttar Pradesh J.zool.*, **4** (2) : 217-219.

Khanna, V. & Yadav, B.E. (in press) Indian species of the centipede genus *Scolopendra* Linn. with a key to their identification (Chilopoda : Scolopendridae). *Rec. Zool. Surv. India*, mss. : 1-9, with one plate.

Silvestri, F. 1924. Myriapoda from Siju Caves, Garo Hills Assam. *Rec. Indian Mus.*, **31** :263-267.

Note : Distribution of the species reported in the present communication is not only based on the available published references but also on the material actually studied by the author from various states, which is either not at all published or is in the process of preparation of the paper. Mention of original references of known distributional records have also been refrained by the author because of being beyond the scope of the paper.

2552 ZSI/96---31B



Rhysida nuda immarginata : Fig. 1. Head and anterior segments (Dorsal view); 2. Coxosternum; 3. Endsternite and coxopleurae; 4. 20th and 21st tergite; 5. Anal leg segment; 6. Terminal claw of anal leg.

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ARACHNIDA : ARANEAE

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INTRODUCTION

Spiders are potential predators of all kind of insects in nature and are widely distributed throughout the globe, from sea level to high mountain ranges.

The spiders of Delhi have not been studied so far in a comprehensive manner. The present communication list altogether 11 species, contained in eight genera distributed in six families, namely, Pholcidae, Salticidae, Gnaphosidae, Lycosidae, Tetragnathidae and Araneidae.

SYSTEMATIC ACCOUNT

Family : PHOLCIDAE

1. Genus : ***Crossopriza*** Simon

1893. *Crossopriza* Simon, *Hist. Nat. Arign.*, **1** : 476.

1. ***Crossopriza lyoni*** (Blackwall)

1867. *Pholcus lyoni* Blackwall, *Ann. mag. nat. Hist.*, **19** (3) : 302.

1992. *Crossopriza lyoni* : Biswas & Biswas, *Fauna of West Bengal, Part-III*, Araneae : Spiders, *State Fauna Series*, **3** : 383.

Material examined : Delhi : 1 ♀, Humayun Tomb, Mathura Road, 14.xi.. 1994, coll. A.Husain & party.

Diagnostic characters : *Crossopriza lyoni* is a common house spider. It spins an extremely fine irregular cob-web from which it hangs upside down. It prefers old dark and abandoned houses. No cocoon is made but the eggs are glued together and carried by the chalicerae of the mother till hatching ; generally nocturnal in habit ; cephalothorax marked with brown stripe, legs spotted and streaked with black, extremities of femora and tibiae paler, abdomen yellowish brown.

Distribution : India : Uttar Pradesh, West Bengal, Tamil Nadu, Rajasthan. *Elsewhere* : Myanmar.

Family II : SALTICIDAE

2. Genus *Plexippus* Koch

1846. *Plexippus* Koch, *Die. Archn.*, **13** : 107.

2. *Plexippus paykullii* (Audouin)

1825. *Attus paykullii* Audouin, *Descr. Egypte (2nd Ed.)* **22** : 172.

1992. *Plexippus paykullii* : Biswas & Biswas, *Fauna of West Bengal* Part III, Araneae : Spiders, *State Fauna Series* **3** : 397.

Material examined : Delhi ; 1 ♀, Pond and vicinity near IFC building, Naraina, 9 .v. 1994, coll. A. Husain & party.

Diagnostic characters : Cephalothorax dark brown or black, legs olive brown, abdomen deep brown. Anterior row of eyes recurved ; anterior middle eyes very large and milky white, anterior lateral eyes pearly-white and smaller than middle eyes by about half. Middle row of eyes very small, situated equidistant from anterior and posterior rows of eyes ; posterior row of eyes medium sized and pearly white. A pale longitudinal patch on the middle of thorax and centre provided with fovea. Sternum oval and narrowed in front, clothed with hair. Abdomen longer than wide, narrowing posteriorly. Mid-dorsal with a longitudinal light patch extending from base to near end of abdomen.

Distribution : India : Uttar Pradesh, West Bengal, Meghalaya, Sikkim, Madhya Pradesh. *Elsewhere* : Africa ; Myanmar ; Europe ; Sri Lanka.

Family III : GNAPHOSIDAE

3. Genus *Zelotes* Gistel

1846. *Zelotes* Gistel, *Mat. Thierr.*, 11.

3. *Zelotes sajali* Tikader & Gajbe

1979. *Zelotes sajali* Tikader & Gajbe, *Bull. zool. Surv. India*;**2** (1) : 84.

1982. *Zelotes sajali* : Tikader, *Fauna of India,* Araneae : Spiders, **2** (2) : 485.

Material examined : Delhi ; 1 ♀, south campus, Delhi University, 23. xii. 1994, coll. A. Husain & party.

Diagnostic characters : Cephalohorax longer than wide, narrow in front, slightly convex, clothed with pubescence, posterior middle provided with a conspicuous fovea and with a deep brown narrow line encircling almost the entire border. Eyes closely grouped, silvery white except anterior medians, posterior row of eye slightly longer than the anterior row. Anterior row of eyes very slightly procurved, medians smaller than the laterals and close to lateral than to each other. Posterior row of eyes straight, medians irregular in shape. Chelicerae moderately strong,

vertical, inner margin provided with two teeth and outer margin with three teeth. Legs are relatively long and strong, clothed with hair and spines. Legs formula is 4,1,2,3. Abdomen longer than wide, elliptical, clothed with fine hair and posterior half of abdome provided with seven deep brown transverse chevrons. Anterior margin of abdomen provided with very thick spine like hair directed forward.

Distribution :India : Uttar Pradesh, Delhi.

Remarks : The species has been recorded for the first time from Delhi.

Family IV : LYCOSIDAE

4. Genus *Lycosa* Latreille

1804. *Lycosa* Latreille, *Nouv. dist. Hist. Nat.*, **24** : 135.

1970. *Lycosa* : Tikader, *Rec. zool. Surv. India,* **64** (1-4) : 63.

Diagnostic characters : This is a very large genus including majority of the species of wolf-spiders. Carapace long, facial area vertical and sides of the face slanting, four posterior eyes large and arranged in a quadrangle which is slightly wider behind than in front. The labium is always longer than wide and the basal excavation is prominent, usually one-third or more of the length of the labium. The species of this genus spin no web. The larger forms live in silk-lined burrows and under stones. The female carry the cocoon attached to their spinnerets and the young, after hatching swarm on the mothers back.

Type-species : Lycosa tarantula Rossi.

Distribution : Cosmopolitan.

Key to species

1. Coxae of all legs pale ventrally and extremeties of ventral side of IV tibia without any band ..... *carmichaeli*
- Coxae of all legs not pale ventrally and extremities of ventral side of IV tibia provided with band 2

2. Carapace brown and provided with mid-longitudinal and sub-marginal pale bands. Coxae not provided with any patches. Maxillae not much broader at the distal end ..... *poonaensis*
- Ventral side of abdomen pale. Maxillae much broader at the distal end 3

3. Sternum pale brown and ventral side of abdomen with three longitudinal broad, dark brown conspicuous bands ..... *prolifica*

4. *Lycosa carmichaeli* Gravely

1924. *Lycosa carmichaeli* Gravely, *Rec. Indian Mus.*, **26** : 604.
1951. *Lycosa carmichaeli* : Sinha, *Rec. Indian Mus.*, **48** (2) : 32.
1980. *Lycosa carmichaeli* : Tikader & Malhotra, *Fauna of India*, Araneae : Spiders, **1** (2) : 407.

Material examined : Delhi; 2 ♀, Masudpur, Vasant Kunj, 13.ix. 1994, coll. J.P. Sati & party.

Distribution : India : Uttar Pradesh, Delhi, West Bangal, Assam, Meghalaya. *Elsewhere*: Bhutan ; Pakistan.

Remarks : The species has been recorded for the first time from Delhi.

5. *Lycosa poonaensis* Tikader & Malhotra

1980. *Lycosa poonaensis* Tikader & Malhotra, *Fauna of India*, Araneae : Spiders, **1** (2) : 392.

Material examined : Delhi ; 1 ♀, Majnu Ka Tila, Wazirabad, 15.xii.1994, coll. A. Husain & party.

Distribution : India : Delhi, Uttar Pradesh, Maharashtra,

Remarks : The species has been recorded for the first time from Delhi.

6. *Lycosa prolifica* Pocock

1901. *Lycosa prolifica* Pocock, *J. Bombay nat. Hist. Soc.*, **13** : 485.
1951. *Lycosa prolifica* : Sinha, *Rec. Indian Mus.*, **48** (2) : 23.
1980. *Lycosa prolifica* : Tikader & Malhotra, *Fauna of India*, Araneae : Spiders, **1** (2) : 409.

Material examined : Delhi : 25 ♀, Okhla, 14.ii.1995, coll. J.P. Sati & party.

Distribution: India : Uttar Pradesh, Maharashtra, Punjab.

Family V : TETRAGNATHIDAE

5. Genus *Tetragnatha* Latreille

1804. *Tetragnatha* Latreille, *Neuv. Diet. d'Hist. Nat.*, **24** : 135.
1977. *Tetragnatha* : Tikader, *Rec. zool. Surv. India*, **72** : 275.

Diagnostic charactrs : Cephalothorax longer than wide, eyes two rows, lateral eyes nearly contiguous ; chelicerae very long, especially in the male. Abdomen long and narrow and bears the spinnerets near its end. These are orb-weaving spiders ; they are common on grass and on low plants. The spiders rest by day with their legs stretched before and behind and are only active at night.

Type-species : *Tetragnatha extensa* Linn.

Distribution : Tropical countries of the world.

7. *Tetragnatha andamanensis* Tikader

1977. *Tetragnatha andamanensis* Tikader, *Rec. zool. Surv. India,* **72** : 175.

Material examined : Delhi ; 5 ♀, 25 ♂, Lake Garden, Shakur Basti, 31.x.1993, coll. N.K. Sinha & party : 1 ♂, 3 ♀, Bhalsawa lake, Karnal Road, 15. xii. 1994, coll. A. Husain & party ; 1 ♀. Brass Coir nala, Naraina vill., 9.ix. 1994, coll. J.P. Sati & party.

Diagnostic characters : Cephalothorax longer than wide, narrowing in cephalic region ; centrally depressed. Ocular quad longer than wide and a slightly narrower in front than behind. Cheliceras nearly as long as carapace and strongly divaricate, outer margin provided with ten teeth. Fang slender and unarmed. spinnerets nearly to the posterior end of the abdomen.

Distribution : India : Delhi, Uttar Pradesh, West Bengal, Andaman Islands.

Family VI : ARANEIDAE

Key to genera

1. Eyes of anterior row not evenly spaced or medians ; closer to each other than laterals ..... *Argiope*
- Eyes of anterior row evenly spaced or medians ; not closer to each other than laterals 2

2. Thoracic groove longitudinal ; epigyne with wrinkled scape and not provided with lateral lobes ..... *Neoscona*
- Thoracic groove not longitudinal ; epigyne without wrinkled scape and not provided with lateral lobes 3

3. Cephalic region truncate in front ; abdomen blunt at both ends and ornamented with bands ..... *Leucauge*

6. Genus *Argiope* Audouin

1826. *Argiope* Audouin, in Savigny, *Descriptons de l' Egypts,* **2** (4) : 121.

1982. *Argiope* : Tikader, *Fauna of India,* Araneae : Spiders, **2** (1) : 111.

Type-species : *Argiope lobata* (Thorell).

Distribution : Tropical and temparate countries of the world.

8. *Argiope pulchella* Thorell

1881. *Argiope pulchella* Thorell, *Annali. Mus. civ. Geneva*, **18** : 74.

1982. *Argiope pulchella* : Tikader, *Fauna of India,* Araneae : Spiders, **2** (1) : 129.

Material examined : Delhi : 1 ♀, Tuglaqabad forest Nursery near Air force station, 12.ix.1994, coll. J.P. Sati & party.

Diagnostic characters : Cephalothroax slightly longer than wide, narrowing in front, clothed with thick layer of silky white pubescence ; cephalic region slightly elevated than thoracic region. Ocular quad much longer than wide and wider behind than in front ; both anterior and posterior median eyes sub-equal in size. Sternum heart-shaped, pointed behind, brown in colour, provided with a large chalk white patch, clothed with hair and pubescence. Chelicerae provided with rudimentary boss. Leg segmented, provided with alternative brown yellow patches. Dorsum of abdomen white with deep brown transverse patches and stripes and with three pairs of conspicuous sigilla.

Distribution : India : Delhi, Uttar Pradesh, West Bengal, Assam, Orissa, Maharashtra, Madhya Pradesh, Tamil Nadu. *Elsewhere* : Myanmar; Malaya Peninsula.

7. Genus *Neoscona* Simon

1864. *Neoscona* Simon, *Hist. nat. des Aragin.*, **1** : 261.

1981. *Neoscona* : Tikader & Biswas, *Rec. zool. Surv. India,* occ. pap., **30**(1) : 22.

Type-species : *Neoscona anabesca* (Walckenaer).

Distribution : Cosmopolitan.

9. *Neoscona theis* (Walckenaer)

1841. *Epeira theis* Walckenaer, *Hist. nat. Ins. Apt.*, **2** : 53.

1982. *Neoscona theis* : Tikader, *Fauna of India,* Araneae : Spiders, **2** (1) : 269.

Material examined : Delhi : 1 ♂, Dhaulakuan Forest, Ridge, 2.ix. 1994, coll. J.P. Sati & party.

Diagnostic characters : Cephalothroax longer than wide, narrowing in front, clothed with pubescence and hair, provided with two lateral and one median longitudinal dark brown bands ; thoracic region provided with distinct longitudinal groove. Ocular quad longer than wide and wider in front than behind. Sternum heart shaped, pointed behind, clothed with pubescence and hair, dark brown, provided with a conspicuous mid-longitudinal bar. Chelicerae strong, light brown with prominent boss. Abdomen sub-oval, longer than wide, anterior end wider than posterior end, clothed with pubescence and hair, overlapping on the cephalothorax. Four pairs of sigilla presnet on the dorsum.

Distribution : India : Delhi, U.P., West Bengal, Gujarat, Maharashtra, Orissa. *Elsewhere* : South New Guinea.

8. Genus *Leucauge* White

1841. *Leucauge* White, *Ann. mag. nat. Hist.*, 7 (1) : 463.

1981. *Leucauge* : Tikader & Biswas, *Rec. zool. Surv. India* , occ. pap.,30 (1) : 39.

Type species : *Leucauge hortorum* (Hents).

Distribution : Tropical and sub-tropical countries of the world.

Key to species

1. Abdomen uniformly silver white and decorated with longitudinal black bands ..... *celebesiana*

\- Abdomen having some silver white specks and not decorated with longitudinal black bands. Both paired tubercles and median caudal tubercle highly prominent ..... *decorata*

10. *Leucauge celebesiana* (Walckenaer)

1841. *Tetragnatha celebesiana* Walckenaer, *Hist. Nat. Ins.Apt.*, 2 : 222.

1982. *Leucauge celebesiana* : Tikader, *Fauna of India*, Araneae : Spiders, 2 (91) : 83.

Material examined : Delhi; 1 ♀, I.A.R.I. campus, 2.ix.1994. coll. J.P. Sati & party.

Distribution : India : Delhi, Uttar Pradesh, West Bengal, Gujarat, Maharashtra, Meghalaya, Orissa.

Diagnostic characters : Cephalothorax brown yellow, longer than wide, flat, clothed with hair, cephalic region slightly higher than thoracic region having a posteriorly trifid deep groove. Ocular quad forming a trapezium, wider posteriorly than in front ; both rows of eyes recurved but posterior row very narrowly recurved. Chelicerae large, very strong and stout, brownish yellow, provided with small boss. Abdomen rather elongated, moderately overlapping anteriorly on carapace ; anterior end having a median depression. Dorsum of abdomen decorated with silvery white and blackish patches and lines forming a characteristic pattern.

11. *Leucauge decorata* (Blackwall)

1864. *Tetragnatha decorata* Blackwall, *Ann. mag. nat. Hist.*, 14 (3) : 44.

1982. *Leucauge decorata* : Tikader, *Fauna of India*, Araneae : Spiders, 2 (1) : 78.

1992. *Leucauge decorata* : Biswas & Biswas, *Fauna of West Bengal*, Part III, Araneae : Spiders, State Fauna Series, 3 : 472.

Material examined : Delhi : 2 ♀, Tuglaqabad forest Nursery near Air Force Station, 12.ix.1994, coll. J.P. Sati & party.

Distribution : India : Delhi, Uttar Pradesh, West Bengal, Assam, Bihar, Gujarat,

Karnataka, Kerala, Meghalaya, Orissa, Pondichery, Sikkim. *Elsewhere* : Myanmar ; Bhutan, from sea to high mountain ranges.

REFERENCES

Biswas Bijan, 1984. Description of six new species of spiders of the families Clubionidae, Gnaphosidae, and Salticidae from India. *Bull. zool. Surv. India,* **6** (1-3) : 133.

Biswas Bijan, 1987. *Fauna of Orissa*, Part I, Araneae : Spiders, State Fauna Series **1** : 257-272.

Biswas Bijan and Biswas Kajal, 1992. *Fauna of West Bengal,* Part III. Araneae : spiders. State Fauna Series **3** : 357-500.

Tikader, B.K. 1966. Studies on some crab-spiders of the family : Thomisudae from Khasi and Jaintia Hills, Assam, India. *Proc. Indian Acad. Sci.*, **64** (1) : 53-61.

Tikader, B.K. & Biswas Bijan, 1974, Studies on some spiders of the genus *Xysticus* (Family : Thomisidae) from Darjeeling, India. *Proc. Indian Acad. Sci.*, **80** (6) : 262 - 266.

Tikader, B.K. & Malhotra, M.S. 1980. *Fauna of India*, Araneae : Spiders, **1** (1-2) : 1-447.

Tikader, B.K. & Biswas Bijan, 1981. Spider Fauna of Calcutta and vicinity. *Rec. zool. Surv. India,* occ. pap., **30** (1) : 1-149.

Tikader, B.K., 1982, *Fauna of India*, Araneae : Spiders, **2** (1-2) : 1-536.

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ACARI : PLANT MITES

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Zoological Survey of India, Calcutta - 700 053

Mites associated with plants have important role to play in agriculture and horticulture as some of them are injurious pests, causing reduction of yield while many are useful predators and help to keep the pest population in check. In view of their importance, these mites have received world wide attention including India and fairly good amount of work has been done not only towards exploration of fauna but on thier bioecology and control as well.

So far as the plant mites of Delhi are concerned, although a good amount of publications are available towards exploration of fauna but no consolidated account is available. Prasad (1974) listed 61 species, while Gupta (1985) listed 85 species from Delhi. Major workers who have helped in exploring the plant mite fauna of Delhi are : Menon & Ghai (1968, 1968a); Nassar & Ghai (1981) on Tetranychidae; Menon *et al.* (1971), Maninder & Ghai (1978, 1978a), Nassar & Ghai, (1981), Ghai & Baker (1989) on Tenuipalpidae ; Saxena (1942); ChannaBasavanna (1966), Mohanasundaran (1982) on Eriophyidae. Ghai & Maninder (1976) on Tuckerellidae; Khot (1963, 1964, 1965) on Erythraeidae; Baker (1968); Dhooria (1982) on Tydeidae; Narayanan & Kaur (1960), Naraynan, Kaur & Ghai (1960), Ghai and Menon (1967), Dhooria (1980), Narayanan and Ghai (1965), Ghai (1964), Ghai (1965) on Phytoseiidae; Narayanan and Ghai (1964, 1964a); Menon and Ghai (1968) on Ascidae. In addition, one of the authors of this paper (SKG) recently collected some mites from Delhi which are also included here to make the account comprehensive one. Through all these a total of 112 species under 46 genera belonging to 16 families and 3 orders are so far known, of these, 75 species are phytophagous, 35 are predatory species and 3 are fungus feeders. Taxonomic account of all these species are included in this paper, giving relevant references, hosts, habitats, distribution and wherever available the information on their economic importance. Besides, keys to all taxonomic categories are provided. It is hoped that, this being a consolidated account of plant mite fauna of Delhi, will be useful to future workers both in basic and applied aspects.

SYSTEMATIC ACCOUNT

Key to orders

1. With full coxae to ambulacral appendages; pedipalpal ambulacram represented by a fine claw near linear basal angle of the palp tarsus; stigmata situated lateral to coxae II-IV, typically elongate peritreme, tritosternum present usually with lacineae : ....**Mesostigmata**

Lacking free exoae to ambulatory appendages; pedipalpal ambulacrum completely lost; stigmata never situated lateral to legs II-IV.....2

2. Pedipalpi small and comprising of 2 free podomeres and closely adpressed to the sides of the hypognathum; comprising a median empodial claw with an associated pulvillus or a sucker like pulvilus situated on an elongated pre-tarsus; stigmata and trachae never present; idiosoma without tricolothria and never covered dorsally by overlapping scelerites; body never vermiform .....**Astigmata**

\- Pedipalpi usually with 3-5 podomeres; conspicious; if small with fewer podomeres and incospicuous, then idiosoma either vermiform or with overlapping sclerites dorsally in the female; chelicera chelate or variously modified into piercing stylets or hook-like organs; respiratory system usually present; idiosoma often with tricobothria.....**Prostigmata**

Key to families of order Prostigmata

1. Body wormlike or annulate with 2 pairs of legs.....2

\- Body rounded,not wormlike or annulate, normally with four pairs of legs.....3

2. Rostrum of various sizes, usually small in comparison to body size, feather claw small simple or divided; female genital cover flap usually ribbed.....Eriophyidae

\- Rostrum large in comparison to body; feather claw often large; simple or divided; female genital cover flap smooth, less often ribbed.....Rhyncaphytoptidae

3. With palp thumb - claw process, in some cases the claw may be small or obsolete, it is replaced by a relatively long setae.....7

\- Without palp thumb - claw process.....4

4. Cheliceral bases fused, or if not fused not capable of lateral scissors like motion over gnathosoma.....5

\- Chelicera free, attached at base and free to move scissors like laterally across gnathosoma 6

5. Propodosoma without obvious pseudostigmata and pseudostigmatid organs...Tenuipalpidae
Propodosoma with 1 or 2 pairs of distinct pseudostigmata and pseudostigmatid organs .....Tydeidae

6. With 2 pairs of genital suckers, the relatively long palp turned inwards distal segment usually claw-like.....Cunaxidae

\- With 3 pairs of genital suckers, relatively long palpi elbowed with distal long seta..... .....Bdellidae

7. Body densly clothed with setae, larvae usually heteromorphic.....Erythraeidae
- Body setae relatively few, arranged in transverse rows; larvae homomorphic.....8

8. Cheliceral bases closely fused with gnathosoma without indication of suture, peritreme usually `M' shaped.....Cheyletidae
- Cheliceral bases fused with each other but not with gnathosoma having suture conspicuous, peritreme usually present on anterior propodosoma.....9

9. Chelicera forming a long whiplike stylet occurring within the body, cheliceral bases fused to form stylophore.....10
- Movable chela straight, stiff and relatively short, no stylophore.....11

10. Claws with series of comb - like tenent hairs, empodia similarly ornamented, caudal aspect of idiosoma with a series of flagelliform setae.....Tuckerallidae
- Each claw terminating in a pair tenent hairs or bordered with combs of tenent hairs, empodia claw-like or pad-like, often divided distally or with a basal divided spur, with or without tenent hairs, caudal aspect of idiosoma without highly modified setae.....Tetranychidae

11. Chelicera forming a stylophore, coxae II & III contiguous.....Raphignathidae
- Chelicera independently movable but may be adnate or stylophore - like in a few genera, coxae II and III not contiguous, legs I and II directed anteriorly, III and IV directed posteriorly.....Stigmaeidae

Key to families of order Mesostigmata

1. Normally with fewer than 20 pairs of dorsal setae except in Gnoriminae where there are upto 23 pairs of setae.....12
- Always with more than 20 pairs of dorsal setae.....Ascidae

2. Anus in terminal position, fixed digit of chelicera of female reduced or absent .....Otopheidomenidae
- Anus in ventral position, fixed digit of chelicera of female normal .....Phytoseiidae

Family : **TETRANYCHIDAE**

Key to the subfamilies, tribes and genera of Tetranychidae

1. Empodium with tenent hairs; female with 3 pairs of anal setae and male with 5 pairs of

genito anal setae.....Bryobiinae, 2

- Empodium without tenent hairs or empodium may be absent, female with 2 or 1 pair of anal setae and male with 3-4 pairs of genito anal setae.....Tetranychinae, 5

2. True claw uncinate or if pad-like, prodorsum with well developed setae setiferous lobes, empodium pad-like.....Bryobiini
   Prodorsum with 8 setae.....*Bryobia*
- True claw pad-like, pad rarely with a strong hook on mid ventral surface; anteriorly prodorsum may have 0-3; setiferous lobes, empodium pad-like or uncinate.....3

3. True claw pad-like but rarely with mid ventral hook; empoduim pad-like..Hystrichonychini
   with 3 anterior projection over rostrum.....*Monoceronychus*
- True claw pad-like and empodium uncinate distally with mid ventral hook...Petrobiini, 4

4. Dorsal body setae not on turbercles.....Petrobia
- Dorsal body setae on tubercles.....Tetranychina

5. Tarsus I dorsally with a single set of usually loosely associated duplex setae or duplex setae absent.....Eutetranychini
- Female with 2 pairs of anal setae, 4th pair of dorsocentral setae in normal position.....
  .....*Eutetranychus*
- Tarsus I dorsally with 2 sets of closely associated duplex setae.....*Tetranychini*, 6

6. With 2 pairs of para-anal setae.....7
- With 1 pair of para-anal setae.....8

7. Empodium claw like, entire or splits bilaterally into claw like structure...Schizotetranychus
- Empodium ending in a tuff of hairs .....*Eotetranychus*

8. Tarsus I with duplex setae distal and approximate.....*Oligonychus*
- Tarsus I duplex setae well seperated, dividing segments into 3 more or less equal parts
  .....*Tetranychus*

Subfamily : BRYOBINAE
Tribe : BROYBIINI

Genus *Bryobia* Koch

1836. *Bryobia* Koch, *Deutesche Crustacea Myriapoda, Arachnida,* Fasc. 1: 8.

Key to species of Bryobia

1. Propodosomal and hysterosomal setae broadly spatulate.....*praetiosa*
- Propodosomal and hysterosomal setae sub-spatulate.....eharai

1. *Bryobia eharai* Pritchard & Keifer

1955. *Bryobia cristata* Pritchard and Baker, *Pacific coast ent. soc. Mem. Ser.*, **2** : 22-26.
1958. *Bryobia eharai* : Pritchard & Keifer, *Ann. Ent. Soc. America*, **51** : 506.
1968. *Bryobia eharai* : Menon & Ghai, *Indian J. Ent.*, **30** : 88.
1985. *Bryobia eharai* : Gupta, *Handbook Plant Mites of India* : 47.
1994. *Bryobia eharai* : Gupta & Gupta, *Mem. zool. Surv. India*, **18** : 10-12.

Host : In Delhi, this mite was collected on Chrysanthemum.

Distribution : India : Delhi, Maharashtra, Karnataka, Uttar Pradesh, Jammu & Kashmir, Himachal Pradesh. *Elsewhere* : Japan.

Remarks : Menon & Ghai (1968) reported this mite infesting Chrysanthemum in Delhi causing no injury to the plants. The senior author while reporting this species from different parts of India also found that the infestation of this mite produced no apparent damage symptoms.

2. *Bryobia praetiosa* Koch

1836. *Bryobia praetiosa* Koch, *Duet. Crust. Myr. Arach.*, **1** : 8.
1955. *Bryobia praetiosa* : Pritchard & Baker, *Pacific Coast ent. soc. Mem. Ser.*, **2** : 26.
1968. *Bryobia praetiosa* : Menon & Ghai, *Indian J. Ent.*, **30** : 85.
1985. *Bryobia praetiosa* : Gupta, *Handbook Plant Mites of India* : 47-48.
1994. *Bryobia praetiosa* : Gupta & Gupta, *Mem. zool. Surv. India*, **18** : 13-14.

Hosts : In Delhi, this mite was collected on pear, plum. Outside India this mite has been reported from over 50 other hosts (Gupta & Gupta, 1994).

Distribution : India : Delhi, Himachal Pradesh, Punjab, Jammu & Kashmir, Uttar Pradesh, West Bengal, Meghalaya. *Elsewhere* : Taiwan; Japan; Europe (Eastern Part); U.S.A; South America ; Southern part of Africa; Australia; New Zealand.

Remarks : Menon & Ghai (1968) reported this mite occurring on pear in Delhi. Gupta et al. (1975) reported that injury to plants was evidenced by appearance of minute yellowish spots, which later turned brown then dried up and subsequently fell off making the tree almost completely denuded.

Genus *Monoceronychus* McGregor

1945. *Monoceronychus* McGregor, *Proc. Ent. Soc. Wash.*, **47** : 100.

3. *Monoceronychus terpoghossiani* (Bagdasarian)

1959. *Petrobia terpoghossiani* Bagdasarian, Lectures of Armenian Acad. Sci. U.S.S.R., **28** : 139-142.

1960 *Monoceronychus terpoghossiani* : Wainstein, Kaza. Akad. Selnk. Nauk. Wauch Issled. Inst. Zash. Rast, Trudy, **5** : 126 128.

1968. *Monoceronychus terpoghossiani* : Menon & Ghai, *Indian J. Ent.*, **30** : 88.

1985. *Monoceronychus terpoghossiani* : Gupta, *Handbook Plant Mites of India* : 51-52.

Host : Grass.

Distribution : India : Delhi. *Elsewhere* : U.S.S.R.

Remakrs : Menon & Ghai (1968) recorded this species infesting upon grasses in Delhi.

4. ***Petrobia latens*** Muller

1776. *Acarus latens* Muller, *Zool. Dan. Prodr* : 187.

1961. *Petrobia latens* : Bindra & Kittur, *Indian J. Ent.*, **23** : 71.

1968. *Petrobia latens* : Menon & Ghai, *Indian J. Ent.*, **30** : 77.

1985. *Petrobia latens* : Gupta, *Handbook Plant Mites of India* : 56-57.

1994. *Petrobia (Petrobia) latens* : Gupta & Gupta, *Mem. zool. Surv. India,* **180** : 24-26.

Hosts : Pear, *Chenopodium album, Citrus* sp., *Convolvulus arvensis, Cynodon dactylon, Fumeria indica, Hordeum vulgare, Trifolium* sp., wheat, maize, *Vicia hirsuta.* This has also been reported from over 50 other hosts from outside India (Gupta & Gupta, 1994).

Distribution : India : Delhi, Haryana, Punjab, U.P., M.P., Rajasthan, Bihar, J&K. *Elsewhere* : Pakistan; Japan; Egypt; South Africa; U.S.A; U.S.S.R.

Remarks : This mite has been recorded from Delhi infesting wheat. This is an important pest of wheat in northern India causing drying of leaves from tip backwards.

Genus ***Eutetranychus*** Banks

1917. *Neotetranychus (Eutetranychus)* Banks, *Ent. News,* **28** : 197.

1950. *Eutetranychus* Banks, McGregor, *Ann. Midl. Nat.*, **44** (2) : 267.

Key to species of *Eutetranychus*

1. Striae forming `V' pattern between 2nd & 3rd pairs of dorsocentral hysterosomal setae.....2

   Striae longitudinal, between 2nd & 3rd pairs of dorsocentral hysterosomal setae.....4

2. Dorsocentral, hysterosomal setae relatively much longer reaching to the bases of setae behind; 3rd pair even going beyond bases of 4th pair.....*maximae*

   Dorsocentral hysterosomal setae very short not reaching to the bases of setae next

behind.....3

3. Propodosomal, mediodoral striae with less developed lobes; 3rd pair of dorsocentral setae tapering; 3rd and 4th dorsocentral, hysterosomal setae forming a rectangle.....*phaseoli*
- Propodosomal, mediodorsal striae with developed lobes, 3rd pair of dorsolateal setae similar to other lateral setae; 3rd and 4th dorsocentral, hysterosomal setae forming a square.....*orientalis*

4. Peritreme ending in simple bulb, longitudinal striae starting at the bases of 2nd pair of dorsocentral, hysterosomal setae.....5
- Peritreme ending in bilobed bulb, longitudinal striae starting behind the bases of 2nd dorosocentral hysterosomal setae.....*bilobatus*

5. Tibia II with 5 tactile setae.....6
- Tibia II with 6 tactile setae.....7

6. All dorsocentrals, humerals and 3rd pair of propodosomals not set on tubercles.....*citri*
- All setae on dorsum set on tubercles.....*caricae*

7. First pair of dorsolateral setae situated anterior to first pair of dorsocentral setae.....*nagai*
- First pair of dorsocentral setae situated at the level of first pair of dorsocentral setae.....*anneckei*

5. *Eutetranychus anneckei* Meyer

1974. *Eutetranychus anneckei* Meyer. *Ent. Mem. Dep. agric.Tech. Serv. Repub. S. Afr.*,**36** : 148.
1981. *Eutetranychus anneckei* : Nasser & Ghai, *Oriental Ins.*, **15** : 349.
1983. *Eutetranychus anneckei* : Gupta, *Handbook Plant Mites of India* : 63.
Hosts : *Luffa acutangula*, Sapota, Jackfruit, peach, mulberry, ficus, citrus, sour orange.
Distribution : India; Delhi. *Elsewhere* : Mozambique.
Remarks : This has been reported to infest *Citrus* sp. causing no significant damage to the hosts.

6. *Eutetranychus bilobatus* Nassar & Ghai

1981. *Eutetranychus bilobatus* Nassar & Ghai, *Oriental Ins.*, **18** : 343-345.
1994. *Eutetranychus bilobatus* Gupta & Gupta, *Mem. zool. Surv. India*, **18** : 30-31.
Host : *Zizyphus* sp.
Distribution : India : Delhi.

Remarks : This mite is not of any economic importance.

7. ***Eutetranychus citri*** Attiah

1967. *Eutetranychus citri* Attiah, *Bull. soc. Ent. Egypt,* **51** : 15-16.
1981. *Eutetranychus citri* : Nassar & Ghai, *Oriental Ins.*, : **5** : 345-346.
1985. *Eutetranychus citri* : Gupta, *Handbook Plant Mites of India* : 64-65.
1994. *Eutetranychus citri* : Gupta & Gupta, *Mem. zool. Surv. India,* **18** : 33.
Hosts : *Citrus* sp.
Distribution : India : Delhi. *Elsewhere* : Egypt; South Africa.
Remarks : Nassar & Ghai (1981) reported this mite for the first time from India

8. ***Eutetranychus caricae*** Nassar & Ghai

1981. *Eutetranychus caricae* Nassar & Ghai, *Oriental Ins.*, **15** : 347.
1985. *Eutetranychus caricae* : Gupta, *Handbook Plant Mites of India* : 64.
1994. *Eutetranychus caricae* : Gupta & Gupta, *Mem. zool. Surv. India*, **10** : 31-32.
Host : *Ficus carica.*
Distribution : India : Delhi.

9. ***Eutetranychus nagai*** Nassar & Ghai

1981. *Eutetranychus nagai* Nassar & Ghai, *Oriental Ins.*, **15** : 347-349.
1985. *Eutetranychus nagai* : Gupta, *Handbook Plant Mites of India* : 65.
1994. *Eutetranychus nagai* : Gupta & Gupta, *Mem. Zool. surv. India*, **18** : 34-35.
Host : *Eriobotrya japonica.*
Distribution : India : Delhi.

10. ***Eutetranychus maximae*** Nassar & Ghai

1981. *Eutetranychus maximae* Nassar & Ghai, *Oriental Ins.*, **15** : 339.
1985. *Eutetranychus maximae* : Gupta, *Handbook Plant mites of India* : 33-34.
1994. *Eutetranychus maximae* : Gupta & Gupta, *Mem. zool. Surv. India,* **18** : 33-34.
Host : *Eriobotrya japonica.*
Distribution : India : Delhi

11. ***Eutetranychus orientalis*** (Klein)

1936. *Anychus orientalis* Klein, *Bull. Agr. Res. Stn. Rehonoth,* **21**: 3.
1940. *Anychus orientalis : Proc. Indian. Acad. Ser.*, **11** B : 194.

1946. *Anychus orientalis* : Sayed, *Ler. Ent. Bull. Soc. Ionad,* **30** : 146.
1981. *Eutetranychus orientalis* : Nassar & Ghai, *Oriental Ins.*, **15** : 343.
1985. *Eutetranychus orientalis* : Gupta, *Handbook Plant Mites of India* : 66-68.
1994. *Eutetranychus orientalis* : Gupta & Gupta, *Mem. zool. Surv. India,* **18** : 35-37.

Hosts : Citrus spp. banana, pear, neem, jackfruit, pigeonpea, papaya, *Cocos nucifera, Dolichos lablab, Eichornia* sp., *Erytherina indica, Ficus sp., Polyalthea longifolia,* almond, plum, peach, guava, *Ravoulfia serpentina, Ricinus communis, Rosa indica, Sesamum indicum, Tabernae montana coronaria, Terminalia arjuna, Zea mays.*

Remarks : Nassar & Ghai (1981) recorded it occurring on citrus, banana, pear in Delhi. This is a serious pest of citrus all over India, causing browning and drying of leaves. The infested leaves get crumpled disturbing the physiological activity of plants.

12. *Eutetranychus phaseoli* Nassar & Ghai

1981. *Eutetranychus phaseoli* Nassar & Ghai, *Oriental Ins.*, **15** : 37-38.
1985. *Eutetranychus phaseoli* : Gupta, *Handbook Plant Mites of India* : 37-38.
1994. *Eutetranychus phaseoli* : Gupta & Gupta, *Mem. zool. Surv. India,* **18** : 37-38.

Host : *Phaseolus vulgaris.*

Distribution : India : Delhi.

Remarks : Nassar & Ghai (1981) described this species basing upon mite specimens collected on *Phaseolus vulgaris* from Delhi.

Genus *Eotetranychus* Oudemans

1931. *Eotetranychus* Oudemans, *Ent. Ber. Amst.*,**8**(178) : 224.

Key to species of Eotetranychus

1. Dorsal idiosomal setae serrate.....2
- Dorsal idiosomal setae not serrate.....4

2. Dorsal idiosomal setae longer than distance between their longitudinal bases 3
- Dorsal idiosomal seta as long as interval between their longitudinal bases .....*irregularis*

3. Shaft of aedeagus short, broad and curved dorsad, not forming a knob.....*rajouriensis*
Shaft of aedeagus straight, turning slightly dorsad to form a knob.....*rohilae*

4. Distal portion of aedeagus sigmoid.....*hirsti*
- Distal portion of aedeagus curved but not sigmoid.....*suginamensis*

13. *Eotetranychus hirsti* Pritchard & Keifer

1926. *Tetranychus fici*, Hirst, *Proc. zool. Soc. Lond.*, : 828.
1940. *Tetranychus fici* : Rahman & Sapra, *Proc. Indian Acad. Sci.*, (Ser. B) **1** : 156.
1955. *Tetranychus hirsti* : Pritchard & Baker, *Pacific coast Ent. Soc. Mem.* Ser., **2** : 200.
1981. *Eotetranychus hirsti* : Nassar & Ghai, *Oriental Ins.*, **15** : 357.
1985. *Eotetranychus hirsti* : Gupta, *Handbook Plant Mites of India* ; 73-74.
1994. *Eotetranychus hirsti* : Gupta & Gupta, *Mem. zool. Surv. India*, **18** : 67-68.
Hosts : *Ficus carica, Ficus cunea, Ficus racemosa, Bauhinia* sp.
Distribution : India : throughout. *Elsewhere* : Pakistan.
Remarks : Nassar & Ghai (1961) reported this mite infesting *Ficus carica* in Delhi. This is a serious pest of fig in India making the leaves first yellowish green, then brown with rough texture and ultimately these leaves fall off. The infested fruits shrivel and fail to ripe.

14. *Eotetranychus irregularis* Nassar & Ghai

1981. *Eotetranychus irregularis*, Nassar & Ghai, *Oriental Ins.*, **15** : 357-359.
1985. *Eotetranychus irregularis* : Gupta, *Handbook Plant Mites of India* : 74-75.
1994. *Eotetranychus irregularis* : Gupta & Gupta, *Mem. zool. surv. India*, **18** (1) : 70-71.
Host : Ficus carica.
Distribution : India : Delhi.
Remarks : Nassar & Ghai (1981) described this species and thereafter no record of the species was made.

15. *Eotetranychus rajouriensis* Nassar & Ghai

1981. *Eotetranychus rajouriensis* Nassar & Ghai, *Oriental Ins.*, **15** (4) : 359-361.
1985. *Eotetranychus rajouriensis* : Gupta, *Handbook Plant Mites of India* : 77.
1994. *Eotetranychus rajouriensis* : Gupta & Gupta, *Mem. zool. Surv. India*, **18**(1) : 78.
Host : Zizyphus sp.
Distribution : India : Delhi.
Remarks : Nassar & Ghai (1981) did not mention any economic importance of this species.

16. *Eutetranychus rohilae* Nassar & Ghai

1981. *Eotetranychus rohilae* Nassar & Ghai, *Oriental Ins.*, **15** (4) : 335 - 357.
1985. *Eotetranychus rohilae* : Gupta, *Handbook Plant Mites of India* : 76.
1994. *Eotetranychus rohilae* : Gupta & Gupta, *Mem. zool. Surv. India*, **18** (1) : 78-80.
Host : Morus sp.
Distribution : India : Delhi.

Remarks : No economic importance of this species is known.

17. *Eotetranychus suginamensis* (Yokoyama)

1922. *Tetranychus suginamensis* Yokoyama, *Bull. Imp. Ser. St. Japan,* **8** : 282.
1955. *Eotetranychus suginamensis* : Pritchard & Baker, *Pacific Coast Ent. Soc. Mem. Ser.*, **2** : 200.
1985. *Eotetranychus suginamensis* : Gupta, *Handbook Plant Mites of India* : 78.
1994. *Eotetranychus suginamensis* : Gupta & Gupta, *Mem. zool. Surv. India,* **18**(1) : 83.

Hosts : In Delhi, this mite has been reported on *Morus alba*, but outside India it has been collected on *Quercus* sp.

Distribution : India : Delhi, Punjab, West Bengal. *Elsewhere* : Pakistan; Japan.

Remarks : Though this mite is known to infest mulberry causing wrinkling and curling of leaves but this infestation never causes any substantial economic loss of the crop.

Genus *Oligonychus* Berlese

1886. *Oligonychus* Berlese, *Acari dannosi alle piante coltivati, Padova,* : 24.

Key to species of Oligonychus

1. Aedeagus bent, ventrad, tarsus I with not more than single tactile seta on venter just distard of duplex setae.....2
- Aedeagus bent dorsad, although the distal end may be directed ventrad; tarsus I with 2 tactile setae on ventrad just distard of duplex setae.....*indicus*

2. Aedeagus bent ventrad, forms acute angel with axis of shaft.....3
- Aedeagus bent ventrad at right angle to axis of shaft.....*vitis*

3. Bent portion of aedeagus forming acute angle to shaft.....*mangiferus*
- Bent portion of aedeagus with tip directed ventrad.....*coffeae*

18. *Oligonychus coffeae* (Nietner)

1861. *Acarus coffeae* Nietner, *Observe. Enem. coffee Tree Ceylon* : 31.
1955. *Oligonychus coffeae* : Pritchard & Baker, *Pacific Coast Ent. Soc. Mem.* Ser., 2 : 315.
1981. *Oligonychus coffeae* : Nassar & Ghai, *Oriental Ins.*, **15** : 363.
1985. *Oligonychus coffeae* : Gupta, *Handbook Plant Mites of India* : 83.
1994. *Oligonychus coffeae* : Gupta & Gupta, *Mem. zool. Surv. India*, **18** (1) : 102-104.

Hosts : In Delhi, it has been recorded on *Prunus persica*. Apart from this, it has been recorded on as many as 32 hosts from other parts of the world (Gupta & Gupta, 1994).

Distribution : India : Delhi, Assam, West Bengal, Tamil Nadu, Himachal Pradesh, Meghalaya. *Elsewhere* : Australia; Thailand; Hawaii, Japan; Philippines; Sri Lanka; Taiwan; U.S.A; South and East Africa; Russia; Mauritius; Middle East; Egypt.

19. *Oligonychus indicus* (Hirst)

1923. *Paratetranychus indicus* Hirst, *Proc. zool. Soc. Lond.* : 990.
1955. *Oligonychus indicus* : Pritchard & Baker, *Pacific Coast Ent. Soc. Mem. Ser.*, **2** : 354-355.
1985. *Oligonychus indicus* : Gupta, *Handbook Plant Mites of India* : 84-86.
1994. *Oligonychus indicus* : Gupta & Gupta, *Mem. zool. Surv. India*, **18** (1) : 104-105.

Material examined : Delhi; 14 ♀♀, 2 ♂♂, IARI Campus, ex *Cynodon dactylon*, 3.x.91, coll. S.K.Gupta.

Hosts : Besides, it has been recorded on as many as 16 hosts from India and 4 from outside India (Gupta & Gupta, 1994).

Distribution : India : Delhi, Haryana, Punjab, Uttar Pradesh, Andhra Pradesh, Tamil Nadu, West Bengal, Orissa. *Elsewhere* : Pakistan.

Remarks : This mite is known to be an important pest of sugarcane in northern India including Delhi, causing the appearanceof reddish spots on infested leaves which later dry up and defoliate.

20. *Oligonychus mangiferus* (Rahman & Sapra)

1940. *Paratetranychus mangiferus* Rahman & Sapra, *Proc. Indian Acad. Sci.*, **11** B : 192.
1955. *Oligonychus mangiferus* : Pritchard & Baker, *Pacific Coast Ent. Soc. Mem. Ser.*, **2** : 330.
1985. *Oligonychus mangiferus* : Gupta, *Handbook Plant Mites of India* : 87-88.
1994. *Oligonychus mangiferus* : Gupta & Gupta, *Mem. zool. Surv. India*, **18**(1) : 108-110.

Hosts : In Delhi, this species has been recorded on *Mangifera indica, Vitis vesiifera, Prunus persica* and *Ficus carica*. In addition , it has been recorded on a large number of hosts both in India and abroad.

Distribution : India : Delhi, Haryana, Himachal Pradesh, Punjab, Karnataka, Gujarat, West Bengal, Meghalaya. *Elsewhere* : Mauritius; S.Africa.

Remarks : This mite is an important pest specially of grape vine and mango in north India (including Delhi) causing the appearence of characteristic yellow spots on grape vine leaves and yellowing of middle laminar area in case of mango. In eastern India, it also infests Litchi causing browning of leaves.

20. *Oligonychus vitis* Zacher & Shehata

1965. *Oligonychus vitis* Zacher & Shehata, *Bull. Soc. Ent. Egypt*, **49** : 67-69.
1985. *Oligonychus vitis* : Gupta, *Handbook Plant Mites of India* : 91.

1994. *Oligonychus vitis* : Gupta & Gupta, *Men. zool. Surv. India* , **18** (1) : 117.

Hosts : In Delhi, this species has been collected on *Vitis vinifera*. However, from abroad it is also known on *Hetropyxis natalensis*.

Distribution : India: Delhi. *Elsewhere* : Egypt; South Africa.

Remarks : The species has not been reported to be of any economic importance in India.

Genus ***Schizotetranychus*** Tragardh

1915. *Schizotetranychus* Tragardh, *Meddn, Cent. Anst. Fors. Vas. Jordbr. Omrad Stockh.*

Key to the species of Schizotetranychus

1. Dorsal idiosomal setae serrate .....*tephrosiae*
- Dorsal idiosomal setae not serrate.....*andropogoni*

22. ***Schizotetranychus andropogoni*** (Hirst)

1926. *Tetranychus (Schizotetranychus) andropogoni* Hirst, *Proc. zool. Soc. Lond.* : 829.

1955. *Schizotetranychus andropogoni* : Pritchard & Baker, *Pacific Coast Ent. Soc. Mem. Ser. 2* : 248-249.

1985. *Schizotetranychus andropogoni* : Gupta, *Handbook Plant Mites of India* : 96-97.

1994. *Schizotetranychus andropogoni* : Gupta & Gupta, *Mem. zool. Surv. India,* **18** (1) : 87-89.

Hosts : In Delhi; this mite has been recorded on *Andropogon annulatus, Saccharum officinarum, S. spontaneum.* In addition, this has also been recorded on several other hosts both in India and abroad (Gupta & Gupta, 1994).

Distribution : India : Delhi, West Bengal, Bihar, Orissa, Punjab, Tamil Nadu, Karnataka, Kerala, Gujarat, Haryana, Uttar Pradesh. *Elsewhere* : Thailand; Mexico.

Remarks : This is an important pest of sugarcane specially in north India causing whitish blotches on either side of mid rib. All such affected leaves gradually look sickly and later wither.

23. ***Schizotetranychus tephrosiae*** Gutierrez

1968. *Schizotetranychus tephrosiae* Gutierrez, *Acarologia,* **10** (1) : 24-28.

1981. *Schizotetranychus tephrosiae* : Nassar & Ghai, *Oriental Ins.,* **15** (4) : 353.

1985. *Schizotetranychus tephrosiae* : Gupta, *Handbook Plant Mites of India* : 100.

1994. *Schizotetranychus tephrosiae* : Gupta & Gupta, *Mem. zool. Surv. India,* **18**(1) : 98-99.

Host : In Delhi, this mite has been reported from *Eriobotrya japonica.*

Distribution : India: Delhi. *Elsewhere* : Madagascar.

Remarks : No economic importance of this species is known.

Genus ***Tetranychus*** Dufour

1832. *Tetranychus* Dufour, *Annls. Sci. nat.*, **25** : 276.

Key to species of Tetranychus

1. Proximal duplex setae on tarsus I of female placed distal to tactile setae.....3
- Proximal duplex setae on tarsus I of female more or less in line with tactile seate 2

2. Aedeagal knob with small anterior and posterior projections; empodium II of male with proximoventral tridigitate spurs.....*macfarlanei*
- Aedeagal knob with anterior acute projection while posterior projection absent, empodium II of male with 3 pairs of proximoventral hairs and small distinct medidorsal spur....*ludeni*

3. Female with longitudinal to irregularly longitudinal striae between 3rd pairs of dorsocentral hystrosomals and longitudinal between 4th pair of dorsocentrals.....4
- Female with transverse to irregularly longitudinal striae between 3rd pair of dorsocentral, hysterosomals and longitudinal between 4th pair of dorsocentrals.....*angloensis*

4. Female hysterosoma with longitudinal striae between 4th pair of dorsocentral hysterosomal seta forming a more or less diamond shaped figure between 3rd and 4th pair of dorsocentral, hysterosomals.....5
- Female hystorsoma with irregular longitudinal striae between 4th pair of dorsocentral hysterosomals not forming diamond shape.....*afrindicus*

5. Female hystrosoma with longitudinal striae between 3rd pair of dorsocentral setae.....6
Female hystrosoma with irregular longitudinal striae between 3rd pair of dorsocentral setae.....*sayedi*

6. Upper surface of aedeagues knob straight or rounded with some kind of projection.....7
- Upper surface of aedeagus knob concave with anterior and posterior rounded projections like berry shaped.....*neocaledonicus*

7. Aedeagus knob with anterior projections rounded.....*urticae*
Aedeagus with anterior projection acute.....8

8. Anterior and posterior portion of aedeagal knob acuminate and similar, axis of knob parallel to axis of shaft; upper surface of aedeagal knob rounded.....*zaheri*
Anterior portion of aedeagal knob strongly acuminate and curved ventrad, axis of knob not parallel to axis of shaft, upper surface of aedeagal knob straight.....,...*papayae*

24. *Tetranychus afrindicus* Nassar & Ghai

1981. *Tetranychus afrindicus* Nassar & Ghai, *Oriental Ins.*, **15**. : 367-369.
1985. *Tetranychus afrindicus* : Gupta, *Handbook Plant Mites of India* : 104.
1994. *Tetranychus afrindicus* : Gupta and Gupta, *Mem. zool. Surv. India*, **18** (1) : 119-120.

Host : This mite was described on the basis of material collected on *Phaseolus* sp.

Distribution : India : Delhi.

Remarks : This mite is of no known economic importnace.

25. *Tetranychus angloensis* Meyer

1974. *Tetranychus angloensis* Meyer, *Ent. Mem., Dep. Agric, Tech. Serv. Repub. S.Africa*, **36** : 219.
1981. *Tetranychus angloensis* : Nassar & Ghai, *Oriental Ins.*, **15**(4) : 367.
1988. *Tetranychus angloensis* : Gupta, *Handbook Plant Mites of India* : 103.
1994. *Tetranychus angloensis* : Gupta & Gupta, *Mem. zool. Surv. India*, **18**(1) : 121.

Hosts : In Delhi, this mite has been recorded on sweet gourd; while outside India its other hosts *Elaeis quineensis* (Gupta & Gupta, 1994).

Distribution : India: Delhi. *Elsewhere* : Angola.

Remarks : This mite is so far of no known economic importance.

26. *Tetranychus hydrangeae* Pritchard & Baker

1955. *Tetranychus hydrangeae* Pritchard & Baker, *Pacific Coast Ent. Soc. Mem. Ser.*, **2** : 425.
1981. *Tetranychus kanzawai* : Nassar & Ghai, *Oriental Ins.*, **15** (4) : 371.
1985. *Tetranychus kanzawai* : Gupta, *Handbook Plant Mites of India* : 104-105.

Hosts : In Delhi, this mite has been recorded on *Morus* sp. Besides, it has been reported on *Prunus americana* and *Prunus persica* in India and on a large number of hosts from outside India (Gupta & Gupta, 1994).

Distribution : India: Delhi. *Elsewhere* : Worldwide.

Remarks : Opinions differ about the taxonomic status of *Tetranychus banzawai* Kishida. While some authors consider this species as distinct one while others synonymised it with *T. hydrangeae (Gupta & Gupta, 1994).* This mite is of no economic importance.

27. *Tetranychus ludeni* Zacher

1913. *Tetranychus ludeni* Zacher, *Mitt Kais Biol.Aust. Land, U. Forslew*, **14** : 40.
1981. *Tetranychus ludeni* : Nassar & Ghai, *Oriental Ins.*, **15**(4) : 366-367.
1985. *Tetranychus ludeni* : Gupta, *Handbook Plant Mites of India* : 110-112.

1994. *Tetranychus ludeni* : Gupta & Gupta, *Mem. zool. Surv. India,* **18**(1) : 127-129.

Hosts : In Delhi, it has been recorded on cauliflower, citrus, cowpea and brinjal. Gupta & Gupta (1994) reported the occurrence of this species on a large number of hosts both in India and abroad.

Distribution : India : Delhi, Uttar Pradesh, Punjab, Haryana, Gujarat, Andhra Pradesh, Tamil Nadu, Kerala, Karnataka, West Bengal, Assam, Bihar, Orissa, Tripura. *Elsewhere* : Australia; New Zealand; Hawaii; USA (southern part); Mexico; South America; South Africa; Zimbabawe; France; Portugal.

Remarks : This mite is considered to be one of the most serious pests of vegetables in India. Because of feeding, the leaves turn first yellow, then necrotic patches encompasses the leaves and ultimately all the affected leaves dry up and plants suffer defoliation. The yield loss is quite high in this case.

28. *Tetranychus macfarlanei* Baker & Pritchard

1960. *Tetranychus macfarlanei* Baker & Pritchard, *Hilgardia,* **29** : 537.

1981. *Tetranychus macfarlanei* : Nassar & Ghai, *Oriental Ins.*, **15** (4) : 366.

1985. *Tetranychus macfarlanei* : Gupta, *Handbook Plant Mites of India* : 109-110.

1994. *Tetranychus macfarlanei* : Gupta & Gupta, *Mem. zool. Surv. India,* **18**(1) : 129-130.

Hosts : In Delhi, this mite has been recorded on *Solanum melongena.* Gupta & Gupta (1994) reported several other hosts from India and abroad.

Distribution : India : Delhi, Rajasthan, Uttar Pradesh, Gujarat, Tamil Nadu, Karnataka, Madhya Pradesh, Andaman & Nicobar Islands, West Bengal. *Elsewhere* : Mauritius.

Remarks : This is a sporadic pest of brinjal in south India causing the appearance of yellowish patches resulting in drying up of the infested leaves.

29. *Tetranychus neocaledonicus* Andre

1993. *Tetranychus neocaledonicus* Andre, *Bull. Mus. Nat. Hist. nat. Paris,* (2) **5** : 302.

1981. *Tetranychus neocaledonicus* : Nassar & Ghai, *Oriental Ins.*, **15** (4) : 369-370.

1985. *Tetranychus neocaledonicus* : Gupta, *Handbook Plant Mites of India* : 113-115.

1994. *Tetranychus neocaledonicus* : Gupta & Gupta, *Mem. zool. Surv. India,* **18**(1) : 131 - 133.

Hosts : In Delhi, this mite has been collected on citrus, while Gupta & Gupta (1994) reported a large number of hosts both in India and abroad.

Remarks : This is considered to be one of the most serious pests of vegetables and fruit trees throughout the world. In India, this is a pest of vegetables like brinjal and bhindi. The continuous sucking from leaves make these spots yellowish and ultimately those turn brownish. Such leaves gradually wither, fall off and the yield of the plant is seriously affected.

30. ***Tetranychus papayae*** Nassar & Ghai

1981. *Tetranychus papayae* Nassar & Ghai, *Oriental Ins.*, **15** (4) : 375-377.
1994. *Tetranychus papayae* : Gupta & Gupta, *Mem. zool. Surv. India*, **18**(1) : 133-134.
Host : In Delhi, this mite has been described and collected on *Carica papaya*.
Distribution : India : Delhi.
Remarks : This mite is of no known economic importance.

31. ***Tetranychus sayedi*** Baker & Pritchard

1960. *Tetranychus sayedi* Baker & Pritchard, *Hilgardia*, **29**(1) : 543-545.
1981. *Tetranychus sayedi* : Nassar & Ghai, *Oriental Ins.*, **15**(4) : 369.
1985. *Tetranychus sayedi* : Gupta, *Handbook Plant Mites of India* : 104.
1994. *Tetranychus sayedi* : Gupta & Gupta, *Mem. zool. Surv. India*, **18** (1) : 135-136.
Hosts : In Delhi, this mite has been collected on brinjal and mulbery.
Distirbution : India: Delhi. *Elsewhere* : Zaire.

32. ***Tetranychus zaheri*** Nassar & Ghai

1981. *Tetranychus zaheri* Nassar & Ghai, *Oriental Ins.*, **15**(4) : 373-375.
1985. *Tetranychus zaheri* : Gupta, *Handbook Plant Mites of India* : 105.
1994. *Tetranychus zaheri* : Gupta & Gupta, *Mem. zool. Surv. India*, **18**(1) : 142-143.
Host : In Delhi, it has been recorded on *Phaseolus vulgaris*.
Distribution : India : Delhi.

Family : **TUCKERELLIDAE** Baker & Pritchard

1953. *Tuckerllidae* Baker & Pritchard, *Ann. Ent. Soc. Amer.*, **46** : 243-258.

33. ***Tuckerella delhiensis*** Ghai & Maninder

1976. *Tuckerella delhiensis* Ghai & Maninder, *Oriental Ins.*, **10** : 169-172.
1985. *Tuckerella delhiensis* : Gupta, *Handbook Plant Mites of India* : 118.
Host : *Terminalia tomentosa*.
Distribution : India : Delhi.

Family : **TENUIPALPIDAE** Berlese

1913. *Tenuipalpidae* Berlese, *Acarotheca Italica Firenze Berlese Tipograficia di M. Ricci* : 17.

Key to the genera of Tenuipalpidae

1. Adults and nymphs with 3 pairs of legs, palpus 1 segmented.....*Larvacarus*
   Adults and nymphs with 4 pairs of legs.....2

2. Hysterosoma with dorsocentral and 1 pair or without dorsosublateral setae; 1st and 2nd dorsocentral setae simple.....3
   Hysterosoma with 1 pair or without dorso sublateral or dorsocentral setae.....*Terminalichus*

3. Hysterosoma normally with penultimate pair of dorsolateral seta flagelliform...*Tenuipalpus*
   Hysterosoma normally with penultimate pair of dorsolateral setae of normal length.....*Brevipalpus*

Genus ***Brevipalpus*** Donnadieu

1875. *Brevipalpus* Donnadieu, *Recherches pour server a l'historie des Tetranyques,* pp. 143-144.

Key to species of Brevipalpus

1. Hysterosoma without dorsosublateral setae.....2
   Hysterosoma with dorsosublateral setae.....*pulchur*

2. Hystorosoma with 6 pairs dorsolateral setae.....*californicus*
   Hysterosoma with 5 pairs dorsolateral setae.....3

3. Tarsus with single, sensory rod.....*obovatus*
   Tarsus II with two sensory rods.....*phoenicis*

34. ***Brevipalpus californicus*** (Banks)

1904. *Tenuipalpus californicus,* Banks., *J. New York Ent. Soc.,* **12** : 55.
1981. *Brevipalpus californicus* : Nassar & Ghai, *Oriental Ins.,* **15**(4) : 387.
1985. *Brevipalpus californicus* : Gupta, *Handbook Plant Mites of India* : 125-126.

Hosts : In Delhi, this mite has been recorded from *Citrus* sp. and *Phaseolus vulgaris*. Besides, it has been collected from *Vitis vinifera* and *Mangifera indica*. In addition, this mite has been reported from 100 host plants (Gupta, 1985).

Distribution : India : Delhi, Punjab, West Bengal, Assam, Karnataka.

Remarks : This mite often poses problem as pest of *Citrus* and is known to suck sap not only from leaves but from fruits and young twigs as well. All these make the plants unhealthy and trees suffer fruit drops.

35. *Brevipalpus phoenicis* (Geijskes)

1939. *Tenuipalpus phoenicis* Geijskes, *Meded Handb. Hoogesch Wangningen,* **42** : 230.
1981. *Brevipalpus phoenicis* : Nassar & Ghai, *Oriental Ins.,* **15**(4) : 387-388.
1985. *Brevipalpus phoenicis* : Gupta, *Handbook Plant Mites of India* : 130-131.
1995. *Brevipalpus phoenicis* : Gupta, *State fauna series* 4 : *Fauna of Meghalaya* Part : 26.

Hosts : In Delhi this mite has been reported on *Musa paradisca, Ficus carica, Citrus aurantium, Psidium guajava, Prunus persica, Solanum melongena, Artocarpus heterophylla, Punica granatum, Morus sp., Eriobotrya japonica.*

Distribution : India : Delhi, Assam, Bihar, Meghalaya, West Bengal, Orissa, Punjab, Himachal Pradesh, Karnataka, Tamil Nadu, Maharashtra. *Elsewhere* : Kenya; Spain; Okinawa Island; Australia; Holland; Portugal; Syria; Italy; USA; Trinidad; Argentina; Brazil.

Remarks : This mite is one of the most serious Tenuipalpid mite species known to infest large number of fruit trees of which guava, peach, pear, citrus are most importnat. Excessive feeding by this mite makes the leaves yellowish first, later brownish and ultimately the trees suffer heavy defoliation.

36. *Brevipalpus obovatus* Donnadieu

1875. *Brevipalpus obovatus* Donnadieu, *Recherches pour. servi. alhistoria des Tetranyques* : 116.
1981. *Brevipalpus obovatus* : Nassar & Ghai, *Oriental Ins.,* **15**(4) : 388.
1985. *Brevipalpus obovatus* : Gupta, *Handbook Plant Mites of India* : 129-130.
1992. *Brevipalpus obovatus* : Gupta, *State fauna series 3, Fauna of West Bengal.* Part II : 93.

Hosts : In Delhi, this mite has been recorded on *Punica granatum, Ficus carica* and *Zizyphus* sp. In addition, Gupta (1985) listed a large number of hosts for this species.

Distribution : India : Delhi, Himachal Pradesh, Punjab, West Bengal. *Elsewhere* : Pakistan; Sri Lanka; Hawaii; U.S.A; Venezuela; Argentina; Canada; France; Spain; Cyprus; Israel; Iran; Egypt; South Africa; Australia; Japan.

Remarks : This mite although infests a large number of fruit trees but mainly it is known as pest of tea in India. Infested leaves turn pale yellow.

37. *Brevipalpus pulchur* (Canestrini & Fanzago)

1876. *Caligonus pulchur*, Canestrini & Fanzago, *Attiacc. Sci. ven. trent. istr.* **5** : 134.
1971. *Cynopalpus pulchur* : Menon *et al.*, *Indian J. Ent.,* **33** : 469-470.
1985. *Cynopalpus pulchur* : Gupta, *Handbook Plant Mites of India* : 132.

Hosts : In Delhi, this mite has been reported on *Pyrus malus*. Its other hosts in India and abroad have been listed in Gupta (1985).

Distribution : India : Delhi. *Elsewhere* : England; Denmark; Holland; Portugal; Austria;

Bulgaria; Iran; Syria; Germany; Italy; Cyprus; Lebanon; Algeria; Egypt; Israel; Turkey; Afghanistan; Georgia; Crimea; Transcaucasea; Soviet Union.

Remarks : This mite is not of much economic importance in India.

Genus ***Tenuipalpus*** Donnadieu

1875. *Tenuipalpus* Donnadieu, *Recherches pour Servir a l'histoire des Tetranyques* : 139-145.

Key to species of Tenuipalpus

1. Gnathosoma without ventral setae.....2
   Gnathosoma with 1 or 2 pairs of ventral setae.....3

2. Dorsum with strong reticulations and striation.....*punicae*
   Dorsum without reticulation.....*yousefi*

3. Dorsocentral setae 1 pair.....*granati*
   Dorsocentral setae 3 pairs.....4

4. Anterior medioventral metapodosomal setae 2 pairs.....5
   Anterior medioventral metapodosomal setae 1 pair.....6

5. Seta on femora IV 4-4-2-1.....*pernicis*
   Seta on femora IV 5-5-2-2.....*cissampelosa*

6. Dorsum with polygonal reticulation.....7
   Dorsum without polygonal reticulation.....8

7. 2nd dorsolateral hysterosomal pair reaching upto bases of 3rd dorsolateral pair.....*dimensus*
   2nd dorsolateral hysterosomal pair not reaching upto the bases of 3rd dorsolateral pair.....*pyrusae*

8. Dorsal body setae lanceolate.....*fici*
   Dorsal body setae not lanceolate.....*farisianus*

38. ***Tenuipalpus cissampelosa*** Maninder & Ghai

1978. *Tenuipalpus cissampelosa*, Maninder and Ghai, *Oriental Ins.*, **12** : 249-251.

1985. *Tenuipalpus cissampelosa* : Gupta, *Handbook Plant Mites of India* : 142.

Host : In Delhi; this mite has been recorded on *Apissampelosa parcera*.

Distribution : India : Delhi.

39. *Tenuipalpus dimensus* Chaudhri

1971. *Tenuipalpus dimensus* Chaudhri, *Pakistan. J. zool.*, **3** (2) : 205-207.

1978. *Tenuipalpus dimensus* : Maninder & Ghai, *Oriental Ins.*, **12** : 251.

Hosts : The only hosts on which this mite has been reported are *Pyrus malus* and *Pyrus persica*.

Distribution : India : Delhi. *Elsewhere* : Pakistan.

Remarks : No economic importance of this mite is known so far.

40. *Tenuipalpus faresianus* Maninder & Ghai

1985. *Tenuipalpus faresianus* Maninder & Ghai, *Oriental Ins.*, **12** : 251-253.

1985. *Tenuipalpus faresianus*, Gupta, *Handbook Plant Mites of India* : 142-143.

Host : The only host on which this mite has been reported in Delhi is *Acacia farnesiana*.

Distribution : India : Delhi.

Remarks : No economic importance of this species is known so far.

41. *Tenuipalpus fici* Maninder & Ghai

1978. *Tenuipalpus fici* Maninder & Ghai, *Oriental Ins.*, **12** : 253.

1985. *Tenuipalpus fici* : Gupta, *Handbook Plant Mites of India* : 143.

Host : The only host of this mite is *Ficus carica* in Delhi.

Distribution : India : Delhi.

42. *Tenuipalpus granati* (Sayed)

1942. *Tenuipalpus orchidarum* Sayed, *Bull. Soc. Foud. Ier. Ent.*, **26** : 96.

1971. *Tenuipalpus granati* : Menon, Ghai & Katiyar, *Indian. J. Ent.*, **33** : 469-470.

1985. *Tenuipalpus granati* : Gupta, *Handbook Plant Mites of India* : 143.

Hosts : In Delhi this mite has been collected on pomegranate, *Plumbago zeylanica*, Gupta (1985) listed other hosts from outside India.

Distribution : India : Delhi. *Elsewhere* : Egypt; Greece; Georgia.

Remarks : It is not known to cause any damage to host.

43. *Tenuipalpus pernicis* Chaudhri, Akbar & Rasool

1974. *Tenuipalpus pernicis* Chaudhri, Akbar & Rasool : 85.

1978. *Tenuipalpus pernicis* : Maninder & Ghai, *Oriental Ins.*, **12** : 255.

1985. *Tenuipalpus pernicis* : Gupta, *Handbook Plant Mites of India* : 146-147.

Hosts : The only hosts on which this mite has been recorded are *Trianethema microphila and Calotropis procera* in Delhi.

Distribution : India : Delhi. *Elsewhere* : Pakistan.

Remarks : No economic importance of this species is known.

44. *Tenuipalpus punicae* Pritchard & Baker

1958. *Tenuipalpus punicae* Pritchard & Baker. *Univ. Calif. Pub. Ent.*, **14** (3) : 240-242.

1981. *Tenuipalpus punicae* : Nassar & Ghai, *Oriental Ins.*, **15**(4) : 383-384.

1985. *Tenuipalpus punicae* : Gupta, *Handbook Plant Mites of India* : 147-148.

Hosts : In Delhi this mite has been reported on *Punica granatum, Prunus* sp. and *Psidium guajava*. Gupta (1985) included *Tecoma stans* as a host of this mite.

Distribution : India : Delhi, Punjab, Meghalaya. *Elsewhere* : Spain; Palestine.

Remarks : This is of no known economic importance.

45. *Tenuipalpus pyrusae* Maninder & Ghai

1978. *Tenuipalpus pyrusae* Maninder & Ghai, *Oriental Ins.*, **12** : 257-258.

1985. *Tenuipalpus pyrusae* : Gupta, *Handbook Plant Mites of India* : 148.

Hosts : *Pyrus malus and Pyrus communis.*

Distribution : India : Delhi.

Remarks : No economic importance of this mite is known.

46. *Tenuipalpus yousefi* Nassar & Ghai

1981. *Tenuipalpus yousefi* Nassar & Ghai, *Oriental Ins.*, **15** : 384-385.

1985. *Tenuipalpus yousefi*, Gupta, *Handbook Plant Mites of India* : 151.

Host : *Psidium guajava.*

Distribution : India : Delhi.

Remarks : No economic importance of this species is known.

Genus *Terminalichus* Anwarullah & Khan

1973. *Terminalichus* Anwarullah & Khan, *Prot. Acta Biol. (Ser.B)*, **12**(1-4) : 5.

Key to species of Terminalichus

1. Hysterosoma with prominent furrow.....2
   Hysterosoma without furrow.....*karachiensis*

2. 2nd pair of propodosomal setae more than 3 times as long as 3rd pair of propodosomal setae. .....*serratus*

\- 2nd pair of propodosomal setae less than 2 times as long as 3rd pair of propodosomal setae... .....*delhiensis*

47. ***Terminalichus delhiensis*** Maninder & Ghai

1978. *Terminalichus delhiensis* Maninder & Ghai, *Ind. J. Ent.*, **40** : 381.

1981. *Terminalichus delhiensis* : Nassar & Ghai, *Oriental Ins.*, **15** (4) : 381.

1985. *Terminalichus delhiensis* : Gupta, *Handbook Plant Mites of India* : 152.

Host : *Terminalia arjuna.*

Distribution : India : Delhi.

Remarks : This is not known to cause any damage to its host.

48. ***Terminalichus karachiensis*** Anwarullah & Khan

1973. *Terminalichus karachiensis* Anwarullah & Khan, *Proc. Acta Biol. (Ser.B)*, **12** (1-4) :5.

1971. *Terminalichus karachiensis* : Nassar & Ghai, *Oriental Ins.*, **15** (4) : 380.

1985. *Terminalichus karachiensis* : Gupta, *Handbook Plant Mites of India* : 152.

Hosts : *Terminalia arjuna, Psidium guajava.* Its other host is *Terminalia katappa* from Pakistan.

Distribution : India : Delhi. *Elsewhere* : Pakistan.

Remarks : It has no known economic importance.

49. ***Terminalichus serratus*** Nassar & Ghai

1981. *Terminalichus serratus* Nassar & Ghai, *Oriental Ins.*, **15** : 380-181.

1985. *Terminalichus serratus* : Gupta, *Handbook Plant Mites of India* : 153.

Host : *Psidium guajava.*

Distribution : India : Delhi.

Remarks : It is of no known economic importance.

Genus ***Larvacarus*** Baker & Pritchard

1952. *Larvacarus* Baker & Pritchard, *Proc. ent. Soc. Wash.*, **24** : 108.

50. ***Larvacarus transitans*** (Ewing)

1922. *Phytoptus transitans* Ewing, *Proc. Ent. Soc. Washington*, **24** : 108.

1952. *Larvacarus transitans* : Baker & Pritchard, *Proc. Ent. Soc. Wash.*, **54** : 132.

1985. *Larvacarus transitans* : Gupta, *Handbook Plant Mites of India* : 133.

1989. *Larvacarus transitans* : Ghai & Baker, *Progress in Acarology* (Eds. G.P. Channa Basavanna & C.A. Viraktamath). Oxford & IBH Pub., **2** : 81-90.
Host : *Zizyphus jujuba*.
Distribution : India : Delhi, Bihar, Rajasthan, Punjab.
Remarks : This mite is responsible for formation of reddish round galls on the young stems. In case of heavy infestation the trees suffer severe yield loss. This is especially a problem in Delhi and Rajasthan areas of north India.

Superfamily : ERIOPHYOIDEA Nalepa

Key to the families of Eriophyoidea

1. Rostrum of various sizes usually small in comparison to body size; feather claw small, simple or divided; female genital coverflap usually ribbed; mostly gall makers or rust mites.....Eriophyidae
Rostum large in comparison to body; feather claw often large, simple or deeply divided; female genital coverflap smooth, less often ribbed; mostly vagrants
.....Rhyncaphytoptidae (genus *Rhyncaphytoptus)*

Family : **ERIOPHYIDAE** Nalepa

1878. *Eriophydae* Nalepa, Das Tierreich, **4** : 5.

Key to subfamilies and genera of Eriophyidae

1. Body worm like, thanosomal rings subequal dorsoventrally, at least on anterior half of 2/3; shield typically lacking anterior lobe or with slight projection over rostrum bases, if anterior shield projection present over rostrum, then this extension is narrow basally, flexible and combined with narrow thanosomal rings.....Eriophyidae, 2
Body fusiform and fitted for exterior living, shield normally broad based and rigid anterior lobe over rostrum; thanosome typically divided laterally into broad and heavy dorsal tergites and narrow and soft sternites; if no anterior lobe present or only a slight one, then some form of tergal-sternal differentiation discernible, at least in larger dorsal microtubules; if no dorsoventral contrast present, then broad shield lobes present....
.....Phyllocoptindae, 5

2. Dorsal tubercle more or less ahead of rear shield margin and projecting dorsal setae ahead of some degree or tip; dorsal tubercle which are close to rear margin incline ahead, all have longitudinal axis.....*Phytoptus*
Dorsal tubercle on or very near shield margin with transverse basal axis directing setae to rear, usually divergently.....3

3. Rear part of thanosome with rings subequal, dorsoventral and divided into tergites and sternites.....4

- Rear 1/5th to 1/2 of thanosome with rings divided into broader tergites and narrower sternites.....*Paraphytoptus*

4. Dorsal shield seta situated on tubercles or usually ahead of rear shield margin pointing up necessarily, anteriorly.....*Eriophyes*
- Dorsal shield setae situated on tubercles on rear shield pointing backward over rostrum .....*Aceria*

5. Feather claw divided.....*Acaphylla*
Feather claw simple with central stem undivided.....6

6. Dorsal tubercle set more or less ahead of rear shield margin and directing seta ahead or diagonally centrad; if these tubercles are near margin, then they are sub-cylinderical and bent forward, or their axis are longitudinal or diagonal to body.....*Caleptrimerus*
Dorsal tubercles on or very near rear shield margin, directing setae to rear, usually, divergently; dorsal tubercle either sub-cylindrical or with axis at right angles to body.....7

7. Dorsum evenly arched transversely.....8
- Thanosome with central longitudinal ridge.....9

8. Thanosomal tergites usually broad and abruptly contrasting with narrower telosomal rings.....*Authocoptes*
- Thanosomal tergites narrowing to and blending with telosomal rings.....*Aeulops*

9. 4th tibial seta absent, 5 longitudinal wax bearing ridges on dorsum seperated moderately, broad furrow; dorsal tubercles on rear shield margin.....*Neocalacarus*
4th tibial seta present; thanosomal dorsum with atmost 3 ridges.....*Abacarus*

Genus *Aceria* Keifer

1944. *Aceria* Keifer, *Bull, Calif. Dep. Agr.*, **33** : 22.

Key to species of Aceria

1. Feather claw six rayed.....2
Feather claw less than six rayed.....6

2. Abdomen with over 60 rings.....3
   Abdomen with less than 60 rings.....*mangiferae*
3. Female genital cover flap with over 10 lines.....4
   Female genital cover flap with less than 10 lines.....*sorghi*

4. Female genital cover flap with 10-12 lines.....*cajani*
   Female genital cover flap with over 12 lines.....5

5. Submedian, represented at rear 3/4 of the shield.....*delhiensis*
   Submedian, represented uniformly on shield.....*balanitis*

6. Feather claw 5 rayed.....7
   Feather claw 4 rayed.....9

7. Female genital seta longer than length of genitalia.....*infectoriae*
   Female genital seta not longer than length of genitalia.....8

8. Coxae smooth.....*mori*
   Coxae truncated or granulated.....*ficus*

9. Genital shield with one or more longitudinal lines on mid shield, coxae truncated or granulated.....*nerii*
   Genital shield with one or more longitudinal lines on mid shield, coxae truncated or granulated.....10

10. Shield sides granulated or micro tuberculated.....11
    Shield sides not granulated or micro tuberculated.....*dalbergiae*

11. Coxae granulated.....*granati*
    Coxae smooth.....*lycopersici*

51. *Aceria balanitis* (Massee)

1927. *Eriophyes balanitis* Massee, *Ann. Mag. nat. Hist.*, **20** : 372.
1966. *Aceria balanitis* : ChannaBasavanna, *Univ. Agric. Sci. Bull.*, : 64-65.
1985. *Aceria balanitis* : Gupta, *Handbook Plant Mites of India* : 190.
Host : *Balanites aegyptica.*
Distribution : India : Delhi.

52. *Aceria cajani* ChannaBasavanna

1966. *Aceria cajani* ChannaBasavanna. *Univ. Agr. Sci. Bull.*, : 62-63.

1985. *Aceria cajani* : Gupta, *Handbook Plant Mites of India* : 191-192.

Host : *Cajanus cajan.*

Distribution : India : Delhi, Karnataka, Maharashtra, Gujarat, Punjab, Haryana, West Bengal, Bihar.

Remarks : This mite has been found to be a vector of pigeonpea sterility mosaic disease. The infested leaves become more greener than the normal leaves, smaller and velvety to touch. All the infested plants become sterile, resulting the yield to be nil.

53. *Aceria delhiensis* (Mohanasundaram)

1982. *Eriophyes delhiensis* Mohanasundaram, *Entomon*, 7 (4) : 431.

Host : Undetermined shrub.

Distribution : India : Delhi.

54. *Aceria dalbergiae* ChannaBasavanna

1966. *Aceria dalbergiae* ChannaBasavanna, *Univ. Agric. Sci. Bull,* : 82-83.

1985. *Aceria dalbergiae* : Gupta, *Handbook Plant Mites of India* : 193.

Host : *Dalbergia sissoo.*

Distribution : India : Delhi, Tamil Nadu.

Remarks : This mite produces whitish or pale yellowish warty patches on infected leaves; such patches later turn brown.

55. *Aceria ficus* (Cotte)

1920. *Eriophyes ficus* Cotte, *Bull. soc. Path. Veg.*, 7 : 26.

1966. *Aceria ficus* : ChannaBasavanna, *Univ. Agr. Sci. Bull.* : 71-72.

1985. *Aceria ficus* : Gupta, *Handbook Plant Mites of India* : 193-194.

Host : Fig.

Distribution : India : Delhi, Himachal Pradesh.

Remarks : This mite is an established vector of fig mosaic virus which causes mottling of leaves. Such leaves gradually wither and plants become stunted.

56. *Aceria granati* Canestrini and Masalongo

1894. *Phytoptus granati*, Canestrini & Masalongo, *Atti. Soc. Veneto. Trent,* 2(2) : 465.

1966. *Aceria granati* : ChannaBasavanna, *Univ. Agric. Sci. Bull.* : 80.

1895. *Aceria granati* : Gupta, *Handbook Plant Mites of India* : 194-195.
Host : Pomegranate.
Distribution : India : Delhi, Karnataka, Tamil Nadu.
Remarks : This mite is known to cause tight rolls at edges of leaves. The infested leaves become thinner and later become highly deformed.

57. *Aceria infectoriae* ChannaBasavanna

1966. *Aceria infectoriae* ChannaBasavanna, *Univ. Agric. Sci. Bull.* : 70-71.
1985. *Aceria infectoriae* : Gupta, *Handbook Plant Mites of India* : 195.
Host : *Ficus infectoria.*
Distribution : India : Delhi, West Bengal, Tamil Nadu.

58. *Aceria lycopersici* (Wolff)

1879. *Phytoptus lycopersici* Wolff, *Momatscher Gartonb.*, **22** : 424.
1966. *Aceria lycopersici* : ChannaBasavanna, *Univ. Agric. Sci. Bull.* : 80-82.
1985. *Aceria lycopersici* : Gupta, *Handbook Plant Mites of India* : 197-198.
Hosts : Brinjal, tomato.
Distribution : India : Delhi, Punjab, West Bengal, Tamil Nadu, Karnataka. *Elsewhere* : Cosmopolitan.
Remarks : This species is known to cause excessive growth of hairs (erineum) on under surface of leaves. The affected plants turn greyish white.

59. *Aceria mangiferae* Sayed

1946. *Aceria mangiferae* Sayed, *Bull. Soc. Fouad. Ler. Ent. Egypte,* **30**: 7-10.
1966. *Aceria mangiferae* : ChannaBasavanna, *Univ. Agric. Sci. Bull.* : 60.
1985. *Aceria mangiferae* : Gupta, *Handbook Plant Mites of India* : 108-200.
Host : *Mangifera indica.*
Distribution : India : Delhi, Haryana, Bihar, Punjab, West Bengal, Karnataka, Tamil Nadu. *Elsewhere* : Egypt; S. Asia; Brazil.
Remarks : This is considered to be one of the most serious pests among the Eriophyid mites and is incriminated with malformation of mango. This disease is most serious in the sense that the trees do not bear fruits.

60. *Aceria mori* (Keifer)

1939. *Eriophyes mori* Keifer, *Calif. Dep. Agr.*, **30** : 206.
1966. *Aceria mori* : ChannaBasavanna, *Univ. Agric. Sci. Bull.* : 71.

1985. *Aceria mori* : Gupta, *Handbook Plant Mites of India* : 200.
Host : Mulberry.
Distribution : India : Delhi, Punjab.

61. ***Aceria nerii*** ChannaBasavanna

1966. *Aceria nerii* ChannaBasavanna, *Univ. Agric., Sci. Bull.* : 78-79.
1985. *Aceria nerii* : Gupta, *Handbook Plant Mites of India* : 201.
Hosts : *Nerium odorum* and *Nerium indicum.*
Distribution : India : Delhi, Punjab, West Bengal, Karnataka, Tamil Nadu.

62. ***Aceria sorghi*** ChannaBasavanna

1966. *Aceria sorghi* ChannaBasavanna, *Univ. Agric. Sci. Bull.* : 63-64.
1985. *Aceria sorghi* : Gupta, *Handbook Plant Mites of India* : 204.
Host : *Sorghum vulgare.*
Distribution : India : Delhi, Tamil Nadu.

Genus ***Eriophyes*** von Siebold

1851. *Eriophyes* von Siebold, *Schles. Ges.*, **28** : 89.

63. ***Eriophyes prosopidis*** Saxena

1942. *Eriophyes prosopidis* Saxena, *Indian J. Ent.*, **4** : 215.
1966. *Eriophyes prosopidis* : ChannaBasavanna, *Univ. Agric. Sci. Bull.* : 126.
1985. *Eriophyes prosopidis* : Gupta, *Handbook Plant Mites of India* : 209.
Host : *Prosopis spicigera.*
Distribution : India : Delhi.

Genus ***Paraphytoptus*** Nalepa

1896. *Paraphytoptus* Nalepa, *Anz. Acad. Wiss. Wien.*,**33** : 55.

64. ***Paraphytoptus chrysanthemi*** Keifer

1940. *Paraphytoptus chrysanthemi* Keifer, *Bull. Calif. Dep. Agr.*, **29** : 27.
1966. *Paraphytoptus chrysanthemi* : ChannaBasavanna, *Univ. Agric. Sci. Bull.* : 87-88.
1985. *Paraphytoptus chrysanthemi* : Gupta, *Handbook Plant Mites of India* : 210.
Host : Chrysanthemum.
Distribution : India : Delhi, Tamil Nadu, Karnataka.

Genus ***Phytoptus*** Dujardin

1851. *Phytoptus* Dujardin, *Ann. Sci. Nat. 3. zool.*, **15** : 166.

Key to species

1. Coxal area granular or with scorings.....*ficivorus*
   Coxal area smooth without markings.....*terminaliae*

65. ***Phytoptus ficivorus*** (ChannaBasavanna)

1966. *Eriophyes ficivorus* ChannaBasavanna, *Univ. Agric. Sci. Bull.*, : 49-50.
1985. *Phytoptus ficivorus* : Gupta, *Handbook Plant Mites of India* : 214.
Host : *Ficus infectoriae.*
Distribution : India : Delhi.

66. ***Phytoptus terminaliae*** (ChannaBasavanna)

1966. *Eriophyes terminaliae* ChannaBasavanna, *Univ. Agric. Sci. Bull.* : 47-48.
1985. *Phytoptus terminaliae* : Gupta, *Handbook Plant Mites of India* : 217-218.
Hosts : *Terminalia arjuna* and *Terminalia catappa.*
Distribution : India : Delhi, Punjab, West Bengal.

Genus ***Acaphylla*** Keifer

1943. *Acaphylla* Keifer, *Bull. Calif. Dep. Agric.*, **32** : 214.

67. ***Acaphylla syzygii*** ChannaBasavanna

1966. *Acaphylla syzygii* ChannaBasavanna, *Univ. Agric. Sci. Bull.* : 90-91.
1985. *Acaphylla syzygii* Gupta, *Handbook Plant Mites of India* : 220-221.
Host : *Syzygium operculatum.*
Distribution : India : Delhi.

Genus ***Calepitrimerus*** Keifer

1938. *Calepitrimerus* Keifer, *Bull. Calif. Dep. Agric.*, **27** : 310.

68. ***Calepitrimerus azadirachtae*** ChannaBasavanna

1966. *Calepitrimerus azadirachtae* ChannaBasavanna, *Univ. Agric. Sci. Bull.* : 98-99.
1985. *Calepitrimerus azadirachtae* : Gupta, *Handbook Plant Mites of India* : 234-235.
Host : *Azadirachta indica.*
Distribution : India : Delhi, Karnataka.

Genus : ***Abacarus*** Keifer

1944. *Abacarus* Keifer, *Bull. Calif. Dep. Agr.*, **33** (1) : 28.

Key to species of Abacarus

1. Shield with median line absent .....*sacchari*
   Shield with median line present.....*delhiensis*

69. ***Abacarus delhiensis*** ChannaBasavanna

1966. *Abacarus delhiensis* ChannaBasavanna, *Univ. Agric. Sci. Bull.* : 118-119.
1985. *Abacarus delhiensis* : Gupta, *Handbook Plant Mites of India* : 249.
Host : *Saccharum spontaneum.*
Distribution : India : Delhi, Tamil Nadu.

70. ***Abacarus sacchari*** ChannaBasavanna

1966. *Abacarus sacchari* ChannaBasavanna, *Univ. Agric. Sci. Bull.* : 117-118.
1985. *Abacarus sacchari* : Gupta, *Handbook Plant Mites of India* : 250.
Host : Sugarcane.
Distribution : India : Delhi, Bihar, West Bengal, Karnataka, Tamil Nadu.

Genus : ***Aculops*** Keifer

1966. *Aculops* Keifer, *Eriophyid studies, Calif. Dep. Agric.*, B-21 : 9.

71. ***Aculops kumari*** Mohanasundaram

1985. *Aculops kumari* Mohanasundaram, *Entomon*, **7** (4) : 431-433.
1985. *Aculops kumari* : Gupta, *Handbook Plant Mites of India* : 253.
Host : Undetermined plant.
Distribution : India : Delhi.

Genus ***Anthocoptes*** Nalepa

1892. *Anthocoptes* Nalepa, *Anz, Acad. Wiss. Wien.*, **29** (5) : 16.

72. ***Anthocoptes adhatodae*** ChannaBasavanna

1966. *Anthocoptes adhatodae* ChannaBasavanna, *Univ. Agric. Sci. Bull.* : 105.
1985. *Anthocoptes adhatodae* : Gupta, *Handbook Plant Mites of India* : 259.
Host : *Adhatoda vasica.*

Distribution : India : Delhi, Tamil Nadu.

Genus ***Neocalacarus*** ChannaBasavanna

1966. *Neocalacarus* ChannaBasavanna, *Univ. Agric. Sci. Bull.* : 100.

73. ***Neocalacarus mangiferae*** ChannaBasavanna

1966. *Neocalacarus mangiferae* ChannaBasavanna, *Univ. Agric. Sci. Bull.* : 101-102.
1985. *Neocalacarus mangiferae* : Gupta, *Handbook Plant Mites of India* : 267-268.
Host : Mango.
Distribution : India : Delhi, Karnataka, Tamil Nadu.

Family : **RHYNCAPHYTOPTIDAE** Keifer

1961. *Rhyncaphytoptidae* Keifer, *Eriophyid Studies, Calif. Dep. Agr.*, B-4 : 20.

Genus ***Rhyncaphytoptus*** Keifer

1939. *Rhyncaphytoptus* Keifer, *Bull. Calif. Dep. Agric.*, **28** : 149.

74. ***Rhyncaphytoptus ficifoliae*** Keifer

1939. *Rhyncaphytoptus ficifoliae* Keifer, *Bull. Calif. Dep. Agric.*, **28** : 149.
1966. *Rhyncaphytoptus ficifoliae* : Keifer, ChannaBasavanna, *Univ. Agric. Sci. Bull.* : 123.
1985. *Rhyncaphytoptus ficifoliae* : Gupta, *Handbook Plant Mites of India* : 281-282.
Host : *Ficus carica*.
Distribution : India : Delhi.

Family : **CHEYLETIDAE** Leach

1815. *Cheyletidae* Leach, *Trans. Linn. Soc. Lond.*, **11** : 399.

Key to genera of Cheletidae

1. Leg I normal with 2 claws.....*Cheyletus*
Leg I sensory organ without claws.....*Cheletogenes*

Genus ***Cheletogenes*** Oudemans

1905. *Cheletogenes* Oudemans, *Ent. Ber. Nederl. Ver.*, **1** (21) : 208.

75. ***Cheletogenes ornatus*** Canestrini & Fanzago

1876. *Cheletogenes ornatus* Canestrini & Fanzago, *Att. Soc. Vencto-Trentica* : 106.

1905. *Cheletogenes ornatus* : Oudemans, *Ent. Ber. Niderl. ver.*, **1**(21) : 208.
1960. *Cheletogenes ornatus* : Narayanan, Kaur & Ghai, *Proc. Nat. Inst. Sci.*, **26** : 390.
1985. *Cheletogenes ornatus* : Gupta, *Handbook Plant Mites of India* : 300.

Hosts : In Delhi, this mite has been recorded on mango, while the other host of this species is fig (Gupta, 1985).

Distribution : India : Delhi, Punjab. *Elsewhere* : Italy; China; Hawaii; West Indies; Australia; U.S.A.; Galapagos Islands.

Remarks : This mite has often been seen amidst mango bud mite *(Aceria mangiferae)* feeding upon them and therefore keeps effective check on its population.

Genus ***Cheyletus*** Latreille

1976. *Cheyletus* Latreille, *Precis des caractes generiques des insects, An.* : 179.

76. ***Cheyletus malaecensis*** Oudemans

1904. *Cheyletus malaecensis* Oudemans, *Ent. Ber. Nat. Ver.*, : 84.
1974. *Cheyletus malaecensis* : Prasad, *A Catalogue of Mites of India* : 105.

Material examined : One ♀ specimen of this species was collected at Delhi, IARI campus on guava, November 1992, coll. S.K.G.

Distribution : India : Delhi, Kerala, West Bengal, Bihar. *Elsewhere* : Cosmopolitan.

77. ***Cheyletus*** sp.

Material examined : Two ♂♂ specimens were collected on an ornamental plant at I.A.R.I. campus, New Delhi, coll. S.K.Gupta, January 1993.

Family : **STIGMAEIDAE** Oudemans

1931. *Stigmaeidae* Oudemans, *Ent. Ber.*, **8**(179) : 251-263.

78. ***Agistemus fleschneri*** Summers

Material examined : Two ♀♀, of the speceis were collected on guava in January 1992 from Delhi, IARI Campus, coll. S.K.Gupta.

Distribution : India : Delhi, Punjab, West Bengal, Meghalaya. *Elsewhere* : U.S.A.; Mexico; Chile.

Remarks : This is an important predator and has often been seen in the field voraciously feeding on both tetranychid and tenuipalpid species mainly infesting fruit trees. Field observations recorded in various parts of the country indicate that proper utilization of this predator will be quite profitable in biological control programme in India.

Family : **TYDEIDAE** Kramer

1877. *Tydeidae* Kramer, *Arch. Naturg.*, **43** : 232-246.

Genus ***Pronematus*** Canestrini

1886. *Pronematus* Canestrini, *Atti Ist. Venet,* (6)**4** : 698.

Key to species of Pronematus

1. Solenidion on tarsus I distal.....*fleschneri*
   Solenidion on tarssus I median.....*sextoni*

79. ***Pronematus fleschneri*** Baker

1968. *Pronematus fleschneri* Baker, *Ann. Ent. Soc. Amer.*, **61** : 1092.

1985. *Pronematus fleschneri* : Gupta, *Handbook Plant Mites of India* : 308.

Host : Citrus.

Distribution : India : Delhi, Punjab, Bihar, West Bengal. *Elsewhere* : Belgian Congo.

Remarks : This is an important predatory mite which has been seen feeding on the eggs of citrus mite, *Eutetranychus orientalis*. Hence, it is likely to be of economic importance in biological control programme in India.

80. ***Pronematus sextoni*** Baker

1968. *Pronematus sextoni* Baker, *Ann. Ent. Soc. Amer.*, **61** : 1092.

1982 *Pronematus sextoni* : Dhooria, *Acar. News,* **11**: 6.

1985. *Pronematus sextoni* : Gupta, *Handbook Plant Mites of India* : 308-309.

Host : *Citrus*.

Distribution : India : Delhi. *Elsewhere* : Belgian Congo.

Remarks : Dhooria (1982) reported this mite as predator feeding upon *Eutetranychus orientalis*.

Family : **RAPHIGNATHIDAE**

81. ***Raphignathus*** sp.

Material examined : One undetermined species of this genus was collected on grass in Delhi during January 1991, coll : S.K.Gupta.

Family : **BDELLIDAE** Duges

Genus ***Bdellodes*** Oudemans

1937. *Bdellodes* Oudemans, *Kritich Hist. Overzicht der Acarologie,* **3**(c) : 1217.

82. ***Bdellodes*** sp.

Material examined : An undetermined and damaged specimen of *Bdellodes* was collected from Mango at IARI campus, Delhi in October, 1992. coll. S.K.Gupta.

Family : **CUNAXIDAE** Thor

Genus ***Cunaxa*** von Heyden

1826. *Cunaxa* von Heyden, *Isis* (Oken), **18** : 609.

83. ***Cunaxa*** sp.

Material examined : A damaged specimen of *Cunaxa* sp. was collected on *Amaranthus* in Delhi during September 1990, coll. S.K.Gupta.

Family : **ERYTHRAEIDAE** Robineau-Desvoidy

1828. *Erythraeidae* Robineau-Desvoidy, *K.H.O.A. III D* : 144.

Key to subfamilies, genera and species of Erythraeidae

1. 2 eyes on either side.....Erythraeinae, 3
   1 eye on either side.....2

2. Eyes anterior to crista.....Leptinae, *Leptus*
   Eyes behind middle of crista.....Callidosomatinae, 4

3. Legs with highly modified serrate setae.....*Paraerythraeus*
   Legs without serrate setae.....*Erythraeus*

4. Palp tarsus greatly enlarged globular or pyriform and extending beyond palpal. tibial, claw.....*Sphaerolophus*
   Palp tarsus not greatly enlarged, or normal or nearly normal structure, not over reaching palp tibial claw or only slightly over reaching palp, tibial claw.....*Abrolophus*

Genus ***Sphaerolophus*** Berlese

1885. *Rhyncolophus* Berlese, *A.M.S.*, **18** : 7.

1910. *Sphaerolophus* : Berlese, *Redia,* **6** : 349.

Key to species of Sphaerolophus

1. Palp tarsus pyriform.....*gigas*
   Palp tarsus spherical.....*delhiensis*

84. ***Sphaerolophus delhiensis*** Khot

1965. *Sphaerolophus delhiensis* Khot, *Acarologia*, **7** : 66.
1985. *Sphaerolophus delhiensis* : Gupta, *Handbook Plant Mites of India* : 322.
Host : Cotton.
Distribution : India : Delhi.

85. ***Sphaerolophus gigas*** Khot

1965. *Sphaerolophus gigas* Khot, *Acarologia*, **7** : 64.
1985. *Sphaerolophus gigas* : Gupta, *Handbook Plant Mites of India* : 322.
Host : Sugarcane.
Distribution : India : Delhi.

Genus ***Abrolophus*** Berlese

1891. *Abrolophus* Berlese, *A.M.S.*, **59** (1) : 2.

Key to species of Abrolophus

1. Ist tarsus 3 3-1/2 times as long as wide.....*ripicola*
   Ist tarsus 2 2-1/2 times as long as wide.....*delhiensis*

86. ***Abrolophus delhiensis*** Khot

1965. *Abrolophus delhiensis* Khot, *Acarologia*, **7**: 71.
1985. *Abrolophus delhiensis* : Gupta, *Handbook Plant Mites of India* : 322.
Host : Sugarcane.
Distribution : India : Delhi.

87. ***Abrolophus ripicola*** Womersley

1934. *Abrolophus ripicola* Womersely, *Rec. S.Aust. Mus.*, **7** : 228.
1965. *Abrolophus ripicola* : Khot, *Acarologia*, **7** : 71.
1985. *Abrolophus ripicola* : Gupta, *Handbook Plant Mites of India* : 324.
Host : Orchid.
Distribution : India : Delhi.

Genus ***Leptus*** Latereille

1796. *Leptus* Latereille, *K.H.O.A.* II : 177.

88. ***Leptus indicus*** Khot

1964. *Leptus indicus* Khot, *Acarologia,* **6** : 682.
1974. *Leptus indicus,* Prasad, *A Catalogue of Mites of India* : 73.
Host : Debris.
Distribution : India : Delhi.

89. ***Leptus ovatus*** Khot

1964. *Leptus ovatus* Khot, *Acarologia,* **6** :686.
1974. *Leptus ovatus* : Prasad, *A Catalogue of Mites of India* : 73.
Host : Debris.
Distribution : India : Delhi.

Genus ***Erythraeus*** Letreille

1806. *Erythraeus* Letreille, *K.H.O.A.,* III D : 146.

90. ***Erythracus plumosus*** Khot

1963. *Erythraeus plumosus* Khot, *Acarologia,* **5** : 240.
1985. *Erythraeus plumosus* : Gupta, *Handbook Plant Mites of India* : 325.
Host : Grass.
Distribution : India : Delhi.

Genus ***Paraerythraeus*** Southcott

1946. *Paraerythraeus* Southcott, *Proc. Linn. Soc. N.S.W.,* **71** (1-2) : 11.

91. ***Paraerythraeus serratociliatus*** Khot

1963. *Paraerythraeus serratociliatus* Khot, *Acarologia,* **5** : 236.
1985. *Paraerythraeus serratociliatus* : Gupta, *Handbook Plant Mites of India* : 326.
Host : Grass.
Distribution : India : Delhi.

Genus ***Microsmaris*** Khot

92. ***Microsmaris pinnata*** Khot

1963. *Microsmaris pinnata* Khot, *Acarologia*, **5** : 557.
1974. *Microsmaris pinnata*, Prasad, *A Catalogue of Mites of India* : 74.
Host : Debris.
Distribution : India : Delhi, Rajasthan.

Family : **ASCIDAE** Voigts & Oudemans

Key to genera of Ascidae

1. Corniculi long, convergent distally, lying close to one another, ventral denticles on gnathosoma often reduced, fixed digit of chelicera with a memberanous lobe in place of *pilus dentilis*.....*Melichares*
Corniculi soft, parallel or divergent, ventral denticles on gnathosoma well developed with 5 or more transverse rows; fixed digit & chelicera with unifrom *pilus dentilis*.....*Lasioseius*

Genus ***Malichares*** Hering

1839. *Melichares* Hering, *Acta Acad. Caes, Leop car. Nat. Cur.*, **18** : 626.

93. ***Melichares fici*** Narayanan & Ghai

1964. *Melichares (Melichares) fici* Narayanan & Ghai, *Proc. Nat. Inst. Sci. India*, **29** B (5) : 549-550.
1985. *Melichares (Melichares) fici*, Gupta, *Handbook Plant Mites of India* : 330.
Host : Fig.
Distribution : India : Delhi.
Remarks : This mite was collected in association with Hymenopterous insects inside the fruit of *Ficus infectoria*.

94. ***Blatisocius*** sp.

Material examined : An undetermined species of *Blatisocius* was collected from malformed mango twig in Delhi during November 1992. coll : S.K.Gupta.

Genus ***Lasioseius*** Berlese

1916. *Lasioseius* Berlese, *Redia*, **12** : 34.

95. ***Lasioseius terrestris*** Menon & Ghai

1968. *Lasioseius terrestris* Menon & Ghai, *Ind. J. Ent.*, **30** : 77-79.
1985. *Lasioseius terrestris* : Gupta, *Handbook Plant Mites of India* : 331.

Host : Wheat.

Distribution : India : Delhi.

Remarks : Though this mite was reported to be associated with *Petrobia latens* but it is not known to feed upon it.

Family : **OTOPHEIDOMENIDAE** Treat

96. ***Hemipteroseuis indicus*** (Krantz & Khot)

1962. *Treatia indica* Krantz & Khot, *Acarologia*, **4** : 536-541.
1965. *Hemipteroseius indicus* : Treat, *Acarlogia,* **7** : 2-3.
1974. *Hemipteroseius indicus* : Prasad, *A Catalogue of Mites of India* : 176.

Host : Associated with red cotton bug, *Dysdercus koenigii*.

Distribution : India : West Bengal, Delhi.

Family : **PHYTOSEIIDE** Berlese

1952. *Phytoseiidae* Baker & Wharton; *An Introduction to Acarology* : 87.

Key to subfamilies, genera, subgenera and species of Phytoseiidae

1. Prolateral setae 4 pairs, in all 6-9 pairs of lateral setae, preanal setae 3 pairs ....Amblyseiinae, *Amblyseius*, 3

\- Preanal setae 5 or more pairs, in all 9-12 pairs of lateral setae, preanal setae 3-7 pairs.....Phytoseiinae, 2

2. r_3 on dorsal shield, genu II with 7 setae, genu III with 6 setae.....*Phytoseius*, 5

r_3 on lateral integument, genu II with 7 or 8 setae, genu III with 6 or 7 setae.....*Typhlodromus*, 6

3. Sternal shield distinct and straight or concave posteriorly, ventri anal shield approximately shield -shaped or pentagonal.....4

Sternal shield indistinct may be trilobed posteriorly, ventrianal shield elongate, vase shaped or concave laterally.....*A. (euseius)*, 9

4. Z_5 and Z_4 distinctly serrate, sternal shield as wide as or wider than long, macroseta may be present on genu I and genu II and genu III.....A.*(Typhlodromips) mangiferae*

Z_5 and Z_4 mostly smooth, sternal shield longer than wide, genu I, II, III without macroseta.....*A. (neoseuilus)*, 8

5. R_1 present.....*P. (Pennaseius) minutus*

R_1 absent.....*P. (Phytoseius) macropilis*

6. Dorsal shield with 11 pairs of setae ..... *T. (Typhloctonus) nesbitii*
Dorsal shield with less than 11 pairs of setae.....7

7. Dorsal shield with 10 pairs of setae.....*T. (Amblydromella)* ,11
Dorsal shield with less than 10 pairs of setae.....*T. (Brethria)*, 12

8. Fixed digit of chelicera with 3 teeth & ventrianal shield more or less pentagonal.....*indicus*
Fixed digit of chelicera with 2 teeth & ventrianal shield more or less triangular....*cucuneris*

9. Seta j_1 and j_5 either equal or j_5 longer than j_1.....10
j_1 longer than j_5.....*finlandicus*

10. Seta S_2 noticeably longer than Z_1.....*alstoniae*
S_2 & Z_1 almost equal.....*delhiensis*

11. Seta Z_5 knobbed & serrate.....*darjeelingensis*
Seta z_5 not knobbed but may be serrate.....*rhenanus*

12. Ventrianal shield very long almost 2 times as long as wide, lateral margins straight.....*roshanlali*
Ventrianal shield only slightly longer than wide, lateral margins slightly concave.....*confusus*

Genus ***Amblyseius*** Berlese

1914. ***Amblyseius*** Berlese, *Redia*, **10** : 143.

97. *Amblyseius (Euseius) alstoniae* Gupta

1975. *Amblyseius alstoniae* Gupta, *Internat. J. Acarol.*, **1** (2) : 31-32.
1980. *Amblyseius alstoniae* : Dhooria, *Acarol. Newsl.*, **10** : 5.
1986. *Amblyseius (Euseius) alstoniae* : Gupta, *Fauna of India* : 74-76.

Hosts : *Citrus*, in addition to several other hosts reported from other parts of the country (Gupta, 1986).

Distribution : India : Delhi, West Bengal, Orissa, Bihar, Tripura, Sikkim, Rajasthan, Gujarat, Madhya Pradesh, Jammu and Kashmir, Punjab, Tamil Nadu.

Remarks : Dhooria (1980) reported this species as effective predator of citrus mite

98. ***Amblyseius (Euseius) delhiensis*** Narayanan & Kaur

1960. *Typhlodromus (A.) delhiensis* Narayanan & Kaur, *Proc. Ind. Acad. Sci.*, **51** : 5-7.
1986. *Amblyseuis (Euseius) delhiensis* : Gupta, *Fauna of India,* : 82-84.
Hosts : *Citrus* sp., *Abelmoschus esculentus, Gossypium* sp.
Distribution : India : Delhi, Uttar Pradesh, West Bengal.

99. ***Amblyseuis (Eusesius) finlandicus*** (Oudemans)

1950. *Seiulus finlandicus* Oudemans, *Ent. Ber.*, **4** : 183.
1967. *Amblyseius hibisci* : Ghai & Menon, *Oriental Ins.*, : **1**: 71.
1986. *Amblyseius finlandicus* : Gupta, *Fauna of India* : 86-88.
Hosts : *Coleus* sp., *Coloeasia esculentum, cotton.*
Distribution : India : Delhi, Punjab, Himachal Pradesh, Jammu and Kashmir, Uttar Pradesh, West Bengal. *Elsewhere* : Cosmopolitan.
Remarks : This is one of the important predatory mites and was often seen to feed upon *Tetranychus ludeni, Eutetranychus orientalis* and *Tetranychus urticae,* infesting various crops.

100. ***Amblyseius (Neoseiulus) cucumeris*** Oudemans

1930. *Typhlodromus cucumeris* Oudemans, *Acarol. Anat. Ent. Bericht.*, **8** : 16-17.
1959. *Ablyseius cucumeris* : Narayanan & Khot, *Proc. Indian Sci. Congr.*, **46** : 411.
1974. *Amblyseius cucumeris* : Prasad : 162.
Host : *Citrus* sp.
Distribution : India : Delhi, Punjab.
Remarks : This mite was found feeding upon *Oligonychus mangiferae.*

101. ***Amblyseius (Neosiulus) indicus*** (Narayanan & Kaur)

1960. *Typhlodromus (A.) indicus* Narayanan & Kaur, *Proc. Ind. Acad. Sci.*, **51 B** : 2-5.
1986. *Amblyseius (N.) indicus* : Gupta, *Fauna of India* : 112-114.
Hosts : Maize, potato and paddy, feeding on *Tyrophagus putrescentiae.*
Distribution : India : Delhi, West Bengal, Punjab.

102. ***Amblyseius (Typhlodromips) mangiferae*** Ghai & Menon

1967. *Amblyseius mangiferae* Ghai & Menon, *Oriental Ins.*, **1** : 74-75.
1986. *Amblyseius (Typhlodromips) mangiferae* : Gupta, *Fauna of India* : 168.
Host : Malformed mango.
Distribution : India : Delhi.

Genus ***Phytoseius*** Ribaga

1904. *Phytoseius* Ribagà, *Riv. Pat. Veg.*, **10** : 177.

Subgenus ***Pennaseius*** Pritchard & Baker

1962. *Pennaseius* Pritchard and Baker, *Hilgardia*, **33** : 223.

103. ***Phytoseius (Pennaseius) minutus*** Narayanan, Kaur & Ghai

1960. *Phytoseius minutus* Narayanan, Kaur & Ghai, *Proc. Nat. Ins. Sci.*, **26B**(6) : 391-392.

1986. *Phytoseius (Pennaseius) minutus* : Gupta, *Fauna of India* : 223-225.
Host : *Hibiscus esculentus.*
Distribution : India : Delhi, Punjab, Himachal Pradesh.

Subgenus ***Phytoseius*** Ribaga

1904. *Phytoseius* Ribaga, *Riv. Pat. Veg.*, **10** : 177.

104. ***Phytoseius (Phytoseius) macropilis*** (Banks)

1909. *Sejus macropilis* Banks, *Proc. Ent. Soc. Wash.*, **11** : 135.

1960. *Phytoseius macropilis* : Narayanan, Kaur & Ghai, *Proc. Nat. Inst. Sci.*, **26** (B) : 386-387.

1986. *Phytoseius (P) macropilis* : Gupta, *Fauna of India* : 240-242.
Hosts : Fig, *Lantana camera,* mulberry.
Distribution : India : Delhi, Orisssa, Arunachal Pradesh. *Elsewhere* : Cosmopolitan.

Genus ***Typhlodromus*** Scheuten

1857. *Typhlodromus* Scheuten, *Arch. Naturges,* **23** : 111.

Subgenus ***Amblylromella*** Muma

1961. *Amblylromella* Muma, *Bull. Fla. St. Mus.*, **5** (7) : 294.

105. ***Typhlodromus (Amblydromella) darjeelingensis*** Gupta

1986. *Typhlodromus (Amblydromella) darjeelingensis* Gupta, *Fauna of India* : 270-272.
Host : Grapevine.
Distribution : India : Delhi, West Bengal, Tripura, Karnataka, Tamil Nadu.
Remarks : Narayanan, Kaur & Ghai (1960) reported *Typhlodromus (Typhlodromus) bakeri* from Delhi collected on grape vine. Gupta (1986) while revising this family treated *Typhlodromus bakeri* Narayanan, Kaur & Ghai (1960) as misidentification and put it under *Typhlodromus darjeelingensis,* which was described by him as new to science.

106. ***Typhlodromus (Amblydromella) rhenanus*** (Oudemans)

1905. *Seiulus rhenanus* Oudemans, *Tij. Ent.*, **48** : 78.
1964. *Typhlodromus (Typhlodromus) rhenanus* : Narayanan, Kaur & Ghai, *Proc. Nat. Inst. Sci.*, **29** B: 539-541.
1986. *Typhlodromus (Amblydromella) rhenanus* : Gupta,*Fauna of India* : 285-287.
Host : Malformed mango.
Distribution : India : Delhi, Punjab, Himachal Pradesh, Jammu and Kashmir. *Elsewhere :* U.S.A.; Russia; U.K; Canada; Israel; Netherlands; France; Belgium.

Subgenus ***Brethria*** Tuttle & Muma

1973. *Brethria* Tuttle & Muma, *Tech. Bull. Agr. Exp. sta. Univ. Arizona,* **208** : 35.

107. ***Typhlodromus (Brethria) confusus*** Narayanan, Kaur & Ghai

1960 *Typhlodromus (Typhlodromus) confusus* Narayanan, Kaur & Ghai. *Proc. Nat. Inst. Sci.*, **26** B (6) : 392-393.
1986. *Typhlodromus (Brethria) confuses* : Gupta, *Fauna of India* : 293-294.
Host : Sunflower.
Distribution : India : Delhi.

108. ***Typhlodromus (Brethria) roshanlali*** Narayanan & Ghai

1964. *Typhlodromus (Typhlodromus) roshanlali* Narayanan & Ghai, *Proc. Nat. Inst. Sci.*, **29** B (5) : 539.
1986. *Typhlodromus (Brethria) roshanlali* : Gutpa, *Fauna of India*, : 294-296.
Host : Sunflower.
Distribution : India : Delhi.

Subgenus ***Typhloctonus*** Muma

1961. *Typhloctonus* Muma, *Bull. Fla. St. Mus.*, **5** (7) : 299.

109. ***Typhlodromus (Typhloctonus) nesbitti*** Womersley

1954. *Typhlodromus nesbitti* Womersley, *Aust. J. Zool.*, **2** : 179-180.
1964. *Typhlodromus (Typhlodromus) nesbitti* : Narayanan & Ghai, *Proc. Nat. Inst. Sci.*, **29**(5) : 541-542.
1986. *Typhlodromus (Typhloctonus) nesbitti* : Gupta, *Fauna of India* : 312-314.
Host : Mango malformations.
Distribution : India : Delhi. *Elsewhere* : Australia.

Family : **ACARIDAE** Ewing & Nesbitt

Key to genera of Acaridae

1. External vertical setae small, ve arising near the anterior angles of the dorsal propodosomal shield at the same level of vi or slightly posterior.....2
   Seta ve rudimentary or absent or when present arising near middle of lateral edge of propodosomal shield.....*Rhizoglyphus*

2. On genu I, $sigma_1$ is more than 3 times longer than $sigma_2$; claws of female never bifid, femur of male enlarged & bearing venterally a conical process.....*Acarus*
   On genu I, $sigma_1$ is less than 3 times longer than $sigma_2$; femur of male not enlarged and without a ventral conical process.....*Tyrophagus*

Genus ***Acarus*** Linnaeus

110. ***Acarus siro*** Linnaeus

1758. *Acarus siro* Linnaeus, *Systema naturae* : 824.

Material examined : 4 ♀♀ of this species were collected from *Nerium indicum* in Delhi during June 1992, coll. S.K.Gupta.

Distribution : India : Delhi. *Elsewhere* : Cosmopolitan.

Genus ***Tyrophagus*** Oudemans

1924. *Tyrophagus* Oudemans, *Ent. Ber. amst.*, **6** : 250.

111. ***Tyrophagus putrescentiae*** (Schrank)

1781. *Acarus putrescentiae* Schrank, *Enum. Ins. Aust. Indig.* : 521.

1924. *Tyrophagus putrescentiae* : Oudemans., *Ent. Ber.*, **6** : 136, 250.

Material examined : 10 ♀♀, of this species were collected on mango associated with fungus in Delhi during December 1990, coll. S.K.Gupta.

Remarks : Since this mite is truly fungus associated one, its occurrence on mango associated with fungus is nothing unnatural.

Distribution : India : Delhi, Bihar, Uttar Pradesh, West Bengal, Tripura. *Elseshere :* Cosmopolitan.

Genus ***Rhizoglyphus*** Claparede

112. ***Rhizoglyphus echinopus*** (Fumosa & Robin)

1868. *Tyrophagus echinopus* Fumosa & Robin, *J. Anat. Physiol.*, **5** : 287.

Material examined : Three ♀♀, of this species were collected from potato tuber in Delhi during December, 1992, coll., S.K.Gupta.

Distribution : India : Delhi, West Bengal. *Elsewhere* : Cosmopolitan.

DISCUSSION

Among the total of 112 species belonging to 46 genera under 16 families and 3 orders, a total of *52 species have been described as new to science basing on material collected form Delhi.* Of these, 10 belong to Tetranychidae, 15 to Eriophyidea, 9 to Tenuipalpidae, 8 to Erythraeidae, 6 to Phyotseiidae, 2 to Ascidae, and 1 each to Tydeidae and Tuckerelidae. It is quite surprising that almost 50% of the species known from Delhi have been described as new to science and hence show a good deal of endemism. Besides, 29 species are there which form new reports from India basing on collection from Delhi, of those 10 to Tetranychidae, 7 to Tenuipalpidae, 5 each to Erythraeidae and Phytoseiidae and 1 each to Cheyletidae and Tydeidae.

So far as the zoogeographical distribution of plant mite fauna of Delhi is concerned, as has been mentioned earlier, a high degree of endemism exists. Out of 112 species, 52 species are not known outside India. There are as many as 20 species which are cosmopolitan in distribution, 4 are known in other parts of Oriental region besides India, 15 are distributed to Palaearctic, and Oriental regions, 9 are distributed to Paleactic and Ethiopean regions, and 1 each to Oriental and Nearctic, Indian and Australian regions.

So far as economic importance of these species are concerned, there are as many as 10 species which are important pests of agriculture and horticultural crops doing noticeable economic damage. These species are i) *Petropoia latens* on wheat, ii) *Bryobia praetiosa* on pear, iii) *Eotetranychus hirsti* on fig, iv) *Schizotetranychus andropogoni* on sugarcane, v) *Tetranychus ludeni* and *Tetranychus neocaledonicus* on vegetables, vi) *Eutetranychus orientalis* and *Brevipalpus phoenicis* on citrus and *Larvacarus transitans* on *Zizyphus* sp. There are another two species which are also of some economic importance and these are *Aceria mangiferae* on mango and *Aceria cajani* on pegionpea, though ofcourse their roles are still not established. There are at least 5 species of Phytoseeidae and one species each of Stigmaeidae and Tydeidae which have been found to be effectively feeding upon different stages of pest mites. These species are *Amblyseius alstoniae, Amblyseius finlandicus, Amblyseius delhiensis,* and *Typhlodromus darjeelingensis* under Phytoseiidae and *Cheletogenes ornatus* on mango

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REFERENCES

Baker, E.W. 1968. The genus *Pronematus* Conestrini - *Ann. Ent. Soc. Amer.*, **69** : 1091-1907.

ChannaBasavanna, G.P. 1966. A contribution to the knowledge of Indian eriophyid mites (Eriophyoidea : Trombidiformes : Acarina). *Univ. Agri. Sci. Bull.*,Bangalore : 1-153.

Dhooria, M.S. 1980. Feeding behaviour of predatory mites, thrips and beetles of the citrus mite *Eutetranychus orientalis*. *Acarol. News.*, **10** : 4-6.

Dhooria, M.S. 1982. The natural enemy complex of citrus mite *Eutetranychus orientalis* in Delhi, India. *Acarol. Newsl.*, **11** : 6.

Ghai, S. 1964. Mites. In Entomology in India. *Ent. Soc. India* : 385-396.

Ghai, S. 1965. A contribution to our knowledge of the family Phytoseiidae and Aceosejidae (Acarina). Ph.D. thesis, IARI, New Delhi.

Ghai, S. & Baker, E.W. 1989. Notes on the gall forming mite, *Larvacarus transitans* (Tenipalpidae) on *Zizyphus mauritiana* in India. *Progress in Acarology*, **2** : 81-90.

Ghai, S.& Maninder, 1976. A new species of *Tuckerella* from India (Acarina : Tuckerellidae). *Oriental Ins.*, **10** : 169-172.

Ghai, S. and Menon, M.G.R. 1967. Taxonomic studies on Indian mites of the family Phytoseiidae (Acarina). *Oriental Ins.*, **1**: 65-79.

Ghai, S. and Menon, M.G.R. 1969. Taxonomic studies on Indian mites of the family Phytoseiidae (Acarina) II. Two new genera and species of Phytoseiidae. *Oriental Ins.*, **3** : 347-352.

Gupta, S.K. & Dhooria, M.S & Sandhu, G.S. 1975. Studies on the chemical control of clover mite, *Bryobia praetiosa* infesting pear in Punjab. *Sci. & Cult.*, **41**(3) : 126-127.

Gupta, S.K. 1985. *Handbook Plant Mites of India*. Zool. Surv. India, Calcutta : 1-520.

Gupta, S.K. 1986. *Fauna of India (Acari : Mesostigmata), Family : Phytoseiidae.* Zool. Surv. India, Calcutta : 1-350.

Gupta, S.K. 1992. Arachnida : Plant mites (Acari). *State fauna Ser. 3 : Fauna of West Bengal, Part III :* 61-211.

Gupta, S.K. 1995. Plant mites (Acari). *State Fauna Ser. 4: Fauna of Meghalaya,* Part II : 17-50.

Gupta, S.K. & Gupta, Y.N. 1994. A taxonomic review of Indian Tetranychidae (Acari : Prostigmata) with descriptions of new species, redescriptions of known species and keys to genera and species. *Mem. zool. Surv. India,* **18**(1) : 1-196.

Khot, N.S. 1963. Studies on Indian Erythraeidae (Acarina). *Acarologia,* **52** : 232-243.

Khot, N.S. 1964. Studies on Indian Erythraeidae (Acarina). Ser III. Mites of the subfamily Leptinae Southcott. *Acarologia,* **6**(4) : 681-689.

Khot, N.S. 1965. Studies on Indian Erythraeidae (Acarina) : Ser. IV. Mites of the subfamily Callidosomatinae Southcott. *Acarologia,* **7**(1) : 63-78.

Maninder & Ghai, S. 1978. Two new species and new records of the genus *Terminalichus* Anwarullah & Khan from India (Acarina : Tenuipalpidae). *Ind. J. Ent.,* **40** : 217-220.

Maninder & Ghai, S. 1978a. Indian species of *Tenuipalpus (Acarina : Tenuipalpidae).* *Oriental Ins.,* **12** : 243-258.

Menon, M.G.R. & Ghai, S. 1968. Further records of the distribution of *Petrobia latens* (Muller) (Acarina : Tetranychidae), a pest of wheat in India together with description of a new species of predatory mite on the same. *Indian J. Ent.,* **30**(1) : 77-79.

Menon, M.G.R. & Ghai, S. 1968 a Three new records of Bryobiinae from India (Acarina : Tetranychidae). *Indian J. Ent.,* **30** (1) : 88-89.

Menon, M.G.R., Ghai, S. & Katiyar, K.N. 1971. New records of Tenuipalpid mites from India. *Ent. Newsl.,* **1** : 13.

Mohanasundaram, M. 1982. Two new species of eriophyids (Eriophyidae : Acarina) from India. *Entomon,* **7** (4) : 432-433.

Narayanan, E.S. & Kaur, R.B. 1960. Recent trends in the taxonomy of the family Phytoseiidae Berlese, 1913 (Predatory mites) with new records and descriptions of new species. *Proc. Indian Sci. Cong.*, **47** : 467.

Narayanan, E.S., Kaur, R.B. & Ghai, S. 1960. Importance of some taxonomic characters in the family Phytoseiidae Berlese, 1916 (Predatory mite) with new records and descriptions of species. *Proc. Nat.Ins. Sci. India*, **26** B : 384-394.

Narayanan, E.S., & Ghai, S. 1964. Some new records and new species of mites associated with malformation of mango in India. *Proc. Nat. Ins. Sci. India*, **29** B : 535-546.

Narayanan, E.S., & Ghai, S. 1964a. A new species of *Melichares (Melichares)* Hering (Aceosejidae) associated with fig insects. *Proc. Nat. Ins. Sci. India*, **29** B : 547-550.

Narayanan, E.S. & Khot, N.S. 1959. Studies on some entomophagous mites and their possible use in biological control. *Proc. Indian Sci. Cong.*, **46** : 11.

Nassar, O.A. & Ghai, S. 1981. Taxonomic studies on tetranychoid mites infesting vegetables and fruit crops in Delhi and surrounding areas. *Oriental Ins.*, **15** (4) : 333-396.

Prasad, V. 1974. *A catalogue of mites of India*. Indira Acarology Publishing House, Ludhiana : 1-320.

Saxena, R.D. 1942. *Eriophyes prosopidis* sp. nov. a new gall making mite from India. *Indian J. Ent.*, **4** : 215.

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ACARI : SOIL MITES

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INTRODUCTION

The mites constitute a major part of soil inhabitating arthropods. They play a great role in the process of decomposition of organic matter resulting in soil fertility. Some soil mites act as carrier of plant diseases, others as predator of inverterbates including mites. There are group of soil mites which are known to act as intermediate hosts of cestodes to domestic animals. The soil inhabiting mites have been studied in India since 1906 when Pearce recorded oribatid mites from the Himalayan soils. Later through the works of several acarologists a total of 447 species are so far known from the Indian soils. The most extensive studies have been done on the soil mites of northeastern and southern parts of the country. But except a single attempt no study on the soil mites of Delhi has been done. Roy (1988) while studying the soil Macrochelid fauna of India reported two species *viz.*, *Glyptholaspis fimicola* (Berlese, 1882) and *G. americana* (Berlese, 1918) from soils of Delhi and except these no other species of soil inhabiting mite is known from the metropolis.

SYSTEMATIC ACCOUNT

Subclass : ACARI
Order : MESOSTIGMATA
Family : MACROCHELIDAE
Genus ***Glyptholaspis***

Genus ***Glyptholaspis*** (Berlese)

1918. *Macrocheles (Macrocheles)* Berlese, *Redia*, **13**:172.
1960. *Glyptholaspis* Filipponi and Pegazzano, *Redia*, **45**: 133-171.

Key to species

1(2) Measures 1400μ 1600μ ; length of j4 more than half the distances between setal bases j4 and j5; j1 longer than the length of r1, posterior margin adjacent to setae S5 tridentate; j5 shorter or subequal with S5 not reaching the posterior margin of the shield ..... *fimicola* (Berlese)

2(1) Measures 1000μ 1260μ ; length of j4 either equal or longer than the distances between setal bases j4 and j5; j1 is double the length of r1, posterior margin between setae S5 minutely serrated; j5 longer than S5 either reaching or surpassing the posterior margin of the shield .....*americana* (Berlese)

1. ***Glyptholaspis fimicola*** (Berlese)

1882. *Gamasus tardus* Berlese, *Bull. Soc. Ent. Ital.*, **14**:108.
1889. *Holastaspis marginatus* L Berlese, *Acar. Myr. et Scor.* etc., **52** (4-5).
1918. *Macrocheles (Macrocheles) marginatus* : Berlese, *Redia*, **13** : 172.
1931. *Nothrolaspis fimicola* : Sellnick, *Sitzer. Akad. Wiss. Wien*, **140** : 756.
1960. *Glyptholaspis fimicola* : Filipponi & Pegazzano, *Redia*, **45** : 139.
1988. *Glyptholaspis fimicola* : Roy, *Progress in Acarology* (eds. Channa Basavanna & Viraktamath), **1** : 343.

Diagnostic characters : *Female* Dorsal shield 1404μ - 1620μ long, 900μ - 1152μ wide, crenulate-reticulate, with 28 pairs of setae and 21 pairs of large pores. External lateral border of dorsal shield denticulate. Setae i4, i5, j3, z2, z3 and J5 pointed and pilose while the remaining dorsal setae plumose. r1 about 2/3 of i1, i5 slightly shorter than S5; the teeth on the posterior margin of ventral shield reticulated. Sternal seta I plumose, others simple, pointed. Genital shield with a pair of plumose setae. Ganathosoma with seven rows of deutosternal denticles. Tectum trifid. Legs provided with plumose setae on all joints. *Male* - Dorsal shield 596μ long, 396μ wide. Ornamentation and chaetotaxy as in female. i5 inserted anterior to z3 unlike that of female. Holoventral shield ornamented throughout, provided with 9 pairs of setae and with unpaired postanal and 5 pairs of pores; z3, S4, S5 and J5 simple and pointed. Femur, genu, tibia of leg II with spurlike structure. Other characters almost same as in female.

Distribution : India : Delhi (Horticultural Farm, IARI), Assam, Arunachal Pradesh, Andhra Pradesh, Karnataka, Kerala, Maharashtra, Pondicherry, Tamil Nadu, Tripura, Uttar Pradesh. *Elsewhere* : Europe; South Africa; Congo; China.

2. ***Glyptholaspis americana*** (Berlese)

1918. *Macrocheles (Macrochelese) vaqabundus* Berlese, *Redia*, **13** : 172.
1918. *Macrocheles (Macrocheles) americana* : Berlese, *Redia*, **13** : 189.
1960. *Glyptholaspis americana* : Filipponi & Pegazzano, *Redia*, **45** : 135.
1978. *Glyptholaspis americana* : Pramanik & Raychaudhury, *Acarology Newsletter*, *6* : 5.
1988. *Glyptholaspis americana* : Roy, *Progress in Acarology* (eds. Channa Basavanna & Viraktamath), **1** : 343.

Diagnostic characters : *Female* - Dorsal shield 900μ - 1260μ long, 630μ - 810μ wide,

crenulate - reticulate with 28 pairs of setae. Setae i4, i5, z2, z3, J3 and J5 slender, pointed, smooth or finely pilose, remaining dorsal setae densely plumose. r1 very long, nearly as long as i1 or as long as 2/3 of i1. J5 longer than S5 and always reaching posterior margin of the shield or even surpassing the margin. Reticulation of ventral shield sculptured. Sternal shield areolate throughout, sternal setae I distally plumose, others simple, pointed. Genital shield with a pair of plumose setae. Gnathosoma provided with seven rows of deutosternal denticles of which VIth and VII th scarcely visible. Legs provided with plumose setae on all articulations. *Male* Dorsal shield 604μ long and 400μ wide, reticulation and chaetotaxy as in female, all setae relatively short. Lateral and posterior margin of body dentate. J5 simple and shorter than S5, i5 inserted to an anterior level of z3. Other characters almost same as in female.

Distribution : India : Delhi (near Red Fort), Andhra Pradesh, Assam, Goa, Karnataka, Kerala, Meghalaya, Nagaland, Orissa, Pondicherry, Sikkim, Tamil Nadu, Tripura, West Bengal. *Elsewhere* : South America; Europe; Africa.

SUMMARY

The paper is an account of the soil mite fauna from Delhi which includes only two species of mesostigmatid mites *viz. Glypholaspis fimicola* (Berlese, 1882) and *G. americana* (Berlese, 1918). Key to indentification and diagnostic feeatures of these species have been incorporated.

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REFERENCES

Pearce, N.D.F. 1906. On some Oribatide from Sikkim Himalaya. *Journ. Roy. Micr. Soc.*, 269-273.

Pramanik, M.M and Raychoudhuri,D.N., 1978. New records of mesostigmatid mites (Acari) from West Bengal,India. *Acarology Newsletter*, **6**:5-6.

Roy, R.N. 1988. Indian species of the genus *Glyptholaspis* (Acari : Macrochelidae) with description of two new species. *Progress in Acarology* (eds. G.P. Channa Basavanna and C.A. Viraktamath), **1**:343-353.

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ACARI : HOUSE DUST MITES

Species known from Delhi

compiled by
VINOD KHANNA
Zoological Survey of India, Dehra Dun 248 195

Suborder : SARCOPTIFORMES

Family : PYROGLYPHIDAE

1. *Dermatophagoides farinae* Hughes
2. *Dermatophagoides pteronyssinus* Trouessari

Family : GLYCYPHAGIDAE

3. *Blomia tropicalis*
4. *Glycyphagus domesticus* De Geer
5. *Glycyphagus* sp.

Family : ACARIDAE

6. *Tyrophagus purtrescentiae* Schrank
7. *Acarus siro* Linnaeus

Family : CHORTOGLYPHIDAE

8. *Chortoglyphus arcuatus* Tropeau

Suborder : TROMBIDIFORMES

Family : CHEYLETIDAE

09. *Cheyletus malacensis* Oudemans
10. *Cheyletus* sp.

Family : TETRANYCHIDAE

11. *Petrobia latens*

Family : CUNAXIDAE

12. *Cunaxa* sp.

Family : AMEROSEIIDAE

13. *Kleemania* sp.

Family : DERMANYSSIDAE

14. *Dermanysus* sp.

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Family : ASCIDAE

15. *Blattisocius* sp.

REFERENCE

Dar, Natasha & Gupta, V.K.1979 Studies on the house dust mites of India and their role in causation of bronchial asthama and allergic rhinitis - part I. The Mites. *Oriental Ins.*, **13** (1-4) : 261-298.

2552 ZSI/96-35 B

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ACARI : IXODIDAE

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INTRODUCTION

The ixodid ticks are a small group of acarines under the suborder Metastigmata. They are blood-sucking ectoparasites of vertebrates. The ticks occur throughout the world but are more frequently encountered in tropical and subtropical realms.

The taxonomic studies of Indian ticks were taken up for research as early as in 1758. The first record of tick from India was made by Linnaeus (1758). The most comprehensive study of Indian Ixodida was done by Sharif (1928). Later several workers have made extensive studies on Ixodida and approximately 13% of total species of ticks in the world are known from India.

The tick fauna of Delhi was first studied by Nagar (1962) who made a faunistic survey of the ticks (Ixodidae) from Delhi and recorded twelve species belonging to six genera. Later in 1963 he published a revised key for the genus of *Hyalomma* Koch from Delhi. In 1977 Nagar *et al.* made an observation on babesiosis and ecology of ixodid ticks in Delhi and recorded eight species of which two were the first record from Delhi. Besides these works no other attempt to study the ixodid fauna of Delhi was made. Thus the total number of species of ixodid ticks so far known from Delhi stands at 14 belonging to six genera (Table 1).

SYSTEMATIC ACCOUNT

Key to genera

1(4) Eyes absent

2(3) Capitulum long, no lateral salience on palpal article II; dorsal retroverted spur absent on trochanter I; coxa I usually bifid ....*Aponomma* Neumann

3(2) Capitulum short, with lateral salience on palpal article II; blade like dorsal retroverted spur on trochanter I; coxa I never bifid ....*Haemaphysalis* Koch

4(1) Eyes present

5(6) Capitulum long with long narrow palps; scutum usually inornate ... .*Hyalomma* Koch

6(5) Capitulum short with short broad palps; scutum ornate

7(8) Basis capituli rectangular dorsally, lateral saliences absent .....*Nosomma* Schulze

8(7) Basis capituli hexogonal dorsally, lateral saliences present

9(10) Spiracle oval; festoons or grooves faint or obsolete; setiferous ventral plate on palpal article I absent .....*Bophilus* Curtice

10(9) Spiracle sub-triangular or comma-shaped; festoons and anal groove well developed; setiferous ventral plate on palpal article I present .....*Rhipicephalus* Koch

1. Genus *Aponomma* Neumann

1831. *Ixodes* (en partim) Muller, *Nova acta Physico-medica*, **15** (Part 2) : 235.

1899. *Aponomma Neumann, Mem. Soc. Zool. France*, **12** : 180.

Key to species

Male

1(2) Scutum with metallic green background, ornate with numerous punctations; coxa I with one short blunt spur .....*gervaisi*

2(1) Scutum yellow-ocher to brick-red in color, inornate with few superficial fine punctations; coxa I with one short pointed spur .....*laeve*

Female

1(2) Scutum with metallic green background, ornate with numerous punctations; coxa I with two spurs .....*gervaisi*

2(1) Scutum uniformly brown, inornate with few punctations; coxa I with one spur.....*laeve*

1. *Aponomma gervaisi* (Lucas)

1847. *Ixodes gervaisi* Lucas, *Ann. Soc. Ent. Fr.*, **5**(7):259-261.

1899. *Aponomma gervaisi* : Neumann, *Mem. Soc. Zool. France*, **12**:182-185.

1928. *Aponomma gervaisi* : Sharif, *Rec. Indian Mus.*, **30**(3):334.

1962. *Aponomma gervaisi* : Nagar, *Bull. Ent.*, **3**:58.

1977. *Aponomma gervaisi* : Nagar *et al.*, *Indian J. Anim. Sci.*, **47**(10):654.

Remarks : The host specificity of *Aponomma gervaisi* is restricted to reptiles only.

2. *Aponomma laeve* Neumann

1899. *Aponomma laeve* Neumann, *Mem. Soc. Zool. France*, **12**:190,191.
1911. *Aponomma laeve* Neumann, *Das Tierreich*, **26**:95.
1962. *Aponomma laeve* : Nagar, *Bull Ent.*, **3**:58.
Remarks : This species is a common parasite of snakes and lizards.

2. Genus *Boophilus* Curtice

1891. *Boophilus* Curtice, *Journ. Compar. Med. Veter. Arch.*,**12**:313.

3. *Boophilus microplus* (Canestrini)

1887. *Haemaphysalis micropla* Canestrini, *Atti. Soc. Veneto-Trent. Sci. nat. Padova*, **11**:104.
1901. *Boophilus australis* Stiles and Hassall, *Bur. Anim. Ind. U.S. Dept. Agric.*, Washington, D.C. Circ. No. **34** :2-3.
1928. *Boophilus australis* : Sharif, *Rec. Indian Mus.*, **30**(3):284.
1943. *Boophilus microplns* : Fairchild, *Am. J. Trop. Med.*, **23**(6):586.
1962. *Boophilus microplus* : Nagar, *Bull. Ent.*, **3**:59.
1977. *Boophilus microplus* : Nagar *et al.*, *Indian J. Anim. Sci.*, **47**(10):654.
Diagnostic characters : *Male* Scutum quite hirsuate; caudal appendage short, tapering; inner margin of basal palpal segment ventrally concave; dentition 4/4. *Female* - Coxa I with deep inverted `V'- shaped cleft, inner margin of basal palpal segment ventrally short, deeply concave; dentition 4/4.
Remarks : This is a very common cattle infesting tick.

3. Genus *Haemaphysalis* Koch

1844. *Haemaphysalis* Koch, *Arch Naturgesch.*, **10**(1):217-239.

Key to species

Male

1(2) Scutum ovate with numerous and deep punctations; palpal article III with distinct dorsal retroverted spur, more or less erect .....*intermedia*

2(1) Scutum 1.5 to 1.7 times as long as broad with few punctations; palpal article III without dorsal spur but posterior border may protrude ....*indica*

Female

1(2) Scutum ovate, punctation numerous and deep; salience usually not broad, palpal segment 2 rounded; palpal segment III with distinct retroverted dorsal spur .....*intermedia*

2(1) Scutum 2.5 times as broad as long; salience broad, palpal segment 2 developed into a spur or projection; palpal segment III without spur .....*indica*

4. *Haemaphysalis intermedia* Warburton and Nuttall

1909. *Haemaphysalis bispinosa* var. *intermedia* Warburton and Nuttall, *Parasitology*, 2:69.
1928. *Haemaphysalis intermedia* var. *intermedia* : Sharif, *Rec. Indian Mus.*, 30:258.
1962. *Haemaphysalis intermedia* : Nagar, *Bull. Ent.*, 3:58.

Remarks : This species is a parasite of domestic and wild animals in India. It is also reported to carry KFD virus.

5. *Haemaphysalis indica* Warburton

1910 *Haemaphysalis leachi* var. *indica* Warburton, *Parasitology*, 3:403.
1928. *Haemaphysalis leachi* var *indica* Sharif, *Rec. Indian Mus.*, 30:264-264.
1962. *Haemaphysalis indica*, Nagar, *Bull. Ent.*, 3:59.

Remarks : The carnivore animals are the common host of this species. Occassionally rodents and insectivore animals are also attacked.

4. Genus *Hyalomma* Koch

1884. *Hyalomma* Koch, *Arch. Naturgesch*, 10(1):220.

Key to species
Male

1(6) Adanal shields broad; subanal shields absent
2(3) Lateral grooves short or absent; punctations few; tarsus IV humped .....*kumari*

3(2) Lateral grooves long; punctations discrete; tarsus IV flat
4(5) Punctations large, few median and paramedian grooves deep; spiracular plates elongate oval ....*hussaini*

5(4) Punctations small, numerous; median and paramedian grooves indistict; spiracular plates comma-shaped ....*brevipunctata*
6(1) Adanal shields elongate; subanal shields present

7(10) Lateral grooves long; punctations variable

8(9) Scutum smooth with scattered large punctations; posterior grooves well marked; legs usually not ringed ....*detritum*

9(8) Scutum irregularly punctate; posterior area not strikingly differentiated; cervical grooves deep; legs with white rings near the joints..... .....*marginatum isaaci*

10(7) Lateral grooves short or absent; punctations few

11(12) Subanal shields exterior to axis of adanal shields; adanal shields curved; posteromedian grooves reaching parma; cervical grooves deep .....*dromedarii*

12(11) Subanal shields on the axis of adanal shields; adanal shields straight; posteromedian groove not reaching parma; cervical grooves shallow .....*anatolicum anatolicum*

Female

1(6) Adanal shields broad, subanal shields absent

2(3) Operculum profile slightly bulging; punctations few; tarsus IV humped .....*kumari*

2(4) Operculum profile distinctly bulging; punctations numerous; tarsus IV flat

4(5) Operculum wide, depressed medioposteriorly; punctations large; cervical grooves distinct .....*hussaini*

5(4) Operculum elongate oval, not depressed medioposteriorly; punctations few; cervical grooves indistinct ....*brevipunctata*

6(1) Adanal shields elongate, subanal shields present

7(10) Scutum with variavle punctations; cervical grooves deep; legs with or without rings

8(9) Scutum smooth with scattered large punctations; legs without rings .....*detritum*

9(8) Scutum with irregualr punctations; legs with rings ..... *marginatum isaaci*

10(7) Scutum with few large punctations; cervical grooves almost shallow; legs with or without rings

11(12) Operculum almost `V' shaped,surrounded by a narrow raised integumental fold; scutal surface frequently rugose; legs usually ringed ....*dromedarii*

12(11) Operculum knob like; scutal surface with few large punctations; legs usually without rings ....*anatolicum anatolicum*

6. *Hyalomma antolicum antolicum* Koch

1844. *Hyalomma anatolicum anatolicum* Koch, *Arach. Naturgesch*, **10**(1):220.
1962. *Hyalomma anatolicum anatolicum* : Nagar, *Bull. Ent.*, **3**:59.
1977. *Hyalomma anatolicum anatolicum* : Nagar *et al.*, *Indian J. Anim. Sci.*, **47**(10):659.
Remarks : It is a common parasite of domestic animals.

7. *Hyalomma brevipunctata* Sharif

1928. *Hyalomma brevipunctata* Sharif, *Rec. Indian Mus.*, **30**(3):318.
1977. *Hyalomma brevipunctata* : Nagar *et al.*, *Indian J. Anim. Sci.*, **47**(10):659.
Remarks : This species has been reported from widely seperated geographical areas.

8. *Hyalomma detritum* Schulze

1919. *Hyalomma detritum* Schulze, *Sitzungsh Ges. Naturf. Freunde Berl.* **5**:189-196.
1962. *Hyalomma detritum* : Nagar, *Bull. Ent.*, **3**:59.
Remarks : This species is known in India by very few specimens. These are probably restricted to some northern Indian states.

9. *Hyalomma dromedarii* Koch

1844. *Hyalomma dromedarii* Koch, *Arach. Naturgesch*, **10**:220.
1962. *Hyalomma dromedarii* : Nagar, *Bull. Ent.*, **3**:59.
1977. *Hyalomma dromedarii* : Nagar *et al.*, *Indian J. Anim. Sci.*, **47**(10):654.
Remarks: It is mainly an arid area tick.

10. *Hyalomma hussaini* Sharif

1928. *Hyalomma hussaini* Sharif, *Rec. Indian Mus.*, **30**(3):314.
1962. *Hyalomma hussaini* : Nagar, *Bull. Ent.*, **3**:59.
1977. *Hyalomma hussaini* : Nagar *et al.*, *Indian J. Anim. Sci.*, **47**(10):654.
Remarks : This species exist in varied ecological conditions in India.

11. *Hyalomma kumari* Sharif

1928. *Hyalomma kumari* Sharif, *Rec. Indian Mus.*, **30**(3):319.
1962. *Hyalomma kumari* : Nagar *Bull. Ent.*, **3**:59.
Remarks: This species has a wide geographical distribution in India.

12. *Hyalomma marginatum isaaci* Sharif

1928. *Hyalomma marginatum isaaci* Sharif, *Rec. Indian Mus.*, **30**(3):307.
1977. *Hyalomma marginatum isaaci* : Nagar *et al.*, *Indian J. Anim. Sci.*, **47**(10):654.

Remarks : The nymphs of this species carry Crimeran haemorrhagic fever virus. This species has a wide distribution by scarce in coastal areas and western Ghats.

5. Genus *Nosomma* Schulze

1919. *Nosomma* Schulze, *Sitzungsh.. Ges. Naturf. Freunde Berl.*, **5**:191.

13. *Nosomma monstrosum* (Nuttall & Warburton)

1908. *Nosomma monstrosum* (Nuttall & Warburton), *Proc. Cambridge Phil. Soc.*, **14**:414.
1919. *Nosomma monstrosum* : Schulze, *Sitzungsh. Ges. Naturf. Freunde Berl.*, 5:191.
1962. *Nosomma monstrosum* : Nagar, *Bull. Ent.*, **3**:59.

Diagnostic characters: *Male* - Scutum with whitish secretion; cervical grooves short, deep; punctutions unequal; coxae II to IV with two short subequal spurs; dentition 3/3. *Female* Ornamentaion better developed than in male, cervical grooves narrow, punctations strongly unequal; coxae and dentitiion as in female.

6. Genus *Rhipicephalus* Koch

1844. *Rhipicephalus* Koch, *Arch. Naturgesch.*, **10**(1):238.

14. *Rhipicephalus sanguineus* (Latrielle)

1806. *Ixodes sanguineus* Latrielle, *Genera Crustaceorum et. Insectorum*, **1**:157.
1844. *Rhipicephalus sanguineus* : Koch, *Arch. Naturgesch.*, **10**(1):238.
1928. *Rhipicephalus sanguineus* : Sharif, *Rec. Indian Mus.*, **30**(3):275.
1962. *Rhipicephalus sanguineus* : Nagar, *Bull. Ent.*, **3**:59.
1977. *Rhipicephalus sanguineus* : Nagar *et al.*, *Indian J. Anim. Sci.*, **47**(10):654.

Diagnostic characters : *Male* Cervical grooves elongated, lateral grooves narrow, deep; punctations numerous, unequal, irregularly arranged; basis capituli 3 times as long as broad; adanal shields triangular; dentition 3/3. *Female* Scutum sub-hexagonal, cervical grooves deep, punctated; punctations as in male; spiracle sub-triangualr with a postero-dorsal angle.

SUMMARY

The paper deals with the ixodid tick fauna of Delhi. Altogether 14 species under 6 genera

hitherto known from Delhi have been recorded.

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REFERENCES

Linnaeus, C. 1758. Systema naturae per ragna tria naturae, secundum classes, ordines, genera, species cum characteribus, differentiis synonymis, locis, Edilio dicima, reformata, Tomm I. Laurentii Selvii, Holmiae, 823 pp.

Nagar, S.K. 1962. A faunistic survey of the ticks (Ixodidae) from Delhi State with a revision of the genus *Hyalomma* Koch reported from India. *Bull. Ent.*, 3:58-61.

Nagar, S.K. 1963. A revised key for the Delhi genus *Hyalomma* Koch (Acarina : Ixodidae). *Annls. Zool.*, 4(4):39-45.

Nagar, S.K., Raizada,R.N. and Saxena, V.K., 1977. Observations on the prevalence of babesiosis and composition and ecology of ixodid ticks in Delhi. *Indian J. Anim. Sci.*, 47(10):654-663.

Sharif, M. 1928. A revision of the Indian Ixodidae, with special reference to the collection in the Indian Museum. *Rec. Indian Mus.*, 30(3):217-344.

Table 1. Species of ticks so far reported from Delhi with their distribution and hosts :

Sl. no.	Species	Distribution in India	Hosts in India (hosts in Delhi in italics)
1.	*Aponomma gervaisi*	Assam, Madhya Pradesh, Maharashtra, Orissa Uttar Pradesh, West Bengal	Snakes, Varanus, *Monitor lizard*, *python*
2.	*Aponomma laeve*	Delhi, Karnataka, Orissa, Maharashtra, Tamil Nadu	*Cobra*
3.	*Boophilus microplus*	Almost all over the country	*Cattle*, *buffalo*, sheep, goat, squirrel, ratel, barking deer, rodents, dog, mithun, horse, nilgai, camel
4.	*Haemaphysalis indica*	Bihar, Delhi, Gujarat Karnataka, Orissa, West Bengal	Cattle, goat, *jackal*, *hare*, fox, dog, ratel, leopard, wolf, rodents
5.	*Haemophysalis intermedia*	Andhra Pradesh, Bihar, Delhi, Karnataka, Maharashtra Orissa, Tamil Nadu	Cattle, dog, goat, *jackal*, *fox*, *hare*, sheep, wild animals, birds
6.	*Hyalomma anatolicun anatolicum*	Andhra Pradesh, Assam, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Maharashtra,Madhya Pradesh, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal	*Cattle*, buffalo, goat, rodents, dog, *horse*, *donkey*, *pig*, *camel*, *sheep*.

Sl no.	Species	Distribution in India	Hosts in India (hosts in Delhi in italics)
7.	*Hyalomma brevipunctata*	Andhra Pradesh, Bihar, Delhi, Gujarat, Himachal Pradesh, Karnataka, Maharashtra, Madhya Pradesh, Manipur, Orissa, Punjab, Uttar Pradesh, Tamil Nadu, West Bengal	*Cattle*, buffalo, goat, sheep, *camel*, cheetal, nilgai, rodents
8.	*Hyalomma detritum*	Delhi, Himachal Pradesh, Haryana,Jammu & Kashmir, Maharashtra, Punjab Uttar Pradesh	Cattle, *buffalo*, *bullock*, *camel*, *sheep*, goat
9.	*Hyalomma dromedarii*	Andhra Pradesh, Delhi, Gujarat, Himachal Pradesh, Jammu & Kashmir, Maharashtra, Orissa, Punjab, Uttar Pradesh	Cattle, lizard, horse, *camel*, goat, sheep, donkey, rodents, hares, hedgehog, birds
10.	*Hyalomma hussaini*	Andhra Pradesh, Bihar, Delhi, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Orissa, Punjab, Rajasthan, Sikkim, West Bengal	*Cattle*, buffalo, goat, *camel*, dog,horse, sheep, rodents
11.	*Hyalomma kumari*	Assam, Bihar, Delhi, Himachal Pradesh, Jammu & Kashmir,Kerala, Maharashtra, Orissa, Punjab, Rajasthan, Uttar Pradesh	*Cattle*, buffalo, goat, sheep, *camel*, dog, horse, tiger,barking deer, Indian muntjak,rodents

Sl no.	Species	Distribution in India	Hosts in India (hosts in Delhi in italics)
12	*Hyalomma marginatum isaaci*	Arunachal Pradesh, Bihar, Delhi, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Madhya Pradesh, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh	*Cattle*, buffalo, sheep, goat, camel, dog, hare, horse, man, birds
13.	*Nosomma monstrosum*	Bihar, Delhi, Karnataka, Maharashtra, Orissa, West Bengal	Cattle, buffalo, goat, sambar, rodents, *horse*, dog
14.	*Rhipicephalus sanguineus*	Almost all over the country	Cattle, bullock, *dog*, *jackal*, horse, donkey, goat, wild boar, bear, fox

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INTRODUCTION

Fishes have always been of great importance for their food, sport and aesthetic values. The fish fauna of Delhi has received attention of various ichthyologists and other workers in the past. The earliest available reference of any fish of Delhi is that by Day (1871) who described a new catfish, *Aillichthys punctata (= Ailia punctata)* from river Yamuna and latter (Day, 1876, 1877, 1878, and 1889) added twelve more species. Three species by local names (*Mahsir, Rohu and Batchwa*) and additional eight species were reported in Gazetteers of Delhi District for the years 1883-84 and 1912 respectively. Majumdar (1951a, b) reported extension of range of *Psilorhynchus balitora* to Delhi and observations on barbles of *Silonia silondia* and *Wallago attu* from Delhi and studied the anatomy and histology of the palate of *Cirrihinus mrigala* from Delhi, and subsequently (Majumdar, 1958) listed 62 species from Delhi, out of which 44 species were the first records. Raj and Sehgal (1964) mentioned some species reported earlier in `Census of India 1961, Delhi. Raza et al. (1976) almost repeated Majumdar's (1958) list of fishes in Delhi Gazetteer for the year 1976 except for five species viz. *Puntius punjabensis, Garra gotyla, Heteropneustes fossilis, Sisor rhabdophorus, Nangra punctata (= Nangra viridescens)* and added *Puntius ambassis (= Puntius guganio)*. Jayaram (1981) mentioned the distribution of four species viz. *Psilorhynchus balitora, Botia lohachata, Gagata cenia* and *Nangra viridescens* in Delhi in his `Handbook on Freshwater Fishes of India.' Munshi and Srivastava (1988) recorded the distribution of *Botia lohachata, Bagarius bagarius (= B.yarrelli), Gagata cenia* and *Ailia coila* from Delhi in their book `Natural History of Fishes' reported by earlier workers. Talwar and Jhingran (1991) in their book `Inland Fishes of India' have given the distribution of six species viz. *Hilsa ilisha, Setipinna brevifilis, Barilius barila, Gagata cenia, Gagata sexualis* and *Nangra viridescens* in Delhi which adds two more species namely *Setipinna brevifilis, Gagata sexualis* to Delhi fishes, totalling 71 species.

Since the fish fauna of Delhi has been worked out long back (Majumdar 1958) when the conditions were quite different, it was being felt essential to resurvey the whole territory of Delhi in the perspective of present day changed landscape. In view of this and for proper management of fish species and fishery resources an up date knowledge of the fish fauna is necessary and hence the present study was taken up.

During this venture various kinds of ecological niches (river Yamuna at various points, Ramghat and Okhla reservoirs, cananls, nalas, ponds, lakes, tanks, small marshy areas, etc.) were

extensively surveyed in different seasons form 1993 to 1995 and 41 species belonging to 29 genera, 17 families and 5 orders were collected with good number of examples. This adds 16 species (*Labeo bata, L.boga, Puntius chola, P. terio, Salmostoma phulo, Paluciosoma daniconius, Lepidocephalus guntea, Mystus bleekeris, Clarias batrachus, Gambusia affinis, Pseudambassis baculis, Nandus nandus, Badis badis, Oreochromis mossambica, Colisa lalia and Mastacembelus pancalus)* to the existing list of Delhi fishes making it 87. It is interesting to note that species like *Nangra nangra* (Day, 1877), *Securicula gora* (Gazetteer of the Delhi District, 1912), *Amblypharygodon mola* and *Garra gotyla gotyla* (Majumdar, 1958) have been reported only ones; *Ailia punctata* after its first description by Day (1871) was included in his subsequent works (1877, 1889), thereafter there has been no record of the species from Delhi, which is a clear indication of gradual depletion of fish diversity in Delhi. Major carps and other important food fishes have also become rarer. *Tor tor*, the celebrated Red-finned Mahseer once descending to Yamuna at Delhi is also not known to many now.

As per the results it is observed that the fish life of Delhi has been much depleted during the past as inspite of the best efforts only 41 species could be found which is probably due to various human created problems (high degree water pollution from industrial wastes, sewage dumping, unplanned and excessive fishing, etc.), disastrous to the survival of fish. The disturbance in food chain due to change of water chemistry and also the plankton concentration and other insect life which constitute the food of fishes and destruction of breeding grounds appear to be the major contributing factors towards the depletion of fish fauna. The fishes, if at all survive in such environment, become diseased and do not remain suitable for human consumption.

Drainage : River Yamuna is the only river passing through Delhi originating from hills near western slopes of Bandarpur near Yamnotri shrine in Uttarkashi district, Western Himalaya (Uttar Pradesh) at ca 6315 m altitude. It flows down entering into plains after crossing Siwaliks making boundary with Himachal Pradesh and afterwards enter into plains bordering Haryana and Uttar Pradesh and after passing through Delhi again enters into Uttar Pradesh. At Delhi it becomes a broad river of plains. During south west monsoon it gets flooded inundating a vast area but shrinks to a small stream with only a knee deep water at places during winter and summer months. Since most of the sewage (directly or through various drains) and industrial wastes are dumped into it, it is hightly polluted river with changed water colour and chemistry harbouring very little life in it. A small rivulet in Dhaulakuan area, nala near Naraina area, Delhi-Rohtak or Western Yamuna canal, Agra canal, Hindon canal, ponds, tanks, lakes, reservoirs etc. are the other water bodies which are comparatively less polluted and are a potential of inland fisheries to some extent.

Fishing Methods : The fishing is usually carried out by drag nets, cast nets, net and trap combination method, bamboo baskets (*tapia*) and rod and line. The drag nets made of nylon material are operated in the reservoirs at Ramghat and Okhla and cast nets, also made of nylon thread are also used from the fishing boats in the reservoirs and also in the river itself. Rod and line

is a good past time at these points. Other devices are used in shallow waters near the banks. In nalas and canals nylon mosquito nets are in common use. Local people also dig out fishes burried in the mud of ponds and ditches. Okhla and Ramghat still remain a major attraction for anglers/fishermen throughout the year.

SYSTEMATIC ACCOUNT

Class : OSTEICHTHYES
Subclass : ACTINOPTERYGII
Subdivision : TELEOSTEI
Order : OSTEOGLOSSIFORMES

Parasphenoid and tongue bones usually with well-developed teeth. Supramaxilla absent. Nasal capsulrigid, no antorbital-supraorbital system pumping water over olfactory epithelium. Epiplural intermuscular bones absent. Caudal fin with 16 or less branched rays; caudal fin skeleton (except in *Hiodon*) with large first ural centrum and without urodermals.

Suborder : NOTOPTEROIDEI

Maxilla toothed. Anterior prongs of swim bladder passing forward to ear, lateral to skull (intracranially in *Xenomystus* and *Papyrocranus*).

Family : NOTOPTERIDAE (Featherbacks)

Subopercular absent; Anal fin long, (85-141 rays or 100 or more rays in anal and caudal combined) and confluent with a reduced caudal fin; pelvic fins small (3-6 rays) or absent. Lateral line scales 120-180. Ventral scutes 25-45.

Genus *Notopterus* Lacepede

1800. *Notopterus* Lacepede, *Hist. Nat. Poiss.*, **2** : 189 (type-species : *Notopterus kapirat* Lacepede = *Gymnotus notopterus* Pallas).
Small dorsal fins with 7-10 rays and 8-9 branchiostegal rays.

Key to species

1. Maxilla extends considerably beyond posterior border of eye; preorbital smooth; a row of about 15 transverse silvery bars on back.....*Notopterus chitala* (Hamilton-Buchanan)
- Maxilla extends to middle of eye; preorbital serrated; no transverse bars on back.....*Notopterus notopeterus* (Pallas)

1. *Notopterus chitala* (Hamilton-Buchanan)
Humped Featherback

1822. *Mystus chitala* Hamilton Buchanan, *Fish. Ganges* : 236-238, 382 (type - locality : larger freshwater rivers of Bengal and Bihar).

1889. *Notopterus chitala* : Day, *Faun. Brit. India,* Fish.,1 : 407.

1958. *Notopterus chitala* : Majumdar, *J. Bombay nat. His. Soc.*, 55 (2) : 369 (Delhi).

1964. *Notopterus chitala* : Raj and Sehgal, *Census of India 1961, Delhi* : 11.

1976. *Notopterus chitala* : Raza *et al.* : In : *Delhi Gazetteer* : 29, 30.

Local Name : *Chital, Pari*.

Material examined : from literature.

Diagnostic characters : D.I-II/7-9, P.16, V.6, A.+C. 122 - 149, L.l. 180.

Body oblong, deep, humped, strongly compressed. Head compressed, upper profile deeply curved, concave. Mouth wide, maxilla extends considerably beyond eye. Preorbital smooth. Dorsal fin short, tuft-like, inserted nearer to caudal base than to snout tip. Pelvics rudimentary. Vent far forward. Anal long, confluent with caudal. Scales small, on body and head. Colour coppery brown above with many transverse bars, silvery on sides, two dark spots on caudal region, fins spotted with grey. Attains 1.25 m in length.

Distribution : India : Delhi, Uttar Pradesh, Bihar, West Bengal, Assam. *Elsewhere* : Pakistan ; Bangladesh ; Myanmar ; Thailand ; Malaysia ; Indonesia.

Remarks : Inhabits larger freshwater rivers and swamps. Very popular for its flavour and rich oil contents.

2. *Notopterus notopterus* (Pallas)

1769. *Gymnotus notopterus* Pallas, *Spicil Zool.*, 7 : 40, pl. 6, fig. 2 (type - locality : ? Indian Ocean).

1889. *Notopterus notopterus* : Day, *Faun. Brit. India, Fish.*, 2 : 406, fig. 129.

1913. *Notopterus kapirat* : Anonymous, *Gazetteer of the Delhi District Part A -1912* : 18.

1958. *Notopterus notopterus* : Majumdar, *J. Bombay nat. Hist. Soc.*,55 (2) : 369 (Delhi).

1976. *Notopterus notopterus* : Raza *et al.*, In : *Delhi Gazetteer* : 30.

Local names : Mo, Pholee.

Material examined : Delhi; 1 ex. (18 mm, Juvenile). Pond, Indira Gandhi Indoor Stadium Complex, 10. ix. 1994 ; coll. J.P. Sati & party.

Diagnostic characters : D.I-II/6-7, P.17, V.5-6, A.+C.119-129, L.l. 225.

Body oblong, deep, strongly compressed. Head compressed. Mouth moderate, maxilla extends to middle of eye. Eyes large, in anterior half of head; preorbital serrated. Dorsal fin small,inserted nearer to snout tip than to caudal base. Pectorals extend beyond anal origin. Pelvics rudimentary. Anal long, confluent with caudal. Scales minute, considrably larger on opercles than

on body. Lateral line complete. Colour silvery with numerous grey dots. Attains 61 cm. in lenght.

Distribution : India : Delhi, Uttar Pradesh, Bihar, West Bengal, Assam, Orissa, Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra. *Elsewhere* : Pakistan; Nepal; Bangladesh; Maynmar; Thailand; Malaysia; Indonesia.

Remarks : Inhabits fresh and brackish waters. Thrives well in lantic water bodies. Carnivorous. Can be cultivated in ponds having plenty of fish. Breeds both in ponds and rivers during monsoon period. Relished both fresh and dried, soup reported to have medicinal value in measles.

Order : CLUPEIFORMES

Recessus lateralis present (infraorbital canal merging with preopercular canal within a chamber of neurocranium; not known in any other group). Parasphenoid teeth absent; No large foramen on anterior ceratohyal. Parietals separated by supraoccipital.

Suborder : CLUPEOIDEI

Lateral line not extending on body (canals do extend over operculum). Parahypural usually separate from first pleural centrum.

Key to families

Uppar jaw not projecting, not prominent; articulation of lower jaw under or before eyes; scales cycloid, adherent; gill-rackers long; mouth inferior, superior or terminal; snout not "Pig-like".....Clupeidae

Upper jaw projecting, prominent; articulation of lower jaw behind eyes; mouth underslung; snout "Pig-like"; scales ctenoid, deciduous; gill-rackers short.....Engraulididae

Family : CLUPEIDAE (Herrings, Sardines, Shads)

Subfamily : ALOSINAE (Shads)

Upper jaw with a distinct notch in front at base.

Key to genera

1. Scales moderate; 37-50 in lateral series.....*Hilsa* Regan
- Scales minute; 77-110 in lateral series.....*Gudusia* Fowler

Genus *Gudusia* Fowler

1911. *Gudusia* Fowler, *Proc. Acad. nat. Sci. Philad.*, **63** : 207 (type-speceis : *Clupanodon chapra* Hamilton-Buchanan).

3. *Gudusia chapra* (Hamilton-Buchanan)
River Shad

1822. *Clupanodon chapra* Hamilton Buchanan, *Fish. Ganges* : 248-249, 383 (type locality : upper parts of Ganges).

1889. *Clupea chapra* : Day, *Faun. Brit. India, Fish.*, **1** : 375.

1968. *Gudusia godanahiai* Srivastava, *Fish. East. U.P.* : 6, fig. 41, b (type locality : Gorakhpur, Uttar Pradesh).

1958. *Gudusia chapra* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55** (2) : 369 (Delhi).

1976. *Gudusia chapra* : Raza, et al. In : *Delhi Gazetteer* : 30.

Local name : Khuri.

Material examined : from literature.

Diagnostic characters : D. II-IV/11-13, P.I/12-13, V.I/7, A. II-III/19-22, C.17-19, L.l.77-110.

Body oblong, deep, strongly compressed, with a keel of scutes along belly. Head moderate. Snout shorter than eye. Eyes large. Mouth terminal, upper jaw with a distinct notch for corresponding symphysis on lower jaw. Dorsal fin origin opposite or slightly before pelvics, nearer caudal base than snout tip or almost midway between two points. Anal moderate. Caudal deeply forked, lower lobe slightly longer. Scales cycloid, minute. Colour silvery shot with gold, a dark blotch behind angle of operculum, often followed by a series of spots on upper side of body. Attains 20 cm in lenght.

Distribution : India : Delhi, Uttar Pradesh, Bihar, West Bengal, Assam, Orissa, Andhra Pradesh, Tamil Nadu, Maharashtra. *Elsewhere* : Pakistan; Nepal; Bangladesh; Malaysia.

Remarks : Inhabits rivers, lakes, ponds. Contirbutes to riverine fisheries. Not considered good eating due to dense bones and less flesh.

Genus *Hilsa* Regan

1917. *Hilsa* Regan, *Ann. Mag. nat. Hist.*, (8) **19** : 303 (type-species : *Clupea durbanensis* Regan = *Clupea kelee* Cuvier).

4. *Hilsa ilisha* (Hamilton Buchanan)
Hilsa

1822. *Clupanodon ilisha* Hamilton Buchanan, *Fish. Ganges* : 243-246, 382, pl. 19, fig. 73 (type locality frequents Bay of Bengal and large saltwater estuaries of Ganges ; Agra, Kanpur, at Patna on Ganges, Goalpara on Brahmaputra, about Calcutta and Dhaka).

1878. *Clupea ilisha* : Day, *Fish. India* : 635, 640, pl. 162, fig.3 (Delhi).

1889. *Clupea ilisha* : Day, *Faun. Brit. India*, Fish., **1** : 371, 376-377, fig. 115 (as high as Delhi).

1958. *Hilsha ilisha* : Majumdar, *J. Bomaby nat. Hist. Soc.*, **55**(2) : 369 (included under imported varieties).

1965. *Hilsa (Tenualosa) ilisha* : Whitehead, *Bull. Br. Mus. nat. Hist. (Zool)*, **12** (4) : 134, fig. 9.

1985. *Tenualosa ilisha* : Whitehead, *FAO Fish. Synop.*, (125) **7** (1) : 222, fig.

1991. *Hilsa (Tenualosa) ilisha* : Talwar and Jhingran, *Inland Fish. India*, **1** : 99, 100-101, ["Breeds mainly in rivers, in some cases far up (400 km up the Mahanadi system, and even to Agra and Delhi or over 1000 km up the Ganga)"].

Local name : Hilsa.

Material examined : from literature.

Diagnostic characters : D.IV-V/14-16, P.I/14, V.I/7-8, A.II-III/16-20, C.19, L.l.46-49.

Body fusiform, deep, compressed. with a keel of scutes along belly. Head moderate, compressed; without fronto-parietal straie. Eyes far forward. Mouth terminal, upper jaw with a distinct median notch. Dorsal fin origin slightly ahead of pelvics and at about mid point between snout tip and caudal base. Pectorals pointed, not reaching short pelvics. Caudal fin deeply forked, lobes pointed. Scales cycloid, small, adherent. Colour silvery shot with gold and purple; a dark blotch behind gill opening, followed by a series of small spots which may disappear with age. Attains 60 cm in length, males shorter.

Distribution : India : Delhi, Agra, Kanpur, Ganga, Mahanadi system, mouths of rivers Narmada, Tapti, Kaveri, Pennar, Godavari, Krishna, Mahanadi, Hooghly estuary. *Elsewhere* : Northern part of Indian ocean; Persian Gulf; coasts of Pakistan; Bangladesh, Myanmar; Malaysia.

Remarks : Occurs in coastal waters in vicinity of mouths of large rivers and ascending as much as 1200 km. Ascends to Delhi (Day, 1878, 1889 ; Talwar and Jhingan, 1991). Breeds mainly in rivers, younger fishes may breed in tidal zones of rivers. Construction of dams, anicuts, weirs etc. hinder its up river migration, affecting its fishery and population. River pollution by industrial wastes discharge etc. also contributing in its drastic decline. Of tremandous fishery importance. Highly esteemed for its culinary excellence. Artificial porpagation by stripping successful.

Family : ENGRAULIDIDAE (Anchovies)
Subfamily :ENGRAULIDINAE

Body shape normal. Pectoral fin normal or with first fin ray produced as a filament. anal fins separated from caudal. Caudal forked.

Genus *Setipinna* Swainson

1839. *Setipinna* Swainson, *Nat. Hist. Fish.*, **2** : 186, 292 (type-species : *Setipinna megalura* Swainson = *Clupea phasa* Hamilton-Buchanan).

5. *Setipinna brevifilis* (Valenciennes)

Short-hairfin Anchovy

1848. *Engraulis brevifilis* Valenciennes, 1848, *Hist. nat. Poiss.*, **21** : 54 (type locality : Bengal).

1889. *Engraulis telara* (*nec.* Hamilton - Buchanan, 1822) : Day (*partim*), *Faun. Brit. India,* Fish., **1** : 392.

1983. *Setipinna brevifilis* : Wongratana, *Jap. J. Ichthyol.*, **29**(4) : 405.

1991. *Setipinna brevifilis* : Talwar and Jhingran, *Inland Fish. India*, **1** : 133-134, fig. 54 (Delhi).

Local name : Bindi.

Material examiend : from literature.

Diagnostic characters : D.I,II/12-13, P.I/13-14, V.I./6, A.III/65-77.C.19, L.l.52

Body fusiform, strongly compressed, belly sharply keeled. Mouth oblique, maxilla reaching slightly beyond articulations of lower jaw. Dorsal fin short, preceded by a minute spine. Pectoral fin's first ray produced into a filament which may reach from 1st to 15th anal ray. Anal long. Caudal forked, upper lobe truncated, shorter than lower. Colour brownish-gold. Attains about 30 cm in lenght.

Distribution : India : Delhi and Ganga river system at Allahabad and Calcutta.

Remarks : Inhabits freshwater rivers. Contributes to local fisheries in Ganga.

Order : CYPRINIFORMES

Mouth usually protractile, toothless. Head scaleless. Teeth on 5th ceratobranchial ankylosed to bone (bound by collagenous fibres to bone in other ostariophysans with such teeth). Branchiostegal rays 3. Adipose fin absent (except in some cobitids); spine-like rays in dorsal fin of some species.

Key to families

1. Paired fins horizontally inserted; two or more anterior rays of pectoral fins simple.....2
   Paired fins laterally inserted; not more than one anterior ray of pectoral fins simple or may be all branched.....3

2. Barbles absent; swim bladder free in abdominal cavity.....Psilorhynchidae
   Barbles present; swim bladder partly enclosed in bony capsule.....Balitoridae

3. 1-2 pairs of barbles.....Cyprinidae
\- 3-4 pairs of barbles.....Cobitidae

Family : CYPRINIDAE (Barbs, Carps)

Key to subfamilies

1. Abdomen or part of abdomen compressed into a sharp keel-like edge; barbles absent .....Cultrinae
- Abdomen not compressed and no keel formed (except in *Osteobrama*); barbles present or absent.....2
2. Upper lip continuous with skin of snout, crenulated; mouth conspicuously inferior; lower lip with or without adhesive disc.....Garrinae
- Upper lip separate from skin of snout by a groove; mouth terminal, subinferior or inferior; lower lip without adhesive disc.....3

3. Lower jaw without symphysial knob; dorsal fin inserted before or opposite (exceptionally slightly behind) to pelvic fin origin, generally with a spine; lateral line complete or incomplete, running along median line of caudal peduncle.....Cyprininae
- Lower jaw with a symphysial knob (exception *Aspidoparia*), fitting into a notch or emargination of upper jaw; dorsal fin inserted behind pelvic fin base, without spine; lateral line, if present complete and abruptly bent downwards, running below lower half of caudal peduncle.....Rasborinae

Subfamily : CYPRININAE

Key to genera

1. Dorsal fin inserted posterior to pelvic fin base, generally extending over anal fin; abdominal edge sharp and trenchant wholly or partly.....*Osteobranna* Heckel
- Dorsal fin inserted apposite pelvic fin origin or slightly in advance.....2

2. Upper lip absent; head enormously large.....*Gibelion* Heckel
- Upper lip present; head normal.....3

3 Lower jaw with a small symphysial knob..... .....*Cirrhinus* Cuvier
- Lower jaw without symphysial knob.....4

4. Snout with a median and two lateral lobes; snout and cheeks covered with papillae; last anal ray enlongate in males.....*Chagunius* Smith
- Snout entire, without lobes; cheeks not covered with papillae; anal rays not elongate.....5

5. Lower lip developed into a fleshy lobe; scales large.....*Tor* Gray
Lower lip not developed into a fleshy lobe; scales moderate or small.....6

6. Horny covering on inner side of one or both lips.....*Labeo* Cuvier

- Horny covering on inner side of lips absent (except *Puntius lithopidos*) .....*Puntius* Hamilton-Buchanan

Genus ***Gibelion*** Heckel

1842. *Gibelion* Heckel, In : Russegger, *Resien in Europa, Asien und Africa, etc.*, 1(1) : 1014 (type-speceis : *Cyprinus (Cyprinus) catla* Hamilton - Buchanan). Replaces Catla Valenciennes (Jordan, 1919; Rainboth, in press, vide Talwar & Jhingran, 1991. Resurrected to genus *Gibelion* Heckel, 1842.

6. *Gibelion catla* (Hamilton - Buchanan)
Catla

1822. *Cyprinus (Cyprinus) catla* Hamilton - Buchanan, *Fish. Ganges* ; 287-289, 387, pl. 13. fig. 81 (type locality : rivers and tanks of Bengal).
1889. *Catla buchanani* : Day, *Faun. Brit. India,* Fish. : 287-288, fig. 99.
1958. *Catla catla* : Majumdar, *J. Bombay nat. Hist. Soc.*, 55(2) : 367 (Delhi).
1964. *Catla* : Raj and Sehgal, *Census of India 1961, Delhi* : 11.
1976. *Catla catla* : Raza et al., In : *Delhi Gazetteer* : 29, 30.

Local name : *Katla.*

Material examiend : from literature.

Diagnostic characters : D.III-IV/14-16, P.I./20, V.I./8, A.III/5, C.19, L.l.38-43.

Body ovate, deep, somewhat compressed. Head considerably large. Eyes large, visible from underside. Mouth terminal, large, upper lip absent, lower one thick. Barbles absent. Dorsal fin moderate, insertion slightly ahead of pelvics and midway between snout tip and caudal base. Caudal deeply forked. Scales medium. Lateral line complete. Colour greyish-brown above, silvery below. Attains 1.8 m in lenght.

Distribution : India : Delhi, northern India and upto Krishna river, transplanted into peninsular India, notably Kaveri river. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar; Thailand; transplanted into Sri Lanka and China.

Remakrs : Inhabits fresh and brackish waters. Non-predatory, surface and column feeder. Breeds in rivers during monsoon month. Artificial breeding by hypophysation successful. Composite fish culture with other Indian and exotic carps very beneficial. Commercially most important food fish. Hybrids with *Labeo rohita, L. calbasu, L.fimbriatus* and *Cirrhinus mrigala* have been produced artificially.

Genus ***Chagunius*** Smith

1938. *Chagunius* Smith, *Proc. biol. Soc. Washington* , **51** : 157 (type-species : *Cyprinus (Cyprinus) chaguino* Hamilton-Buchanan).

7. *Chagunius chagunio* (Hamilton - Buchanan)
Chagunio

1822. *Cyprinus (Cyprinus) chagunio* Hamilton - Buchanan, *Fish. Ganges* : 295-297, 387 (type locality : Yamuna and northern rivers of Bihar and Bengal).

1878. *Barbus (Barbodes) chagunio* : Day, *Fish.India* : 557, 559-560, pl. 136, fig. 2, pl. 140, fig. 2 (Delhi).

1889. *Barbus (Barbodes) chagunio* : Day, *Faun. Brit. India*, Fish., 1 : 299-300, fig. 103.

Local name : Chaguni.

Material examined : Delhi : 1 ex., (165 mm), Yamuna reservoir, Ramghat, 17.xii.1994, coll. Akhlaq Husain & party.

Diagnostic characters : D.III-V/8, P.I/14-15, V.I/8, A.III/5, C.19, L.l.44-47.

Body elongate, deep, compressed. Head large, compressed with tubercles on snout and cheeks (more heavily in males). Eyes high above. Mouth narrow, subterminal. Barbels two pairs, longer than eye. Dorsal origin, slightly behind that of pelvics, base not extending above anal insertion; spine strong and serrated. Anal short, its last few rays produced in males. Caudal deeply forked. Scales small. Lateral line complete. Colour silvery with pinkish tinge. Fins reddish, dorsal with black tip. Attains about 50 cm in lenght.

Distribution : India : Delhi, Ganga and Brahmaputra drainages along Himalayan foothills.

Remarks : Inhabits large rivers normally with rocky/stony bottom, clear water and fast current; probably was led down to Delhi. Feeds mainly on animal diet comprising insects and their larvae, crustaceans, molluscs, small fishes etc. Breeds after monsoon months. Offers good sport.

Genus *Cirrhinus* Oken

1817. *Cirrhinus* Oken, *Isis* : 1833 (on *"Les Cirrhines"*, Cuvier 1817, *Regne Animal*, **2 ed.** : 193) (type-species : *Cyprinus cirrhousus* Bloch).

Key to species

1. Dorsal fin with 8 branched rays, its height less than body depth; lateral line with 34-38 scales ..... *Cirrhinus reba* (Hamilton-Buchanan)

\- Dorsal fin with 12-13 branched rays, its height-equal to body depth; lateral line with 40-45 scales..... *Cirrhinus mrigala* (Hamilton-Buchanan)

8. *Cirrhinus mrigala* (Hamilton-Buchanan)
Mrigal

1822. *Cyprinus (Bangana) mrigala* Hamilton-Buchanan, *Fish. Ganges* : 279-280, 386, pl. 6, fig.

79 (type-locality : ponds and freshwater rivers of Gangetic provinces).

1889. *Cirrhina mrigala* : Day (*partim*), *Faun. Brit. India,* Fish., 1 : 278.

1913. *Cirrhina mrigala* : Anonymous, *Gazetteer of the Delhi District Part A-1912* : 18.

1964. *Cirrhina* : Raj and Sehgal, *Census of India 1961, Delhi* : 11.

1958. *Cirrhina mrigala* : Majumdar, *J. Bombay nat. Hist. Soc.*, 55 (2) : 376 (Delhi).

1976. *Cirrhina mrigala* : Raza *et al.*, In : *Delhi Gazetter* : 29, 30.

Local names : *Mirga, Mrigal, Narain.*

Material examined : from literature.

Diagnostic characters : D.III-IV/12-13, P. I/14-17, V.I./8,A.III/5, C.15-19, L.l. 40-49.

Body elongate, somewhat compressed; abdomen rounded. Head almost equal to body depth. Snout blunt, depressed, often with pores. Mouth broad, transverse. Rostral pair of barbles, short. Eyes large, in anterior half of head. Dorsal fin moderate (with 12-13 branched rays), inserted anterior to pelvics. Pectorals shorter than head. Anal short. Caudal deeply forked. Scales medium. Colour silvery with yellowish tinge; belly pinkish; paired and anal fins orange tipped (during breeding season). Attains about 1 m length and weighs 12.7 kg.

Distribution : India : Delhi, northern India from Punjab to West Bengal, Assam transplanted into peninsular India. *Elsewhere* : Pakistan ; Nepal ; Bangladesh.

Remarks : Inhabits rivers and lakes. Detritus feeder. Breeds during monsoon months in shallow pools of rivers. Important major carp and game fish. Successfully induced to breed through hypophysation. A large number of intergeneric hybrids with *Gibelion catla*, *Labeo rohita*, *L. calbasu* have been produced.

9. *Cirrhinus reba* (Hamilton-Buchanan)
Reba

1822. *Cyprinus (Bangana) reba* Hamilton-Buchanan, *Fish. Ganges* : 280-281, 386 (type-locality ; rivers and ponds of Bengal and Bihar).

1889 *Cirrhina reba* : Day, *Faun. Brit. India*, Fish., 1 : 279-280, fig. 96.

1958. *Cirrihna reba* : Majumdar, *J. Bombay nat. Hist. Soc.*, 55 (2) : 367 (Delhi).

1976. *Cirrihna reba* : Raza, *et al.*, In : *Delhi Gazetteer* : 30.

Local names : Raia, Suni.

Material examined : Delhi; 2 exs. (98, 100 mm), Delhi-Rohtak Yamuna canal, Najafgarh, 27.x. 1993, coll. N.K. Sinha & party ; 1 ex. (110 mm.), Yamuna reservoir, Ramghat nr. Wazirabad, Jagatpur road, 14.v. 1994, coll. Akhlaq Husain & party ; 3 exs. (34-36 mm), Okhla reservoir, Barrage side nr. U.P. Border, 10.ix.1994, coll. J.P. Sati & party ; 2 exs. (95, 112 mm), Yamuna reservoir, Ramghat, 17. xii. 1994, coll. Akhlaq Husain & party.

Diagnostic characters :

D.II-III/8-9, P.I./15, V.I/8, A.III/5,C.19, L.l. 34-38.

Body elongate, somewhat compressed, abdomen rounded. Head shorter than body depth. Snout slightly projecting beyond mouth, often with pores. Mouth broad, upper lip fringed in

juveniles. Rostral pair of barbels, short. Dorsal fin short (with 8 branched rays), its height less than body depth, origin slightly anterior to pelvics. Pectorals equal to head length. Anal short. Caudal deeply forked. Scales moderate, hexagonal. Colour silvery, scales dark at margins forming bluish longitudinal lines; anal and pelvics orange-tipped. Attains 30 cm in length, males smaller.

Distribution : India : Delhi and throughout. *Elsewhere* : Pakistan ; Nepal ; Bangladesh ; Myanmar ; Thailand.

Remarks : Inhabits clear water rivers and lakes. Plankton and detritus feeder. Breeds in flooded waters during monsoon months. Cultivated with rapid growth. Induced breeding by hypophysation successful.

Genus *Labeo* Cuvier

1817. *Labeo* Cuvier (*nec.* Bowdich, 1825), *Regne Animal,* **2 ed.1** : 194 (type-species : *Cyprinus niloticus* (Forskal) Geoffroy = *Cyprinus rufescens* Hasselquist).

Key to species

1. Lateral line scales 71-84.....*Labeo gonius* (Hamilton-Buchanan)
- Lateral line scales less (37-44).....2

2. Symphysial knob prsent.....*Labeo bata* (Hamilton-Buchanan)
- Symphysial knob absent.....3

3. Snout with lateral lobes.....*Labeo pangusia* (Hamilton-Buchanan)
- Snout wihtout lateral lobes.....4

4. Eye diameter 3.3 times in head length; dorsal fin with 13-16 branched rays .....*Labeo calbasu* (Hamilton-Buchanan)
- Eye diameter less (3.7-6.0) in head length; dorsal fin with less branched rays (9-14) 4

5. Lower lip with papillae inside .....*Labeo dero* (Hamilton-Buchanan)
- Lower lip without papillae.....6

6. Lateral line with 37-39 scales; dorsal fin with 9-10 branched rays; eye diameter 3.7-4.0 in head length .....*Labeo boga* (Hamilton-Buchanan)
- Lateral line with 40-44 scales; dorsal fin with 12-14 branched rays; eye diameter 4.0-6.0 in head length .....*Labeo rohita* (Hamilton-Buchanan)

10. *Labeo bata* (Hamilton-Buchanan)

Bata

1822. *Cyprinus (Bangana) bata* Hamilton-Buchanan, *Fish. Ganges* : 283-284, 386 (type-locality : rivers and ponds of Bengal).

1889. *Labeo bata* : Day, *Faun. Brit. India*, Fish., **1** : 268.

Local name : Bata.

Material examined : Delhi; 16 exs. (90-114 mm.), Delhi-Rohtak Yamuna canal, 27.x. 1993, coll. N.K. Sinha and party ; 35 exs. (42-77 mm), pond nr. Patparganj area nr. Yamuna bridge, Nizamuddin area, 10 .ix. 1994; 1 ex. (52 mm), Okhla reservoir, Barrage side nr. U.P. Border, 10 ix. 1994, coll. J.P. Sati & party ; 2 exs. (128, 150 mm), Yamuna reservoir, Ramghat, 17. xii. 1994, coll. Akhlaq Husain & party.

Diagnostic characters : D.II-IV/9-10, P.I/15-17, V.I./8, A.II-III/5, C. 19, L.l. 37-40.

Body elongate, somewhat compressed; abdomen rounded. Head moderate, Snout slightly projecting, often with pores. Eyes moderate, not visible from ventral side. Mouth subventral, lower jaw with a symphysial knob. Barbels minute, only maxillary pair. Dorsal fin origin slightly ahead of pelvics, distinctly nearer snout tip than caudal base. Pectorals almost equal to head length. Caudal deeply forked. Scales moderate. Colour silvery with an irregular black blotch on anterior few lateral line scales; pelvic and anal fins orange tipped. Attains 61 cm in length.

Distribution : India : Delhi, Uttar Pradesh, West Bengal, Assam, Orissa, Madhya Pradesh, Kaveri, Krishna and Godavari river systerms in South India. *Elsewhere* : Pakistan ; Nepal (introduced) ; Bangladesh

First record from Delhi.

Remarks : Inhabits freshwater rivers, lakes, canals. Breeds in rivers during monsoon months. Cultured both in fresh and estuarine waters. Induced breeding by hypophysation successful. Liked for its taste and flesh.

11. ***Labeo boga*** (Hamilton-Buchnan)

Boga Labeo

1822. *Cyprinus (Bangana) boga* Hamilton-Buchnan, *Fish. Ganges* : 286, 386, pl. 28 fig. 80 (type-locality : Brahmaputra river).

1889. *Labeo boga* : Day, *Faun. Brit. India,* Fish., 1 : 269-270.

Local name : Bhangan.

Material examined : Delhi; 4 exs. (100-115 mm), Rohtak-Delhi Yamuna canal, Najafgarh, 27.x. 1993, coll. N.K. Sinha & party.

Diagnostic characters : D.II-III/9-10 ; P. 1/15, V.I./8, A.II/5, C.19. L.l. 37-39.

Body elongate, somewhat compressed. Head moderate. Snout projecting beyond mouth, devoid of lateral lobe, occasionally covered with pores. Eyes large, slightly visible from underside. Mouth narrow, lips somewhat thickened. Barbles a minute maxillary pair. Dorsal fin placed above or slightly anterior to pectoral tip, origin nearer snout tip than caudal base. Caudal deeply forked, lobes pointed. Scales moderate. Lateral line complete. Colour orangish, young

often with a dark spot on body above pectoral fin; fins with a reddish tinge. Attains 30 cm in length.

Distribution : India : Delhi, Punjab, Uttar Pradesh, Bihar, West Bengal, Orissa, Andhra Pradesh, Tamil Nadu. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar.

First record from Delhi.

Remarks : Inhabits rivers, canals, etc. common in tributaries of Ganga, Godavari and Krishna rivers. Spawns in flooded waters.

12. *Labeo calbasu* (Hamilton - Buchanan)
Orange-fin Labeo

1822. *Cyprinus (Cyprinus) calbasu* Hamilton - Buchanan, *Fish. Ganges* : 297-298, 387, pl. 2, fig. 83 (type - locality : rivers and ponds of Bengal and in western provinces).

1889. *Labeo calbasu* : Day, *Faun. Brit. India,* Fish., 1 : 259-260, fig. 93.

1913. *Labeo calbasu* : Anonymous, *Gazetteer of the Delhi District Part A-1912* : 18.

1958. *Labeo calbasu* : Majumdar, *J.Bombay nat. Hist. Soc.*, 55(2) : 367 (Delhi).

1976. *Labeo calbasu* : Raza et al. In : *Delhi Gazetteer* : 30.

Local names : Dini, Kalabenis, Kalbans, Kalbons, Kalbose, Karnaunchar.

Material examined : Delhi; 11 exs. (1, 70 mm in SL; 10, 90-104 mm), Delhi Rohtak Yamuna canal, Najafgarh, 27.x.1993, coll. N.K.Sinha & party.

Diagnostic characters : D.III-IV/13-16, P.I/16-18, V.I/8, A.II-III/5, C.19, L.l.40-44.

Body elongate, somewhat compressed, deep; abdomen rounded. Head length less than depth of body. Snout pointed, without lateral lobe, beset with pores. Eyes moderate, slightly visible from underside. Mouth inferior. Barbles two pairs, rostral longer and almost equal to eye. Dorsal fairly long, origin slightly in advance of pelvics and midway between snout tip and caudal base. Caudal deeply forked, upper lobe longer. Scales moderate. Colour blackish with a tinge of pink or scarlet; fins blackish, upper caudal lobe white tipped. Attains over 90 cm in length.

Distribution : India : Delhi and throughout. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar; Thailand; China.

Remarks : Inhabits freshwater rivers and ponds, can tolerate slightly brackish water. Bottom feeder. Induced breeding in ponds by hypophysation successful. Important major carp and game fish, takes small fly-spoon. Stocked and cultivated with other like-fishes in tanks and lakes where it thrives well.

13. *Labeo dero* (Hamilton - Buchanan)
Kalabans

1822. *Cyprinus (Bangana) dero* Hamilton - Buchnan, *Fish. Ganges* : 277-278, 385, pl. 22, fig. 78 (type - locality : Brahmaputra river).

1889. *Labeo diplostomus* : Day, *Faun. Brit. India*, Fish., 1 : 265-266.

1958. *Labeo dero* : Majumdar, *J.Bombay nat. Hist. Soc.*, 55(2) : 376 (Delhi).

1976. *Labeo dero* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Arangi, Bongs, Chilwa, Gauwah, Gaolaria.

Material examined : from literature.

Diagnostic characters : D.II-III/9-12, P.I/16-17, V.I/7-8, A.II-II/5, C.19, L.l.40-44.

Body elongate, somewhat compressed, predorsal part raised and blunt edged; abdomen rounded. Head short. Snout overhanging mouth, with a prominent transverse groove and horny turbercles but without lateral lobe. Males with a deep transverse groove and greatly enlarged cornified tubercles on snout and prolonged anterior few rays of dorsal fin. In females groove less marked, tubercles rudimentary and fin simple. Eyes small, not visible from ventral side. Interorbital space broad. Mouth ventral, arched; lower lip fimbriated with its inner surface studded with nodular tubercles. Barbles small, only maxillary pair. Dorsal fin with deeply concave margin, origin slightly ahead of pelvics, distinctly nearer snout tip than caudal base. Pectoral shorter than head. Caudal deeply forked, upper lobe slightly longer. Colour bluish-silvery with scales tinged red; fins dark. Attains 75 cm in length (Talwar and Jhingran, 1991).

Distribution : India : Delhi, all along Himalaya, Arunachal Pradesh, Orissa, Madhya Pradesh. *Elsewhere :* Pakistan; Nepal; Bangladesh; Myanmar; China.

Remakrs : Inhabits hill streams; probably washed down to Delhi. Feeds mainly on vegetative matter. Breeds during monsoon months. Highly esteemed as food for its flavour. Smaller specimens used as bait for Mahseer sport.

14. *Labeo gonius* (Hamilton - Buchanan)
Gonius

1822. *Cyprinus (Cyprinus) gonius* (Hamilton - Buchanan), *Fish. Ganges* : 292-294, 387, pl. 4, fig. 82 (type - locality : fresh water rivers and ponds of Bengal).

1889. *Labeo gonius* : Day, *Faun. Brit. India*, Fish., 1 : 261-262.

1958. *Labeo gonius* : Majumdar, *J. Bombay nat. Hist. Soc.*, 55(2) : 367 (Delhi).

1976. *Labeo gonius* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Kaloose, Kurchia, Kursa.

Material examined : Delhi; 1 ex. (122 mm), Lake Park , Dhaulakuan, Sardar Patel road, 12.v.1994, coll. Akhlaq Husain & party.

Diagnostic characters : D.II-III/13-16, P.I/16, V.I/8, A.II/5-6, C.19, L.l.71-84.

Body elongate, somewhat compressed; abdomen rounded. Snout slightly projecting, without lateral lobes and studded with pores. Eyes moderate, slightly visible from underside. Mouth small, subventral; lips fringed. Barbles two pairs, short rostral and maxillary. Dorsal fin moderate, inserted slightly in advance of pelvics and nearer tip of snout than caudal base. Pectorals almost equal to head. Caudal deeply forked, lobes pointed. Scales small. Colour sivlery with indistinct longitudinal lines. Attains 1.5 m in length (Talwar & Jhingran, 1991).

Distribution : India : Delhi, Uttar Pradesh, Bihar, West Bengal, Assam, Orissa, Andhra

Pradesh. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar.

Ramarks : Inhabits freshwater rivers. Spawns during south-west monsoon. Cultured in ponds with other carps. Hypophysation for induced breeding successful.

15. *Labeo pangusia* (Hamilton - Buchanan)
Pangusia

1822. *Cyprinus (Bangana) pangusia* Hamilton - Buchanan, *Fish. Ganges :* 285-286, 386 (type - locality : Kosi river).
1889. *Labeo pangusia* : Day, *Faun. Brit. India*, Fish., 1 : 266-267.
1958. *Labeo pangusia* : Majumdar, *J.Bombay nat. Hist. Soc.*, 55(2) : 367 (Delhi).
1976. *Labeo pangusia* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Boala, Rewa.

Material examined : from literature.

Diagnostic characters : D.II-III/10-11, P.I/14-15, V.I/8, A.II/5, C.19, L.1.40-42.

Body elongate, somewhat compressed, abdomen rounded. Head short. Snout overhanging, covered with pores, with distinct lateral lobes. Eyes small, slightly visible ventrally. Mouth small, with interrupted inner fold. Barbles a short maxillary pair. Dorsal fin origin slightly ahead of pelvics and distinctly nearer snout tip than caudal base. Pectorals almost equal to head. Caudal deeply forked. Scales moderate. Colour dull greenish above, lighter below, scales often with dark mark. Attains 60 cm in lenght.

Distribution : India : Delhi, Ganga and Brahamaputra drainage systems, Godavari and Krishna rivers, Andhra Pradesh. *Elsewhere* : Pakistan; Bangladesh; Myanmar.

Remakrs : Inhabits rivers, lakes and ponds. Excellent food fish. Of minor fishery value in some parts.

16. *Labeo rohita* (Hamilton - Buchanan)
Rohu

1822. *Cyprinus (Cyprinus) rohita* : Hamilton - Buchanan, *Fish. Ganges* : 301-303, 388, pl. 36, fig. 85 (type locality : freshwater rivers & ponds of Gangetic provinces and of Ava).
1884. *Rohu* : Anonymous, *A Gazetter of the Delhi District (1883-4)* : 21.
1889. *Labeo rohita* : Day, *Faun. Brit. India*, Fish., 1 : 262-263.
1913. *Labeo rohita* : Anonymus, *Gazetteer of the Delhi District Part A-1912* : 18.
1958. *Labeo rohita* : Majumdar, *J. Bombay nat. Hist. Soc.*, 55(2) : 367 (Delhi).
1964. Rohu : Raj and Sehgal, *Census of India 1961, Delhi* : 11
1976. *Labeo rohita* : Raza et al., In : *Delhi Gazetteer* : 29, 30.

Local names : Bhobari, Rohu.

Material examined : from literature.

Diagnostic characters : D.III-IV/12-14, P.I./16-18, V.I/8, A.II-III/5, C.19, L.1.40-42.

Body elongate, moderately compressed; abdomen rounded. Head moderate. Snout projects beyond mouth, devoid of lateral lobe. Eyes large, slightly visible from underside. Mouth small, inferior; lips thick and fringed. Barbles one maxillary pair, sometimes a rostral pair also present. Dorsal fin inserted slightly ahead of pelvics and placed almost midway between snout tip and caudal base. Pectorals shorter than head. Caudal deeply forked. Scales moderate. Colour sivery with reddish tinge during breeding season; pinkish white below. Attains about 1 m in length.

Distribution : India : Delhi, northern and central India, transplanted into some rivers of peninsular India, Andamans and Powai lake, Bombay. *Elsewhere* : Pakistan; Nepal; Bangladesh; transplanted to Sri Lanka; Myanmar.

Remakrs : Inhabits rivers. Bottom feeder and prefers plant and decaying vegetative matter. Spawning coincides with south-west monsoon and takes place in flooded rivers. Induced breeding successful. One of the major carps, sought for culture. Excellent as food and game fish, takes light hook with a bait of weed. Interspecific and intergeneric hybrids have been produced, the most sought for is one through male Catla and female Rohu.

Genus *Osteobrama* Heckel

1842. *Osteobrama* Heckel, In : Russegger, *Reisen in Europa, Asien und Africa,* **1**(2) : 1033 (type-speceis : *Cyprinus (Cabdio) cotio* Hamilton - Buchanan).

17. *Osteobrama cotio cotio* (Hamilton Buchanan)
Cotio

1822. *Cyprinus (Cabdio) cotio* Hamilton Buchanan, *Fish. Ganges :* 339-341, 392, pl. 39, fig. 93 (type locality : ponds and ditches of Bengal).

1889. *Rohtee cotio* : Day *(partim), Faun. Brit. India,* Fish., **1** : 340-341

1940. *Rohtee cotio cotio* : Hora and Misra, *Rec. Indian Mus.*, **42** (1) : 166-168.

1958. *Rohtee cotio* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55** (2) : 367 (Delhi).

1976. *Rohtee cotio* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Chanda, Chandala, Gurda, Makhni.

Material examined : from literature.

Diagnostic characters : D.III-IV/8, P.I/12-14, V.I/8-9, A.II-III/27-38, C.19, L.l.55-70.

Body trapezoid and strongly compressed, abdominal edge trenchant between pelvic bases and anal fin but rounded in front of pelvics. Mouth small. Barbles absent. Dorsal spine weak, serrated behind. Anal long. Caudal deeply forked. Scales small, deciduous, irregularly arranged. Colour silvery with a dark blotch on nape. Attains 15 cm in length.

Distribution : India : Delhi, Punjab, Uttar Pradesh, Bihar, West Bengal, Assam, Madhya Pradesh. *Elsewhere* : Pakistan; Nepal; Bangladesh.

Remarks : Inhabits freshwater rivers, ponds and lakes. Useful larvicidal fish.

Genus ***Puntius*** Hamilton - Buchanan

1822. ***Puntius*** Hamilton - Buchanan, *Fish. Ganges* : 310, 388 (type-species : *Cyprinus (Puntius) sophore* Hamilton - Buchanan).

Key to species

1. Barbles present.....2
- Barbles absent.....3

2. Barbles one pair, maxillary; a black spot behind gill-opening .....
.....***Puntius chola*** Hamilton-Buchanan
- Barbles two pairs, maxillary and rostral; no black spot behind gill-opening.....
.....***Puntius sarana sarana*** Hamilton-Buchanan

3. Dorsal spine serrated; lateral line incomlete.....4
- Dorsal spine not serrated; lateral line complete or incomplete.....6
4. Two lateral spots (one each on body above pectoral fin and anal fin).....
.....***Puntius ticto*** Hamilton-Buchanan
- One lateral spot.....5

5. Lateral line scales 22-28; no black spot at base and anterior dorsal fin rays.....
.....***Puntius conchonius*** Hamilton-Buchanan
- Lateral line scales 29-36; black spot at base and anterior dorsal fin rays.....
.....***Puntius guganio*** Hamilton-Buchanan

6. Lateral line complete.....***Puntius sophore*** Hamilton-Buchanan
- Lateral line incomplete.....7

7. Black stripe on side of body; anterior few dorsal fin rays and membrane dark; black spot at caudal base.....***Puntius punjabensis*** Hamilton-Buchanan
- No black stripe on side of body, dorsal fin rays and membrane not black; black spot above anal fin, extending in a line to caudal base (an indistinct dark marking under posterior extremity of drosal fin).....***Puntius terio*** Hamilton-Buchanan

18. ***Puntius chola*** Hamilton - Buchanan
Bitter Barb

1822. *Cyprinus (Puntius) chola* Hamilton Buchanan, *Fish. Ganges* : 312-313, 389 (type

locality : north eastern parts of Bengal).

1889. *Barbus (Capoeta) chola* : Day, *Faun. Brit. India*, Fish., **1** :297-317.

Local name : Puti.

Material examined : Delhi : 2 exs. (87, 90 mm), Yamuna reservoir, Kalindi Kunj, Okhla, 15.v.1994, coll. Akhlaq Husain & party; 1 ex. (60 mm), Okhla reservoir across Barrage nr. U.P. Border, 10.ix.1994, coll. J.P.Sati & party.

Diagnostic characters : D.III/8, P.I/14, V.I/8, A.II/5, C.19, L.l. 24-28.

Boyd ovate, compressed. Head moderate. Mouth terminal, small. Barbles maxillary pair, short. Dorsal fin origin almost equidistnat between snout tip and caudal base, last undivided ray osseous, smooth. Caudal forked, upper lobe slightly longer. Scales moderate. Lateral line complete. Colour silvery, with a black spot just behind gill - opening and other at caudal base. Male with orange tinted pelvic and anal fins. Attains 13 cm in length.

Distribution : India : Delhi and throughout. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar.

First record from Delhi.

Remarks : Inhabits ponds and lakes. Food comprises algae, crustaceans, insects etc. Breeds before onset of monsoon. An aquarium fish.

19. *Puntius conchonius* Hamilton - Buchanan
Rosy Barb

1822. *Cyprinus (Puntius) conchonius* Hamilton Buchanan, *Fish. Ganges* : 317-318, 389 (type - locality : ponds of north east Bengal and rivers Kosi and Ami).

1889. *Barbus (Puntius) conchonius* : Day, *Faun. Brit. India*, Fish., **1** : 298, 325.

1958. *Puntius conchonius* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 367 (Delhi).

1976. *Puntius conchonius* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Bhur, Pothi, Punti.

Material examined : Delhi; 132 exs. (18-38 mm), Nala nr. village Nariana, Ring road, 6.vi.1993; 56 exs. (16 59 mm), Tank, National Zoological Park, 7.vi.1993; 227 exs. (11- 52 mm), Dhaulakuan Ridge, Cantonment area, 10.vi.1993, coll. Vinod Khanna & party; 46 exs. (26-51 mm), Ridge area nr. Dhaulakuan, 23.x.1993; 3 exs. (28-30 mm), Bawana, 30.x.1993, coll. N.K.Sinha & party; 3 exs. (21-37 mm), Pond, Indira Gandhi Indoor Stadium Complex, 11.v.1994; 11 exs. (22- 28 mm, one damaged), River Yamuna, Wazirabad, N.H. No. 1, 14.v.1994; 45 exs. (18-56 mm), Yamuna reservoir, Ramghat nr. Wazirabad, Jagatpur road, 14.v.1994; 2 exs. (17, 23 mm), River Yamuna, Yudhistra bridge, 16.v.1994, coll. Akhlaq Husain & party; 7 exs. (25-60 mm), Brass Coir Nala, Naraina, 9.ix.1994; 1 ex. (56 mm), Pond, Indira Gandhi Indoor Stadium Complex, 10.ix.1994, coll. J.P.Sati & party; 2 exs. (68, 71 mm), Yamuna reservoir, Ramghat, 17.xii.1994; 106 exs. (21-51 mm), Piggery Farm Nala, Uri Enclave, 18.xii.1994; 3 exs. (26-29 mm), Okhla reservoir, 18.xii.1994, coll. Akhlaq Husian & party; 4 exs. (23-38 mm), Piggery Farm Nala nr. Dhaulakuan, 16.ii.1995; 1 ex. (18 mm, juvenile), Okhla reservoir, Barrage side,

29.vii.1995, coll. J.P.Sati & party.

Diagnostic characters : D.III/7-8, P.I/10-13, V.I/7-8, A.II-II/5, C.19, L.l. 22-28.

Body ovate, compressed. Head moderate. Mouth terminal, small. Barbles absent. Dorsal fin origin opposite or slightly behind pelvics, nearer caudal base than snout tip or midway between two points; spine osseous, strong and serrated on posterior edge. Caudal forked, lobes subequal. Scales moderate. Lateral line incomplete. Colour silvery with a black spot on caudal peduncle above end of anal base. In breeding males dorsal, pelvic and anal fins black-tipped and body olive green above and pinkish below. Females lack this colourations. Attains 14 cm in length.

Distribution : India : Delhi, Punjab, Uttar Pradesh, Bihar, West Bengal, Assam, Orissa, Andhra Pradesh, Kaveri river system. *Elsewhere* : Afghanistan; Pakistan; Nepal; Bangladesh.

Remarks : Inhabits small rivers, lakes and ponds with clear water. Feeds both on plant and animal matter. Breeds before onset of monsoon. Popular among aquarists, can be kept with other small fishes.

20. ***Puntius guganio*** Hamilton - Buchanan
Glass Barb

1822. *Cyprinus (Cabdio) guganio* Hamilton Buchanan, *Fish. Ganges* : 338-339, 392 (type locality : rivers and ponds of Gangetic provinces, Brahmaputra and Yamuna).

1889. *Barbus (Puntius) ambassis* : Day, *Faun. Brit. India*, Fish., **1** : 298, 324.

1889. *Barbus (Puntius) guganio* : Day, *Faun. Brit. India*, Fish., **1** 298, 328-329.

1976. *Puntius ambassis* : Raza et al., In : *Delhi Gazetteer* : 30.

Local name : Puti.

Material examined : from literature.

Diagnostic characters : D.II-III/8, P.I./10-11, V.I/8, A.II/5, C.19, L.l. 29-36.

Body ovate, compressed. Head oval, blunt and dotted. Eyes large, far forward. Mouth small. Barbles absent. Dorsal fin origin slightly ahead of pelvics, midway between snout tip and caudal base; spine osseous, strong and posterioly serrated. Caudal deeply forked. Scales small. Lateral line incomplete. Colour light greenish with a silvery band along side, diaphanous; a balck spot each at base of anterior dorsal fin rays and caudal peduncle. Attains 8 cm in length.

Distribution : India : Delhi, Ganga and Brahmaputra river systems, Orissa, Andhra Pradesh, Tamil Nadu. *Elsewhere* : Bangladesh.

Remarks : Inhabits fresh water bodies. Kept in aquaria for its colouration.

21. ***Puntius punjabensis*** Hamilton Buchanan
Ravi Barb

1871. *Barbus (Puntius) punjabensis* Day, *J. Asiat. Soc. Beng.*, **40**(2) : 334 (type locality : Ravi river at Lahore).

1889. *Barbus (Puntius) punjabensis* : Day, *Faun. Brit. India*, Fish., **1** : 297, 331.

1958. *Puntius punjabensis* : Majumdar, *J. Bombay nat. Hist. Soc.*, 55 (2) : 367 (Delhi).

Local name : Puti.

Material examined : from literature.

Diagnostic characters : D.III/8, P.I/12, V.I/8, A.II/5, C.19, L.1.43.

Body ovate, compressed. Head small. Eyes rather large, in anterior half of head. Mouth small, terminal. Barbles absent. Dorsal fin inserted midway between snout tip and caudal base; last undivided ray weak, articulated. Caudal deeply forked, lobes pointed. Scales small. Lateral line incomplete. Colour silvery with a bright stripe along side and a black spot at caudal base; anterior two rays of dorsal fin and membrane dark black. Attains 5 cm in length.

Distribution : India : Delhi, Jabalpur. *Elsewhere* : Pakistan.

Remarks : Inhabits rivers and ponds.

22. *Puntius sarana sarana* Hamilton - Buchanan
Olive Barb

1822. *Cyprinus (Cyprinus) sarana* Hamilton - Buchanan, *Fish. Ganges* : 307-310, 388 (type - locality : ponds and rivers of India).

1889. *Barbus (Barbodes) sarana* : Day (*partim*), *Fauna. Brit. India*, Fish., 1 : 300-301.

1958. *Puntius sarana* : Majumdar, *J. Bombay nat. Hist. Soc.*, 53(2) : 368 (Delhi).

1976. *Puntius sarana* : Raza et al., In : *Delhi Gazetteer* : 30.

1981. *Puntius saberi* Datta and Karmakar, *Bull. zool. Surv. India*, 3(3) : 179, fig. 1 (type - locality : Cherogaru Talao, Dist. Bastar, Madhya Pradesh).

Local names : Durhi, Potah, Pothi, Puti.

Material examined : from literature.

Diagnostic characters : D.III-IV/8, P.I/14-16, V.I/8, A.III/5, C.18-19, L.1. 30-34.

Body ovate, compressed. Head short, oval. Eyes moderate, slightly visible from underside. Mouth somewhat subterminal. Barbles two pairs, maxillary almost equal to eye, rostral shorter. Dorsal origin opposite or slightly behind pelvic origin, midway betwen snout tip and caudal base or nearer to either side; spine osseous strong, finely serrated behind. Caudal forked, upper lobe slightly longer. Scales moderte, those at dorsal and anal bases form a sheath. Lateral line complete. Colour silvery, young ones with an oval blackish - brown spot below base of anterior few dorsal rays and another near caudal base which fades away with age. Horizontal lines passing through centre of scales, more prominent in young examples. Attains 34 mm in lenghth, sometimes grows to 61 cm.

Distribution : India : Delhi and throughout except peninsular India south of Krishna river. *Elsewhere* : Afghanistan; Pakistan; Nepal; Bhutan; Bangladesh.

Remarks : Inhabits freshwater rivers, lakes and ponds in plains. Feeds both on animal and plant matter. Breeds during monsoon months. Suitable for reservoir fisheries. Good as food. Can be used in controlling vegetation and molluscan population.

Puntius saberi Datta and Karmakar (1981) is young of this species.

23. *Puntius sophore* Hamilton Buchanan
Spot-fin Barb

1822. *Cyprinus (Puntius) sophore* Hamilton - Buchanan, *Fish. Ganges* : 310-311, 389, pl. 19, fig. 86 (type - locality : ponds, place not mentioned).

1889. *Barbus (Puntius) stigma* : Day, *Faun. Brit. India*, Fish., **1** : 297, 329.

1889. *Barbus (Puntius) chrysopterus* : Day, *Faun. Brit. India*, Fish., **1** : 298, 329-330.

1958. *Puntius sophore* : Majumdar (*nec.* Day, 1878, 1889), *J. Bombay nat. Hist. Soc.*, **55**(2) : 367 (Delhi).

1976. *Puntius sophore* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Bhur, Potia, Pothi, Punti.

Material examined : Delhi; 2 exs. (30, 31 mm), Nala nr. vill. Naraina, Ring road, 6.vi.1993; 2 exs. (55, 63 mm), Tank, National Zoological Park, 7.vi.1993, coll. Vinod Khanna & party; 24 exs. (35-60 mm), Horse-shoe Lake, Water Sport Complex, vill. Bhalswa, 26.x.1993; 39 exs. (30-35 mm), Najafgarh, 27.x.1993; 39 exs. (30-88 mm), Delhi Rohtak Yamuna canal, Najafgarh, 27.x.1993; 1 ex. (22 mm), Swampy area, Wazirabad Yamuna bridge, 28.x.1993; 16 exs. (1, 43 mm, adult; 15, 10-18 mm, juveniles), Bawana, 30.x.1993; 23 exs. (26-98 mm), Auchandi, 30.x.1993, coll. N.K.Sinha & party; 2 exs. (35, 37 mm), Pond nr. Yamuna barrage, Okhla, 10.v.1994; 1 ex. (57 mm), Old Fort Lake nr. Pragati Maidan, Mathura road, 10.v.1994; 25 exs. (14-55 mm), Pond, Indira Gandhi Indoor Stadium Complex, 11.v.1994; 8 exs. (68 87 mm), River Yamuna, Pantoon bridge nr. Indira Gandhi Indoor Stadium Complex, Bhairon Marg, 11.v.1994; 24 exs. (67 - 91 mm), Yamuna reservoir, Ramghat nr. Wazirabad, Jagatpur road, 14.v.1994, 2 exs. (60, 63 mm), Yamuna reservoir, Kalindi Kunj, Okhla, 15.v.1994; 117 exs. (37-83 mm), Horse-shoe Lake, Bhaleswa, 16.v.1994, coll. Akhalq Husian & party; 3 exs. (22-46 mm), Gopalpur Nala nr. Wazirabad, 8.ix.1994; 5 exs. (32-68 mm), Pond, Indira Gandhi Indoor Stadium Complex, 10.ix.1994; 3 exs. (30-39 mm), Pond nr. Patparganj area (nr. Yamuna bridge, Nizamuddin area), 10.ix.1994; 8 exs. (23-48 mm), Okhla reservoir, Barrage side nr. U.P.Border, 10.ix.1994, coll. J.P.Sati & party; 46 exs. (35-68 mm), Horse-shoe Lake, Bhalswa, 15.xii.1994; 1 ex. (93 mm), Yamuna reservoir, Ramghat, 17.xii.1994; 2 exs. (22,23 mm), Pond, Nagli-Sakraoti nr. Najafgarh, 20.xii.1994, coll. Akhlaq Husain & party; 1 ex. (48 mm), Jheel Park, Rambagh, 18.ii.1995; 4 exs. (41-63 mm), Yamuna reservoir, Ramghat, Wazirabad, 24.vii.1995; 5 exs. (18-20 mm, juveniles), Okhla reservoir, Barrage side, 29.vii.1995,coll. J.P.Sati & party.

Diagnostic characters : D.II-IV/8-9, P.I/14-16, V.I/8, A.II-III/5, C.19, L.l. 22-27.

Body ovate, compressed. Head short. Eyes moderate, slightly visible from ventral side. Mouth small, subterminal. Barbles obsent. Dorsal origin opposite or slightly behind that of pelvics, slightly nearer snout tip than caudal base; last undivided ray osseous, weak or moderately strong, smooth. Caudal forked, lobes equal. Scales moderate. Lateral line complete. Colour silvery with a black spot each on dorsal fin and caudal base. A lateral scarlet band in males during breeding season. Attains 13.5 cm in length.

Distribution : India : Delhi and throughout. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar; China.

Remarks : Inhabits ponds and rivers of plains and submontane regions. Shoaling fish. Feeds both on plant and animal diet. Breeds in flooded waters during monsoon months. Well known aquarium fish. Considered of medicinal value in some parts.

Chaudhuri (1915) clarified Himilton-Buchanan's error in respect of barbles which are not present in *Puntius sophore*.

24. *Puntius terio* Hamilton - Buchanan
Terio Barb

1822. *Cyprinus (Puntius) terio* Hamilton - Buchanan, *Fish. Ganges* : 313-314, 389 (type - locality : north - east of Bengal).

1889. *Barbus (Puntius) terio* : Day, *Faun. Brit. India*, Fish., **1** : 298, 330-331.

Local name : Puti.

Material examined : Delhi; 6 exs. (11-12 mm, juveniles), Bawana, 30.x.1993, coll. N.K.Sinha & party; 1 ex. (42 mm), River Yamuna, Okhla barrage, 10.v.1994; coll. Akhlaq Husain & party; 1 ex. (22 mm), Yamuna reservoir, Ramghat nr. Wazirabad, 24.vii.1995, coll. J.P.Sati & party.

Diagnostic characters : D.III/8, P.I/14, V.I/8, A.II/5, C.19, L.l.22-23.

Body ovate, compressed. Head moderate. Eyes large. Mouth small, oblique. Barbles absent. Dorsal fin origin slightly in advance of pelvics and equdistant between snout tip and caudal base; last undivided ray osseous, moderate or strong, smooth. Caudal forked. Scales medium sized. Lateral line incomplete. Colour silvery with greenish tinge, scales having fine black dots; an indistinct dark marking under posterior extremity of dorsal fin passing downwards; a large golden edged blotch on body above anal fin from which extends a median line ending in a black spot at caudal base; fins yellowish with blackish margins; dorsal having a median band. Males turn orange during breeding season. Attains 10 cm in length.

Distribution : India : Delhi, Punjab, Uttar Pradesh, Bihar, West Bengal, Assam, Orissa, Andhra Pradesh. *Elsewhere* : Pakistan; Bangladesh.

First record from Delhi.

Remarks : Inhabits rivers ponds and lakes. An aquarium fish of some importance.

25. *Puntius ticto* Hamilton - Buchanan
Fire-fin Barb

1822. *Cyprinus (Puntius) ticto* Hamilton - Buchanan, *Fish. Ganges* : 314-315, 389, pl. 8, fig. 87 (type locality : south east part of Bengal).

1889. *Barbus (Puntius) ticto* : Day, *Faun. Brit. India*, Fish., **1** : 289, 325.

1958. *Puntius ticto* : Majumdar, *J.Bombay nat. Hist. Soc.*, **55**(2) : 367 (Delhi).

1976. *Puntius ticto* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Potia, Puti.

Material examined : Delhi; 1 ex. (42 mm), Bawana, 30.x.1993, coll. N.K.Sinha & party; 1 ex. (58 mm), Yamuna reservoir, Ramghat nr. Wazirabad, Jagatpur road, 14.v.1994, coll. Akhlaq Husain & party.

Diagnostic characters : D.III-IV/8, P.I/12-14, V.I/8, A.II-III/5, C.16 - 19, L.l 23-26.

Body ovate, compressed. Head short. Eyes moderate, most part in anterior half of head, slightly visible from underside. Mouth subterminal. Barbles absent. Dorsal origin slightly behind that of pelvics and midway between snout tip and caudal base or nearer caudal base; spine osseous, strong, serrated behind. In males pelvics comparatively longer, nearly reaching anal opening and with a number of horny tubercles or pearl organs on caudal fin and other fins. Females lack these characters. Caudal forked, upper lobe slightly longer. Scales medium sized. Lateral line incomplete. Colour silvery; with a small black spot on lateral line above pectoral fin and another larger one on caudal peduncle over anal fin; dorsal fin with 2-3 oblique bands formed of blakc dots. Attains 10 cm in length.

Distribution : India : Delhi and throughout. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar; Thailand.

Remarks : Inhabits plains and submontane regions, mostly in ponds and lakes. Food consists of algae, crustaceans, insect larvae, rotifers etc. Breeds during monsoon months. Popular aquarium fish.

Generally confused with *Puntius conchonius* from which if differs in having two spots on body and bands of dorsal fin.

Genus *Tor* Gray

1834. *Tor* Gray, *Illus. Indian Zool.*, **2**, pl. 96 (type-species : *Cyprinus (Cyprinus) tor* Hamilton-Buchanan).

26. *Tor tor* (Hamilton - Buchanan)
Red-finned Mahseer

1822. *Cyprinus (Cyprinus) tor* Hamilton Buchanan, *Fish. Ganges* : 305-306, 388 (type locality : Mahananda river).

1884. *Mahsir* : Anonymous, *A Gazetteer of the Delhi District (1883-4)* : 21

1889. *Barbus (Barbodes) tor* : Day *(partim), Faun. Brit. India*, Fish., **1** : 295, 307-308, fig. 104.

1958. *Barbus (Tor) tor* : Majumdar, *J.Bombay nat. Hist. Soc.*, 55(2) : 367 (Delhi).

1964. *Barbus tor tor* : Raj and Sehgal, *Census of India 1961, Delhi* : 11.

1976. *Barbus tor tor* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Mahser, Raja.

Material examined : from literature.

Diagnostic characters : D.III-IV/8-9, P.I/14-17, V.I/8, A.III/5, C.19, L.l. 22-27.

Body elongate, stout, somewhat compressed. Head bluntly pointed, shorter than depth of body (variable in young). Snout and cheeks smooth. Eyes moderate visible from underside. Mouth moderate, subventral; lips fleshy. Barbles two pairs, maxillary pair equal to eye, rostral shorter. Dorsal origin variable being slightly ahead, opposite or behind pelvics; midway between snout tip and caudal base or slightly nearer to either side; spine strong, smooth. Caudal half forked, upper lobe slightly longer. Scales large. Lateral line complete. Colour greenish - yellow on sides, silvery with pinkish tinge below; dorsal and caudal fins greyish with pinkish tinge, other fins orange or reddish; fry with a black spot on caudal base. Maximum size 1.7 m (Sanderson vide Thomas, 1897).

Distribution : India : Delhi, Haryana, Punjab, Himachal Pradesh, Uttar Pradesh, Bihar, West Bengal, Assam, Arunachal Pradesh, Nagaland, Manipur, all along Himalaya, Madhya Pradesh. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar.

Remarks : Inhabits hill streams; probably washed down to Delhi, not seen now.
Feeds both on insect and plant matter. Breeds during monsoon months and even late when it ascends headwaters. Important food and game fish, weighing 68 kg. (Thomas, 1897).

The population of this fish has dwindled greatly during last few decades due to various reasons (excessive exploitation, water pollution, dynamiting, construction of dams on their way up, etc.). The speceis may be included under Wildlife (Protection) Act, 1972 as a conservation safeguard.

Subfamily : Cultrinae

Key to genera

1. Lower jaw without symphysial knob; predorsal scales not extending to interorbital space ..... *Chela* Hamilton-Buchanan
- Lower jaw with a symphysial knob; predorsal scales extend to interorbital space.....2

2. Abdominal keel hardened, supported anteriorly by a rigid expansion of pectoral girdle; pectoral axial scale thickened along its lower border; lateral line with 120-160 scales ..... *Securicula* Gunther
- Abdominal keel not hardened, not supported by expansion of pectoral girdle; pectoral axial scale not thickened along its lower border; lateral line with 40-112 scales..... ..... *Salmostoma* Swainson

Genus *Chela* Hamilton - Buchanan

1822. *Chela* Hamilton-Buchanan,*Fish. Ganges* : 258, 383 (type-species : *Cyprinus (Chela) cachius* Hamilton - Buchanan).

27. ***Chela cachius*** Hamilton - Buchanan
Silver Hatchet

1822. *Cyprinus (Chela) cachius* Hamilton Buchanan, *Fish. Ganges* : 258-259, 384 (type locality : Ganges, about commencement of delta).

1822. *Cyprinus (Chela) atpar* Hamilton - Buchanan, *Fish. Ganges* : 259-260, 384 (type locality : remote branches of Ganges, Brahmaputra and Yamuna and in ponds near former) (adult of *cachius* vide Silas, 1958).

1889. *Perilampus atpar* : Day, *Faun. Brit. India*, Fish., **1** : 359-360.

1958. *Laubuca atpar* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 367 (Delhi).

1976. *Laubuca atpar* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Cheli, Denara, Moria.

Material examined : Delhi;1 ex. (31 mm), Auchandi, 30.x.1993, col. N.K.Sinha & party; 1 ex. (35 mm), Pond, Indira Gandhi Indoor Stadium Complex, 11.v.1994, coll. Akhlaq Husain & party.

Diagnostic characters : D.II/7-8, P.I/8-11, V.I/4-6, A.II-III/18-23, C.19, L.l. 51-65.

Body elongate, deep, compressed; abdomen keeled between and behind pelvics. Mouth oblique, cleft not reaching eye. Barbles absent. Dorsal short, inserted slightly behind anal origin. Pectorals considerably longer than head. Outer pelvic ray filamentous, very long, reaching beyond, middle of long anal fin. Caudal forked. Colour silvery. Attains 6 cm in length.

Distribution : India : Delhi, Uttar Pradesh, Bihar, West Bengal, Assam, Orissa, Madhya Pradesh, Andhra Pradesh, Tamil Nadu, Karnataka, generally throughout. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar.

Ramarks : Inhabits slow moving streams in plains and submontane regions. Breeds in ponds, lakes and small streams. Larvicidal fish. Used as bait for some carnivore fishes.

Genus ***Salmostoma*** Swainson

1839. *Salmostoma* Swainson, *Nat. Hist. Fish.*, **2** : 184 (type-species : *Cyprinus (Chela) bacaila* Hamilton - Buchanan).

Key to species

Gill-rakers 17-21 on first arch; dorsal fin inserted well in advance of anal fin origin; anal fin with 10-13 branched rays.....*Salmostoma bacaila* (Hamilton-Buchanan)
Gill-rakers 13-16 on first arch; dorsal fin inserted opposite to anal fin origin; anal fin with 17-19 branched rays.....*Salmostoma phulo* Hamilton-Buchanan

28. ***Salmostoma bacaila*** (Hamilton - Buchanan)

Common on Razor-belly Minnow

1822. *Cyprinus (Chela) bacaila* Hamilton - Buchanan, *Fish. Ganges* : 265-266, 384, pl. 8, fig. 76 (type - locality : freshwater rivers of Gangetic provinces and peninsula).

1889. *Chela (Securicula) bacaila* : Day, *Faun. Brit. India*, Fish., **1** : 367.

1958. *Chela bacaila* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 367 (Delhi).

1976. *Chela bacaila* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Chela, Chelia, Chilwa.

Material examined : Delhi;1 ex. (112 mm), Delhi - Rohtak Yamuna Canal, Najafgarh, 27.x.1993; 2 exs. (15, 19 mm, juveniles), Bawana, 30.x.1993, coll. N.K.Sinha & party; 1 ex. (28 mm), Okhla reservoir, Barrage side nr. U.P.Border, 10.ix.1994, coll. J.P.Sati & party.

Diagnostic characters : D.II-III/7, P.I./11-12, V.I/8, A.III/10-13, C.19, L.l. 86-110.

Body elongate, strongly compressed. Mouth oblique, gape extends to below anterior border of eyes; lower jaw with a prominent symphysial knob. Eyes large, suborbital ring of bones broad. Dorsal fin inserted ahead of anal origin. Caudal deeply forked. Scales small. Colour silvery. Attains 18 cm in length.

Distribution : India : Delhi, Ganga, Brahmaputra and Mahanadi drainage systems. *Elsewhere* : Pakistan; Nepal; Bangladesh.

Remarks : Inhabits slow moving streams of plains and submontane regions. Surface feeder. Larvivorous.

29. ***Salmostoma phulo*** (Hamilton - Buchanan)
Short Razor-belly Minnow

1822. *Cyprinus (Chela) phulo* Hamilton - Buchanan, *Fish. Ganges* : 262, 384 (type - locality : rivers and ponds of north - eastern parts of Bengal).

1889. *Chela (Securicula) phulo* : Day (partim), *Faun. Brit. India*, Fish., **1** : 365.

1968. *Salmostoma phulo phulo* : Banarescu, *Revue roum. Biol. (Zool.)*, **13**(1) : 5, fig. 2.

1991. *Salmostoma phulo* : Talwar and Jhindgran, *Inland Fish. India*, **1** : 320, 326.

Local names : Chela, Dunari.

Material examined : Delhi;12 exs. (34-43 mm), Pond nr. Patparganj area (nr. Yamuna bridge, Nizamuddin area), 10.ix.1994, coll. J.P.Sati & party.

Diagnostic characters : D.II-III/7, P.I/12, V.I/7, A.III/17-19, C.19, L.l.80-112.

Body elongate, compressed. Mouth oblique, lower jaw with a distinct symphysial knob. Eyes moderate, equal to interorbital width. Dorsal fin inserted opposite anal origin. Caudal deeply forked. Scales small. Colour silvery. Attains over 12 cm in length.

Distribution : India : Delhi, Ganga and Brahmaputra drainages. *Elsewhere* : Bangladesh.

First record from Delhi.

Remarks : Inhabits ponds, lakes and streams.

Generally confused with young of *Salmostoma bacaila* but can be differentiated by more

number of divided anal fin rays.

Genus ***Securicula*** Gunther

1868. *Securicula* Gunther, *Cat. Fish. Brit. Mus.*, **7** : 332 (type-speceis : *Cyprinus (Chela) gora* Hamilton - Buchanan).

30. ***Securicula gora*** (Hamilton - Buchanan)
Gora Chela

1822. *Cyprinus (Chela) gora* Hamilton - Buchanan, *Fish. Ganges* : 263, 384 (type locality : Brahmaputra, near Goalpara).

1889. *Chela (Oxygaster) gora* : Day, *Faun. Brit. India*, Fish., **1** : 362.

1913. *Chela gora* : Anonymous, *Gazetteer of the Delhi District Part A-1912* : 18.

Local names : Chelua, Chilwa.

Material examined : from literature.

Diagnostic characters : D.II-III/7, P.I./12-14, V.I/7, A.II-II/13-15, C.19, L.l. 120-160.

Body elongate, strongly compressed; abdomen with a sharp keel between isthmus and anal base, not covered by scales. Head compressed, with a muscular mass in front of eyes; suborbital bones very broad, covering most of cheeks. Mouth oblique, almost vertical, cleft extending to eye; lower jaw with a well developed symphysial knob fitting into corresponding notch in upper jaw. Dorsal fin short, far behind inserted slightly in advance of anal origin. Pectorals long. Pelvics nearer anal than pectorals. Caudal deeply forked. Scales minute, extending on head up to nostrils. Lateral line complete, curved downwards. Colour silvery. Attains 23 cm in length.

Distribution : India : Delhi, Punjab, Uttar Pradesh, Bihar, West Bengal, Assam, Orissa. *Elsewhere* : Pakistan; Nepal; Bangladesh.

Remarks : Inhabits rivers, lakes, etc. Generally seen in fish markets during monsoon months.

Subfamily : RASBORINAE
Genus ***Amblypharyngodon*** Bleeker

1859. *Amblypharyngodon* Bleeker, *Natu. Tijdschr. Neder.-Indie*, **20** : 433 (type-species : *Cyprinus (Cabdio) mola* Hamilton - Buchanan).

31. ***Amblypharyngodon mola*** (Hamilton - Buchanan)
Pale Carplet

1822. *Cyprinus (Cabdio) mola* Hamilton - Buchanan, *Fish. Ganges* : 334-336, 392 pl. 38, fig. 92 (type -locality : ponds and freshwater rivers of Gangetic provinces).

1889. *Amblypharyngodon mola* : Day, *Faun. Brit. India*, Fish., **1** : 290,291, fig. 101.

1958. *Amblypharyngodon mola* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 367 (Delhi).

1976. *Amblypharyngodon mola* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Dhawai, Maluwa.

Material examined : from literature.

Diagnostic characters : D.II-III/7, P.I/13-15, V.I/8, A.II-III/5-6, C.19, L.l. 65-91.

Body elongate, compressed. Eyes moderate. Barbles absent. Dorsal fin short, origin about midway between pelvic and anal fins which are short. Caudal forked. Scales small. Colour golden with a silvery lateral band. Attains 8.5 cm in length.

Distribution : India : Delhi and throughout except Kerala. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar.

Remarks : Inhabits rivers and ponds.

Genus *Aspidoparia* Heckel

1843. *Aspidoparia* Heckel, In : Russegger, *Reisen in Europa, Aisen und Africa*, **2**(3) : 288 (type-species : *Aspidoparia sardina* Heckel = *Cyprinus (Chela) morar* Hamilton-Buchanan).

32. *Aspidoparia morar* (Hamilton - Buchanan)
Aspidoparia

1822. *Cyprinus (Chela) morar* Hamilton - Buchanan, *Fish. Ganges* : 264, 384, pl. 31, fig. 75 (type - locality : rivers Yamuna and Tista, branches of Ganges).

1889. *Aspidoparia morar* : Day, *Faun. Brit. India*, Fish., **1** : 338-339, fig. 108.

1958. *Aspidoparia morar* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55** (2) : 367 (Delhi).

1976. *Aspidoparia morar* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Chelua, Chipuah, Moraki.

Material examined : Delhi; 1 ex. (78 mm), Yamuna reservoir, Kalindi Kunj, Okhla, 15.v.1994, coll. Akhlaq Husain & party.

Diagnostic characters : D.II-III/7-8, P.I/12-14, V.I/7-8, A.II/8-10, C.19, L.l. 36-42.

Body elongate, compressed. Mouth small. Eyes moderate. Barbles absent. Dorsal fin inserted distinctly behind pelvic base. Anal fin short (with 8-10 branched rays). Caudal forked. Scales deciduous. Colour silvery. Attains 17.5 cm in length.

Distribution : India : Delhi and throughout except western coast and South of Krishna river. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar; Thailand.

Remarks : Inhabits ponds, lakes and nalas. Feeds on planktons, algae, insect larvae etc. Breed before monsoon.

Genus *Barilius* Hamilton-Buchanan

1822. *Barilius* Hamilton-Buchanan, *Fish. Ganges* : 266-267, 384 (type-species : *Cyprinus (Barilius) barila* Hamilton-Buchanan.

Key to species

Barbles two pairs, rostral pair very short, maxillary pair extend to anterior - third of eye; pectoral fins about as long as head; body with 14-15 vertical bars on sides ....
.....*Barilius barila* Hamilton-Buchanan
Barbels two pairs, rostral pairs shorter than eye diameter, maxillary pair very short; pectoral fins slightly shorter than head; body with 10-14 vertical bars on sides.*Barilius vagra* Hamilton-Buchanan

33. *Barilius barila* Hamilton - Buchanan
Barred Baril

1822. *Cyprinus (Barilius) barila* Hamilton - Buchanan, *Fish. Ganges* : 267-268, 384 (type locality : rivers of northern Bengal).
1878. *Barilius (Bendilisis) barila* : Day, *Fish. India*, : 589, 591, pl. 148, fig. 4 (Delhi).
1889. *Barilius (Bendelisis) barila* : Day, *Faun. Brit. India*, Fish., **1** : 334, 348 (Delhi).
1991. *Barilius barila* : Talwar and Jhingran, *Inland Fish. India*, **1** : 343-344 (Delhi).

Local names : Chilwa, Persi.

Material examined : from literature.

Diagnostic characters :

D.II/7, P.I/12, V.I/8, A.III/10-11, C.19, L.l. 43-46.

Body elongate, low, compressed. Mouth moderate, maxilla extends to below anterior part of eye. Barbles two pairs, rostral minute, maxillary extend to anterior edge of eye or maxilla. Dorsal inserted between pelvics and anal fins and placed nearly in advance of anal fin. Caudal forked. Scales moderate. Colour silvery with several vertical bluish bands. Attains 10 cm in length.

Distribution : India : Delhi, Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Madhya Pradesh, Bihar, West Bengal, Assam, Manipur, Orissa, Andhra Pradesh, Karnataka. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar.

Remarks : Inhabits hill streams; probably washed down to Delhi. Used as bait on hooks for some commercially important fishes.

34. *Barilius vagra* Hamilton - Buchanan
Vagra Baril

1822. *Cyprinus (Barilius) vagra* Hamilton Buchanan, *Fish. Ganges* : 269-270, 385 (type locality : Ganges about Patna).
1889. *Barilius (Pachystomus) vagra* : Day, *Faun. Brit. India*, Fish., **1** : 344-345.

1958. *Barilius vagra* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 367 (Delhi).

1976. *Barilius vagra* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Chilwa, Persi.

Material examined : from literature.

Diagnostic characters : D.II-III/7, P.I/13-15, V.I/8, A.II-III/10-12, C.19, L.l. 38-44.

Body elongate, low. Mouth moderate, oblique, maxilla extends to middle of eye. Barbles two pairs, rostral shorter than eye, maxillary pair very short. Dorsal inserted anterior to anal, its last few rays above anal fin. Caudal deeply forked. Colour silvery with several bluish vertical bands. Attains 12.5 cm in length.

Distribution : India : Delhi and sub-Himalayan streams of north India (Indus, Ganga, Yamuna and Brahmaputra drainages). *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka.

Remarks : Inhabits hill streams; probably washed down to Delhi. Feeds both on animal and plant diet. Breeds during monsoon months.

Genus *Esomus* Swainson

1839. *Esomus* Swainson, *Nat. Hist. Fish.*, **2** : 185, 285 (type-speceis : *Esomus vittatus* Swainson = *Cyprinus (Danio) danirica* Hamilton-Buchanan).

35. *Esomus danricus* (Hamilton - Buchanan)
Flying Barb

1822. *Cyprinus (Danio) danrica* Hamilton - Buchanan, *Fish. Ganges* : 325-326, 390, pl. 16, fig. 88 (type - locality : ponds and ditches of Bengal).

1889. *Nuria danrica* : Day (*partim) Faun. Brit. India*, Fish., **1** : 334-335, fig. 106.

1958. *Esomus danricus* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 367 (Delhi).

1976. *Esomus danricus* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Dendu, Mola, Sumra.

Material examined : Delhi; 7 exs. (30-60 mm), Dhaulakuan Ridge, Cantonment area, 10.vi.1993, coll. Vinod Khanna & party; 1 ex. (37 mm), Ridge area nr. Dhaulakuan, 23.x.1993; 4 exs. (30-50 mm), Horse-shoe Lake, Water Sport Complex, vill. Bhalswa, 26.x.1993; 4 exs. (25-39 mm), Swampy area, Wazirabad bridge, 28.x.1993; 7 exs. (31-53 mm), Auchandi, 30.x.1993; 1 ex. (40 mm), Lake Garden, Shakur Basti, 31.x.1993, coll. N.K.Sinha & party; 2 exs., (40, 41 mm), Brass Coir Nala, Naraina, 9.ix.1994, coll. J.P.Sati & party; 5 exs. (29 - 33 mm), Piggery Farm Nala, Uri Enclave, 18.xii.1994; 3 exs. (33-40 mm), Chhawla Pul Nala, Najafgarh-Bijwasan road, 20.xii.1994, coll. Akhlaq Husain & party; 1 exs. (32 mm), Yamuna barrage side, Wazirabad, 11.ii.1995; 1 ex. (40 mm), Bhalswa Lake, 11.ii.1995; 9 exs. (44-54 mm), Jheel Park, Ranibagh, 18.ii.1995; 10 exs. (39-61 mm), Yamuna reservoir, Ramghat, Wazirabad, 24.vii.1995, coll. J.P.Sati & party.

Diagnostic characters : D.II/6, P.I/10-15, V.I/6-8, A.III/5-6, C.18-19, L.l. 27-34.

Body elongate, low, compressed. Head pointed. Mouth small, obliquely directed upwards. Barbels two pairs, maxillary pair very long, extending to middle of body. Dorsal short, origin slightly ahead of anal and considerably nearer caudal base than snout tip. Pectorals pointed, long, extending to pelvic base end. Caudal deeply forked. Scales moderate. Colour olive-green above, sides silvery with a characteristic black lateral band running between head and caudal base. Attains 12.5 cm in length.

Distribution : India : Delhi, Punjab, Uttar Pradesh, West Bengal, Assam, Orissa, Madhya Pradesh, Andhra Pradesh, Tamil Nadu, Gujarat. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar, Thailand; Malaysia.

Remarks : Inhabits ponds, ditches, lakes and nalas. Surface feeder, feeding on algae, protozoans, crustaceans, insect larvae etc. Breeds during monsoon months. Testified for its great utility in mosquito eradication programme.

Genus ***Parluciosoma*** Howes

1980. *Parlucisoma* Howes, *Bull. Brit. Mus. nat. Hist.* (Zool.), **37**(3) : 183 (type-species : *Leuciscus argyrotaenia* Bleeker).

36. *Parluciosoma daniconius* (Hamilton - Buchanan)
Common Rasbora

1822. *Cyprinus (Danio) daniconius* Hamilton Buchanan, *Fish. Ganges* : 327-328, 391, pl. 15, fig. 89 (type - locality : rivers of southern Bengal).

1889. *Rasbora daniconius* : Day, *Faun. Brit. India*, Fish., **1** : 336-337.

Local names : Chal, Milelua.

Material examined : Delhi; 7 exs. (75-87 mm), Yamuna reservoir, Ramghat nr. Wazirabad, Jagatpur road, 14.v.1994, coll. Akhlaq Husian & party; 5 exs. (57-70 mm), Yamuna reservoir, Ramghat,Wazirabad, 24.vii.1995; 1 ex. (18 mm, juvenile), Okhla reservoir, Barrage side, 29.vii.1995, coll. J.P.Sati & party.

Diagnostic characters : D.II/7, P.I/11-14, V.I-II/8, A.II-III/5, C.19, L.l. 27-34.

Body elongate compressed. Mouth small; lower jaw with a prominent symphysial knob. Barbles absent. Eyes large, distinct. Dorsal fin inserted between short pelvics and anal fins. Pectorals shorter than head. Caudal forked. Scales moderate. Lateral line nearly complete. Colour silvery with a blue-black lateral band, running between eyes and caudal base. Attains 10 cm in length.

Distribution : India : Delhi and throughout. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar; Malaysia.

First record from Delhi.

Remarks : Inhabits lakes, ponds, ditches and streams. Feeds on insects and their larvae, crustaceans, worms, algae and other plant matter. Breeds during monsoon months. Brilliant

coloured fish suitable for aquarium.

Subfamily : GARRINAE

Key to genera

1. Lower lip modified into a suctorial disc; upper and lower lips continuous..... .....*Garra* Hamilton-Buchanan

- Lower lip not modified into a suctorial disc; upper and lower lips not continuous but with a narrow frenulum connecting upper lip with lower jaw or with lower lip..... ....*Crossocheilus* Kuhl & van Hasselt

Genus *Crossocheilus* Kuhl & van Hasselt

1823. *Crossocheilus* Kuhl et van Hasselt, *Allgem. Konst. Letter-Bode,* **2** : 132 (type-species : *Crossocheilus oblongus* Kuhl et van Hasselt).

37. ***Crossocheilus latius*** (Hamilton - Buchanan)
Gangetic Latia

1822. *Cyprinus (Garra) latius* Hamilton - Buchanan, *Fish. Ganges* : 345-346, 393, (type - locality : Tista river).
1889. *Crossocheilus latia* : Day *(partim), Faun. Brit. India*, Fish., **1** : 279.
1934. *Crossochilus latius* : Mukerji, *J. Bombay nat. Hist. Soc.*, **37**(1) : 49-52.
1938. *Crossochilus latius* Hora and Misra, *J. Bombay nat. Hist. Soc.*, **40**(1) : 31-32, pl. 2, figs. 1-5.
1958. *Crossocheilus latius punjabensis* (*nec.* Mukerji, 1934) : Majumdar, *J. Bombay nt. Hist. Soc.*, **55**(2) : 367 (Delhi).
1981. *Crossocheilus latius latius* : Jayaram, *Freshw. Fish. India* : 134, fig. 106.
1991. *Crossocheilus latius latius* : Talwar and Jhingran, *Inland Fish. India*, **1** : 414, 416, fig. 147.

Local names : Goma, Petphorni.

Material examined : Delhi; 2 exs. (73, 77 mm), Yamuna reservoir, Kalindi Kunj, Okhla, 15.v.1994, coll. Akhlaq Husain & party; 1 ex. (49 mm), Pond nr. Patparganj area (nr. Yamuna bridge, Nizamuddin area), 10.ix.1994; 3 exs. (38-45 mm), Okhla reservoir, Barrage side, nr. U.P.Border, 10.ix.1994, coll. J.P.Sati & party.

Diagnostic characters : D.II-IV/7-8, P.I/13-14, V.I/8, A.II/5, C.16-20, L.l. 37-41.

Body elongate, subcylindrical, low. Head and thorax flattened ventrally. Mouth inferior,

upper lip deeply fringed, lower lip with a pendulous lobe at angle. Barbles two pairs, rostral prominent, maxillary minute, sometimes not traceable. Eyes on upper half of head. Interorbital space wide, somewhat flattened. Dorsal fin short, origin in advance of pelvics and neaner snout tip than caudal base. Pectoral, pelvic and anàl fins also short. Caudal deeply forked, lobes pointed, upper lobe slightly longer. Scales moderte. Colour light brownish above with irregular dark spots, lighter below; fins yellowish. Attains 23.5 cm in length.

Distribution : India : Delhi, Ganga, Brahmaputra and Mahanadi drainages, Western Ghats, south to headwaters of Krishna river. *Elsewhere* : Nepal; Bangladesh.

Remarks : Inhabits submontane streams; probably washed down to Delhi. Subsists mainly on algal slime covering rocks and stones. Breed during monsoon months. Not commercially important.

Genus *Garra* Hamilton-Buchanan

1822. *Garra* Hamilton-Buchanan, *Fish. Ganges* : 343, 393 (type-species : *Cyprinus (Garra) lamta* Hamilton-Buchanan).

38. *Garra gotyla gotyla* (Gray)
Stone Sucker

1832. *Cyprinus gotyla* Gray, *Illus. Indian Zool.*, 1, pl 88, figs. 3,3a (type - locality : not mentioned).

1964. *Garra gotyla gotyla* : Menon, *Mem. Indian Mus.*, **14** : 233-236, pl. 13, figs. 1-4.

1958. *Garra gotyla* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55** (2) : 367 (Delhi).

Local names : Patharchat, Siltoka.

Material examined : from literature.

Diagnostic characters : D.III/7-8, P.I/14-16, V.I/8, A.II-III/5, C.17, L.l. 33.

Body elongate, subcylindrical, under surface of head and body flattened. Head depressed, interorbital region convex. Snout with a well developed median proboscis and a transverse groove near upper lip; proboscis and snout beset with thorny tubercles. Mouth ventral, upper lip fimbriated, mental adhesive disc well developed. Barbels two pairs, shorter than eye. Dorsal fin short, origin distinctly ahead of pelvics nearer snout than caudal base. Pectorals considerably shorter than head. Anal short. Caudal forked. Scales moderate. Colour olive-green above with a black spot at angle of operculum, pale below. Attains about 20 cm in length.

Distribution : India : Delhi, all along Himalaya, Assam, Chota Nagpur plateau, Vindya - Satpura mountains. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar.

Remarks : Inhabits hill streams; probably washed down to Delhi. Herbivorous. Monsoon breeder. Whenever collected, sold with local catch.

Family : PSILORHYNCHIDAE (Minnows)

Genus ***Psilorhynchus*** McClelland

1839. *Psilorhynchus* McClelland *Asiat. Res.*, **19**(2) : 300, 428 (type-species : *Cyprinus (Garra) sucatio* Hamiton-Buchanan).

39. *Psilorhynchus balitora* (Hamilton - Buchanan)
Balitora Minnow

1822. *Cyprinus (Garra) balitora* Hamilton - Buchanan, *Fish. Ganges* : 348-349, 394 (type - locality : rivers of north east Bengal).
1889. *Psilorhynchus balitora* : Day, *Faun. Brit. India*, Fish., **1** : 244-245, fig. 86.
1951. *Psilorhynchus balitora* : Majumdar, *J. zool. Soc. India*, **3**(1) : 243-244 (Delhi).
1958. *Psilorhynchus balitora* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 368 (Delhi).
1976. *Psilorhynchus balitora* : Raza et al., In : *Delhi Gazetteer* : 30.
1981. *Psilorhynchus balitora* : Jayaram, *Freshw. Fish. India* : 140 (Delhi).

Local name : Patharchat.

Material examined : from literature.

Diagnostic characters : D.II-III/7-8, P.V-VIII/7-9, V.II/7, A.II/5, C.18, L.l. 35.

Body elongate, arched. Mouth subventral, small. Barbles absent. Eyes large, dorso - lateral, almost in middle of head length. Dorsal fin inserted in advance of pelvics. Paired fins horizontal. Caudal less than half forked. Anterior part of thorax devoid of scales, ventral side behind pectorals with irregularly distributed scales. Colour silvery with dark spots. Dorsal and caudal fins with 1-2 blackish bands. Attains over 6 cm in length.

Distribution : India : Delhi, Uttar Pradesh, Bihar, West Bengal, Assam. *Elsewhere* : Nepal; Bangladesh; Myanmar.

Remarks : Inhabits slow moving submontane streams; probably washed down to Delhi. Variegated coluration camouflages it with surrounding habitat.

Family : BALITORIDAE (Loaches)

Subfamily : NEMACHEILINAE

Paired fins vertical; outer most pectoral fin ray simple; swin bladder reduced to two connected lateral parts and a small posterior part.

Genus ***Nemacheilus*** Bleeker

1823. *Noemacheilus* Kuhl et van Hasselt, *Allgem. Konst Letter-Bode*, **2** : 133 (type-speceis : *Noemacheilus fasciatus* Kuhl et van Hasselt)(*nomen nudum vide* Kottelat, 1987 : 371).
1863. *Nemacheilus* Bleeker, *Ned. Tijdschr. Dierk. Indie*, **1** : 365 (type-speceis : *Cobitis fasciata*

Valenciennes).

Key to species

1. Body spotted; pectoral fin with elongated ray (3rd) ....
   .....*Nemacheilus corica* (Hamilton-Buchanan)
- Body banded; pectoral fin without elongated ray.....2

2. Dorsal fin inserted slightly nearer caudal fin base than to snout tip; caudal fin emarginate; 10-12 vertical bands on sides of body.....*Nemacheilus montanus* (McClelland)
- Dorsal fin inserted equidistant between snout tip and caudal fin base; caudal fin deeply forked; 18-19 vertical bands on sides of body.....*Nemacheilus scaturigina* (McClelland)

40. *Nemacheilus corica* (Hamilton - Buchanan)
Corica Loach

1822. *Cobitis corica* Hamilton - Buchanan, *Fish. Ganges* : 359-395, 394 (type locality : rivers Kosi).
1889. *Nemachilus corica* : Day, *Faun. Brit. India*, Fish., **1** : 229.
1958. *Namachilus corica* : Majumdar, *J. Bombay nat. Hist. Soc.*, 55(2) : 368 (Delhi).
1971. *Nemachilus corica* : Tilak, *Rec. zool. Surv. India*, 65(1-4) : 186, 199-201, 208, figs. 2a-d.
1976. *Nemachilus corica* : Raza et al., In : *Delhi Gazetteer* : 30.
1987. *Noemacheilus corica* : Menon, *Faun. India*, Pisces, 4(1) : 89-91, pl. 12, fig. 3.
1991. *Nemacheilus corica* : Talwar and Jhingran, *Inland Fish. India*, **1** : 463, 476.

Local names : Baluari, Gadera, Karri, Nauni, Natwa.

Material examined : from literature.

Diagnostic characters : D.II-IV/8, P.I/10-12, V.I/7, A.II-III/5, C.17.

Body elongate, dorsal profile gradually rising from snout tip to dorsal origin. Head oval, granulated. Snout obtuse. Eyes small, major part in anterior half of head; males with suborbital flap. Nostrils, nearer eye than snout tip, membranous flaps between anterior and posterior nostrils end in a fine tendril simulating a barble. Mouth semicircular, lips fleshy, lower lip interrupted in middle. Barbles three pairs, short, inner rostral shortest and almost equal to eye, outer rostral longest, reaching middle of eye or slightly behind, this and maxillary pair longer than eye; minute nodular outgrowths on all barbles make them roughened. Dorsal fin slightly shorter than head, slightyly ahead of pelvics, insertions nearer snout tip than caudal base. Pectoral fin longer than head, 3rd outer ray elongated, extneding about middle of pelvic base, upper surface of fin tuberculated in males. Pelvics shorter than pectorals, reaching anal opening but not to anal fin. Anal not reaching caudal base. Caudal deeply forked, lobes almost equal, pointed. Scales minute, not present on ventral side of body. Lateral line complete. Colour yellowish with a series of rounded or oval spots along lateral line and dorsal side of body. Attains over 4 cm in length.

Distribution : India : Delhi and sub Himalayan range from Punjab, Jammu & Kashmir to

West Bengal, Assam. *Elsewhere* : Pakistan; Nepal; Bangladesh.

Remarks : Inhabits slow moving submontane streams with sandy bed; probably washed down to Delhi. Feeds minly on small aquatic insects and their larvae. Breeds during monsoon.

41. *Nemacheilus montanus* (McClelland)
Mountain Loach

1838. *Schistura montanus* McClelland, *J. Asiat. Soc. Bang.*, **7** : 947, pl. 55, fig. 1 (type - locality : mountain streams of Shimla).
1889. *Nemachilus montanus* : Day (partim), *Faun. Brit. India*, Fish., **1** : 230.
1958. *Nemachilus montanus* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 367 (Delhi).
1976. *Nemachilus montanus* : Raza et al., *In : Delhi Gazetteer* : 30.
1987. *Noemacheilus montanus* : Menon, *Faun. India*, Pisces, **4** (1) : 78-80, pl. 11, figs. 6-7.
1991. *Nemacheilus montanus* : Talwar and Jhingran, *Inland Fish. India*, **1** : 465, 489-490.

Local names : Baluari, Karri, Natwa.

Material examined : from literature.

Diagnostic characters : D.III/7-8, P.I/8-10, V.I/6-7, A.I-III/5, C.17-18.

Body elongate, slightly compressed, with almost uniform depth. Head narrow. Snout obtuse. Eyes small, slightly in anterior half of head; males with suborbital flap. Anteriro and posterior nostrils close, nearer eye than snout tip. Mouth inferior, semicircular; lower lip interrupted in middle, dentiform process well developed. Barbles three pairs, short, inner rostral shortest, outer rostrals reaching nostrils and maxillary pair to posterior end of eye. Dorsal fin slightly shorter than head, origin slightly ahead of pelvics, midway between snout tip and caudal base or slightly nearer to caudal base. Upper surface of pectoral fin finely tuberculated in males. Pelvics not reaching anal opening. Anal not reaching caudal base. Caudal deeply emarginate, lobes rounded or obtuse, lower lobe longer. Scales minute, imbricate all over, more prominent posteriorly. Colour yellowish with 10-13 vertical bands on sides of body. Attains over 7 cm in length.

Distribution : India : Delhi and sub - Himalayan range from Punjab to West Bengal, Assam. *Elsewhere* : Nepal.

Remarks : Inhabits fast moving streams with stony bed in hills usually above 600 m.; probably washed down to Delhi during rainy season. Feeds on micro-organisms found on substratum. Breeds during monsoon.

42. *Nemacheilus scaturigina* (McClelland)
Submontane Loach

1839. *Cobitis (Schistura) scaturigina* McClelland, *Asiat. Res.*, **19** : 308, 443, pl. 53, fig. 6 (from Hamilton Buchanan's figure).
1839. *Schistura zonata* McClelland, *Asiat. Res.*, **19** : 308, 441, pl. 53, fig. 1 (type - locality :

upper Assam).

1889. *Nemachilus zonatus* : Day *(partim), Faun. Brit. India*, Fish., **1** : 233.

1935. *Nemachilus scaturigina* : Hora, *Rec. Indian Mus.*, **37**(1) : 51, 64-67, pl. 3, figs. 7-8.

1958. *Nemachilus zonatus* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 368 (Delhi).

1976. *Nemachilus zonatus* : Raza et al., *In : Delhi Gazetteer* : 30.

1987. *Noemacheilus scaturigina* : Menon, *Faun. India*, Pisces, **4**(1) : 86-89, pl. 3, figs. 2-3, pl. 13, figs. 8-9.

1991. *Nemachilus scaturigina* : Talwar and Jhingran, *Inland Fish. India*, **1** : 466, 501-502, fig. 164.

Local names : Baluari, Karri, Natwa.

Material examined : from literature.

Diagnostic characters : D.II-III/7-8, P.I/9, V.I/7, A.I-II/5, C.19.

Body elongate with both dorsal and ventral profiles almost straight, ventral surface in front of pelvics somewhat flattened. Head narrow. Snout pointed. Eyes small, dorso- lateral; males with suborbital flap. Nostrils close to each other, nearer eye than snout tip, anterior one slightly tubular. Mouth small, subventral, semicircular; lips fleshy, may be slightly crenulate, lower lip interrupted in middle; lower jaw sharp, shovel-like; upper jaw vertical and lies in front of lower jaw. Barbles three pairs, longer than eye, outer rostral longest. Dorsal fin origin slightly ahead of pelvics, equidistant between snout tip and caudal base. Pectorals seperated from pelvics by a considerable distance, upper surface tuberculated in males. Pelvics shorter than pectoral, not reaching anal opening. Anal not reaching caudal base. Caudal deeply emarginate, lobes pointed. Colour greyish above, olivaceous below with 9-12 dark vertical bands, broader dorsally and narrowing down; a black spot on anterior dorsal rays; a narrow black bar on caudal base and V-shaped pattern on fin itself. Attains about 5.5. cm in length.

Distribution : India : Delhi, Uttar Pradesh, Bihar, West Bengal, Aruncahal Pradesh, Assam, Meghalaya. *Elsewhere* : Nepal.

Remarks : Inhabits slow moving hill streams; probably washed down to Delhi. Feeds on micro-organisms occurring on bed. Breeds during monsoon.

Family : COBITIDIDAE (Loaches)

Key to subfamilies

1. Two pairs of rostral and one pair of maxillo-mandibular barbles present; caudal fin deeply forked.....Botiinae

\- One pair each of rostral, maxillary and maxillo-mandubular barbles present (absent except a short rudiment of barbles at corner of mouth in genus *Neoeucirrhichtys*); caudal fin rounded, truncate, emarginate or forked.....Cobitidinae

Subfamily : BOTIINAE

Genus ***Botia*** Gray

1831. *Botia* Gray, *Zool. Misc.* (1) : 8(type-species : *Botia almorhae* Gray).

43. *Botia lohachata* Chaudhuri
Chaudhuri's Loach

1912. *Botia lohachata* Chaudhuri, *Rec. Indian Mus.*, 7(5) : 441, pl. 40, figs. 2, 2a, 2b (type - locality : Sandak river at Saran, Bihar).

1958. *Botia lohachata* : Majumdar, *J.Bombay nat. Hist. Soc.*, 55(2) : 368 (Delhi).

1976. *Botia lohachata* : Raza et al., *In : Delhi Gazetteer* : 30.

1981. *Botia lohachata* : Jayaram, *Freshw. Fish. India* : 176.

1988. *Botia lohachata* : Munshi and Srivastava, *Nat. Hist. Fish.* : 202-204, pl. 25, fig. 3 (Delhi).

1992. *Botia almorhae* : Menon (*partim*), *Faun. India*, 4(2) : 31-36, pl. 2, figs. 4,5,6,8, pl. 9, figs. 2, 6.

Local names : Bagh, Baghaua, Billi, Boto.

Material examined : Delhi; 3 exs. (52-56 mm), Pond nr. Patparganj area (nr. Yamuna bridge, Nizamuddin area), 10.ix.1994, coll. J.P.Sati & party.

Diagnostic characters : D.I/9-10, P.I/13, V.I/8, A.I/5-6, C.19.

Body elongate, compressed. Snout shorter than rest of head. Eyes small, suborbital spine short. Barbles three pairs, short. Mental lobes well developed, with a pair of barble like structures. Dorsal fin midway between snout tip and caudal base. Caudal half forked. Scales minute. Colour dull yellowish with a series of black or brown Y-shaped markings and black spots in between. Fins greyish with dark bars. Attains 10 cm in length.

Distribution : India : Delhi, Punjab, Rajasthan, Uttar Pradesh, Bihar. *Elsewhere* : Pakistan; Nepal; Bangladesh.

Remarks : Inhabits plains and submontane regions. Feeds on insects and their larvae, crustaceans, algae etc. Sociable in aquaria. Breeds during monsoon.

Subfamily : COBITIDINAE

Genus ***Lepidocephalus*** Bleeker

1858. *Lepidocephalus* Bleeker, *Nat. Tijdschr. Neder-Indie*, **16** : 303 (type-species : *Cobitis macrochir* Bleeker).

44. *Lepidocephalus guentea* (Hamilton - Buchanan)
Guntea Loach

1822. *Cobitis guntea* Hamilton - Buchanan, *Fish. Ganges* : 353, 394 (type - locality : ponds and freshwater rivers of Bengal).

1889. *Lepidocephalichthys guntea* : Day, *Faun. Brit. India*, Fish., 1 : 220-221.

1981. *Lepidocephalus (Lepidocephalichthys) guntea* : Tilak and Husain, *Rec. zool. Surv. India, Occ. Pap.* No. 32 : 5,7-12, 32, figs. 1-4, 20, 21.

1992. *Lepidocephalus guntea* : Menon, *Faun. India*, Pisces, 4(2) : 53-60, fig. 2c, pl. 4, figs. 1-6, pl. 8, figs. 1,2.

Local names : Gadera, Nakti, Nauni.

Material examined : Delhi; 7 exs. (58-74 mm), Nala nr. vill. Naraina, Ring road, 6.vi.1993; 8 exs. (54-70 mm), Dhaulakuan Ridge, Cantonment area, 10.vi.1993, coll. Vinod Khanna & party; 45 exs. (30-58 mm), Ridge area, Dhaulakuan, 23.x.1993, coll. N.K.Sinha & party; 8 exs. (29-54 mm), Brass Coir Nala, Naraina, 9.ix.1994, coll. J.P.Sati & party; 59 exs. (35-61 mm), Piggery Farm Nala, Uri Enclave, 18.xii.1994, coll. Akhlaq Husain & party; 12 exs. (38-60 mm), Piggery Farm Nala nr. Dhaulakuan, 16.ii.1995, coll. J.P. Sati & party.

Diagnostics characters : D.II-III/6-7, P.I/6-7, V.I/6-7, A.II-II/5, C.16-19.

Body elongate, moderately compressed. Head somewhat deep; interorbital space convex. Snout rounded. Eyes rather small, convered by skin, placed before middle of head; suborbital spine bifid. Nostrils contiguous, anterior with a raised tube, posterior without a raised rim, oval. Mouth small, inferior, moderately large; lips thick. Barbles three pairs, short (rostrals, maxillary and maxillo - mandibular); mental lobes well developed divided into anterior and posterior parts. Dorsal fin inserted opposite or slightly behind pelvics, nearer caudal base than snout tip. Caudal fin truncate. Males with longer pectorals. Scales small with acentric focal area, imbricate, head scales in patches, below and behind eye and upper part of operculum, absent on vertex; on ventral side scales extend anteriorly beyond isthmus. Laterl line absent. Colour highly variable with irregular dark grey spots on body and head, dorsal and caudal fins with rows of dark dots, a prominent dark dot on upper part of caudal base. A dark lateral stripe running between head and caudal base in males. Attains 15 cm in lenght.

Distribution : India : Delhi and throughout except Karnataka, Kerala and south of Krishna river. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar; Thailand.

First record from Delhi.

Remarks : Lives near the banks of slow moving waters or ponds. Feeds on micro-crustaceans, insects, algae etc. Breeds during rainy season. Kept in aquaria for its hardy nature and dark band of males.

Order : **SILURIFORMES** (Catfishes)

Eyes usually small. Maxilla rudimentary (except in Diplomystidae), supporting a barble. Symplectic, subopecular and intermuscular bones absent. Parietals probably present but fused to supraoccipital. Mesopterygoid much reduced. Preopercle and interopercle relatively small. Post-temporal may be fused or not to supracleithrum. Pterygoid and palatine toothed; vomer usually toothed. Weberian apparatus present. Adipose fin usually present. Dorsal and pectoral fins often with spines. Principal caudal fin rays 18 or less (most with 17); caudal skeleton varying between having 6 separate hypural plates to complete fusion of caudal elements. Accessory respiratory

organs in Clariidae and Heteropneustidae. Body naked or covered with bony plates.

Key to families

1. Adipose fin absent.....2
- Adipose fin present.....4

2. Nasal barbles absent; accessory respiratory organ absent.....Siluridae
- Nasal barbles present; accessory respiratory organ present (on gill or in body cavity).....2

3. Dorsal fin long with 23-76 rays; accessory respiratory organ on gills present.....Clariidae
- Dorsal fin short with 6-7 rays; accessory respiratory organs (tubular sacs) in body cavity.. .....Heteropneustidae

4. Nostrils close together, separated by nasal barble.....Sisoridae
- Nostrils wide apart, separated by some interspace.....5

5. Anal fin short with 8-16 soft rays (except *Horabagrus* with 23-28 rays).....Bagridae
- Anal fin long with 24-90 soft rays.....Schilbidae

Family : BAGRIDAE (Bagrid catfishes)

Key to genera

1. Pelvic fin with 7-8 rays.....*Rita* Bleeker
Pelvic fin with 6 rays.....2

2. Interneural shield (between basal bone of dorsal fin and occipital process) present..... .....*Aorichthys* Wu
Interneural shield absent.....*Mystus* Scopoli

Genus *Aorichthys* Wu

1939. *Aorichthys* Wu, *Sinensia*, **10** : 131 (type-species : *Bagrus lamarii* Valenciennes = *Platystoma Seenghala* Sykes). Substitute name for *Aoria* Jordan, 1919.

Key to species

1. Snout rounded; maxillary barbles long, extending to caudal fin base or beyond; width of

gape of mouth less than half of head length; caudal fin with 17 rays.....

.....*Aorichthys aor* (Hamilton-Buchanan)

- Snout spatulate; maxillary barbles short, extending to pelvic fins or beyond to anal fin; width of gape of mouth one-third of head length; caudal fins with 19-21 rays.....
.....*Aorichthys seenghala* (Sykes)

45. *Aorichthys aor* (Hamilton - Buchanan)
Long-whiskered Catfish

1822. *Pimelodus aor* Hamilton - Buchanan, *Fish. Ganges* : 205-207, 379, pl. 20, fig. 68 (type locality : rivers of Bengal and in upper parts of Gangetic estuaries).

1889. *Macrones aor* : Day, *Faun. Brit. India*, Fish., **1** : 149.

1958. *Mystus (Mystus) aor* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 368 (Delhi).

1976. *Mystus aor* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Ayar, Dariai-tengra.

Material examined : from literature.

Diagnostic characters : D.I/7, P.I/9-10, V.I/5, A.III-IV/8-10, C.17-21.

Body elongate, compressed posteriorly. Head large, depressed anteriorly. Eyes large, dorso-lateral, not visible from ventral side. Snout depressed, rounded. Mouth subterminal. Barbles four pairs, maxillary pair extend to caudal base or beyond. Dorsal spine finely serrated posteriorly. Adipose inserted after a gap behind rayed dorsal but anterior to anal. Caudal forked, upper lobe longer. Colour greyish-blue fading on sides and belly, a black spot each on basal bone of dorsal fin and adipose tip; fins yellowish-grey. Attains 1.8 m in length.

Distribution : Delhi, Yamuna, Ganga, Brahmaputra, Mahanadi, Godavari, Narmada, Tapti, Krishna and Kaveri river systems. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar.

Remarks : Inhabits freshwater rivers, lakes, ponds, etc. Feeds on animal diet. Breeds before monsoon months. Of considerable fishery value. Takes dead bait and provides good sport.

46. *Aorichthys seenghala* (Sykes)
Giant River Catfish

1841. *Platystoma seenghala* Sykes, *Trans. Zool. Soc. Lond.*, **2** : 371, pl. 65, fig. 2 (type - locality : Mulla Motha river, Pune).

1877. *Macrones seenghala* : Day, *Fish. India* : 442, 444-445, pl. 99, fig. 1 (Delhi).

1889. *Macrones seenghala* : Day, *Faun. Brit. India*, Fish., **1** : 150-151 (Delhi).

1958. *Mystus (Osteobagrus). seenghala* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 368 (Delhi).

1964. *Mystus* : Raj and Sehgal, *Census of India 1961, Delhi* : 11.

1976. *Myptus seenghala* : Raza et al., In : *Delhi Gazetteer* : 30.

Local name : Singhara.

Material examined : from literature.

Diagnostic characters : D.I/7, P.I/9, V.I/5, A.III-IV/7-9. C.17-21.

Body elongate, compressed posteriorly. Head large, depressed anteriroly. Eyes large, dorso-lateral, in anterior half of head, not visible from ventral side. Snout depressed, spatulate; nostrils wide apart. Mouth subterminal, transverse; upper jaw longer. Barbles four pairs. Dorsal spine weak, feebly serrated posteriorly. Adipose short, equal to dorsal base and inserted a little behind, origin distinctly in advance of pelvics and above anal fin. Anal opening distinctly nearer pelvic base than anal base; males with a minute urinogenital papilla behind anal opening. Caudal deeply forked, upper lobe longer with outer rays produced. Colour brownish-grey above, silvery on sides and belly; a dark spot on adipose tip. Attains 1.5 m in length.

Distribution : India : Delhi, Yamuna, Ganga, Brahmaputra, Mahanadi, Godavari, Krishna, Kaveri, Tapti and Narmada river systems. *Elsewhere* : Afghanistan; Pakistan; Nepal; Bangladesh; China.

Remarks : Inhabits larger freshwater rivers, lakes, ponds, etc. with clear water. Carnivorous. Breeds before monsoon months. Important food fish and of fishery value. Comes on dead bait quickly.

Genus *Mystus* Scopoli

1777. *Mystus* Scopoli, *Introd. Hist. Nat.*: 451 (type-speceis : Bagrus *haplepensis* Valenciennes = *Silurus pelusius* Solander).

Key to species

1. Maxillary barbles reach pelvic fin base; head length not more than 4 times in total length; adipose fin short, origin after a gap from rayed dorsal fin.....*Mystus vittatus* (Bloch)
- Maxillary barbles reach anal fin or beyond; head length more than 5 times in total length; adipose fin long, origin just after rayed dorsal fin.....2

2. Maxillary barbles reach anal fin; interorbital width 3.0 or less (2.0-3.0) in head length; dark spot at dorsal fin base absent; branchiostegal rays 10.....*Mystus bleekeri* (Day)
- Maxillary barbles reach caudal fin base or beyond; interorbital width 3.0 or more (3.0-4.0) in head length; dark spot at dorsal fin base present; branchiostegal rays 6.....
.....*Mystus cavasius* (Hamilton-Buchanan)

47. *Mystus bleekeri* (Day)
Day's Mystus

1846. *Bagrus keletius* (*nec* Valenciennes, 1839) Bleeker, *Nat. Geneesk. Arch. Ned. Indie*, (2)3 :

135 (type - loclaity : Bengal).

1877. *Macrones bleekeri* Day, *Fish. India*, : 451, pl. 101. fig.

1889. *Macrones bleekeri* : Day, *Faun. Brit. India*, Fish., 1 : 162.

Local name : Tengra.

Material examined : Delhi; 1 ex. (144 mm), Yamuna reservoir, Kalindi Kunj, Okhla, 15.v.1994, coll. Akhlaq Husain & party.

Diagnostics characters : D.I/7-8, P.I/8-10, V.I/5, A.II-III/6-8, C.15-17.

Body elongate, compressed posteriorly. Head somewhat depressed; occipital process twice as long as broad or less at base; median longitudinal groove shallow, reaching base of occipital process; occipital process touching basal bone of dorsal fin. Eyes almost in middle of head. Nostril separated. Mouth inferior, upper jaw slightly longer. Barbles four pairs, maxillary pairs extend to anal fin. Dorsal fin anterior; spine smooth on both edges. Adipose fin large, inserted just after rayed dorsal fin. Pectoral spine strong, rugose on outer edge. Pelvic origin just behind last ray of dorsal fin. Anal opening nearer to pelvic base than to anal base; males with an enlarged urino-genital papilla. Anal fin may reach caudal base. Caudal forked, upper lobe longer. Colour brownish above with two light longitudinal bands on sides of body and a dark shoulder spot, lighter below. Attains 13.5 cm in length.

Distribution : India : Delhi, generally confined to northern India, southern limit up to Mahanadi head waters. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar; Indonesia.

First record from Delhi.

Remarks : Inhabits lakes, ponds, rivers etc. Descends to upper reaches of tidal rivers. Feeds on insects etc. Breeds during monsoon months. Takes earthworm bait quickly.

Cosely allied to *Mystus cavasius* but can be differentiated by shorter maxillary barbles, colouration etc.

48. *Mystus cavasius* (Hamilton - Buchanan)
Gangetic Mystus

1822. *Pimelodus cavasius* Hamilton - Buchanan, *Fish. Gnges* : 203-205, 379, pl. 11, fig. 67 (type - locality : larger freshwater rivers of Gangetic provinces).

1889. *Macrons cavasius* : Day, *Faun. Brit. India*, Fish., 1 : 148, 155-156.

1958. *Mystus (Mystus) cavasius* : Majumdar, *J. Bombay nat. Hist. Soc.*, 555(2) : 368 (Delhi).

1976. *Mystus cavasius* : Raza et al., In : *Delhi Gazetteer* : 30.

Local name : Tengra.

Material examined : from literature.

Diagnostics characters : D.I/7, P.I/8, V.I/5, A.IV/7-9, C.16.

Body elongate, compressed posteriorly. Head conical; occipital process narrow, extends to basal bone of dorsal fin; median longitudinal groove extends to base of occipital process. Mouth subterminal; upper jaw a little longer. Barbles four pairs, maxillary pairs extend beyond caudal base in adult but not so in young. Dorsal spine weak, may be feebly serrated. Adipose fin large, inserted

just behind rayed dorsal. Pectoral spine strong, serrated behind. Anal opening nearer pelvic base than anal base; male with an elongated urino-genital papilla. Caudal deeply forked, upper lobe longer and pointed. Colour greyish above with a longitudinal stripe on lateral side; a dark spot on caudal base. Attains 40 cm in standard length and a weight of 10 kg (Talwar and Jhingran, 1991).

Distribution : India : Delhi and throughout. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar; Thailand; Malaysia; Indonesia.

Remarks : Inhabits freshwater and tital rivers, lakes, ponds, ditches etc. Feeds on insects etc. Breeds during monsoons months. Pectoral spines may inflict painfull wounds. Common food fish. Offers good sport on earthworm bait.

49. *Mystus vittatus* (Bloch)
Striped Mystus

1797. *Silurus vittatus* Bloch, *Ichthyol. Hist. Nat.*, **11** : 40, pl. 371, fig. 2 (type - locality : Tranquebar).

1822. *Pimelodus tengara* Hamilton - Buchanan, *Fish. Ganges* : 183-185, 377, pl. 3, fig. 61 (type - locality : ponds of India).

1889. *Macrones tengara* : Day, *Faun. Brit. India*, Fish., **1** : 156.

1889. *Macrones vittatus* : Day, *Faun. Brit. India.*, Fish., **1** : 157.

1913. *Macrones* : Anonymous, *Gazetteer of the Delhi District Part A-1912* : 18.

1958. *Mystus (Mystus) tengara* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 368 (Delhi).

1976. *Mystus tengara* : Raza et al., In : *Delhi Gazetteer* : 30.

Local name : Tengra.

Material examined : Delhi; 6 exs. (83-95 mm), Delhi - Rohtak, Yamuna Canal, Najafgarh, 27.x.1993, coll. N.K.Sinha & party; 9 exs. (48-100 mm), Yamuna reservoir, Kalindi Kunj, Okhla, 15.v.1994; 3 exs. (42-45 mm), Pond nr. Patparganj area (nr. Yamuna bridge, Nizamuddin area), 10,ix.1994; 3 exs. (56-58 mm), Okhla reservoir, Barrage side nr. U.P. Border, 10.ix.1994, coll. J.P.Sati & party; 1 ex. (80 mm), Okhla reservoir, 18.xii.1994, coll. Akhlaq Husain & party.

Diagnostic characters : D.I/7, P.I/7-9, V.I/5, A.II-IV/7-10, C.15-19.

Body elongate, compressed posteriorly. Head depressed; occipital process long extending anteriorly to basal bone of dorsal fin; median longitudinal groove may (in young) or may not reach base of occipital process. Eyes moderate, dorso-lateral, major part in anterior half of head. Mouth subterminal; upper jaw slightly longer. Barbles four pairs, maxillary pair extend to pelvics or anal fin. Dorsal spine weak, finely serrated on its inner edge and tip of anterior edge. Adipose fin short, inserted much behind rayed dorsal but in advance of anal fin. Males possess a well-developed urino-genital papilla and have a pear-shaped thickening at caudal base. Caudal forked, upper lobe longer. Colour greyish-silvery or golden with 4-5 dark longitudinal bands on sides of body; a dark shoulder spot. Attains about 23 cm in length.

Distribution : India : Delhi and throughout. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar; Thailand; Malaysia.

Remarks : Inhabits stagnant and flowing waters and within tidal zones. Feeds mostly on aquatic insects, crustaceans etc. Breeds during monsoon months in ponds and ditches. Most common catfish.

Conspecific with *Mystus tengara.*

Genus ***Rita*** Bleeker

1853. *Rita* Bleeker, *Verh. Batav. Genootsch.*, **25**(8) : 122-123 (type-speceis *: Pimelodus rita* Hamilton-Buchanan).

50. ***Rita rita*** (Hamilton - Buchanan)
Rita

1822. *Pimelodus rita* Hamilton - Buchanan, *Fish. Ganges* : 165-167, 376, pl. 24, fig. 53 (type - locality : estuaries of Bengal).

1889. *Rita buchanani* : Day, *Faun. Brit. India*, Fish., **1** : 165, fig. 66.

1958. *Rita rita* : Majumdar, *J.Bombay nat. Hist. Soc.*,**55**(2) : 368 (Delhi).

Local names : Chegra, Chona, Chua, Khagga, Rita.

Material examined : from literature.

Diagnostics characters. : D.I-II/6, P.I/10. V.I./6-7, A.IV-V/8-11, C.17-19.

Body elongate, robust, compressed posteriorly. Head large, depressed, covered with skin. Occipital process subcutaneous, extends to predorsal plate. Snout obtuse. Eyes small dorso-lateral, in anterior part of head. Mouth transverse. Teeth on palate is two wide apart elliptical patches. Barbles three pairs, maxillary pair extend to operculum. Dorsal spine strong, serrated posteriorly on its upper edge Adipose short. Pectoral spine serrated on both edges. Caudal forked. Colour greyish-green above, dull white below. Attains 1.5 m in length.

Distribution : India : Delhi, most rivers of northern India. *Elsewhere* : Afghanistan; Pakistan; Nepal; Bangladesh; Myanmar; China.

Remarks : Inhabits fresh and tidal water bodies. Foul feeder. One of the largest food fishes, contributing to fairly good fishery in northern India.

Family : SILURIDAE (Sheatfishes)

Key to genera

1. Anal fin long with 52-75 rays; cleft of mouth not reaching eyes; branchiostegal rays 12-15 ..... *Ompok* Lacepede

- Anal fin very long with 74-96 rays; cleft of mouth reaching beyond eyes; branchiostegal rays 18-21..... *Wallago* Bleeker

Genus ***Ompok*** Lacepede

1803. *Ompok* Lacepede, *Hist. Nat. Poiss.*, **5** : 49 (type-species : *Ompok siluroides* Lacepede = *Silurus bimaculatus* Bloch).

51. *Ompok bimaculatus* (Blach)
Butter Catfish

1797. *Silurus bimaculatus* Bloch, *Ichthyol. Hist. nat. des. Poiss.*, **11** : 17, pl. 264 (type - locality : Malabar).

1889. *Callichrous bimaculatus* : Day, 1889, *Faun. Brit. India*, Fish., **1** : 131, fig. 57.

1958. *Ompok bimaculatus* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 368 (Delhi).

1976. *Ompok bimaculatus* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Pabda, Papta.

Material examined : from literature.

Diagnostics characters : D.4, P.I/12-14, V.I/7-8, A.II-III/55-72, C.17.

Body elongate, strongly compressed. Head some what depressed. Eyes small, in anterior half of head. Mouth small, oblique; lower jaw slightly longer. Barbles two pairs, maxillary barbles long and extend slightly beyond anal origin. Dorsal short. Pectoral spine strong, feebly serrated on its inner edge. Anal long. Caudal deeply forked. Colour silvery with purple tinge and a large dusky shoulder spot. Attains a length of 46 cm.

Distribution : India : Delhi and throughout. *Elsewhere* : Afghanistan; Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar; Thailand; China; Malaysia; Vietnam; Indonesia.

Remarks : Inhabits freshwater rivers, lakes, ponds in plains and submontane regions. Feeds on animal diet. Breeds during monsoon months. Considered good eating for its taste and flavour.

Genus ***Wallago*** Bleeker

1851. *Wallago* Bleeker, *Nat. Tijdschr. Neder.-Indie*, **2** : 202 (type-species : *Silurus mulleri* Bleeker=*Silurus attu* Schneider).

52. *Wallago attu* (Schneider)
`Freshwater Shark'

1801. *Silurus attu* Schneider, *Syst. Ichth.* : 378, pl. 75 (type - locality : Malabar).

1889. *Wallago attu* : Day, *Faun. Brit. India*, Fish., **1** : 126-127, fig. 54.

1913. *Wallago attu* : Anonymous, *Gazetteer of the Delhi Distirct Part A-1912* : 18.

1951. *Wallago attu* : Majumdar, *J. zool. Soc. India*, **3**(1) : 243-253 (Delhi).

1958. *Wallago attu* : Majumdar, *J. Bombay nat. Hist. soc.*, **55**(2) : 368 (Delhi).

1964. *Wallago* : Raj and Sehgal, *Census of India 1961, Delhi* : 11.

Local names : Lanchi, Malli, Paran.

Material examined : Delhi; 1 ex. (235 mm), Yamuna reservoir, Ramghat, 17.xii.1994, coll. Akhlaq Husain & party; seen a large specimen with fisherman at Yamuna reservoir, Kalindi kunj, Okhla on 15.v.1994 by the author.

Diagnostics characters : D.I/4, P.I/13-15, V.I/7-9, A.III-IV/74-93, C.17.

Body elongate, compressed. Head large, depressed anteriorly. Eyes small, above angle of mouth. Mouth wide, gape long extending beyond eyes. Lower jaw slightly longer, both jaws with broad tooth bands. Barbles two pairs; maxillary barbles extending to anal fin. Dorsal fin short, spineless. Pectoral spine serrated, strong in male, weak in female. Pelvics short, extending to anal. Anal opening nearer anal origin than pelvic base. Anal fin very long. Caudal deeply forked, upper lobe longer. Colour silvery. Grows to about 2 m and weighs above 45 kg.

Distribution : India : Delhi and throughout. *Elsewhere* : Pakistan, Nepal; Bangladesh; Sri Lanka; Myanmar; Thailand; China; Vietnam; Kampuchea; Malaysia; Indonesia.

Remarks : Inhabits large fresh water rivers, reservoirs, ponds and tidal waters. Feeds mostly on dead animals and garbage. Monsoon breeder. Offers good sport on a hook with dead or live bait. Destructive to other food fishes. Esteemed as food due to less bones and rich oil contents.

Family : SCHILBIDAE (Shilbid catfishes)

Key to subfamilis

1. Teeth on vomer large; dorsal fin present; adipose fin vestigial, small or absent; anal fin long with 24-54 rays; pelvic fin present ..... Schilbinae
- Teeth on vomer minue; dorsal fin absent; adipose fin small; anal fin very long with 58-90 rays; pelvic fin present or absent..... Ailiinae

Subfamily : AILIINAE

Genus *Ailia* Gray

1831. *Ailia* Gray, *Zool. Miscell.*(1) : 8 (type-species : *Malapterus (sic) (Ailia) bengalensis* Gray = *Malapterurus coila* Hamilton-Buchanan).

Key to species

1. Pelvic fins present; anal fin with 58-75 rays..... *Ailia coila* (Hamilton-Buchanan)
- Pelvic fin absent; anal fin with 76-90 rays..... *Ailia punctata* (Day)

53. *Ailia coila* (Hamilton - Buchanan)

Gangetic Ailia

1822. *Metapterurus coila* Hamilton Buchanan, *Fish. Ganges* : 158-159, 375 (type - locality : freshwater rivers of Bengal).

1877. *Ailia coila* : Day, *Fish. India* : 488-489, pl. 114, fig. 4 (Delhi).

1889. *Ailia coila* : Day, *Faun. Brit. India*, Fish., **1** : 134, fig. 58.

1958. *Ailia coila* : Majumdar, *J. Bombay. nat. Hist. Soc.*, **55** (2) : 368 (Delhi).

1976. *Ailia coila* : Raza et al., In : *Delhi Gazetteer* : 30.

1988. *Ailia coila* : Munshi and Srivastava, *Nat. Hist. Fish.*, : 278-280, pl. 34, fig.1 (Delhi).

Local names : Basanguti, Banspati.

Material examined : from literature.

Diagnostics characters : D.0, P.I/14-16, V.I/5, A.58-75, C.19.

Body elongate, strongly compressed, leafy. Mouth small, subterminal. Barbles four pairs extending beyond pectoral. Rayed dorsal fin absent. Adipose fin minute, slightly ahead of anal end. Pectoral spine slender, serrated on its inner edge. Pelvics small. Caudal forked, lower lobe longer. Colour silvery, caudal edged black. Attains a length of 30 cm.

Distribution : India : Delhi, northern India and up to Krishna river system. *Elsewhere* : Pakistan; Nepal; Bangladesh.

Remarks : Inhabits freshwater rivers. Surface and column dweller, living in shoals. Feeds on insects etc. Breeds during monsoon months. Much esteemed as food.

54. *Ailia punctata* (Day)
Yamuna Ailia

1871. *Ailiichthys punctata* Day, *Proc. Zool. Soc. Lond.*, : 713 (type - locality : Yamuna river below Delhi).

1877. *Ailiichthys punctata* : Day, *Fish. India* : 489, pl. 114, fig. 5 (Jamuna below Delhi).

1889. *Ailiichthys punctatus* : Day, *Faun. Brit. India*, Fish., **1** : 135 - 136, fig. 59 (Yamuna below Delhi).

1962. *Ailia punctata* : Jayaram, *J. zool. Soc. India*, **14**(2) : 244.

Local names : Patasi.

Material examined : from literature.

Diagnostics characters : D.0. P.I/12, V.0, A.76-90. C.17.

Body elongate, compressed, almost leaf - like, ventral profile arched. Upper profile of head slightly concave. Mouth subterminal, cleft extending about midway to eyes; upper jaw somewhat longer. Eyes large, situated more than half below angle of mouth, being partly on lower side of head. Barbles four pairs, subequal, extending beyond anal origin. Rayed dorsal fin absent. Adipose fin minute, slightly ahead of anal end. Pectorals large, extending beyond anal origin; spine slender, smooth. Pelvics absent. Caudal deeply forked, lower lobe longer. Colour silvery; upper surface of head nearly black; a large black spot at caudal base. Attains 10 cm in length.

Distribution : India : Delhi, Yamuna and Ganga drainages. *Elsewhere* : Pakistan; Bangladesh.

Remarks : Inhabits clear water rivers. Feeds on insects etc. Breeds during monsoon months. good eating fish.

Subfamily : SCHILBINAE

Key to genera

1. Barbles two pairs, minute (maxillary and mandibular), either pair may become vestigial or absent.....*Silonia* Swainson
- Barbles four pairs.....2

2. Small adipose fin present; nostrils wide apart; cleft not extending to eye.....
.....*Clupisoma* Swainson
- Small adipose fin, generally present in young only; nostrils closely placed; cleft extending below anterior edge or beyond to about posterior edge of eye.....*Eutropiichthys* Bleeker

Genus *Clupisoma* Swainson

1839. *Clupisoma* Swainson *Nat. Hist. Fish.*, **2** : 306 (type-species : *Pimelodus argentata* Swainson = *Silurus garua* Hamilton-Buchanan).

55. *Clupisoma garua* (Hamilton - Buchanan)
Garua Bachcha

1822. *Silurus garua* Hamilton - Buchanan, *Fish. Gnages* : 156-157, 375, pl. 21, fig. 50 (type locality : freshwater rivers of Gangetic provinces).
1889. *Pseudeutropius garua* : Day *(partim), Faun. Brit. India*, Fish., **1** : 141-142.
1958. *Clupisoma garua* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 368 (Delhi).
1976. *Clupisoma garua* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Bacha, Bachua, Bekri, Karhi.

Material examined : from literature.

Diagnostics characters : D.I/7, P.I/II, V.I/5, A.III/26-33, C.17.

Body elongate, compressed, abdominal edge keeled between pelvics and vent. Head convered with soft skin. Eyes latero-ventral, placed behind cleft of mouth. Nostrils separated. Mouth moderate, subterminal; upper jaw longer. Barbles four pairs, maxillary pair reaching pelvic base, to middle of pelvics in young. Dorsal spine slender. Adipose absent in adult. Anal moderate. Caudal deeply forked. Colour silvery; dorsal and pectorals dotted black. Attains 1 m in length.

Distribution : India : Delhi and throughout north, Poonch valley upto 1065 m, Madhya Pradesh and up to Mahanadi. *Elsewhere* : Pakistan; Nepal; Bangladesh.

Remarks : Inhabits freshwater rivers. Bottom feeder, subsisting on insects, crustaceans small fishes etc. Destructive in tanks. Considered good eating because of less bones. Takes worm and mole cricket as bait.

Genus ***Eutropiichthys*** Bleeker

1862. *Eutropiichthys* Bleeker, *Versl. Akad. Amsterdam,* **14** : 398 (type-species : *Pimelodus vacha* Hamilton-Buchanan).

56. *Eutropiichthys vacha* (Hamilton - Buchanan)
Bachwa, Vacha

1822. *Pimelodus vacha* Hamilton - Buchanan, *Fish. Ganges* : 196, 378, pl. 19, fig. 64 (type - locality : larger freshwater rivers of Gangetic provinces).
1884. *Batchwa* : Anonymous, *A Gazetteer of the Delhi District (1883-4)* : 21.
1889. *Eutropiichthys vacha* : Day, *Faun. Brit. India*, Fish., **1** : 128, fig. 55.
1913. *Eutropiichthys vacha* : Anonymous, *Gazetteer of the Delhi District Part A-1912* : 18.
1958. *Eutropiichthys vacha* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 368 (Delhi).
1976. *Eutropiichthys vacha* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Bacha, Bachwa, Banjhu.

Material examined : from literature.

Diagnostics characters : D.I/7, P.I/13-16, V.I/5-6, A.III-IV/41-52, C.17

Body elongate, compressed. Eyes large. Mouth oblique, cleft reaching nearly posterior edge of eye; vomero palatine band of teeth wider than maxillary band. Nostrils wide apart. Barbles four pairs, not extending beyond head. Dorsal fin short, inserted almost opposite that of pelvics; spine finely serrated behind. Anal long. Caudal forked. Colour silvery; caudal fin black edged. Grows to about 35 cm in length and 1.35 kg. in weight.

Distribution : India : Delhi and north India, in south up to Mahanadi. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar; Thailand.

Remarks : Inhabits fresh and tidal waters. Feeds on fish and insects. Breeds during monsoon months. Destructive in tanks hence not culturable.

Genus ***Silonia*** Swainson

1839. *Silonia* Swainson, *Nat. Hist. Fish.*, **2** : 305 (type-species : *Silonia lurida* Swainson = *Pimelodus silondia* Hamilton-Buchanan).

57. *Silonia silondia* (Hamilton - Buchanan)

Gangetic Silond

1822. *Pimelodus silondia* Hamilton - Buchanan, *Fish. Ganges* : 160-162, 375, pl. 7, fig. 50 (type - locality : Gangetic estuaries).
1889. *Silundia gangetica* : Day, *Faun. Brit. India*, Fish., 1 : 145, fig. 62.
1913. *Silundia gangetica* : Anonymous, *Gazetteer of the Delhi District Part A-1912* : 18.
1951. *Silonia silondia* : Majumdar, *J. zool. Soc. India*, 3(1) : 244-245, fig. 1.
1958. *Silonia silondia* : Majumdar, *J. Bombay nat. Hist. Soc.*, 55(2) : 368 (Delhi).
1964. *Silonia silondia* : Raj and Sehgal, *Census of India 1961, Delhi* : 11.
1976. *Silonia silondia* : Raza et al., In : *Delhi Gazetteer* : 29, 30.

Local names : Silond, Silund.

Material examined : from literature.

Diagnostics characters : D.I/7, P.I/10-13, V.I/5, A.IV/36-44, C.17.

Body elongate, compressed. Mouth wide, terminal, obliquely directed. Eyes moderate. Barbles two pairs; maxillary pair minute, in grooves; mandibular pair vestigial. Dorsal fin short, above pelvics. Spine weak, smooth or rugose anteriorly, finely serrated posteriorly on upper portion. Pectoral spine strong, serrated internally. Anal long. Caudal forked. Colour silvery; pectoral, anal and caudal fins with orange band at base. Attains 1 m or more in length.

Distribution : India : Delhi and Indo-gangetic basin. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar.

Remarks : Inhabits rivers, reservoirs, Gangetic estuaries. Lives in shoals. Voracious feeder, causing considerable damamge to fisheries. Breeds during monsoon months. Provides good sport to anglers. Delicacy in some parts.

Family : SISORIDAE (Sisorid catfishes)

Key to genera

1. Adhesive thoracic apparatus present.....*Glyptothorax* Blyth
- Adhesive thoracic apparatus absent.....2

2. Adipose fin in the form of a spine, upper caudal fin ray much prolonged.....
.....*Sisor* Hamilton-Buchanan
- Adipose fin normal; upper caudal fin ray may or may not be prolonged.....3

3. Dorsal, pectoral and caudal fins with filamentous extensions; dentition on lower jaw heterodont.....*Bagarius* Sykes
- Dorsal, pectoral and caudal fins without filamentous extensions; villiform teeth on both jaws.....4

4. Gill-membranes broadly united with isthmus; mendibular pair of barbles inserted on a transverse line at the same level.....*Gagata* Bleeker
- Gill-membranes free from isthmus or slightly adherent to it; mandibular pair of barbles inserted on a transverse line at different levels.....*Nangra* Day

Genus ***Bagarius*** Bleeker

1853. *Bagarius* Bleeker, *Verh. batav. Genoot. Kunst. Wet.*, **25** : 121 (type-species : *Bagarius buchanani* Bleeker = *Pimelodus bagarius* Hamilton-Buchanan).

58. *Bagarius yarrelli* Sykes
`Freshwater Shark' or Goonch

1841. *Bagarius yarrellii* Sykes, *Trans. Zool. Soc. Lond.*, **2** : 370, fig. 65(1) (type - locality : Mula Mutha river, Pune).
1877. *Bagarius yarrellii* : Day(partim) *Fish. India* : 495, pl. 115, fig. 3. (Delhi).
1889. *Bagarius yarrellii* : Day *(partim), Faun. Brit. India*, Fish., **1** : 194, fig. 71 (Okhla, Delhi).
1913. *Bagarius yarrellii* : Anonymous, *Gazetteer of the Delhi District Part A-1912* : 18.
1958. *Bagarius bagarius* (*nec.* Hamilton - Buchanan, 1822) : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 368 (Delhi).
1976. *Bagarius bagarius* : Raza et al., In : *Delhi Gazetteer* : 30.
1983. *Bagarius yarrelli* : Roberts, *Copeia*, **(2)** : 438, figs. 2b, 3.

Local names : Gonch, Goonch.

Material examined : Delhi; 1 ex. (198 mm), Yamuna reservoir, Ramghat, 17.xii.1994, coll. Akhlaq Husain & party.

Diagnostics characters : D.I/6-7, P.I/11-14, V.I/5, A.III/9-12, C.17.

Body robustly elongate, scabrous. Head large, broad, depressed and roughened. Eyes small, dorsal. Nostrils close together. Mouth wide, inferior. Barbles four pairs, maxillary pair large, with broad bases. Dorsal spine smooth. Adipose origin variable, being anterior, opposite or slightly behind vertical of anal origin. Pectoral spine short, serrated. Pelvics inserted posterior to vertical of rayed dorsal end. Caudal forked, upper lobe longer; both lobes produced into soft filamentous prolongations. Colour olivaceous or greyish - brown above with three dark and broad bands on sides, lighter below. Fins and body dotted with black. Grows to 2 m in length and 135 kg in weight.

Distribution : India : Delhi, Punjab, Rajasthan, Uttar Pradesh, Himachal Pradesh, Bihar, West Bengal, Assam, Manipur, Orissa, Madhya Pradesh, Andhra Pradesh, Tamil Nadu, Maharashtra. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar; Thailand; Vietnam; Laos; Kampuchea; Indonesia.

Remarks : Inhabits larger feshwaters rivers. One of the largest Asian catfishes. Mostly bottom dweller. Predatory and voracious feeder. Breeds before onset of monsoon. Takes spoon

and spinning bait also live bait but not popular among anglers for its tough sport. Mr. Van Cotland captured one, 1.52 m long 61.69 kg in weight at Okhla Weir, Delhi at the end of 1875 (vide Day, 1889). Generally not preferred as food for its stiff flesh.

Bagarius yarrelli differs from *B. bagarius* (Hamilton Buchanan) in pelvic origin usually posterior in relation to last dorsal ray in *B.yarrelli* versus anterior in *B.bagarius*; adipose origin in relation to anal origin anterior, opposite or posterior versus distinctly posterior; 21-24 abdominal verterbrae versus 17-20; maximum length 2 m versus 19.2 cm; food habits carcinophagous and ichthyophagous versus chiefly entomophagous and range of distribution as above versus Ganges, Chao Phrya and Mekong basins, Pattani river, Malay peninsuala as per Roberts (1983).

Genus *Gagata* Bleeker

1858. *Gagata* Bleeker, *Act. Soc. Sc. Indo-Neerl.* **4** : 35, 204 (type-species : *Gagata typus* Bleeker = *Pimelodus gagata* Hamilton-Buchanan).

Key to species

1. Dorsal spine finely serrated along anterior edge; pectoral fins simple; pelvic fins extend to vent .....*Gagata cenia* (Hamilton-Buchanan)

- Dorsal spine smooth with long prolongation; pectoral fins with filamentous prolongation; pelvic fins extend beyond anal opening.....*Gagata sexualis* Tilak

59. *Gagata cenia* (Hamilton - Buchanan)
Common Gagata

1822. *Pimelodus cenia* Hamilton Buchanan, *Fish. Ganges* : 174-175, 376, pl. 31 fig. 57 (type locality : northern parts of Bengal).
1877. *Gagata cenia* : Day, *Fish. India* : 492, pl. 115, figs. 4,5 (Delhi).
1889. *Gangata cenia* : Day *(partim), Faun. Brit. India*, Fish., **1** : 208.
1958. *Gagata cenia* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 368 (Delhi).
1976. *Gagata cenia* : Raza et al., In : *Delhi Gazetteer*, : 30.
1981. *Gagata cenia* : Jayaram, *Freshw. Fish. India*, : 176 (Delhi).
1988. *Gagata cenia* : Munshi and Srivastava, *Nat. Hist. Fish.*, : 255-257, pl. 32, fig.2 (Delhi).
1991. *Gagata cenia* : Talwar and Jhingran, *Inland Fish. India*, **2** : 239 (Delhi).

Local names : Baghi, Tinkatia.

Material examined : from literature.

Diagnostics characters : D.I-II/6, P.I/9, V.I/5, A.II-IV/10-12, C.17-19.

Body slender. Head short; median groove on head extends to base of occipital process.

Snout longer than eye. Eyes small, dorso-lateral. Mouth small, ventral. Barbles four pairs, maxillary pair stiff based, shorter than head. Dorsal spine short, strong, finely serrated along anterior edge. Pectoral spine serrated along its inner edge and outer uper part. Pelvics extend to vent. Caudal forked. Colour greyish, young with four dark dorso - lateral blotches; adipose black edged; caudal fin with black band on each lobe. Attains 15 cm in length.

Distribution : India : Delhi, Punjab, Uttar Pradesh, Bihar, West Bengal, Assam, Orissa. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar; Thailand.

Remarks : Inhabits freshwater and tidal rivers, can withstand salinity to some extent. Feeds on insects, worms etc. Breeds during monsoon season. Moves in shoals. Considered wholesome food.

60. *Gagata sexualis* Tilak
Koel Gagata

1970. *Gagata sexualis* Tilak, *Zool. Med.* **44**(14), figs. 1-6 (type - locality : North Koel river at Daltonganj, Chhotanagpur, Bihar).

1991. *Gagata sexualis* : Talwar and Jhingran, *Inland Fish. India*, **2** : 639 (Delhi).

Local name : Tinkatia.

Material examined : from literature.

Diagnostics characters : D.I/6, P.I/8, V.I/5, A.III/10-12, C.19.

Body slender, somewhat compressed posteriorly. Head compressed, median longtudinal groove not extending to base of occipital process. Snout accuminate, equal to or slightly longer than eye. Eyes large, lateral. Mouth small. Barbles four pairs, maxillary pair stiff - based, longer than head extending up to one third of pectorals. Dorsal spine strong, usually smooth with long prolongation. Pectoral fin with filamentous prolongation; spine serrated internally. Pelvics extend beyond anal opening. Caudal forked. Colour yellowish with dark vertical bands on head and body; dorsal fin with a dark patch; caudal with a dark band on each lobe. Attains about 6 cm in length. Males comparatively slim bodied.

Distribution : India : Delhi, Bihar, (Ganga river system).

Remarks : Inhabits freshwater rivers, Yamuna and Koel as per the present information.

Genus *Glyptothorax* Blyth

1860. *Glyptothorax* Blyth, *J. Asiat. Soc. Beng.*, **29** : 154 (type -species : *Glyptothorax trilineatus* Blyth).

61. *Glyptothorax telchitta* (Hamilton - Buchanan)
Telchitta Sisorid

1822. *Pimelodus telchitta* Hamilton Buchanan, *Fish. Ganges* : 185-186, 378 (type locality :

freshwater rivers of Bengal and Bihar).

1877. *Glyptosternum botia* : Day, *Fish. India* : 496, 497-498, pl. 63, fig. 4 (Delhi).

1889. *Glyptosternum botia* : Day, *Faun. Brit. India*, Fish., **1** : 196, 198-99 (Delhi).

1889. *Glyptosternum telchitta* : Day, *Faun. Brit. India*, Fish., **1** : 199.

1958. *Glyptothorax telchitta* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 368 (Delhi).

1976. *Glyptothorax telchitta* : Raza et al., In : *Delhi Gazetteer* : 30.

Local name : Patharchat.

Material examined : from literature.

Diagnostic characters : D. I/6-7, P.I/7-9, V.I/5, A.I-II/9-10, C.15-18.

Body spindle - shaped. Head depressed, pointed; occipital process separated from basal bone of dorsal fin. Eyes small, dorsal. Mouth inferior. Barbles four pairs, shorter than head, maxillary broad - based. Adhesive thoracic apparatus long, without central pit. Dorsal fin nearer adipose fin than snout tip, its spine weak and smooth. Pectoral fins horizontal, spine equal to head length, spine denticulated internally. Caudal forked. Skin tuberculated. Colour dark brown above, mottled with dark spots; dirty yellowish below; fins somewhat banded. Attains a lenght of 10 cm.

Distribution : India : Delhi, Uttar Pradesh, Madhya Pradesh (Vindhya range of mountains), Bihar, West Bengal. *Elsewhere* : Pakistan; Nepal; Bangladesh.

Remarks : Inhabits submontane streams and adjoining areas; probably washed down to Delhi. Bottom feeder, feeding on insect larvae etc. Breeds around monsoon. Not valued as food for limited flesh contents and small size.

Genus *Nangra* Day

1877. *Nangra* Day, *Fish. India* : 493 (type-species : *Pimelodus nangra* Hamilton - Buchanan).

Key to species

1. Maxillary barbles long, extending to vent or even end of anal fin; bases of mandibular barbles set wide apart, inner pair placed ahead of outer pair..... .....*Nangra nangra* (Hamilton-Buchanan)

\- Maxillary barbles shorter than head; a pair of finger-like processes between bases of inner mandibular barbles.....*Nangra viridescens* (Hamilton-Buchanan)

62. *Nangra nangra* (Hamilton - Buchanan)

Kosi Nangra

1822. *Pimelodus nangra* Hamilton Buchanan, *Fish. Gnages* : 193-195, 378, pl. 11, fig. 63 (type-locality : Kosi river).

1877. *Nangra buchanani* Day, *Fish. India* : 494, pl. 43, fig. 3 (type-locality : Ganga, Yamuna and Indus : Delhi).

1889. *Nangra buchanani* : Day, *Faun. Brit. India*, **1** : 211 (Ganga, Yamuna and Indus).

1979. *Nangra nangra* : Jayaram, *Rec. zool. Surv. India*, Occ. Pap., (14) : 13, fig. 10 A.

Local name : Muji.

Material examined : from literature.

Diagnostic characters : D.I-II/8-10, P.I/9, V.I/5, A.II-III/8-10, C.16-17.

Body elongate, slender. Head oval with longitudinal ridges and covered by thin skin; median longtudinal groove broad, extends to base of occipital process; occipital process extends to basal bone of dorsal fin. Snout somewhat depressed. Eyes small, dorsal, in anterior half of head and covered with skin. Mouth inferior, transverse; upper jaw considerably longer. Barbles four pairs; maxillary pair with stiff basal parts, extend to vent or even end of anal fin; nasal pair long, almost as long as head; bases of mandibular barbles set wide apart, inner pair placed in front of outer pair. Dorsal fin origin distinctly in advance of pelvics and much nearer to snout tip than caudal base; spine strong, smooth, shorter than head. Adipose fin small. Pectoral spine moderately strong, denticulated on its inner edge. Caudal fin deeply forked, lobes equal, tips pointed. Colour dirty yellow with three indistinct vertical greenish bands, a vertical bar on caudal base. Attains 5 cm in length.

Distribution : India : Delhi, Yamuna and Ganga river systems. *Elsewhere* : Pakistan; Nepal; Bangladesh.

Remarks : Inhabits fresh and tidal waters. Feeds on insect diet. Breeds during monsson period. Of little food value.

63. *Nangra viridescens* (Hamilton - Buchanan)
Huddah Nangra

1822. *Pimelodus viridescens* Hamilton Buchanan, *Fish. Ganges* : 173-174, 376 (type - locality : rivers of northern parts of Bengal).

1877. *Nangra viridescens* : Day, *Fish. India* : 494-495, pl. 115, fig. 7 (Delhi).

1889. *Nangra punctata* : Day, *Faun. Brit. India*, Fish., **1** : 211-212, fig. 76.

1889. *Nangra viridescens* : Day, *Faun. Brit. India*, Fish., **1** : 211,212-213 (Delhi).

1958. *Nangra punctata* : Majumdar, *J. Bombay nat. Hist. Soc.*, 5592) : 368 (Delhi).

1981. *Nangra viridescens* : Jayaram, *Feshw. Fish. India*, : 241 (Delhi).

1991. *Nangra viridescens* : Talwar and Jhingran, *Inland Fish. India*, **2** : 677-678 (Delhi).

Local name : Huddah.

Material examined : from literature.

Diagnostic characters : D.I/6-8, P.I/8, V.I/5, A.II-IV/8-9, C.18-21.

Body short. head depressed, broad; median longitudinal groove extends to base of occepital process. Eyes moderate, dorsal. Mouth inferior, wide. Barbles four pairs, maxillary pair stiff based, much shorter than head; a pair of finger like - processes in between bases of inner mandibular barbles. Dorsal spine strong, smooth. Adipose fin short. Pectoral spine strong, serrated on its inner edge. Caudal deeply forked. Colour coppery-gold with a black blotch on

occiput and 3-4 bands on back descending on sides; dorsal fin with a black band. Young ones greenish - brown with short bands. Attains 8.5 cm in length.

Distribution : India : Delhi, Punjab, Uttar Pradesh, Bihar, West Bengal, Assam. *Elsewhere* : Nepal; Bangladesh.

Remarks : Inhabits freshwater bodies. Feeds on insects etc. Breeds during rainy season. Good fishery exists in Bihar and West Bengal.

Genus *Sisor* Hamilton Buchanan

1822. *Sisor* Hamilton Buchanan, *Fish. Ganges* : 207, 379 (type species : *Sisor rabdophorus* Hamilton - Buchanan).

64. *Sisor rabdophorus* Hamilton - Buchanan
Long-tailed Sisorid

1822. *Sisor rabdophorus* Hamilton Buchanan, *Fish. Ganges* : 208-209, 379 (type locality : northern rivers of Bengal and Bihar).
1877. *Sisor rhabdophorus* : Day, *Fish. India* : 491-492, pl. 115, figs. 1, 1a, 1b (Delhi).
1889. *Sisor rhabdoporus* : Day, *Faun. Brit. India*, Fish., **1** : 105-106, fig. 43 (Delhi).
1958. *Sisor rhabdoporus* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 368 (Delhi).

Local names : Bistuiya, Chenua.

Material examined : from literature.

Diagnostic characters : D.I/6, P.I/8, V.I/6-7, A.II/4, C.11.

Body elongate, whip - like, depressed anteriorly. Head roughened with ridges and covered by skin, median longitudinal groove reaching base of occipital process, occipital process separated from basal bone of dorsal. Snout obtuse. Eyes minute, dorsal. Mouth small, inferior, transverse. Bables six pairs, short, maxillary pair broad based, reaching pectoral base, mandibular five pairs, minute. Dorsal spine weak, serrated anteriorly. Pectoral spine flattened, serrated along both edges. Pelvics inserted under posterior dorsal rays. Anal short, almost midway between pelvics and caudal base. Caudal fin truncate, uppermost ray prolonged into a long filament, almost equal to body length. Posterior half of body covered with 12 osseous rings; five plates on either side of dorsal base behind which extend six elevated scale-like plates along median line, the last one forms a spine above anal fin. Lateral line with a series of small rough bony plates. Colour blackish above, lighter below. 18 cm in standard length.

Distribution : India : Delhi, Yamuna, Ganga, Brahmaputra river systesms. *Elsewhere* : Pakistan; Bangladesh.

Remarks : Inhabits freshwater streams below base of Himalaya. Young ones live around small stones on bed. Feeds on insects and their larvae. Breeding takes place during monsoon months. Not valued as food.

Family : CLARIIDAE (Airbreathing catfishes)
Genus *Clarias* Scopoli

1777. *Clarias* Scopoli, *Introd. Hist. Nat.*, : 455 (type - species : *Clarias orontis* Gunther Linnaeus).

65. *Clarias batrachus* (Linnaeus)
Magur

1758. *Silurus batrachus* Linnaeus, *Syst. Nat.*, 1, ed. 10 : 305 (type - locality Aisa; Africa).

1822. *Macropteronotus magur* Hamilton - Buchanan, *Fish. Ganges* : 146-147, 374, pl. 26, fig. 45.

1889. *Clarias magur* : Day, *Faun. Brit. India*, Fish., 1 : 115-116, figs. 48, 49.

1958. *Clarias batrachus* : Majumdar, *J. Bombay nat. Hist. Soc.*, 55(2) : 370 (Delhi, under imported varieties).

Local names : Magur, Mangur.

Material examined : Local information.

Diagnostic characters : D.62-76, P.I/8-11, V.I/5, A.45-58, C.14-21.

Body elongate, cylindrical anteriorly, compressed posteriorly. Head broad, depressed, covered with - osseous plates; two fontanells on head, anterior one deep, oblong, pointed anteriorly, placed between eyes; posterior one oval, behind; occipital process rounded, well seperated from base of dorsal fin. Nostrils wide apart. Eyes small, dorso-lateral, not visible form ventral side. Mouth subterminal, transverse fairly wide, upper jaw slightly longer. Barbles four pairs, maxillary pair extending beyond pectoral base, nasal pair to gill - openings and equal to mandibulars. Dorsal long, spinelss, origin distinctly in advance of pelvics and almost opposite tip of pectorals. Pectoral spine bony, strong, serrated on both edges, covered with skin. Anal opening nearer anal fin than pelvic base. Males with urino-genital papilla during breeding season. Anal long. Caudal rounded, free from dorsal and caudal fins. Colour brownish or greenish - blue above, lighter below with reddish tinge; dorsal and anal fins red margined. Attains 46 cm in length.

Distribution : India : Delhi and throughout. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar; Malaysia; Indonesia; Singapore; Philippines.

First report from Delhi.

Remarks : Inhabits fresh and brackish waters. Hardy, can tolerate all types of water and can live out of water for some time and move short distances over moist soil due to presence of an accessory repiratory organ in gill cavity. In harsh dry conditions lie concealed under mud. Subsists on animal diet comprising insects, crustaceans, fishes etc. Breeds during south-west monsoon period in ponds and pools. Induced breeding successfully performed by using homoplastic pituitary gland. Cultured in shallow ponds, cages, cement cisterns, paddy fields and sewage water. Highly esteemed for its nourishing properties, especially during convulscence. Used as test animal for biological assay of pituitary harmones. Airbladder provides isinglass.

Family : HETEROPNEUSTIDAE (Airsac or Stinging catfishes)

Genus ***Heteropneustes*** Muller

1839. *Heteropneustes* Muller, *Abh. Akad. Wiss. Berlin* : 243 (type-specis : *Silurus fossilis* Bloch = *Silurus singio* Hamilton-Buchanan).

66. ***Heteropneustes fossilis*** (Bloch)
Stinging Catfish

1794. *Silurus fossilis* Bloch, *Naturgesch. ausl. Fische*, **8** : 46, pl. 370, fig. 2 (type-locality : Tranquebar).
1964. *Saccobranchus microps* Gunther, *Cat. Fish. Brit. Mus.*, **5** : 31 (type-locality : Sri Lanka).
1889. *Saccobranchus fossilis* : Day, *Faun. Brit. India*, Fist., **1** : 125, fig. 53.
1958. *Heteropneustes fossilis* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 368 (Delhi).

Local names : Bitchu, Singhi, Singi, Telia.

Material examined : Delhi; 7 exs. (50 - 80 mm), River Yamuna, Okhla barrage, 10.v.1994; 2 exs. (1, 170 mm TL; 2, 170 mm SL), Yamuna reservoir, Kalindi Kunj, Okhla, 15.v.1994; 1 ex.(67 mm), Piggery Farm Nala, Uri Enclave, 18.xii.1994; 2 exs. (130, 140 mm), Okhla reservoir, 18.xii.1994, coll. Akhlaq Husain & party.

Diagnostic characters : D.0/6-8, P.I/6-7, V.I/5, A.II/58-68, C.15-19.

Body elongate, compressed. Head depressed. Eyes small, lateral. Nostrils wide apart. Mouth small, terminal, transverse. Barbles four pairs, nasal, maxillary and mandibular, all reaching beyond head. Dorsal fin short, spineless, above pelvics. Adipose represented by a low ridge in posterior region. Pectoral fin with a strong spine, serrated on both edges. Males possess an elogated and pointed urino-genital papilla. Anal fin long, may be sometimes confluent with rounded caudal. Colour chocolate - brown above, lighter below. Attains a lenght of 30 cm.

Distribution India : Delhi and throughout including Andamans. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka; Thailand; Laos.

Remarks Inhabits freshwater rivers, nalas, lakes, ponds. During harsh dried conditions bury themselves under semi dried mud and survive due to presence of accessory respiratory organs in the form of two tubular sacs running from gill-cavity one on either side of vertebral column. Breeds in confined waters during monsoon. Induced breeding by using homoplastic pituitary glands also successful. Much dreaded for painful wounds inflicted by pectoral spines but also in great demand for its medicinal value.

Datta Gupta et al. (1963) made a comparative study of the taxonomic characters of material of *H. fossils* (Bloch) and *H. microps* (Gunther) and observed that the latter species lies within the range of variation of the former. In addition to confluence of anal and caudal fins, a mere anomaly, they also found 8 rays in dorsal fin of *H. fossilis*. Interestingly *H. microps* (type-locality : Sri

Lanka) type of specimens have also been reported from Indian waters (vide Jayaram, 1981; Talwar & Jhingran, 1991) and *H. fossilis* (type-locality : Tranquebar, India) occur in both the places.

Order : CYPRINODONTIFORMES

Opercular and preopercular margin without spines. Single dorsal fin; spines very rarely present in fins. 2nd circumorbital bone absent. Branchiostegal rays 3-15. Ctenoid scales rare. Swim bladder physoclistic.

Key to suborders

1. Narial opening single; branchiostegal rays 6-15; lateral line running along ventral edge of body (absent in some Hemiramphids and Scomberesocoid *Elassichthys*).....Exocoetoidei
- Narial opening paired; branchiostegal rays 3-7; lateral line mainly on head, not on body... .....Cyprinodontoidei

Suborder : EXOCOETOIDEI
Family : BELONIDAE (Gar or Needle fishes)

Mouth large; both jaws elongate with numerous needle-like teeth (except two Soth American freshwater species which have short upper jaw). Dorsal fin ray 10-26; anal fin rays normally 13-25 (24-48) in *Ablennes,* a coastal fish). Scales cycloid, small (usually 130-350 in lateral line).

Genus *Xenentodon* Regan

1911. *Xenentodon* Regan, *Ann. Mag. nat. Hist.*, (8) **7** : 332 (type-species : *Esox cancila* Hamilton - Buchanan).

67. *Xenentodon cancila* (Hamilton - Buchanan)
Freshwater Garfish

1822. *Esox cancila* Hamilton - Buchanan, *Fish. Ganges* : 213-215, 380, pl. 27, fig. 70 (type - locality : ponds and smaller rivers of Gangetic provinces).
1889. *Belone cancila* : Day, *Faun. Brit. India*, Fish., **1** : 420 fig. 136.
1958. *Belone cancila* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55** (2) : 369 (Delhi).
1976. *Belone cancila* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Chonchwali, Kauwa, Sua.

Material examined : Delhi ; 1 ex. (64 mm), Yamuna reservoir, Ramghat nr. Wazirabad, Jagatpur road, 14.v.1994, coll. Akhlaq Husain & party; 2 exs. (40, 80 mm), Okhla reservoir,

Barrage side nr. U.P.Border, 10.ix.1994, coll. J.P.Sati & party; 1 ex. (212 mm), Yamuna reservoir, Ramghat, 17.xii.1994, coll. Akhlaq Husain & party; 1 ex. (75 mm), Yamuna reservoir, Ramghat, Wazirabad, 24.vii.1995; 1 ex. (73 mm), Okhla reservoir, Barrage side, 29.vii.1995, coll. J.P.Sati & party.

Diagnostic characters : D.II-III/13-15, P.I/10, V.I/5-6, A.II-III/14-16, C.15.

Body elongate, cylindrical. Head long, jaws long, beak-like. Eyes moderate. Mouth terminal, cleft very deep. Dorsal and anal fins short, about equal in length and inserted nearly opposite each other. Caudal truncate. Scales small. Lateral line complete, pierced very low. Colour light greenish above with a silvery lateral band, a series of 4-5 dark blotches on sides of body; whitish below. Attains a length of 40 cm.

Distribution India : Delhi and throughout. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar; Thailand; Malyasia.

Remarks : Inhabits freshwater rivers, reservoirs and ponds with clear water, swimming on water surface. Carnivorous and predatory, feeding on small fishes, prawns etc. Breeds twic a year, before and after monsoon months. Considered good eating.

Suborder : CYPRINODONTOIDEI
Family : POECILIIDAE (Livebearers)

First three anal fin rays unbranched; male with elongated anterior anal fin rays (gonopodium, primarily formed from 3rd, 4th and 5th rays) with internal fertilization; bear young alive (except in *Tomeurus* which lay eggs). Gonopodium under pectoral fins in Tomeurinae and pectoral clasper in Xenodexiinae.

Subfamily : POECILIINAE

Gonopodium form from anal fin rays.

Genus ***Gambusia*** Poey

1854. *Gambusia* Poey, *Mem. Cuba*, **1** : 382 (type-species : *Gambusia punctata* Poey).

68. *Gambusia affinis* (Baird & Girard)
Mosquito-eating Fish

1853. *Heterandria affinis* Baird and Girard, *Proc. Acad. nat. Sci. Philad.*, **6** : 390 (type - locality : San Antanio river drainage, Texas).

1991. *Gambusia affinis* Talwar and Jhingran, *Inland Fish. India*, **2** : 756-759, fig. 242.

Local name : Gambusia.

Material examined : Delhi; 41 exs. (15-30 mm), Nala nr. Farmer's Hostel, IARI,

4.vi.1993, coll. Vinod Khanna & party; 87 exs. (14-38 mm), Nala, IARI Campus, 24.x.1993, coll. N.K.Sinha & party; 28 exs. (18-34 mm), Nala, IARI Campus, 9.v.1994; 2 exs. (20,23 mm), Pond, Indira Gandhi Indoor Stadium Complex, 11.v.1994; 6 exs. (5, 15-17 mm TL, 1, 38 mm SL), Park Lake, Dhaulakuan, Sardar Patel road, 12.v.1994; coll. Akhalq Husain & party; 6 exs. (18-35 mm), Indira Gandhi Indoor Stadium Complex, 10.ix.1994, coll. J.P.Sati & party; 64 exs. (16-51 mm), Tank Lodhi Garden, 19.xii.1994, coll. Akhalq Husain & party; 4 exs. (21 - 26 mm), Lodhi Garden, 25.vii.1995, coll. J.P.Sati & party.

Diagnostic characters : D.I/7-8, P.13-14, V.6, A.8-10. C.19, L.l. 32.

Body elongate, compressed posteriorly, abdomen rounded. Head moderate. Mouth small; lower jaw projecting. Eyes large, major part in anterior half of head. Dorsal fin short, inserted behind anal fin origin, in middle of body in males and midway between anterior edge of eye and tip of caudal fin in females. Gonopodium about as long as or longer than head (in male) and with a series of denticles on posterior edge of 3rd anal ray. Scales moderate. Lateral line on head, not on body. Colour olive - brown above, black dots on sides and a dark transverse bar across eye; lighter below. Females develop a large black patch just above anal fin. 62 mm in length, males smaller.

Distribution : India : Delhi and throughout (Introduced). *Elsewhere* (Introduced) : Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar; Thailand; Malaysia; Philippines; Taiwan; Formosa; Hawaii (USA). Native of U.S.A.

First report from Delhi.

Remarks : Withstands dirty water conditions and wide range of temperature from above freezing point to 33° celsius. Feeds on mosquito larvae. Active breeder throughout the year. Good mosquito controller.

Order : SYNBRANCHIFORMES

Body eel-like. Mouth fairly large; maxilla and premaxilla long and strut-like, with symphyseal and articulatory processes, reduced or absent. Eyes small, well forward on head. Anterior and posterior nostrils present. Paired fins absent (pectorals present in early stage of some species); caudal small, vestigial or absent; dorsal and anal fins vestigial (reduced to rayless ridge). Gill-membranes united, continuous around isthumus, with a single gill-opening in the form of a slit or pore under head or throat. Vent in anterior half of body. Scales often absent. Swim bladder absent.

Family : SYNBRANCHIDAE (Swampels)

Characters same as under order. Scales present in species of subgenus *Amphipnous* Muller.

Genus *Monopterus* Lacepede

1800. *Monopterus* Lacepede, *Hist. Nat. Poiss.*, 2 : 138 (type-species : *Monopterus javanensis*

Lacepede = *Muraena alba* Zuiew).

69. *Monopterus cuchia* (Hamilton - Buchanan)
Gangetic Mud-eel

1822. *Unibranchapertura cuchia* Hamilton - Buchanan, *Fish. Ganges* : 16-17, 363, pl. 16, fig. 4 (type - locality : rivers and ponds of south - east parts of Bengal).
1889. *Amphipnous cuchia* : Day, *Faun. Brit. India*, Fish., 1 : 69, fig. 27.
1958. *Amphipnous cuchia* : Majumdar, *J. Bombay nat. Hist. Soc.*, 55 (2) : 369 (Delhi).
1976. *Amphipnous cuchia* : Raza et al., In : *Delhi Gazetteer* : 30.
1976. *Monopterus cuchia* : Rosen and Greenwood, *Bull. Am. Mus. nat. Hist.*, 157(1) : 59, 66.

Local names : Anhaya Bam, Bam.

Material examined : from literature.

Diagnostic characters : Body eel-like, robust. Head not conspicuous. Eyes small, covered by skin. Mouth terminal; teeth on jaws and palate uniserial. Gill-opening crescentic, skin around drawn into deep longitudinal folds. Dorsal and anal fin folds rudimentary. Scales present cycloid, small, longitudinally arranged on posterior half of body. Colour greenish or chestnut-brown above and lighter below; with numerous black spots. Attains 60 cm in length.

Distribution : India : Delhi, northern and north-eastern India. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar.

Remarks : Inhabits fresh and brackish waters from 76 to 1350 m altitude. Relished as food in some parts.

Order : PERCIFORMES

Most diversified order. Most perciformes have following common characters :

Dorsal, pelvic and anal fins with spines; pelvic fin with a spine and usually 5 or less soft rays (all fins without spines, pelvic fin with six soft rays or absent in Channoides). Caudal fin (absent in Scombroidei) with 17 or less principal rays. Adipose fin absent. Scales usually ctenoid. Gills 4, a slit behind last one; branchiostegal rays 7 or less.

Key to suborders

1. A suprabranchial organ present.....2
- A suprabranchial organ absent.....3

2. Pelvic fins with one spien and five soft rays (sometimes vestigial).....Anabantoidei
- Pelvic fins with six soft rays (absent in *Channa*).....Channoidei

3. Pelvic fins absent.....Mastacembeloidei
- Pelvic fins present.....4
4. Head generally with mucous canals and open pores; pelvic fins often united.....Gobioidei
Head without mucous canals and open pores; pelvic fins not united.....5

5. Pelvic bones attached to cleithra.....Percoidei
- Pelvic bones not attached to cleithra.....Mugiloidei

Suborder : PERCOIDEI

Key to families

1. Single nostril on each side of head (lateral line interrupted).....Cichlidae
- Two nostrils on each side of head 2

2. Lateral line incomplete or absent.....Nandidae
- Lateral line present, complete.....Centropomidae

Family : CENTROPOMIDAE (Snooks)
Subfamily : AMBASSINAE

Key to genera

1. Canine teeth on lower jaw present, mouth large with prominent lower jaw; lateral line with 100-107 scales.....*Chanda* Hamilton-Buchanan
- Canine teeth on lower jaw absent, mouth moderate; jaws more or less equal; lateral line with 47-90 scales.....*Pseudambassis* Bleeker

Genus *Chanda* Hamilton - Buchanan

1822. *Chanda* Hamilton - Buchanan, *Fish. Ganges* : 103, 370 (type-species : *Chanda nama* Hamilton-Buchanan).

70. *Chanda nama* Hamilton - Buchanan
Elongate Glassperchlet

1822. *Chanda nama* Hamilton Buchanan, *Fish. Ganges* : 109-111, 371, pl. 39, fig. 37 (type-locality : ponds throughout Bengal).
1889. *Ambassis nama* : Day, *Faun. Brit. India*, Fish., 1 : 484-485, fig. 149.
1958. *Ambassis nama* : Majumdar, *J. Bombay nat. Hist. Soc.*, 55(2) : 369 (Delhi).

1976. *Ambassis nama* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Chanda, Channa, Chanri.

Material examined : Delhi; 55 exs. (15-29 mm), Pond, Indira Gandhi Indoor Stadium Complex, 11.v.1994; 5 exs. (68-82 mm), Yamuna reservoir, Ramghat nr. Wazirabad, Jagatpur road, 14.v.1994, coll. Akhlaq Husian & party; 4 exs. (33-39 mm), Indira Gandhi Indoor Stadium Complex, 10.ix.1994; 27 exs. (26 - 52 mm), Pond, Patparganj area (nr. Yamuna bridge, Nizamuddin area), 10.ix.1994; 12 exs. (26-53 mm), Okhla reservoir, Barrage side nr. U.P.Border, 10.ix.1994; 16 exs. (20 - 30 mm), Yamuna barrage, Wazirabad, 11.ii.1995, coll. J.P.Sati & party.

Diagnostic characters : D.VII, I/13-17, P.II/11-12, V.I/5, A.III/14-17, C.17, L.l. 100-107.

Body small, ovate, strongly compressed, transparent. Mouth large with longer lower jaw; 2-3 canines on lower jaw; tongue edentate. Suborbital ridge smooth ending in an indistinct spine. Vertical limb of preopercle entire, except its angle which bears 2-3 denticulations. Dorsal fin divided into spiny and soft parts. Caudal forked. Scales minute. Lateral line indistinct. Colour diaphanous with an oblong black patch on shoulder; upper half of dorsal fin black; caudal fin with pale margin. Attains 11 cm in length.

Distribution : India : Delhi and throughout plains *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar.

Remarks : Inhabits fresh and brackish waters, both stangnant and slow moving. Feeds on small insects and their larvae. Breeding occurs in rainy season. Fish may be used in controlling guinea worms and mosquito larvae.

Genus *Pseudambassis* Bleeker

1876. *Pseudambassis* Bleeker, *Arach. Neerl. Sci. Nat.*, **11**(2) : 292 (type-species : *Chanda lala* Hamilton - Buchanan).

71. *Pseudambassis baculis* (Hamilton - Buchanan)
Small Glassy Perchlet

1822. *Chanda baculis* Hamilton - Buchanan, *Fish. Ganges* : 112-113, 371, pl. 22, fig.7 (type-locality : north - eastern parts of Bengal).

1976. *Ambassis baculis* : Day, *Faun. Brit. India*, Fish., **1** : 485-486.

1991. *Pseudambassis baculis* : Talwar and Jhingran, *Inland Fish. India*, **2** : 803-804.

Local names : Chanda, Chanri.

Material examined : Delhi; 148 exs. (27-33 mm), Pond, Patparganj area (nr. Yamuna bridge, Nizamuddin area), 10.ix.1994; 3 exs. (29-30 mm), Okhla reservoir, Barrage side nr. U.P.Border, 10.ix.1994, coll. J.P.Sati & party.

Diagnostic characters : D.VI, I/12-13, P.I/11-2, V.I/5, A.III/12-13, C.17, L.l.90.

Body ovate, compressed, transparent. Mouth small. Tongue edantate. Supraorbital edge

serrated; preorbital strongly serrated along its lower edge and having a sharp spine directed towards orbit at its anterio-superior angle followed by several more along its upper edge; vertical limb of preopercle entire, lower edge of horizontal limb strongly serrated and a few serrations near angle of its upper edge. Dorsal fin divided into spiny and soft parts. Caudal forked. Lateral line complete. Colour translucent with a silvery band on sides. Attains about 6 cm in length.

First record from Delhi.

Distribution : India : Delhi, Punjab, Uttar Pradesh, Bihar, West Bengal, Orissa. *Elsewhere*: Pakistan; Bangladesh; Myanmar; Thailand.

Remarks : Inhabits freshwater ponds, lakes and rivers. Feeds on small insects and their larvae. Breeds during rainy season in pools and puddles with vegetation. Popular aquarium fish.

72. *Pseudambassis ranga* (Hamilton - Buchanan)
Dwarf Glass Perchlet

1822. *Chanda ranga* Hamilton Buchanan, *Fish. Ganges* : 113-114, 371, pl. 16, fig. 38 (type - locality : freshwaters of all parts of Gangetic provinces).

1889. *Ambassis ranga* : Day, *Faun. Brit. India*, Fish., 1 : 485.

1958. *Ambassis ranga* : Majumdar, *J. Bombay. nat. Hist. Soc.*, 55(2) : 369 (Delhi).

1976. *Ambassis ranga* : Raza et al., In : *Delhi Gazetteer* : 30.

1991. *Pseudambassis ranga* : Talwar and Jhingran, *Inland Fist. India*, 2 : 803, 805.

Local names : Chanda, Chanri.

Material examined : Delhi; 1 ex. (33 mm), Pond, Patparganj area (nr. Yamuna bridge, Nizmuddin area), 10.ix.1994; 1 ex. (38 mm), Okhla reservoir, Barrage side nr. U.P. Border, 10.ix.1994, coll. J.P.Sati & party; 1 ex. (19 mm), Sabhaypur, Ghaziabad road, 17.xii.1994, coll. Akhlaq Husain & party; 3 exs. (23 - 37 mm), Okhla reservoir, Barrage side, 29.vii.1995, coll. J.P.Sati & party.

Diagnostic characters : D.VII, I./11-15, P.I/11-12, V.I/5, A.III/13-16, C.17, L.l.46-70.

Body roundish, strongly compressed, translucent. Mouth oblique, tongue edantate. Supraorbital ridge smooth with 1-2 spines posteriorly. Vertical limb of preopercle entire or serrated finely or coarsly. Dorsal fin divided into spiny and soft parts. Caudal forked. Scales minute. Lateral line complete. Colour diaphanous with a dusky spot on shoulder; dorsal and caudal fins with blackish edges. Attains 7 cm in length.

Distribution : India : Delhi and throughout plains. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar; Thailand; Malaysia.

Remarks : Inhabits fresh and brackish waters. Feeds on insects and their larvae. Breeds during rainy season. Popular among aquarists.

Family : NANDIDAE (Leaf-fishes)

Key to subfamilies

1. Mouth large, strongly protrusible; maxilla extending beyond hind border of eye; preopercle serrate near its angle.....Nandinae
- Mouth small, slightly protrusible; maxilla not extending to posterior border of eye; none of opercular bone serrate.....Badinae

Subfamily : NANDINAE

Genus *Nandus* Valenciennes

1831. *Nandus* Valenciennes, In : Cuvier & Valenciennes, *Hist. Nat. Poiss.*, 7 : 481 (type-species : *Nandus marmoratus* Cuvier = *Coius nandus* Hamilton-Buchanan).

73. *Nandus nandus* (Hamilton - Buchanan)

Mottled Nandus

1822. *Coius nandus* Hamilton Buchanan, *Fish. Ganges* : 96-98, 370, pl. 30, fig. 32 (type-locality : ponds of Gangetic provinces).

1889. *Nandus marmoratus* : Day, *Faun. Brit. India*, Fish., 2 : 82-83, fig. 39.

1958. *Nandus nandus* : Majumdar, *J.Bombay nat. Hist. Soc.*,55(2) : 370 (included under "imported varieties").

Local name : Dhebri.

Material examined : 1 ex. (70 mm), Horse-shoe Lake, Water Sport Complex, vill. Bhalswa, 26.x.1993, coll. N.K.Sinha & party.

Diagnostic characters : D.XII-XIV/11-13, P.I/14-15, V.I/5, A.III/7-9, C.15, L.l. 46-57.

Body oblong, deep, compressed. Head large, compressed. Eyes moderate, dorso-lateral, in anterior part of head. Mouth large, protrusible, cleft deep extending to below posterior margin of eye, lower jaw projecting. Operculum with a prominent spine, preopercle serrate near its angle. Dorsal fin divided into spiny and soft parts, origin above pectoral base. Caudal rounded. Scales small, ctenoid on head, body and bases of dorsal and anal fins. Lateral line incomplete. Colour greenish-brown, marbled with three broad patchy bands, yellowish bands across soft dorsal, anal and caudal fins. Attains 20 cm in length.

Distribution : India : Delhi and throughout plains. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar; Thailand.

First record from Delhi.

Remarks : Inhabits fresh and brackish waters, commonly in ditches and inundated fields. During summer months conceals itself in dried up beds. Food consists of small fishes, crustaceans, insects etc. Breeding takes place in muddy waters during monsoon season. Highly esteemed as food inspite of spinous fins and ugly look.

Subfamily : BADINAE

Genus ***Badis*** Bleeker

1853. *Badis* Bleeker, *Verh. Batav. Genootsch*, **25** : 106 (type-species : ***Badis buchanani*** Bleeker = *Labrus badis* Hamilton-Buchanan).

74. *Badis badis* (Hamilton - Buchanan)
Dwarf Chameleon Fish

1822. *Labrus badis* Hamiton - Buchanan, *Fish. Ganges* : 70-71, 368 pl. 25, fig. 23 (type - locality : ponds and ditches of Gangetic provinces).

1889. *Badis buchanani* : Day, *Faun. Brit. India*, Fish., **2** : 80-81, fig. 38.

Local name : Sumha.

Material examined : Delhi; 4 exs. (17-30 mm), Yamuna reservoir, Ramghat, 17.xii.1994; 7 exs. (24-50 mm), Sabhaypur, Ghaziabad road, 17.xii.1994, coll. Akhlaq Husain & party.

Diagnostic characters : D.XVI-XVIII/7-10, P.12, V.I/5, A.III/6-8, C.16, L.l. 26-33.

Body oblong, compressed. Eyes, moderate, dorso-lateral in anterior part of head. Mouth small. Dorsal fin long, anterior part spiny, posterior soft. Pelvics below pectorals. Anal far behind. Caudal fin rounded. Scales ctenoid, small. Lateral line incomplete. Colour dark with black and dirty red alternate bands and bluish-black spot behind gill-opening; fins light greenish or bluish, dorsal fin base with a row of dark spots. Attains 8 cm in length.

Distribution : India : Delhi and throughout plains and low elevations. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar.

First record from Delhi.

Remarks : Inhabits slow moving streams, lakes, ponds and ditches with submerged weeds. Feeds on insects and their larvae. Breeds during monsoon months in ponds, shallow pools along nalas, etc. Popular among aquarists for its colour changing quality.

Family : CICHLIDAE (Cichlids)

Genus ***Oreochromis*** Gunther

1889. *Oreochromis* Gunther, *Ann. Mag. nat. Hist.*, (6) **4** : 70 (type-species : ***Oreochromis hunteri*** Gunther).

75. *Oreochromis mossambica* (Peters)
Mozambique Cichlid, Tilapia

1852. *Chromis (Tilapia) mossambicus* Peters, *Montab. Akad. Wiss.*, Berlin : 681 (type - locality : Mozambique).

1952. *Tilapia mossambica* : Jones and Sarojini, *J. Bombay nat. Hist. Soc.*, **50**(3) : 606.

1983. *Oreochromis mossambica* : Trewavas, *Tilapiine Fish.*, : 292, fig. 10.

Local name : Tilapia.

Material examined : Delhi; 11 exs. (24-51 mm), Water Sport Complex, Bhaleswa, 26.x.199; coll. N.K.Sinha & party; 2 exs. (21, 22 mm), Park Lake, Dhaula Kuan, Sardar Patel road, 12.v.1994; 41 exs. (2, 133, 137 mm, adults; 39, 7-26 mm, juveniles), Horse-shoe Lake, Bhaleswa, 16.v.1994, 78 exs. (♂♂ & ♀♀, 42-158 mm), Horse-shoe Lake, Bhaleswa, 15.xii.1994, coll. Akhlaq Husain & party.

Diagnostic characters : D.XV-XVI/10-12, P.14-15, A.III/10-11, C.19, L.l.30-32.

Body robust, compressed, deep. Mouth terminal, large. Eyes large, lateral. Dorsal fin long with 15-16 spines; soft rays extending above proximal part of caudal fin in females/immature males and half or three-fourths of caudal length in adult/breeding males. Caudal fin truncate, often with rounded corners. Scales cycloid. Lateral line incomplete. Colour, females/non breeding males greyish or yellowish with 3-4 dark blotches, apparant along flanks; males in breeding season blackish with bluish upper lip and whitish lower part of head; dorsal and caudal fins with red margins, pectorals transluscent red.

Distribution : India : Delhi and other places (introduced). *Elsewhere* : Pakistan (Introduced); East Africa to Natal; South Africa.

First report from Delhi.

Remarks : Inhabits primarily brackish waters, also freshwaters. A warm water fish, hardy, suitable for farming as can breed easily but should not be cultured along with major Indian carps for its adverse affect on growth and production of carps.

Suborder : MUGILOIDEI
Family : MUGILIDAE (Mullets)

Mouth-moderate; teeth small or absent. Gill-rakers long. Spiny (4 spines) and soft rayed dorsalfins widely separated; pelvic fins with a spine and five soft rays. Lateral line vestigial or absent.

Key to genra

Operculum with a spine (above pectoral fin base); head much flattened dorsally.....*Sicamugil* Fowler

Operculum without a spine; head concave between eyes.....*Rhinomugil* Gill

Genus *Rhinomugil* Gill

1864. *Rhinomugil* Gill, *Proc. Acad. nat. Sci. Philad.*, **15** : 169 (type-species : *Mugil corsula* Hamilton - Buchanan).

76. *Rhinomugil corsula* (Hamilton-Buchanan)

Corsula Mullet

1822. *Mugil corsula* Hamilton-Buchanan, *Fish. Ganges* : 221-222, 381, pl.9, fig.97 (type-locality : most rivers of Gangetic provinces).
1889. *Mugil corsula* : Day, *Faun. Brit. India*, Fish., **2** : 341, 349.
1958. *Mugil corsula* : Majumdar, *J.Bombay nat. Hist. Soc.*, **55**(2) : 369 (Delhi).
1962. *Rhinomugil corsula* : Pillay, *J. Bombay nat. Hist. Soc.*, **59**(2) : 568-570.
1976. *Mugil corsula* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Andowari, Hunra.

Material examined : from literature.

Diagnostic characters : D.IV, I/7-8, P.I/12-15, V.I/5, A.III/9, C.15-16, L.l.48-53.

Body elongate, somewhat compressed. Head moderate, concave between eyes, Snout obtuse overhung.. Eyes somewhat dorsal, on anterior part of head, bulging, not visible from ventral side. Mouth ventral, protrusible; symphysial knob on lower jaw present. Two dorsal fins, spiny and rayed, well separated; spiny dorsal almost midway between pelvics and anal fin. Pectorals shorter than head, extending over pelvic bases or beyond. Anal origin slightly ahead of rayed dorsal. Caudal fin emarginate. Scales cycloid in young, ctenoid in adult. Lateral line absent. Colour brownish. Attains about 46 cm in length.

Distribution India : Delhi, Punjab, Uttar Pradesh, Bihar, West Bengal, Orissa, Gujarat, Introduced in Andhra Pradesh and Tamil Nadu. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar.

Remarks : Inhabits fresh and brackish waters. Very active fish, difficult to catch as they swim in shoals on water surface with head out. Surface feeder, subsisting on insect diet. Breeds in turbid waters around monsoon months. Valued for food.

Genus ***Sicamugil*** Fowler

1939. *Sicamugil* Fowler, *Notul. Nat. Acad. Philad.*, **17** : 9(type-species : *Mugil hamiltonii* Day).

77. ***Sicamugil cascasia*** (Hamilton - Buchanan)
Yellow-tail Mullet

1822. *Mugil cascasia* Hamilton - Buchanan, *Fish. Ganges* : 217-218, 380 (type-locality : northern rivers of Bengal).
1876. *Mugil cascasia* : Day, *Fish. India* : 347, 355-356, pl. 76, fig. 6 (Delhi).
1889. *Mugil cascasia, Faun. Brit. India*, **2** : 341, 351 (Yamuna, Ganga).
1958. *Mugil cascasia* Majumdar, *J. Bombay nat. Hist. Soc.*, 5592) : 369 (Delhi).
1962. *Sicamugil cascasia* : Pillay, *J. Bombay nat. Hist. Soc.*, : **59**(1), 263-265, fig.2.
1976. *Mugil cascaisa* Raza et al.,In : *Delhi Gazetteer* : 30.

Local name : Lorhia.

Material examined : from literature.

Diagnostic characters : D.IV, I/8, P.I/11-14, V.I/5, A.III/8-9, C.14-15, L.l. 36-47.

Body somewhat elongate, compressed. Head short, broad, dorsally flattened. Mouth protrusible; a symphysial knob on lower jaw. Eyes moderate, lateral, in anterior part of head, visible from ventral side; preorbital with spines. Opercle with one strong spine. Two dorsal fins, spiny and rayed, well separated, spiny dorsal behind pelvic base. Pectorals shorter than head, entending over pelvic bases. Anal fin opposite but slightly ahead of rayed dorsal. Caudal forked. Scales strongly ctenoid. Lateral line absent. Colour greenish-yellow with several dark bands; bases of fins yellowish; belly silvery. Attains a lenght of 10 cm.

Distribution India : Delhi; Yamuna, Ganga and Brahmaputra river systems. *Elsewhere* : Pakistan; Bangladesh; Sri Lanka; Myanmar.

Remarks Inhabits freshwaters, common in Yamuna and Ganga rivers. Subsists on insects etc. Breeds during monsoon months. Not important food fish.

Suborder : GOBIOIDEI
Family : GOBIIDAE (Gobies)

Spinous dorsal, when present, separate from soft dorsal and with 2-8 flexible spines; pelvic fins below pectorals, well developed, united; usually forming an adhesive or sucking disc. Scales cycloid or ctenoid or both (rarely absent). Barbles on head in some species.

Subfamily : GOBIINAE

Body elongate or short. Head naked between and before eys. Teeth on upper jaw in one to several rows, on lower jaw in two to several rows. Gill-openings moderate to wide. 2nd dorsal fin longer than first, rarely absent. Pelvic fins entirely nearly so united, attached to belly with there bases only.

Genus *Glossogobius* Gill

1860. *Glossogobius* Gill, *Proc. Acad. nat. Sci. Philad.* : 146 (type-speceis : *Gobius platycephalus* Richardson = *Gobius giuris* Hamilton - Buchanan).

78. *Glossogobius giuris* (Hamilton - Buchanan)
Tank Goby

1822. *Gobius giuris* Hamilton - Buchanan, *Fish. Ganges* : 51-42, 366, pl. 33, fig. 15 (type-locality : ponds and freshwater rivers of Gangetic provinces).

1889. *Gobius gutum* : Day (*nec.* Hamilton Buchanan, 1822), *Faun. Brit. India*, Fish 2: 248, 265.

1889. *Gobius giuris* Day, *Faun. Brit. India*, 2 : 248, 266.

1958. *Glossogobius giuris* Majumdar, *J. Bomaby nat. Hist. Soc.*, 55(2) : 369 (Delhi).

Local names : Bhelua, Bulla.

Material examined : Delhi; 2 exs. (56, 76 mm), Yamuna reservoir, Kalindi Kunj, Okhla, 15.v.1994; 2 exs. (31, 72 mm), Yamuna reservoir, Ramghat, 17.xii.1994; 3 exs. (58-61 mm), Sabhaypur, Ghaziabad road, 17.xii.1994, coll. Akhlaq Husian & party; 1 ex. (52 mm), Yamuna barrage side, Wazirabad, 11.ii.1995; 1 ex. (75 mm), Yamuna reservoir, Ramghat, Wazirabad, 24.vii.1995, coll. J.P. Sati & party.

Diagnostic characters : D.VI, I/8-10, P.I/12-21, V.I/5, A.I/7-10, C.17, L.l.30-34.

Body elongate, cylindrical. Head depressed, scaled above. Eyes dorsal. Mouth large, oblique; lower jaw longer. Two dorsal fins, spiny and soft, well separated, spiny fin behind pelvics. Pelvics united, forming a disc. Anal fin almost opposite rayed dorsal fin. Caudal ablong. Scales ctenoid on body, cycloid on head. Lateral line absent. Colour yellowish - brown above, with five dark blotches on sides of body; fins mottled with dark spots. Attains about 45 cm in length (Day, 1889) but normally much less.

Distribution : India : Delhi and throughout plains. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka; Mauritius; Myanmar; Malaysia; Thailand; China; Japan; Philippines; Australia; Indo-west Pacific.

Remarks : Inhabits primarily freshwater and estuaries, also the sea. Forms a minor fishery in Hooghly estuary (West Bengal) and an important commercial fish of Andhra Pradesh.

Suborder : ANABANTOIDEI
Family : BELONTIIDAE (Gouramies)

Body deep, strongly compressed. Opercle and interopercle smooth. Mouth small; upper jaw protrusible; prevomer and palatine without teeth. Gill-openigns narrow; pseudbranchiae rudimentary or absent. Dorsalfin with 5-14 soft rays and 4-19 spines. Pelvic fins inserted below base of pectoral fins, often with an elongate ray on each side. Caudal fin rounded or obtuse. Lateral line vestigial or absent.

Subfamily : TRICHOGASTERINAE

Supraoccipital crest absent. Branchiostegal rays five. Lateral line absent.

Genus *Colisa* Cuvier

1831. *Colisa* Cuvier, In : Cuvier & Valenciennes, *Hist. Nat. Poiss.*, 7 : 359 (type-speceis : *Colisa vulgaris* Cuvier = *Trichopodus colisa* Hamilton-Buchanan = *Trichogaster fasciatus* Schneider).

Key to species

1. Dorsal fin with 9-14 branched rays; mouth slightly protrusible; upper lip thick and papillose; anal fin scaly at base only.....*Colisa fasciata* (Schneider)
- Dorsal fin with 7-10 branched rays; mouth strongly protrusible; lips normal; anal fin densely scaled, scales covering fin to tips of posterior spines ....*Colisa lalia* (Hamilton-Buchanan)

79. ***Colisa fasciata*** (Schneider)
Giant Gourami

1801. *Trichogaster fasciatus* Schneider, *Syst. Ichth.* : 164, pl. 36 (type-locality : Transquebar).
1889. *Trichogaster fasciatus* : Day, *Faun. Brit. India*, Fish., **2** : 372, fig. 123.
1958. *Colisa fasciatus*, Majumdar,*J.Bombay nat. Hist. Soc.*, 55(2) : 369 (Delhi).

Local names : Khadra, Khosti.

Material examined : Delhi; 5 exs. (20 - 68 mm), Horse-shoe Lake, Water Sport Complex, vill. Bhaleswa, 26.x.1993; 12 exs. (35-45 mm), Swampy area, Wazirabad bridge, 28.x.1993, coll. N.K.Sinha & party; 1 ex. (83 mm), Pond below Yamuna barrage, Okhla, 10.v.1994; 1 ex. (78 mm), Old Fort Lake nr. Pragati Maidan, Mathura road, 10.v.1994; 2 exs. (73, 74 mm), Yamuna reservoir, Ramghat nr. Wazirabad, Jagatpur road, 14.v.1994; 3 exs. (66-90 mm), Horse-shoe Lake, Bhalswa, 16.v.1994; 8 exs. (54-68 mm), Horse-shoe Lake, Bhalswa, 15.xii.1994; 3 exs. (44-63 mm), Chhawla Pul Nala, Najafgarh - Bijwasan road, 20.xii.1994, coll. Akhlaq Husain & party; 1 ex. (47 mm), Horse-shoe Lake, Bhalswa , 11.ii.1995; 2 exs. (33, 35 mm), Yamuna reservoir, Okhla, 14.ii.1995; 3 exs. (58-78 mm), Jheel Park, Ranibagh, 18.ii.1995; 2 exs. (61, 75 mm), Horse-shoe Lake, Bhalswa, 24.vii.1995; 4 exs. (27-62 mm), Okhla reservoir, Barrage side, 29.vii.1995, coll. J.P.Sati & party.

Diagnostic characters : D.XV-XVII/9-14,P.9-10,V.1,A.XV-XVIII/14-19. C. 15, L.l.29-31.

Body oblong, compressed. Dorsal and anal fins long, soft parts produced. Anal fin scaly at base. Plevics filamentous. Caudal fin truncate or slightly notched. Scales ctenoid, moderate. Lateral line present, interrupted in middle. Colour greenish with orange and purple oblique bars; vertical fins with alternate dark and light spots or bars; anal fin often with red marign. Attains 12 cm in length.

Distribution : India : Delhi, Punjab, Uttar Pradesh, Bihar, West Bengal, Assam, Coromondal coast as far as river Krishna. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar.

Remarks : Inhabits rivers, estauries, tanks, ditches, ponds. Feeds on insects. Breed in ponds, lakes mostly in rainy season. Liked for its good taste in Bengal. Beautiful aquarium fish.

80. ***Colisa lalia*** (Hamilton-Buchanan)

Dwarf Gourami

1822. *Trichopodus lalius* Hamilton-Buchanan, *Fish. Ganges* : 120, 372 (type-locality : not given).

1889. *Trichogaster lalius*, Day, *Faun. Brit. India*, Fish., 2 : 373.

1959. *Colisa lalia*, Sterba, *Freshw. Fish. World* : 790.

Local names : Khadra, Khosti.

Material examined : Delhi; 7 exs. (22-35 mm), Horse-shoe Lake, Water Sport Complex, Vill. Bhalswa, 26.x.1993; 84 exs. (17-38 mm), Swampy area, Wazirabad bridge, 28.x.1993; 18 ex. (21-50 mm), Lake Garden, Shakur Basti, 31.x.1993, coll. N.K.Sinha & party; 22 exs. (24-36 mm), Pond nr. Yamuna barrage, Okhla, 10.v.1994; 7 exs. (15-33 mm), Old Fort Lake nr. Pragati Maidan, Mathura road, 10.v.1994; 1 ex. (45 mm), Yamuna reservoir, Ramghat nr. Wazirabad, Jagatpur road, 14.v.1994; 2 exs. (34,35 mm), Yamuna river, temporary bridge nr. Children's Jail between Wazirabad bridge and Gurudwara, 14.v.1994; 36 exs. (25-43 mm), Horse-shoe Lake, Bhalswa, 16.v.1994, coll. Akhlaq Husain & party; 4 exs. (30-39 mm), Gopalpur Nala nr. Wazirabad, 8.ix.1994; 3 exs. (33-37 mm), Okhla reservoir, Barrage side, nr. U.P.Border, 10.ix.1994, coll. J.P.Sati & party; 13 exs. (24-45 mm), Horse-shoe Lake, Bhalswa Lake, 15.xii.1994; 1 ex. (41 mm), Yamuna reservoir, Ramghat, 17.xii.1994; 5 exs. (26-53 mm), Sabhaypur, Ghaziabad road, 17.xii.1994; 1 ex. (32 mm), Okhla reservoir, 18.xii.1994; 7 exs. (23-25 mm), Nala across Okhla reservoir, 18.xii.1994; 4 exs. (22-34 mm), Chhawla Pul Nala, Najafgarh - Bijwasan road, 20.xii.1994, coll. Akhlaq Husian & party; 10 exs. (18-42 mm), Yamuna barrage side, Wazirabad, 11.ii.1995; 1 ex. (30 mm), Horse-shoe Lake, Bhalswa, 11.ii.1995; 245 exs. (24-57 mm), Jheel Park, Ranibagh, 18.ii.1995; 31 exs. (21-46 mm), Yamuna reservoir, Ramghat, Wazirabad, 24.vii.1995; 2 exs. (25, 48 mm), Bhalaswa Lake, 24.vii.1995; 30 exs. (19-43 mm), Okhla reservoir, Barrage side, 29.vii.1995, coll. J.P.Sati & party.

Diagnostic characters : D.XV-XVII/7-10, P.10, V.1, A.XVII-XVIII/13-17, C.15, L.l.26-28.

Body oblong, compressed. Head short, compressed. Eyes moderate; preorbital denticulate. Mouth small, strongly protrusible. Dorsal and anal fins long with rounded posterior soft parts. Anal fin densely scaly, scales covering fin to tips of posterior spines. Caudal fin truncate or rounded. Scales ctenoid, moderate. Lateral line present, interrupted in middle. Colour scarlet in life with oblique light blue bands; fins with scarlet dots or bars, anal with red margin. Attains 5 cm in length.

Distribution : India : Delhi; Yamuna, Ganga and Brahmaputra river systems. *Elsewhere* : Pakistan; Bangladesh.

First record from Delhi.

Remarks : Inhabits stagnant or slow moving water bodies. Insects and larvae feeder. Monsoon breeder. Popular aquarium fish, often sold in bottles filled with water.

Suborder : CHANNOIDEI

Family : CHANNIDAE (Murrels, Snakeheads)

Body elongate. Lower jaw protruding beyond uper. Suprabranchial organ present. Branchiostegal rays five. Dorsal and anal fins long; pelvics present (except in *Channa*) with six rays; spines absent. Scales cycloid or ctenoid.

Genus ***Ophiocephalus*** Bloch

1793. *Ophicephalus* Bloch, *Naturges. ausland. Fische*, (7) : 137 (type-speceis : *Ophicephalus punctatus* Bloch) (corrected by latter workers to *Ophiocephalus*).

Presence of pelvic fins and girdle in genus *Ophiocephalus* Bloch, 1793 distinguishes from genus *Channa* Scopoli, 1777 which lacks these characters.

Key to species

1. • 4-5 rows of scales between preopercular angle and posterior border of eye; 12 predorsal scales.....2
- 9-10 rows of scales between preopercular angle and posterior border of eye; predorsal scales 16-20.....3

2. Pelvic fin less than half of pectoral fin; pectoral fin with vertical bands ....*Ophiocephalus gachua* Hamilton-Buchanan
- Pelvic fin more than half of pectoral fin; pectoral fin without vertical bands..... .....*Ophiocephalus punctatus* Bloch

3. Predorsal scales 18-20; lateral line with triangular dark colour bands; ocellus on caudal base absent.....*Ophiocephalus striatus* Bloch
- Predorsal scales 16; pale-edged ocellus on upper half of caudal fin base present..... .....*Ophiocephalus marulius* Hamilton-Buchanan

81. ***Ophiocephalus gachua*** Hamilton-Buchanan
Brown Snakehead

1822. *Ophiocephalus gachua* Hamilton-Buchanan, *Fish. Ganges* : 68-69, 367, pl. 21, fig. 21 (type-locality : ponds and ditches of Bengal).
1889. *Ophiocephalus gachua* : Day, *Faun. Brit. India*, Fish., 2 : 364.
1958. *Channa gachua* Majumdar, *J. Bombay nat. Hist. Soc.*, 55(2) : 369 (Delhi).
Local name : Shouli.
Material examined : Delhi; 7 exs. (37-65 mm), Nala nr. Vill. Naraina, Ring road, 6.vi.1993; 8 exs. (36-48 mm), Dhaula Kuan Ridge, Cantonment area, 10.vi.1993, coll. Vinod

Khanna & party; 2 exs. (48, 58 mm), Ridge area, Dhaula Kuan, 23.x.1993, coll. N.K.Sinha & party; 2 exs. (26,28 mm, juveniles), River Yamuna, Wazirabad, N.H.No.1., 14.v.1994; 5 exs. (55-70 mm), Piggery Farm Nala, Uri Enclave, 18.xii.1994, coll. Akhlaq Husain & party; 1 ex. (58 mm), Piggery Farm Nala nr. Dhaula Kuan, 16.ii.1995, coll. J.P.Sati & party.

Diagnostic characters : D.32-37, P.14-17, V.I/5-6, A.20-23, C.12-14, L.l.40-50.

Body elongate, cylindrical. Head large. Mouth large. Dorsal and anal fins long. Pectorals and caudal fins rounded; pectorals cover pelvics and extend to anal. Scales on head large, rosette situated behind eyes hence touching frontal head - scale in front and basal head - scale behind; 4-5 scales between preopercular angle and posterior border of eye; predorsal scales 12. Lateral line complete, interrupted around 12th - 14th scale. Colour greyish above, with oblique bands; whitish below. Pectorals with dark bands; caudal margin bright orange; young with an ocellus on last few dorsal rays. Attains 20 cm or more in length.

Distribution : India : Delhi and throughout plains and base of Himalaya. *Elsewhere* : Iran; Afghanistan; Pakistan; Nepal; Bangladesh.

Remarks : Inhabits hill streams and low land water bodies. Feeds mainly on insect larvae, small fishes, frogs and tadpoles. Breeds during monsoon months. Not much in demand as food, being small sized. Can be utilized in controlling mosquito larvae.

The form without pelvics is *Channa orientalis* found in Sri Lanka, Myanmar and Indonesia and is often confused with *O. gachua*, the Indian form.

82. *Ophiocephalus marulius* Hamilton-Buchanan
Giant Snakehead

1822. *Ophiocephalus marulius* Hamilton - Buchanan, *Fish. Ganges*. 65-66, 367, pl. 17, fig. 19 (type-locality : ponds and and freshwater rivers of India).

1889. *Ophiocephalus marulius* : Day, *Faun. Brit. India*, Fish., 2 : 360.

1958. *Channa marulius* : Majumdar, *J. Bombay nat. Hist. Soc.*,55(2) : 369 (Delhi).

1964. *Ophicephalus marulius* : Raj and Sehgal, *Census of India 1961, Delhi* : 11.

1976. *Channa marulius* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Shai, Shouli.

Material examined : from literature.

Diagnostic characters : D.45-55, P.16-18, V.6, A.28-36, C.14, L.l.60-70.

Body elongate, cylindrical. Head large. Eyes moderate, far forward. Mouth large. Dorsal and anal fins long. Pectoral and caudal fins rounded; pectorals cover pelvics. Scales on head moderate, rosette lies between eyes, frontal head-scale in centre of rosette, two scales between rosette and base of head scale; 10 scales between opercular angle and hind border of eye; predorsal scales 16. Lateral line complete, interrupted around 16th - 18th scales. Colour greyish-green above with 5-6 dark oval blotches on sides and scattered white spots; pale below with reddish tinge. Dorsal and anal fins with white spots. Caudal fin dark with bands of white spots and a distinct white-edged ocellus at its upper half base (fades away with age). Young ones with an orange band

between eye and caudal fins. Attains 1.8 m in length (commonly 46 cm).

Distribution : India : Delhi and throughout plains. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar; Thailand; China.

Remarks : Inhabits rivers and lakes with sandy or rocky bed. Carnivorous, feeding on fishes, frogs, small dead animals etc. Breeds throughout the year. An important constituent of freshwater fishery. Takes live bait very well.

83. *Ophiocephalus punctatus* Bloch
Olive - Green Snakehead

1793. *Ophiocephalus punctatus* Bloch, *Naturges. Ausland. Fische*, (7) : 139, pl. 358 (type-locality : rivers and lakes of Coromondal coast).

1889. *Ophiocephalus punctatus* : Day, *Faun. Brit. India*, Fish., 2 : 360, 364-365.

1958. *Ophiocephalus punctatus* : Majumdar, *J. Bombay nat. Hist. Soc.*, 55(2) : 368 (Delhi).

1964. *Ophicephalus punctatus* : Raj and Sehgal, *Census of India 1961, Delhi* : 11.

Local names : Girai, Shouli, Souli.

Material examined : Delhi; 3 exs. (40-53 mm), Nala nr. vill. Naraina, Ring road, 6.vi.1993; 6 exs. (43-59 mm), Dhaulakuan Ridge, Cantonment area, 10.vi.1993, coll. Vinod Khanna & party; 61 exs. (24-110 mm), Horse-shoe Lake, Water Sport Complex, Vill. Bhalswa, 26.x.1993; 4 exs. (53-110 mm), Swampy area, Wazirabad bridge, 28.x.1993; 1 ex. (33 mm, caudal fin broken), Bawana, 30.x.1993; 2 exs. (38, 85 mm), Lake Garden, Shakur Basti, 31.x.1993, coll. N.K.Sinha & party; 6 exs. (1-70mm; 5, 25-28 mm, juveniles, 1, 70 mm), River Yamuna, Okhla barrage, 10.v.1995; 1 ex. (74 mm), Pond, Indira Gandhi Indoor Stadium Complex, 11.v.1994; 17 exs. (23-28 mm, juveniles), Pond nr. River Yamuna, Vikasnagar, 13.v.1994; 27 exs. (11-17 mm, juveniles), River Yamuna, Wazirabad, N.H.No.1, 14.v.1994; 2 exs. (28,74 mm), Dam site Okhla, 15.v.1994; 1 ex. (22 mm, juvenile), Horse-shoe Lake, Bhalswa, 16.v.1994, coll. Akhlaq Husain & party; 5 exs. (33-58 mm), Gopalpur Nala nr. Wazirabad, 8.ix.1994; 2 exs. (55-78 mm), Brass Coir Nala, Naraina, 9.ix.1994; 14 exs. (34-145 mm), Pond, Indira Gandhi Indoor Stadium Complex, 10.ix.1994, coll. J.P.Sati & party; 4 exs. (41-192 mm), Horse-shoe Lake, Bhalswa, 15.xii.1994; 3 exs. (30-66 mm), Sabhaypur, Ghaziabad road, 17.xii.1994; 3 exs. (52-70 mm), Piggery Farm Nala, Uri Enclave, 18.xii.1994; 14 exs. (34-90 mm), Pond, Nagli-Sakraoti nr. Najafgarh, 20.xii.1994, coll. Akhlaq Husain & party; 6 exs., (45-72 mm), Jheel Park, Ranibagh, 18.ii.1995; 1 ex., Horse-shoe Lake, Bhalswa, 24.vii.1995, coll. J.P.Sati & party.

Diagnostic characters : D.28-33, P.15-18, V.1/5, A.20-23, C.12, L.l. 36-40.

Body elongate, cylindrical. Head large. Eyes moderate, far forward. Mouth large, terminal. Dorsal and anal fins long. Pectoral and caudal fins rounded; pectorals cover pelvics and extend to anal fin. Scales on head large, rosette lies between eyes and hence frontal head scale with cephalic sensory pit in centre forms central plate of rosette; 5 scales between preopercular angle and posterior border of eye; predorsal scales 12. Lateral line complete, interrupted around 13th-16th scales. Colour olive green above with several dark blotches on flanks; vertical fins dark

grey with reddish tinge; paired fins light orange. Attains 30 cm in length.

Distribution : India : Delhi and throughout plains. *Elsewhere* : Afghanistan; Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar; Malaysia; China; Tahiti (Society Is., France).

Remarks : Inhabits ponds, lakes, nalas and rivers; prefers stagnant water bodies. Feeds on animal diet consiting chiefly of small fishes, prawns, molluscs etc. Prolific breeder, generally breeds around monsoon months in shallow pools with plenty of aquatic weeds. Can be exploited for fishery. Sold alive for food purpose.

84. *Ophiocephalus striatus* Bloch
Striped Snakehead

1793. *Ophiocephalus striatus* Bloch, *Naturges. Ausland. Fische*, 7 : 141, pl. 359 (type-locality : Malabar).

1889. *Ophiocephalus striatus* : Day, *Faun. Brit. India*, Fish., 2 : 363.

1958. *Channa striatus* : Majumdar, *J. Bombay nat. Hist. Soc.*, 55(2) : 368 (Delhi).

1964. *Ophicephalus striatus* : Raj and Sehgal, *Census of India 1961, Delhi* : 11.

1976. *Ophiocephalus striatus* : Raza et al., In : *Delhi Gazetteer* : 30.

Local names : Saur, Sauri, Shouli, Soula, Souli.

Material examined : from literature.

Diagnostic characters : D.37-46, P.15-17, V.6, A.23-29, C.13, L.l.50-57.

Body elongate, cylindrical. Head large. Eyes moderate, far forward. Mouth large. Dorsal and anal fins long. Pectoral and caudal fins rounded; pectorals shorter than head, cover pelvics. Scales on head large, rosette lies between eyes and hence frontal head-scale forms central plate of rosette; 9 scales between preopercular angle and posterior border of eye; predorsal scales 18-20. Lateral line complete, turns downwards. Colour greyish-green above with angular oblique bands, whitish below. Dorsal and anal fins darker with dark patches; dorsal in young with black blotch at posterior end; paired fins pale; caudal fin with two light bands. Attains 60-75 cm in length.

Distribution : India : Delhi and throughout plains. *Elsewhere* : Pakistan; Bangladesh; Nepal; Sri Lanka; Myanmar; Malaysia; Thailand; China; Philippines.

Remarks : Inhabits rivers, lakes and ponds. Feeds on animal diet. Breeds throughout the year. Economically important. Cultivated. Takes bait readily.

Suborder : MASTACEMBELOIDEI

Family : MASTACEMBELIDAE (Spiny-eels)

Body elongate, eel-like. Dorsal and anal fins long, continuous to caudal or separated by a notch; dorsal fin preceded by a series of isolated stout spines (usually 14-35); anal fin with 2-3 spines and 30-130 soft rays. Scales cycloid. Fleshy rostral appendage present. Basisphenoid absent.

Key to genera

1. Rostrum slightly to considerably more elongate, ventrally concave, laterally expansible with a paired series of rostral toothplates; preorbital and preopercular spines absent; nostril rim with six digitiform fimbriae.....*Macrognathus* Lacepede
- Rostrum simple without toothplates; preorbital spines present; preopercular spines usually present (absent in *oastesii*, Burmese form); nostril rim with 2 or 6 fimbriae..... .....*Mastacembelus* Scopoli

According to Roberts (1980) *Macrognathus* is morphologically similar to *Mastacembelus* except for its extra ordinary specialized rostrum. In *Mastacembelus* the rostrum is relatively simple, more or less round in cross-section and without bony structures or teeth. In *Macrognatus* the rostrum, slightly or considerably larger than *Mastacembelus*, forms a ventrally opened continuation of the upper jaw lined with a long series of laterally expanded, flexible, dentigerous bony plates. The premaxillary bones form a continuous series with these rostral toothplaes, but do not themselves enter into the rostrum.

Genus *Macrognathus* Lacepede

1800. *Macrognathus* Lacepede, *Hist. Nat. Poiss*, **2** : 283 (type-species : *Ophidium aculeatum* Bloch).

85. ***Macrognathus aral*** (Bloch & Schneider)
Striped Spiny Eel

1801. *Rhynchobdella aral* Bloch and Scneider, *Syst. Ichth.*, : 479, pl. 89 (type-locality : "fluvios Tranquebarensis").
1822. *Macrognathus aculeatus* : Hamilton-Buchanan, *Fish. Ganges* : 29-30, 364 (preferred as *M. ocellatus)*.
1889. *Rhynchobdella aculeata* (*nec.* Bloch) : Day, *Faun. Brit. India*, Fish., **2** : 331, fig. 110.
1921. *Rhynchobdella dhanashorii*, Hora, *Rec. Indian Mus.*, **21**(3) : 205, pl. 9, fig. 2 (type locality : Dhanashori stream nr. Dimapur, Assam, presently in Nagaland).
1958. *Rhynchobdella aculeata* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55**(2) : 369 (Delhi).
1976. *Rhynchobdella aculeata* : Raza et al., In : *Delhi Gazetteer* : 30.
1980. *Macgronathus aral* : Roberts, Copeia, (3) : 385-391, figs. 1,2b.
1991. *Macrognathus aral* : Talwar and Jhingran, *Inland Fish. India*, **2** : 1025, 1026.
Local names : Giluwa, Malga, Patya.
Material examined : from literature.
Diagnostic characters : D.XVI-XX/44-54, P.19-24, V.0, A.II-III/44-52, C.15.
Body elongate, eel-like, compressed. Rostrum elongate, ventrally concave and laterally

expansible with 14-28 paired toothplates. Aperture of anterior tubuler nostril with 6 equally well developed, slender digitiform, fimbriae. Eyes small. Preorbital and preoperculum spineless. Mouth small, inferior. Dorsal fin long, anterior part in the form of a series of low spines, posterior part rayed. Pectorals very short. Pelvics absent. Anal fin almost equal to soft dorsal. Caudal fin somewhat rounded, separated form both dorsal and anal fins. Scales cycloid, minute, present between and around eyes and posterior nostril up to maxilla. Lateral line complete. Colour greenish or brownish above, with two or more broad pale longitudinal bands of varying width extending its entire length; yellowish below; rayed dorsal fin orangish, with 3-11 ocelli at its base; dorsal and caudal fins with streaks. Attains 38 cm in length.

Distribution : India : Delhi and throughout. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar; China; Thailand; Vietnam; Malaysia; Indonesia.

Remarks : Inhabits fresh and brackish water bodies, both running and stagnant in low land areas and at moderate elevations; conceals itself in mud during dry conditions. Feeds on insects, crustaceans, worms etc. Breeds generally before onset of monsoon. Considered wholsome food-fish.

Genus *Mastacembelus* Scopoli

1777. *Mastocembelus* Scopoli, *Introd. Hist. Nat.*, : 458 (type-speceis : *Simakel inglese* Russell =*Ophidium mastacembelus* Solander). (Original spelling *Mastacembelus* Gronow, 1763 which Scopoli, 1777 erroneously amended as above).

Key to species

1. Dorsal and anal fins confluent with caudal fin. opening of anterior tubular nostril guarded by two broad-based triangular flaps alternating with a pair of slender, digitiform fimbriae.....*Mastacembelus armatus* (Lacepede)
- Dorsal and anal fins separate from caudal fin; nostril rim bears 6 equally well developed slender, digitiform fimbriae.....*Mastacembelus pancalus* (Hamilton-Buchanan)

86. *Mastacembelus armatus* (Lacepede)
Tire-track Spinyeel

1803. *Macrognathus armatus* Lacepede, *Hist. nat. Poiss.*, **2** : 286 (type-locality : not mentioned).
1889. *Mastacembelus armatus* : Day, *Faun. Brit. India*, Fish., **2** : 334.
1958. *Mastacembelus armatus* : Majumdar, *J. Bombay nat. Hist. Soc.*, **55(2)** : 369 (Delhi).
1976. *Mastacembelus armatus* : Raza et al., In : *Delhi Gazetteer* : 30.

Local name : Bam.

Material examined : from literature.

Diagnostic characters : D.XXXII-XL/64-90, P.21-24, V.0, A.III/64-90, C.14-17.

Body eel-like, slender anteriorly, compressed posteriorly. Rostrum simple, devoid of toothplates. Rim of anterior tubular nostril guarded by two broad-based triangular flaps alternating with a pair of slender, digitiform fimbrie. Preopercle with 2-3, spines. Eyes small, high up, nearer angle of preoperculum than snout tip; preorbital spine single, strong. Mouth small, gape extending to below posterior nostril. Dorsal fin long divided into low spinous and soft parts, inserted above middle or posterior-third of pectorals. Pectorals short, higher than long. Pelvics absent. Dorsal and anal fins broadly joined to caudal fin, some times leaving a notch at junction. Scales cycloid, minute, imbricately arranged; head except its top also covered with scales. Lateral line complete, straight. Colour greenish - brown with dark zig-zag markings; a black band running through eye and continued in an undulating course on upper half of body. A row of black spots along base of soft dorsal; pectorals and anal fins spotted or broken banded. Attains over 91 cm in length.

Distribution : India : Delhi and widely distributed. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar; Thailand; Malaysia; Vietnam; Kampuchea; Hainan Island, China; Indonesia.

Remarks : Inhabits fresh and brackish waters in plains and submontane regions. Hardy, can withstand extreme drought conditions by concealing iteself under mud. Feeds on animal diet consisting of earthworms, crustaceans, insects, small fishes etc. Breeds before onset of monsson season in north and winter months in south. Considered good eating, flesh said to be invigorating.

87. *Mastacembelus pancalus* (Hamilton - Buchanan)
Spiny Eel

1822. *Macrognathus pancalus* Hamilton - Buchanan, *Fish. Ganges* : 30, 364, pl. 17, fig. 7 (type-locality : tanks, locality not mentioned).

1889. *Mastacembelus pancalus* : Day, *Faun. Brit. India*, Fish., 2 : 332, 333-334.

1956. *Mastacembelus pancalus* : Sufi, *Bull. Raffles Mus.*, (27) : 107,120-122, fig. 20, pl. 22.

1980. *Mastacembelus pancalus* : Roberts, Copeia, (3) : 385-391.

Local names : Bami, Malga, Patya.

Material examined : Delhi; 6 exs. (45-75 mm), Dhaulakuan Ridge, Cantonment area, 10.vi.1993, coll. Vinod Khanna & party; 1 ex. (30 mm, juvenile), Swampy area, Wazirabad bridge, 28.x.1993; 1 ex. (59 mm), Bawana, 30.x.1993, coll. N.K.Sinha & party; 2 exs. (128, 135 mm), Yamuna reservoir, Ramghat nr. Wazirabad, Jagatpur road, 14.v.1994; 4 exs. (37 108 mm), Horse-shoe Lake, Bhalswa, 16.v.1994, coll. Akhlaq Husain & party.

Diagnostic characters : D.XXIV-XXVI/30-42, P.17-19, V.0, A.III/31-46, C.12.

Body elongate, eel-like and slightly compressed. Rostrum smooth below. Rim of tubular anterior nostril with six equally well developed, slender, digitiform fimbriae. Preopercle with 2-5 spines. Eyes small, slightly nearer angle of preoperculum than snout tip. Preorbital spine present. Dorsal fin origin above middle of pectoral fin, with 24-26 spines and 30-42 rays. Pectorals short, longer than high. Dorsal and anal fins separate from caudal fin. Scales cycloid, minute, imbricately arranged. Lateral line complete, arched anteriorly. Colour olive-green above, with whitish spots

and dark brownish vertical stripes; fins yellowish with minute black dots. Attains 18 cm in length.

First record from Delhi.

Distribution India : Delhi and throughout. *Elsewhere* : Pakistan; Nepal; Bangladesh.

Remarks : Inhabits ponds, lakes and rivers of plains and hills up to 366 m elevation and estuaries. Feeds on crustaceans, insect larvae etc. Breeds before monsoon in north and during cold weather in south. Of little commercial value. May be of some help in control of malaria and guinea worm as feeding both on mosquito larvae and Cyclops.

Important Marine Fishes imported for local consumption

Majumdar (1958) listed eight fishes including *Hilsa ilisha, Clarias batrachus* and *Nandus nandus* under "Imported Varieties" available in fish market. Since the consumption of fish in Delhi is more than its production (400 tonnes as per the census vide Bhalla, 1983 in Census of India 1981, Delhi) whatever the local catch is got, is consumed. Besides, commercially important fishes are imported from the neighbouring and far flug states. A brief account of remaining five species as mentioned by Majumdar (op. cit.), all marine, with important characters is provided here for general information of readers/fish consumers so that they are not misled by the sellers for "local" The main centre of fish trade in Delhi is located at Jama Masjid area where a variety of local and outside fish is sold.

Order : PERCIFORMES
Suborder : PERCOIDEI
Family : CENTROPOMIDAE (Snooks)
Subfamily : LATINAE

1. *Lates calcarifer* (Bloch) Giant Seaperch, locally known as Bhetki.

Elongate, moderately compressed. Mouth large; lower jaw longer. Dorsal fin spiny and soft, not separated. Caudal fin rounded. Scales large. Silvery. Grows to 1.5 m, comercial catches between 45 and 61 cm. Marine, ascends estuaries and back waters for food and shelter. Juveniles frequent lower estuarine areas in Hooghly- Maltah river system. Most importnat food fish of India.

Suborder : POLYNEMOIDEI
Family : POLYNEMIDAE (Threadfins)

2. *Eleutheronema tetradactylum* (Shaw) Four-finger - threadfins, locally known as *Salmon.*

Elongate, compressed. Two widely separated dorsal fins. Lower four rays of pectoral fin free, flamentous. Caudal forked. Scales small. Yellowish-white. Grows to a length of about 1.8 m. Marine, enters Hooghly estauary for breeding.

Suborder : SCOMBROIDEI
Family : SCOMBRIDAE (Mackerels, Tunas)
Subfamily : SCOMBRINAE

3. *Rastrelliger kanagurta* (Cuvier) - Indian Mackeral, locally known as Mackerel.

Fusiform. Two dorsal fins, widely separated with finlets behind 2nd dorsal and anal fins. Caudal deeply forked. Scales small. Silivery with narrow dark bands on upper half. Grows to 25 cm in length. Pelegic, shoaling fish. Fishery of high magnitude, most popular food fish.

Suborder : STROMATEOIDEI
Family : STROMATEIDAE (Butterfishes)

4. *Pampus argenteus* (Euphrasen) - Silver Pompret, Locally known as Pomfret.

Roundish, compressed. Single dorsal fin preceded by a series of spines. Caudal fin very deeply forked. Silvery with black dots all over. Scales small. Grows to 31 cm. Occurs in shoals away from sea shore. One of the best table fishes.

Order : PLEURONECTIFORMES
Suborder : SOLEODEI
Family : CYNOGLOSSIDAE (Tongue fishes)
Subfamily : CYNOGLOSSINAE

5. *Cyanoglossus* spp. - Tongue fishes, locally known as Chepti.

Lanceolate flat fishes. Both eyes on left side of head. Long dorsal and anal fins confluent with caudal fin. Pelvic confluent with caudal. Scales small. Marine (*C. macrostomus* Norman, the Malabar Sole is the most important commerical fish).

ACKNOWLEDGEMENTS

The author feels grateful to the Director, Zoological Survey of India, Calcutta and the Officer-in-charge, Northern Regional Station, Zoological Survey of India, Dehra Dun for encouragement and facilities.

REFERENCES

Anonymous, 1884. *A Gazetteer of the Delhi District (1883-4)* : 21.

Anonymous, 1913. *Gazetteer of the Delhi District Part A - 1912* : 18.

Bhalla, V.K. 1983. *Census of India 1981, Series 28, Delhi, Parts XIII A&B, Village and Town Directory* : 11.

Chaudhuri, B.L. 1915. Fauan of Chilka Lake. Fish. Part I. *Mem. Indian Mus.* **5** : 403-439.

Datta, A.K and Karmakar, A.K. 1981. On a new species of *Puntius* : (Family : Cyprinidae) from Bastar district, Madhya Pradesh. *Bull. zool. Surv. India*, 3 (3) : 179-183, fig. 1.

Day, F. 1871. On the freshwaters Siluroids of India. *Proc. Zool. Soc. Lond.*, : 713.

Datta Gupta, A.K., Tilak, R. and Menon, P.K.B. 1963, Intra-specific variation in *Heteropneustes fossilis* Bloch (heteropneustidae : Siluroidea), *Anat. Anz.*, Jena, **112** (2) ; 129-134.

Day, F. 1875-1878. *The Fishes of India being a Natural History of the Fishes known to inhabit the seas and fresh waters of India, Burma and Ceylon.* Vol. I, Text, Vol. II, plates, xx + 778 pp., 195 pls. London.

Day, F. 1889. *The Fauna of British India, including Ceylon and Burma.* Fishes, **1** : 548 pp; **2**, 509 pp. London.

Jayaram, K.C. 1981. *The Freshwater Fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka* - A Handbook, xxii+475 pp, Calcutta.

Jordan, D.S. 1919. *The Genera of Fishes, Ser. No. 36, Part II* : 211, Standford Univ. Pub.

Kottelat, M. 1987. Nomenclatural status of the fish names created by J.C. van Hasselt (1823) and some cobitoid genera. *Jap. J. Ichtyol.*, 33(4) : 368-375.

Majumdar, N.N. 1951a. Notes on Delhi fishes. *J. zool. Soc. India*, 3(1) : 243-247, figs. 1-3.

Majumdar, N.N., 1951b. On the anatomy and histology of the palate of *Cirrihina mrigala* (Hamilton) with special rererence to the papillae present on it together with comments on their possible repiratory function. *J. zool. Soc. India*, 3(1) : 255-265.

Majumdar, N.N. 1958. On a collection of fishes from Delhi State. *J. Bombay nat. Hist. Soc.*, 55(2) : 366-370.

Munshi, J.S.D and Srivastava, M.P. 1988. *Natural History of Fishes and Systematics of*

Freshwater Fishes of India, xviii + 403 pp.

Raj, B. and Sehgal, K.C. 1964. *Census of india 1961, Delhi* : 11.

Raza, M., Dey, A.K., Johri, B.M., Rangaswami, N.S. and Desai, J.H., 1976. In :*Delhi Gazetteer* : 29-30.

Roberts, T.R. 1983. Revision of the south and south-east Asian sisorid catfish genus *Bagarius* with description of a new species from the Mekong. *Copiea* (2) : 435-445.

Silas, E.G. 1958. Studies on the cyprinid fishes of the Oriental genus *Chela* Hamilton. *J. Bombay nat. Hist. Soc.*, **55**(1) : 54-99.

Talwar, P.K. and Jhingran, A.G. 1991. *Inland Fishes of India and Adjacent Countries*, Vol 1, 541 pp, Vol. 2, 543-1158 pp. New Delhi.

Thomas, H.S. 1897. *The Rod in India, 3rd ed.* xxvii + 435 pp. London.

Table - Systamatic list of Species with Records

Classification and names of species	RECORDS													
			Day			Delhi Gaztt.		Majumdar		Delhi Gaztt.	Jaya-ram	Munshi & Srivas.	Talwar & Jhing.	Present study
	1871	1876	1877	1878	1889	1844	1912	1951	1958	1976	1981	1988	1991	1993-95
Grade : Pisces														
Class : Osteichthyes														
Subclass : Actinopteryegii														
Subdivision : Teleostei														
I.Order : Osteoglossiformes														
Suborder : Notopteroidei														
i.Family : Notopteridae (Featherbacks)														
(1) Genus : *Notopterus* Lacepede									+	+				
1. *Notopterus chitala* (Hamilton-Buchanan)														
2. *Notopterus notopterus* (Pallas)							+		+	+				+
II.Order : Clupeiformes														
Suborder : Clupeoidei														
ii.Family : Clúpeidae (Herrings, Sardines, Shads)														
Subfamily : Alosinae (Shads)														
(2) Genus : *Gudusia* Fowler														
3. *Gudusia chapra* (Hamilton-Buchanan)									+	+				
(3) Genus : *Hilsa* Regan														
4. *Hilsa ilisha* (Hamilton-Buchanan)				+	+								+	
iii. Family : Engraulididae (Anchovies)														
Subfamily : Engraulidinae														
(4) Genus : *Setipinna* Swainson														
5. *Setipinna brevifilis* (Valenciennes)													+	
III. Order : Cypriniformes														
iv. Family : Cyprinidae (Barbs, Carps)														
Subfamily : Cyprininae														

Classification and names of species	Day					Delhi Gaztt.		Majumdar		Delhi Gaztt.	Jaya-ram	Munshi & Srivas.	Talwar & Jhing.	Present study
	1871	1876	1877	1878	1889	1844	1912	1951	1958	1976	1981	1988	1991	1993-95
(5) Genus : *Gibelion* Heckel														
6. *Gibelion catla* (Hamilton-Buchanan)									+	+				
(6) Genus : *Chagunius* Smith														
7. *Chagunius chagunio* (Hamilton-Buchanan)				+										+
(7) Genus : *Cirrhinus* Oken														
8. *Cirrhinus mrigala* (Hamilton-Buchanan)							+		+	+				
9. *Cirrhinus reba* (Hamilton-Buchanan)								+		+				+
(8) Genus : *Labeo* Cuvier														
•10. *Labeo bata* (Hamilton-Buchanan)														+
•11. *Labeo boga* (Hamilton-Buchanan)														+
12. *Labeo calbasu* (Hamilton-Buchanan)							+		+	+				+
13. *Labeo dero* (Hamilton-Buchanan)									+	+				
14. *Labeo gonius* (Hamilton-Buchanan)									+	+				+
15. *Labeo pangusia* (Hamilton-Buchanan)									+	+				
16. *Labeo rohita* (Hamilton-Buchanan)						+	+		+	+				
(9) Genus : *Osteobrama* Heckel														
17. *Osteobrama cotio cotio* (Hamilton-Buchanan)									+	+				
(10) Genus : *Puntius* Hamilton-Buchanan														
•18. *Puntius chola* Hamilton-Buchanan														+
19. *Puntius conchonius* Hamilton-Buchanan									+	+				+
20. *Puntius guganio* Hamilton-Buchanan										+				
21. *Puntius punjabensis* Hamilton-Buchanan									+					
22. *Puntius sarana sarana* Hamilton-Buchanan									+	+				
23. *Puntius sophore* Hamilton-Buchanan									+	+				+
•24. *Puntius terio* Hamilton-Buchanan														+
25. *Puntius ticto* Hamilton-Buchanan									+	+				+
(11) Genus : *Tor* Gray														
26. *Tor tor* (Hamilton-Buchanan)						+	+		+	+				

Classification and names of species	Day					Delhi Gaztt.		Majumdar		Delhi Gaztt.	Jaya-ram	Munshi & Srivas.	Talwar & Jhing.	Present study
	1871	1876	1877	1878	1889	1844	1912	1951	1958	1976	1981	1988	1991	1993-95
Subfamily : Cultrinae														
(12) Genus : *Chela* Hamilton-Buchanan														
27. *Chela cachius* Hamilton-Buchanan									+	+				+
(13) Genus : *Salmostoma* Swainson														
28. *Salmostoma bacaila* (Hamilton-Buchanan)									+	+				+
•29. *Salmostoma phulo* (Hamilton-Buchanan)													+	
(14) Genus : *Securicula* Gunther														
30. *Securicula gora* (Hamilton-Buchanan)							+							
Subfamily : Rasborinae														
(15) Genus : *Amblypharyngodon* Bleeker														
31. *Amblypharyngodon mola* (Hamilton-Buchanan)									+					
(16) Genus : *Aspidoparia* Heckel														
32. *Aspidoparia morar* (Hamilton-Buchanan)									+	+				+
(17) Genus : *Barilius* Hamilton-Buchanan														
33. *Barilius barila* Hamilton-Buchanan				+	+								+	
34. *Barilius vagra* Hamilton-Buchanan									+	+				
(18) Genus : *Esomus* Swainson														
35. *Esomus danricus* (Hamilton-Buchanan)									+	+				+
(19) Genus : *Parluciosoma* Howes														
•36. *Parluciosoma daniconius* (Hamilton-Buchanan)														+
Subfamily : Garrinae														
(20) Genus : *Crossocheilus* Kuhl & van Hasselt														
37. *Crossocheilus latius* (Hamilton-Buchanan)									+	+				+
(21) Genus : *Garra* Hamilton-Buchanan														
38. *Garra gotyla gotyla* (Gray)									+					

Classification and names of species	Day					Delhi Gaztt.		Majumdar		Delhi Gaztt.	Jaya-ram	Munshi & Srivas.	Talwar & Jhing.	Present study
	1871	1876	1877	1878	1889	1844	1912	1951	1958	1976	1981	1988	1991	1993-95
v. Family : Psilorhynchidae (Minnows)														
(22) Genus : *Psilorhynchus* (McClelland)														
39. *Psilorhynchus balitora* (Hamilton-Buchanan)								+	+	+	+			
vi. Family : Balitoridae (Loaches)														
Subfamily : Nemacheilinae														
(23) Genus : *Nemacheilus* Bleeker														
40. *Nemacheilus corica* (Hamilton-Buchanan)									+	+				
41. *Nemacheilus montanus* (McClelland)									+	+				
42. *Nemacheilus scaturigina* (McClelland)									+	+				
vii. Family : Cobitididae (Loaches)														
Subfamily : Botiinae														
(24) Genus : *Botia* Gray														
43. *Botia lohachata* Chaudhuri									+	+	+	+		+
Subfamily : Cobitidinae														
(25) Genus : *Lepidocephalus* Bleeker														
•44. *Lepidocephalus guntea* (Hamilton-Buchanan)														+
IV. Order : Siluriformes (Catfishes)														
viii. Family : Bagridae (Bagrid catfishes)														
(26) Genus : *Aorichthys* Wu														
45. *Aorichthys aor* (Hamilton-Buchanan)									+	+				
46. *Aorichthys seenghala* (Sykes)				+	+				+	+				
(27) Genus : *Mystus* Scopoli														
•47. *Mystus bleekeri* (Day)														+
48. *Mystus cavasius* (Hamilton-Buchanan)									+	+				
49. *Mystus vittatus* (Blotch)							+		+	+				+
(28) Genus : *Rita* Bleeker														
50. *Rita rita* (Hamilton-Buchanan)									+	+				

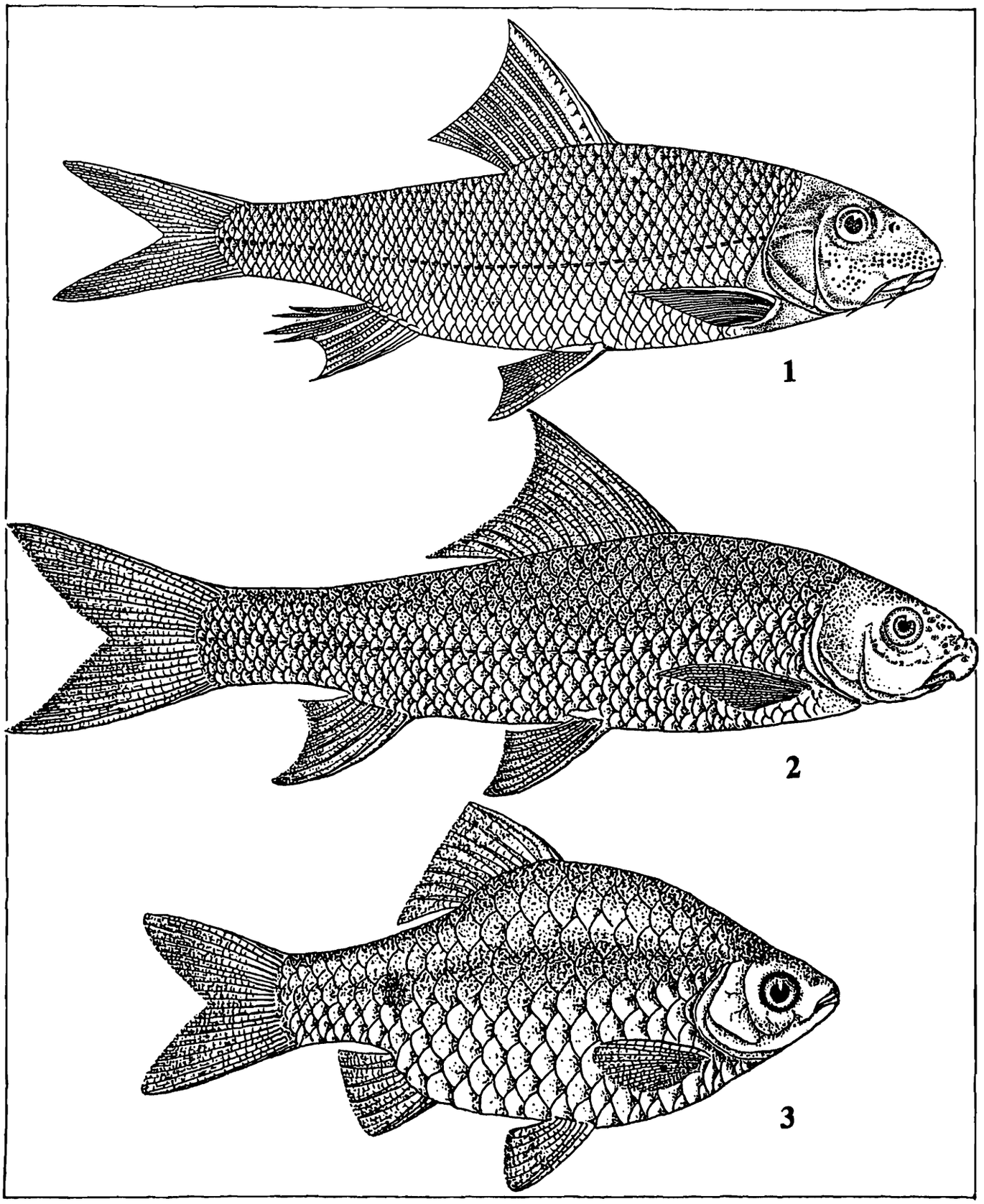
Classification and names of species	Day					Delhi Gaztt.		Majumdar		Delhi Gaztt.	Jaya-ram	Munshi & Srivas.	Talwar & Jhing.	Present study
	1871	1876	1877	1878	1889	1844	1912	1951	1958	1976	1981	1988	1991	1993-95
ix. Family : Siluridae (Sheat fishes or Eurasian catfishes)														
(29) Genus : *Ompok* Lacepede														
51. *Ompok bimaculatus* (Bloch)									+	+				
(30) Genus : *Wallago* Bleeker														
52. *Wallago attu* (Schneider)							+	+	+	+				+
x. Family : Schilbidae (Schilbid catfishes)														
Subfamily : Ailiinae														
(31) Genus : *Ailia* Gray														
53. *Ailia coila* (Hamilton-Buchanan)			+						+	+		+		
54. *Ailia punctata* (Day)	+		+		+									
Subfamily : Schilbinae														
(31) Genus : *Clupisoma* Swainson														
55. *Clupisoma garua* (Hamilton-Buchanan)									+	+				
(32) Genus : *Eutropiichthys* Bleeker														
56. *Eutropiichthys vacha* (Hamilton-Buchanan)						+	+		+	+				
(33) Genus : *Silonia* Swainson														
57. *Silonia silondia* (Hamilton-Buchanan)							+	+	+	+				
xi. Family : Sisoridae (Sisorid catfishes)														
(34) Genus : *Bagarius* Bleeker														
58. *Bagarius yarrelli* Sykes			+		+		+		+	+		+		+
(35) Genus : *Gagata* Bleeker														
59. *Gagata cenia* (Hamilton-Buchanan)			+						+	+	+	+	+	
60. *Gagata sexualis* Tilak													+	
(36) Genus : *Glyptothorax* Blyth														
61. *Glyptothorax telchitta* (Hamilton-Buchanan)			+		+				+	+				

Classification and names of species	Day					Delhi Gaztt.		Majumdar		Delhi Gaztt.	Jaya-ram	Munshi & Srivas.	Talwar & Jhing.	Present study
	1871	1876	1877	1878	1889	1844	1912	1951	1958	1976	1981	1988	1991	1993-95
(37) Genus : *Nangra* Day														
62. *Nangra nangra* (Hamilton-Buchanan)			+											
63. *Nangra viridescens* (Hamilton-Buchanan)			+		+				+		+	+		
(38) Genus : *Sisor* Hamilton-Buchanan														
64. *Sisor rabdophorus* Hamilton-Buchanan			+		+				+					
xii. Family : Clariidae (Airbreathing catfishes)														
(39) Genus : *Clarias* Scopoli.														
•65. *Clarias batrachus* (Linnaeus)														+
xiii Family : Heteropneustidae (Stinging catfishes)														
(40)Genus : *Heteropneustes* Muller														
66. *Heteropneustes fossilis* (Bloch)									+					+
V. Order: Cyprinodontiformes														
Suborder : Exococtoidei														
xiv. Family : Belonidae (Needlefishes)														
(41) Genus: *Xenentodon* Regan														
67. *Xenentodon cancila* (Hamilton-Buchanan)									+	+				+
Suborder : Cyprinodontoidei														
xv. Family : Poeciliidae (Livebearers)														
Subfamily : Poeciliinae														
(42) Genus: *Gambusia* Poey														
•68. *Gambusia affinis* (Baird & Girard)*														+
VI. Order : Synbranchiformes														
xvi. Family : Synbranchidae (Swampeels)														
(43) Genus : *Monopterus* Lacepede														
69. *Monopterus cuchia* (Hamilton-Buchanan)									+	+				
VII. Order : Perciformes														
Suborder : Percoidei														
xvii. Family : Centropomidae (Snooks)														

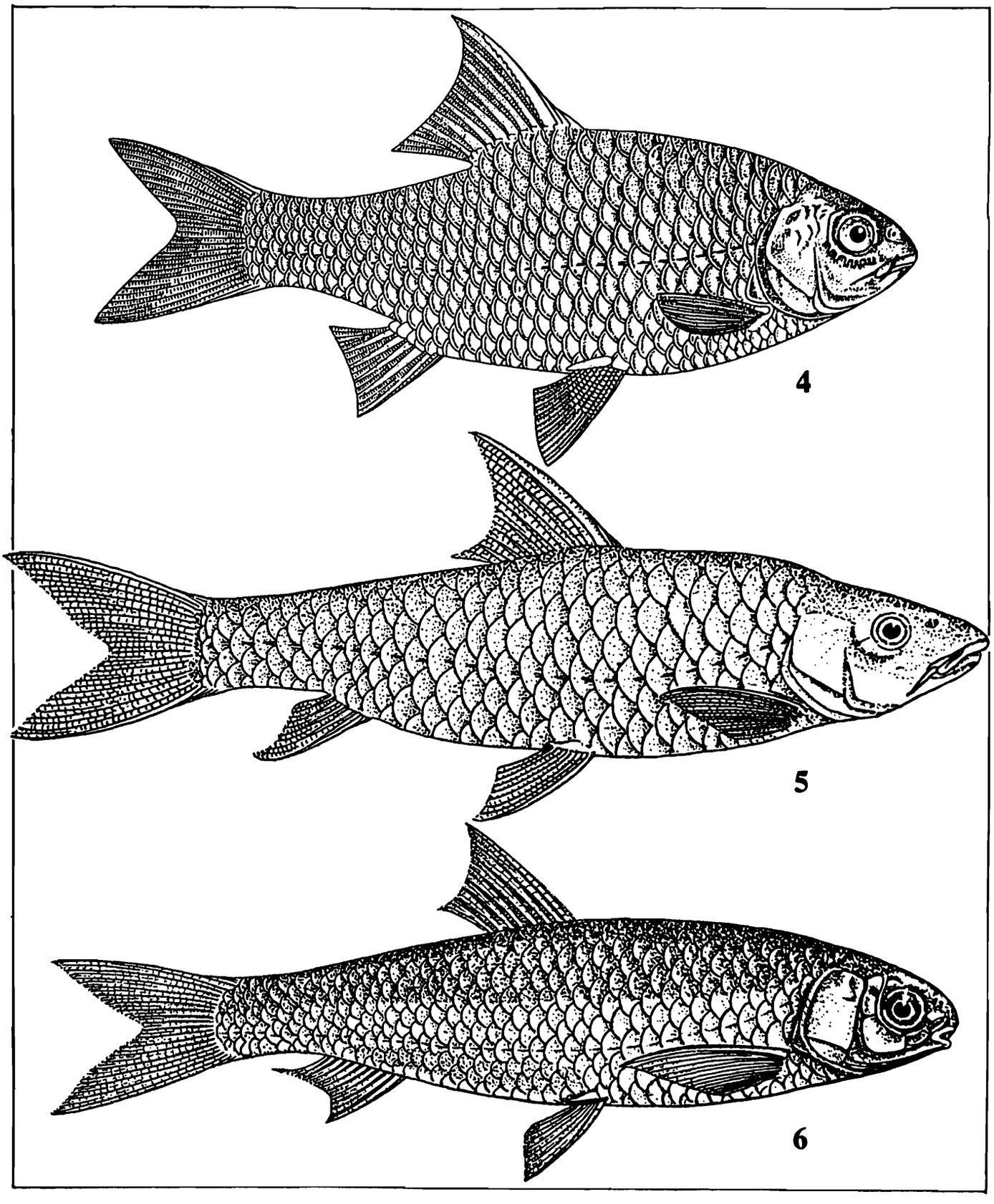
Classification and names of species	Day					Delhi Gaztt.		Majumdar		Delhi Gaztt.	Jaya-ram	Munshi & Srivas.	Talwar & Jhing.	Present study
	1871	1876	1877	1878	1889	1844	1912	1951	1958	1976	1981	1988	1991	1993-95
Subfamily : Ambassinae														
(44) Genus : *Chanda* Hamilton-Buchanan														
70. *Chanda nama* Hamilton-Buchanan									+	+				+
(45) Genus : *Pseudambassis* Bleeker														
•71. *Pseudambassis basculis* (Hamilton-Buchanan)													+	
72. *Pseudambassis ranga* (Hamilton-Buchanan)									+	+				+
xviii. Family : Nandidae (Leaf-fishes)														
Subfamily : Nandinae														
(46) Genus : *Nandus* Valenciennes														
•73. *Nandus nandus* (Hamilton-Buchanan)														+
Subfamily : Badinae														
(47) Genus : *Badis* Bleeker														
•74. *Badis badis* (Hamilton-Buchanan)														+
xix. Family : Cichlidae (Cichlids)														
(48) Genus : *Oreochromis* Gunther														
•75. *Oreochromis mossambica* (Peters)*														+
Suborder : Mugiloidei														
xx. Family : Mugilidae (Mullets)														
(49) Genus : *Rhinomugil* Gill														
76. *Rhinomugil corsula* (Hamilton-Buchanan)									+	+				
(50) Genus : *Sicamugil* Fowler														
77. *Sicamugil cascasia* (Hamilton-Buchanan)		+		+					+	+				
Suborder : Gobioidei														
xxi. Family : Gobiidae (Gobies)														
Subfamily : Gobiinae														
(51) Genus : *Glossogobius* Gill														
78. *Glossogobius giuris* (Hamilton-Buchanan)									+	+				+

Classification and names of species	Day					Delhi Gaztt.		Majumdar		Delhi Gaztt.	Jaya-ram	Munshi & Srivas.	Talwar & Jhing.	Present study
	1871	1876	1877	1878	1889	1844	1912	1951	1958	1976	1981	1988	1991	1993-95
Suborder : Anabantoidei														
xxii. Family : Belontiidae (Gouramies)														
Subfamily : Trichogasterinae														
(52) Genus : *Colisa* Cuvier														
79. *Colisa fasciata* (Schneider)									+	+				+
•80. *Colisa lalia* (Hamilton-Buchanan)														+
Suborder : Channoidei														
xxiii. Family : Channidae (Murrels or Snakeheads)														
(53) Genus : *Ophiocephalus* Bloch														
81. *Ophiocephalus gachua* Hamilton-Buchanan									+	+				+
82. *Ophiocephalus marulius* Hamilton-Buchanan									+	+				
83. *Ophiocephalus punctatus* Bloch									+	+				+
84. *Ophiocephalus striatus* Bloch									+	+				
									-					
Suborder : Mastacembeloidei														
xxiv. Family : Mastacembelidae (Spiny eels)														
(54) Genus : *Macrognathus* Lacepede														
85. *Macrognathus aral* (Bloch & Schneider)									+	+				
(55) Genus : *Mastacembelus* Scopoli														
86. *Mastacembelus armatus* (Lacepede)									+	+				
•87. *Mastacembelus pancalus* Hamilton-Buchanan														+
	1	1	8	5	9	3	11	3	62	57	4	4	6	41

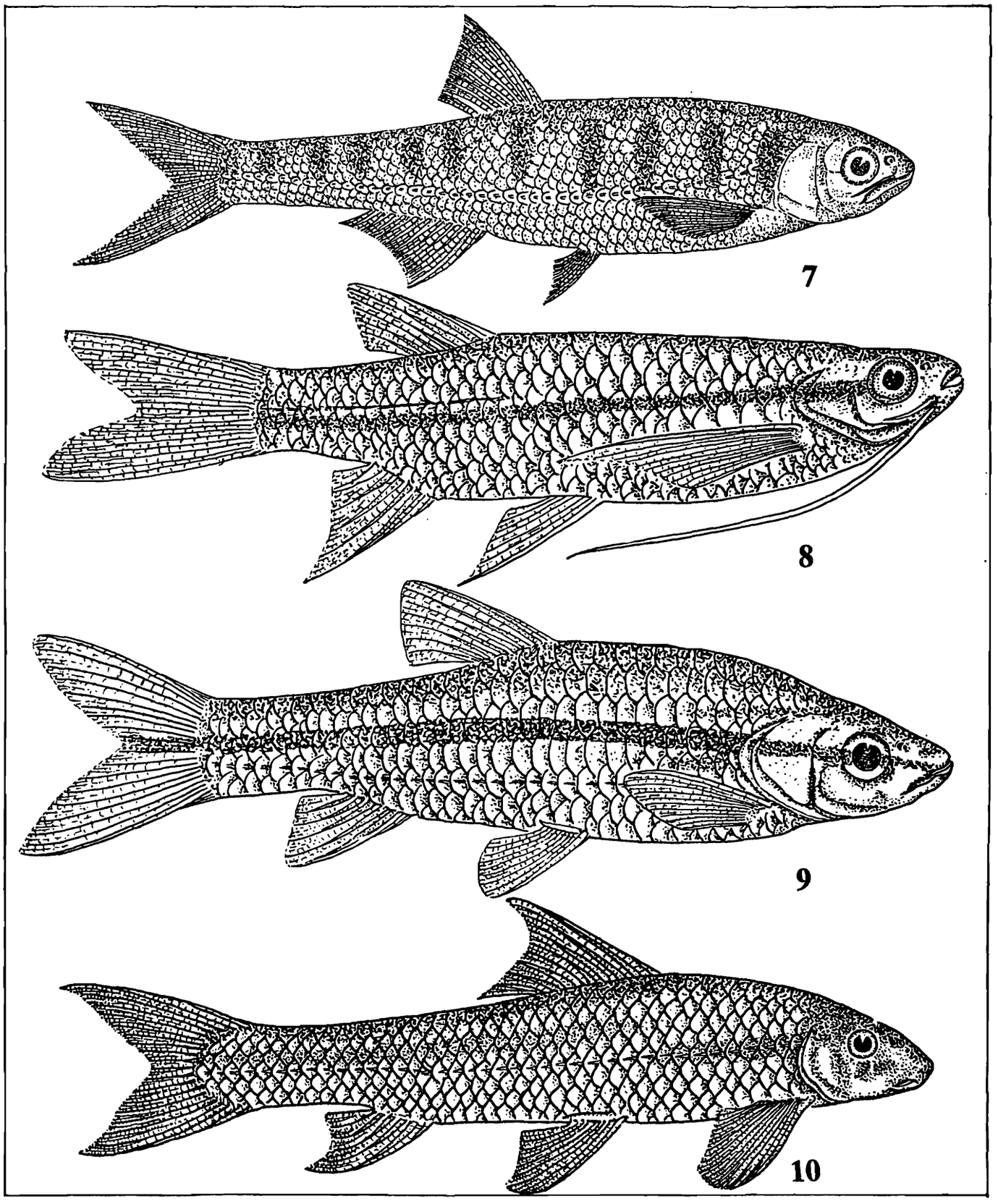
* Introduced (exotic species)
\+ Actual record
• First records from Delhi
L.i Local information



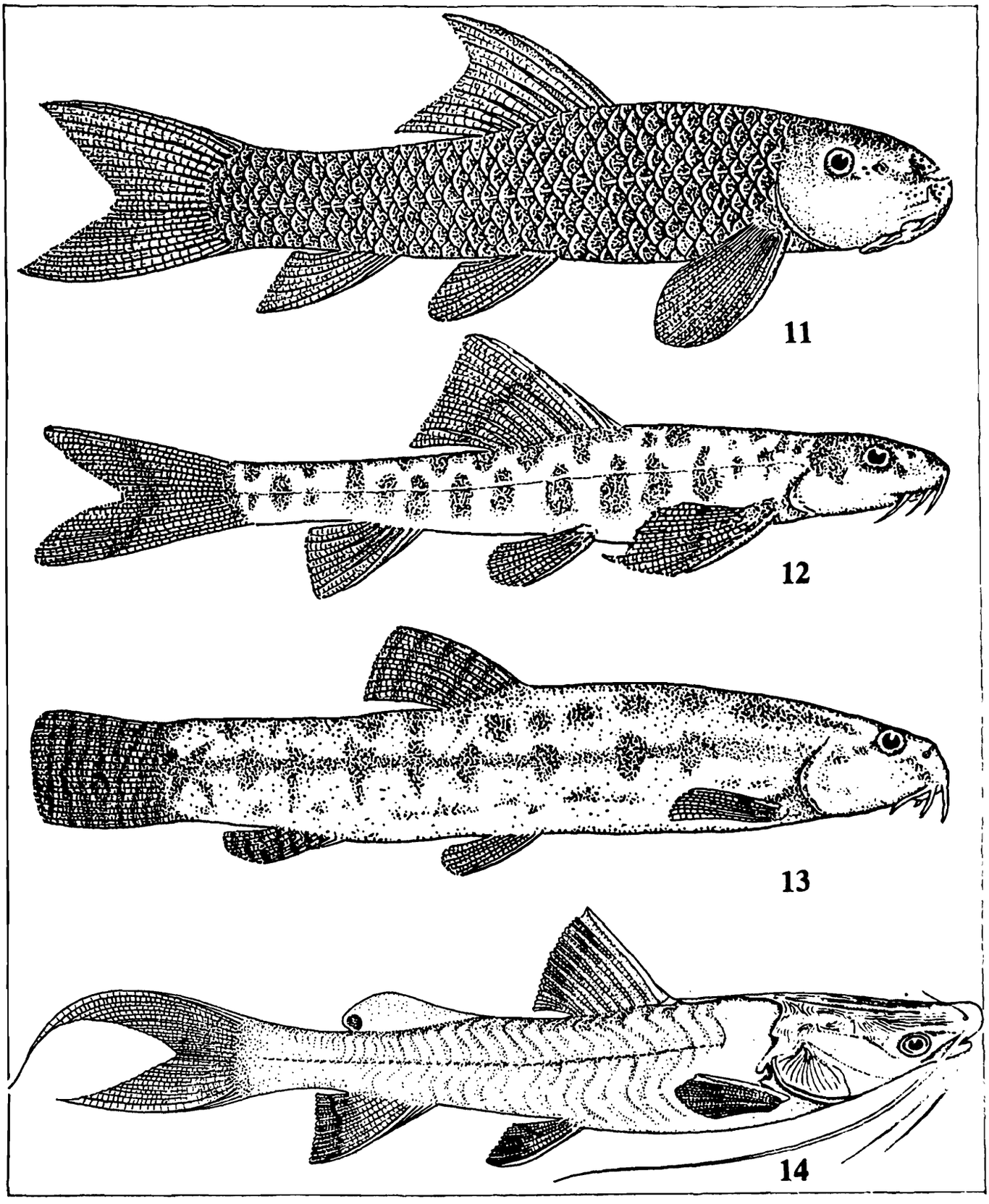
Figs. : 1. *Chagunius chagunio* (Hamilton-Buchanan); 2. *Labeo dero* (Hamilton-Buchanan); 3. *Puntius conchonius* Hamilton-Buchanan.



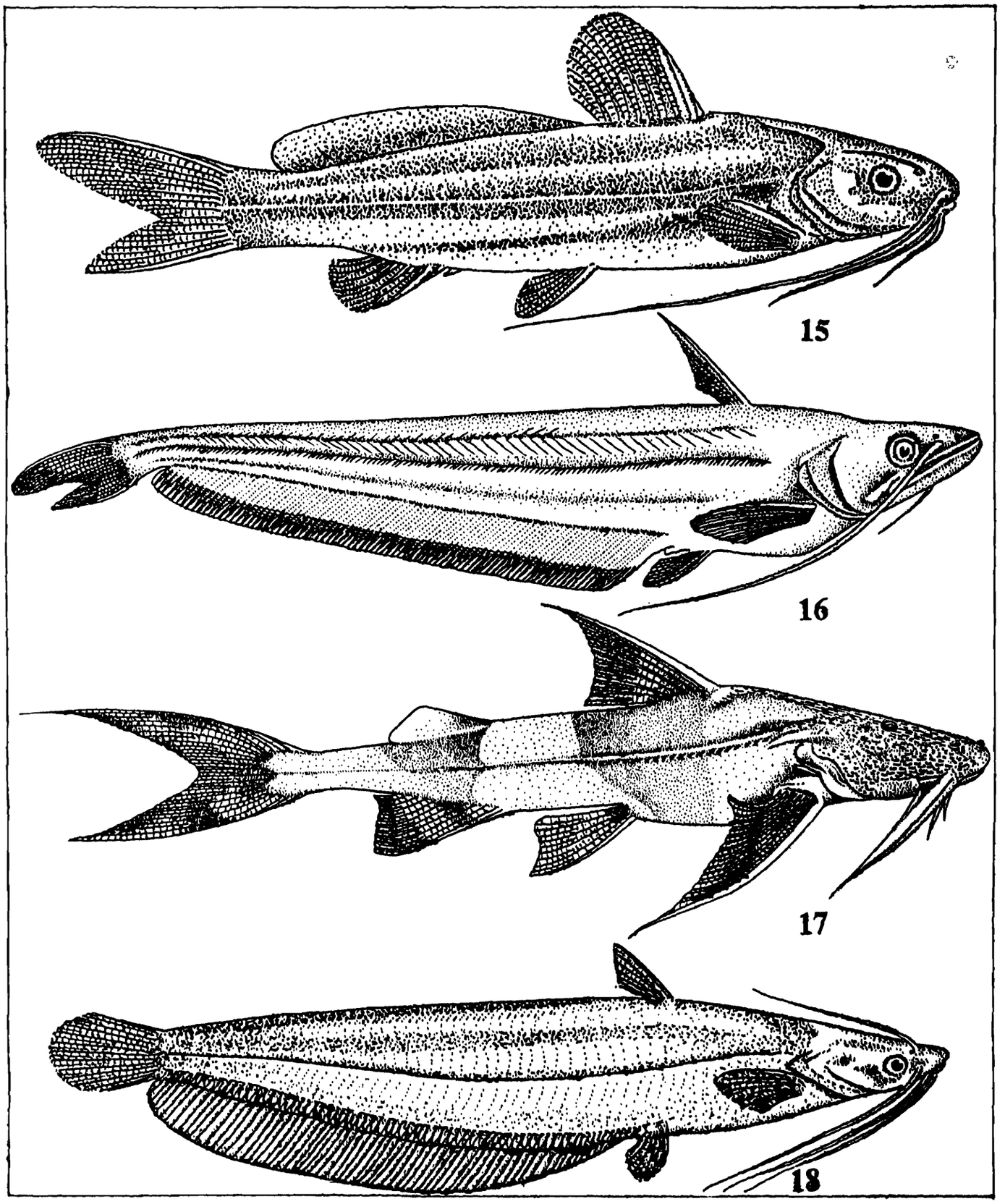
Figs. : 4. *Puntius sarana sarana* Hamilton-Buchanan; 5. *Tor tor* (Hamilton-Buchanan); 6. *Aspidoparia morar* (Hamilton-Buchanan).



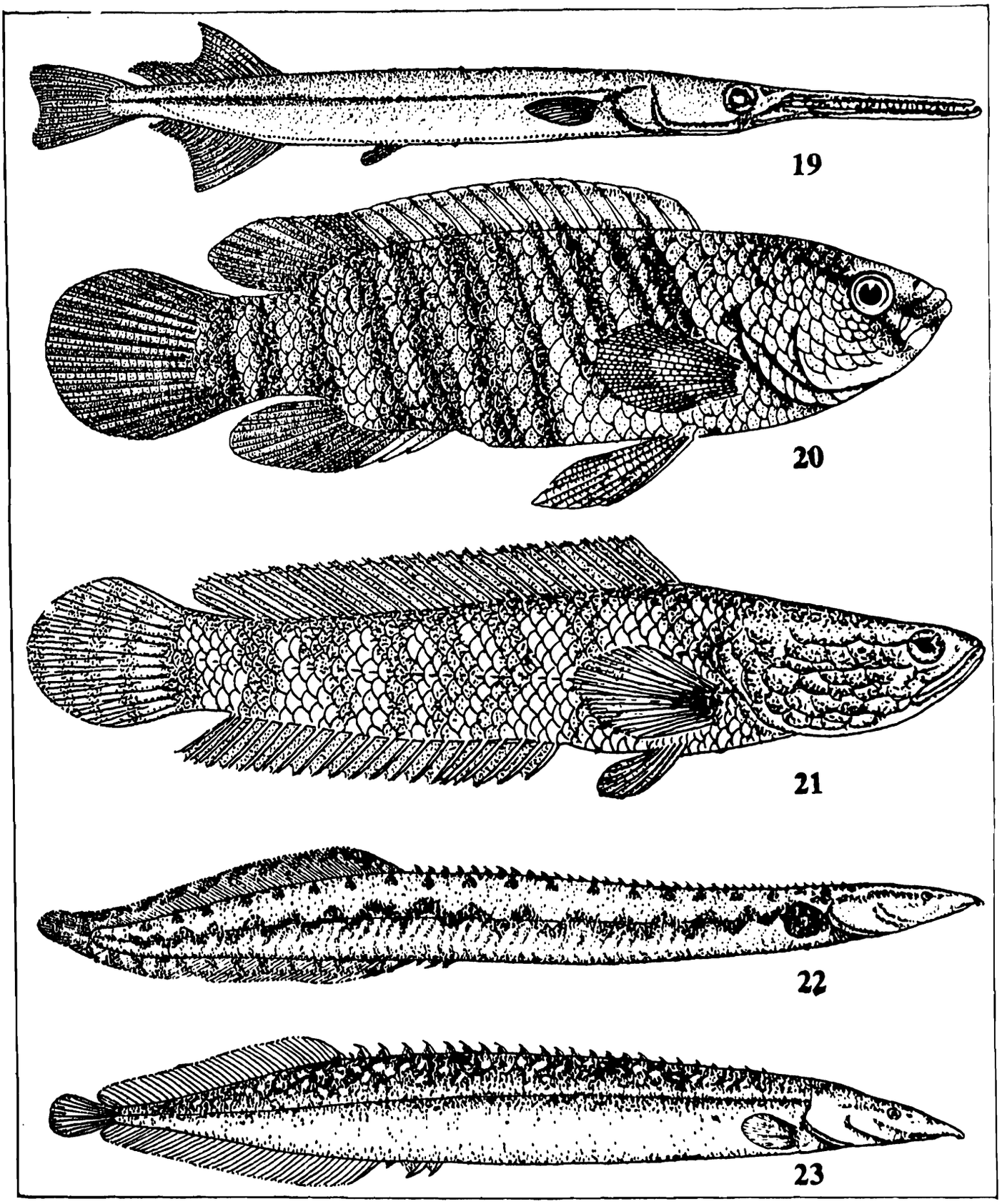
Figs.: 7. *Barilius vagra* Hamilton-Buchanan; 8. *Esomus danricus* (Hamilton-Buchanan); 9. *Parluciosoma daniconius* (Hamilton-Buchanan); 10. *Crossocheilus latius* (Hamilton-Buchanan).



Figs. : 11. *Garra gotyla gotyla* (Gray); 12. *Nemacheilus corica* (Hamilton-Buchanan); 13. *Lepidocephalus guntea* (Hamilton-Buchanan); 14. *Aorichthys seenghala* (Sykes).



Figs. : 15. *Mystus bleekeri* (Day); 16. *Wallago attu* (Schneider); 17. *Bagarius yarrelli* Sykes; 18. *Heteropneustes fossilis* (Bloch).



Figs. : 19. *Xenentodon cancila* (Hamilton-Buchanan); 20. *Badis badis* (Hamilton-Buchanan); 21. *Ophiocephalus punctatus* Bloch; 22. *Mastacembelus armatus* (Lacepede); 23. *Mastacembelus pancalus* (Hamilton-Buchanan).

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AMPHIBIA

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The amphibian fauna of Delhi has not received the attention of herpetologists during the past except for the general mention of two speceis viz. *Bufo melanostictus*, the Common Toad and *Rana tigerina*, the Indian Bull Frog in `Census of India, 1961, Delhi' (Raj and Sehgal, 1964), Delhi Gazetteer (Raza et al., 1976) and the booklet `The Delhi Ridge Forest' (Kalpavriksha, 1991). The Indian Bull Frog has also been referred recently in `Saving the Delhi Ridge One Year of Conservation Action : A Srishti Report' (Malik et al., 1994). In view of the paucity of the scientific information on the group, an attempt has been made to survey and enlist the amphibian fauna of Delhi.

During the present study different types of habitats (gardens, parks, ridge forests, Asola-Bhatti Wildflife Sanctuary, lakes, reservoirs, swamps, ponds, canals, nalas, rivers, I.G.I. Stadium Complex, monuments, open areas etc.) were surveyed and only anurans (frogs and toads) belonging to seven species under four genera and three families were collected, adding five species, as first records from Delhi. The tadpoles and juvenile stages of *Bufo stomaticus*, *Microhyla ornata*, *Rana cyanophlyctis*, *Rana limnocharis* and *Rana tigerina* were also collected during various months showing their breeding activities in Delhi. Out of the seven species *Rana cyanophlyctis*, the Skipping Frog was found to be the commonest species, probably due to its tolerance to highly polluted waters and *Tomopterna breviceps*, the Burrowing Forg, was found to be the least common, may be due to its burrowing habit. all the frogs and toads are generally called `Mendhak' locally. The amphibian fauna of Delhi appears to have been depleted due to speedy urbanisation, polluted waters and exploitation of certain species disturbing the natural food chain.

Rana tigerina and *Bufo melanostictus*, the largest species and *Tomopterna breviceps* need protection under Wildlife (Protection) Act, 1972. *Rana tigerina* has already been included in Appendix-II of Convention for International Trade in Endangered Species (CITES).

SYSTEMATIC LIST OF SPECIES

Order : ANURA
Family : BUFONIDAE
Genus ***Bufo*** Laurenti

1. *Bufo melanostictus* Schneider
2. *Bufo stomaticus* Lutken

Family : MICROHYLIDAE

Genus ***Microhyla*** Tschudi

3. *Microhyla ornata* (Dumeril & Bibron)

Family : RANIDAE

Genus ***Rana*** Linnaeus

4. *Rana cyanophlyctis* Schneider
5. *Rana limnocharis* Boie
6. *Rana tigerina* Daudin

Genus ***Tomopterna*** Dumeril & Bibron

7. *Tomopterna breviceps* (Schneider)

SYSTAMATIC ACCOUNT

Order : ANURA

Diagnostic characters : Head joins trunk directly. Eyes large and higher on head. Superficial ear membranes posterior to eyes. Two pairs of limbs; fore limbs stout; hindlimbs long, webbed and used for jumping and swimming. Vertebral column short. Tail absent in adult. Skin smooth or roughened with warts or tubercles. Sexual dimorphism common, males often smaller and with vocal pouches. Eggs laid in water, fertilization external, larvae or tadpoles with gills and tail. No neoteny.

Family : BUFONIDAE

Diagnosis characters : Mouth broad ; tongue oval, free; jaws toothless; vomerine teeth absent. Pupil horizontal. Terminal phalanges of fingers and toes obtuse or T-shaped. Skin roughened and tuberculated. Omosternum usually absent, if present reduced to a narrow cartilage. Sternum cartilagenous, in some species ossified along centre. Vertebrae procoelus ; coccyx articulating by two, sometimes one, condyles. Diapophyses of sacral vertebra dilated. Ribs absent.

Type-genus : *Bufo* Laurenti,

Genus ***Bufo*** Laurenti

1768. *Bufo* Laurenti, *Synop. Rept. Vienna*, : 25 (type-species : *Bufo vulgaris* Laurenti).

Diagnostic characters : Tongue elliptical or pyriform, entire, free. Parotid glands present, large. Tympanum distinct or hidden, seldom absent. Fingers free; toes more or less webbed; tips simple or dialated into small discs ; outer metatarsal united. Sacral vertebra articulating with coccyx by

two condyles.

Key to species

Head with bony ridges; tympanum two-thirds diameter of eye.....*Bufo melanostictus* Schneider
Head without bony ridges; tympanum nearly equal diameter of eye.....*Bufo stomaticus* Lutken

1. ***Bufo melanostictus*** Schneider
Common Toad

1799. *Bufo melanostictus* Schneider, *Hist. Amph.*, 1 : 216 (type-locality : India).
1890. *Bufo melanostictus* : Boulenger, *Faun. Brit. India*, : 501, 505-507, fig.140.
1964. *Bufo melanostictus* : Raj and Sehgal, *Census of India 1961, Delhi* : 11.
1976. *Bufo melanostictus* : Raza et al., In : *Delhi Gazetteer* : 29.
1991. *Bufo melanostictus* : Kalpavriksh, *The Delhi Ridge Forest* : 33.

Material examined : Delhi; 1 ex. (66 mm from snout to vent), Lodhi Garden, Lodhi road, 19.xii.1994; 2 exs.(35 , 52 mm). A.N. Jha Park, Hauz Khas, 22.xii.1994, coll. Akhlaq Husain & party.

Diagnostic characters : Head with cornified ridges. Tympanum distinct, two-thirds of eye. Parotid glands elevated. First finger longer than second. Toes less than half-webbed. Skin rough with spiny warts, both above and below ; two series of larger warts on middle of back. Colour light brownish above, dull whitish below. Males during breeding season with black callosities on first two fingers and subgular vocal sacs. 16.5 cm in lenght from snout to vent, males shorter.

Tadpoles with oval head and body. Oral disc ventral; upper lip with outer uninterrupted and inner broadly interrupted row of labial teeth; lower lip with three rows of uninterrupted labial teeth, inner one slightly notched medially; beaks black-edged, finely serrated. Colour dark above, lighter below.

Distribution ; India : Delhi and throughout. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar; Malaysia; China; Indo-Chinese region; Hong Kong; Indonesia; Philippines.

Remarks : Found under stones, wooden logs and near water during breeding season. Occurs up to 3658 m altitude (Waltner, 1974). Nocturnal. Feeds on insects and other invertebrates. Population compratively less in Delhi. The speceis may be protected under Wildlife (Protection) Act, 1972.

2. ***Bufo stomaticus*** Lutken
Marbled Toad

1863. *Bufo stomaticus* Lutken, *Vidensk. Meddr. dansk. naturh. Foren.*, 14 : 305.
1890. *Bufo andersonii*, Boulenger *Faun. Brit. India* : 501, 504.

1923. *Bufo stomaticus* : Neiden, *Das Tierreich, Anura*, **1** : 85.

1995. *Bufo stomaticus* : Ray and Tilak, *Faun. Conservation Areas* : 5, Fauna of Rajaji National Park : Amphibia 5 : 56, 58-60.

Material examined : Delhi; 1 ex. (23 mm), Lal Bagh, Model Town, 8.vi.1993, coll. Vinod Khanna & party; 7 exs. (12-15 mm, juveniles), Yamuna river side, Okhla barrage, 10.v.1994; 1 ex. (10 mm juvenile), River Yamuna side, Loknayak bridge, Vikas Marg, 13.v..1994, coll. Akhlaq Husain & party; 2 exs. (26, 38 mm), nr. Palam Air Port, Gurgaon road, 9.ix.1994; 1 ex. (21 mm), Masudpur, Vasant Kunj, 13.ix.1994; 17 exs. (8-10 mm, juveniles), Lodhi Garden, 15.ix.1994, coll. J.P.Sati & party; 1 ex. (35 mm), Humayun Tomb Complex, Mathura Road, 14.xii.1994; 1 ex. (27 mm), Lodhi Garden, Lodhi road, 19.xii.1994; 5 exs. (27-44 mm), A.N.Jha Park, Hauz Khas, coll, Akhlaq Husain & party; 1 ex. (24 mm), Zoological Park, 19.ii.1995; 1 ex. (17 mm, juvenile), Bhalswa Lake side, 11.ii.1995; 1 ex. (30 mm), Tughlaqabad Park, 12.ii.1995; 5 exs. (16-18 mm, juveniles), Lodhi Garden, 13.ii.1995; 1 ex. (25 mm), Humayun Tomb Complex, 14.ii.1995; 1 ex. (29 mm), Ramghat, Wazirabad, 24.vii.1995, coll. J.P.Sati & party.

Diagnostic characters : Parotid glands flattened. First finger equal to second or slightly longer. Toes two -thirds to three-fourths webbed. Skin rough with numerous flat warts. Colour marbled above and dirty whitish below. Males with a sub-gular vocal sac. 76 mm from snout to vent.

Distribution : India : Delhi, Punjab, Uttar Pradesh, West Bengal, Assam, Maharashtra. *Elsewhere* : Oman; Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar.

First record from Delhi.

Remarks : Terrestrial, commonly found near water during breeding season only. Nocturnal. Occurs up to 1524 m altitude (Waltner, 1974). Food consisting of insects etc. Juveniles were collected during February, May and September in Delhi. Common toad of Delhi.

Family : MYCROHYLIDAE

Diagnostic characters : Jaws toothless. Vomerine teeth absent. Pupil vertical or circular. Terminal phalanges of fingers and toes simple or T-shapes. Omosternum rudimentary or absent. Sternum cartilagenous. Procoracoid and clavicles usually absent. Vertebrae procoelous or diplasio-coelous. Diapophyses of sacral vertebra dialated. Ribs and intercalary phalanges absent.

Type genus : *Breviceps* Merrem.

Genus *Microhyla* Tschudi

1838. *Microhyla* Tschudi, *Mam. Soc. Sc. nat. Neuchatel*, **2** : 28 (type-speceis : *Microhyla achatima* Tschudi).

Diagnostic characters : Tongue elliptical, entire, free. Parotid glands absent. Tympanum hidden. Finges free. Toes free, webbed to a greater or lesser extent. Tips of fingers and toes more or less dilated. Terminal phalanges T-shaped. Outer metatarsal united. Omosternum absent. Skin

smooth or with small warts.

3. *Microhyla ornata* (Dumeril & Bibron)
Ornate Frog

1841. *Engystoma ornatum* Dumeril and Bibron, *Erpet. Gen.*, 8 : 745.

1890. *Mycrohyla ornata* : Boulenger, *Faun. Brit.India* : 491-492.

Material examined : Delhi; 1 ex. (14 mm), nr. Palam Air Port, Gurgaon road, 9.ix.1994, coll. J.P.Sati & party; 2 exs. (13, 14 mm), Chhawla Pul area, Najafgarh - Bijwasan road, 20.xii.1994; 2 exs. (14, 15 mm), Jahanpanah Park, Chiragh Dilli, 22.xii.1994, coll. Akhlaq Husain & party; 1 ex. (11mm), Kamla Nehru Ridge, 17.ii.1995, coll. J.P.Sati & party.

Diagnostic characters : First finger small, shorter than 2nd; toes with a rudimentry web; tips of fingers and toes swollen into minute discs. Skin smooth. Colour greyish-olive above, with large dark marking beginning between eyes and gradually widening on hinder part of body, sometimes with reddish-brown spots; dull-whitish below. 28 mm in length between snout and vent.

Distribution : India : Delhi and throughout. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar; China; Taiwan; South East Asia.

First record from Delhi.

Remarks : Inhabits bushy areas, dry leaves on moist soil. Occurs up to 2743 m altitutde (Waltner, 1974). Nocturnal but seen during day time also. Feeds on small insects. Mating call weak and like a rasping note. Juveniles were found in the month of February in Delhi. Not very common in Delhi.

Family : RANIDAE

Diagnostic characters : Upper jaw toothed, lower one toothless. Fingers mostly free; toes more or less completely webbed. Terminal phalanges of fingers and toes variously shaped and sized. Foot may be with 1-2 metatarsal tubercles, blunt, sharp or shovel-shaped, adapted for digging. Omosternum and sternum with or without bony style. Vertebrae procoelus. Diapophyses of sacral vertebra cylindrical or slighly dilated. Ribs absent.

Type genus : *Rana* Linnaeus.

Key to genera

Both outer and inner metatarsal tubercles present; tibio-tarsal articulation reaching tympanum or beyond .....*Rana* Linnaeus

Outer metatarsal tubercle absent, inner metatarsal tubercle present; tibio-tarsal articulation not reaching tympanum (to axil of shoulder).....*Tomopterna* Dumeril & Bibron

Genus *Rana* Linnaeus

1758. *Rana* Linnaeus, *Syst. Nat.*, ed. 10, Holmiae : 210 (type-speceis : *Rana temporaria* Fitzinger)

Diagnostic characters : Tongue free, deeply notched. Vomerine teeth present, rarely absent. Pupil horizontal. Parotid glands absent. Tympanum present, distinct or sometimes hidden. Fingers free; toes webbed, rarely free. Tips of fingers and toes simple or dilated; discs without transverse grooves. Terminal phalanges obtuse or T-shaped. Outer metatarsal separated by web. Skin smooth or with warts. Intercalary ossicle between penultimate and terminal phalanges absent. Omosternum and sternum with a bony style.

Key to species

1. Toes webbed up to tips; tympanum nearly equal diameter of eye.....2
- Toes not webbed up to tips; tympanum nearly shorter than eye diameter .....*Rana limnocharis* Boie

2. First finger equal to second; inner metatarsal tubercle pointed, digit-like .....*Rana cyanophlyctis* Schneider
- First finger longer than second; inner metatarsal tubercle blunt.....*Rana tigerina* Daudin

4. ***Rana cyanophlyctis*** Schneider
Skipping Frog

1799. *Rana cyanophlyctis* Schneider, *Hist.Amph.*, **1** : 137 (type-locality : `India Orientalis')
1890. *Rana cyanophlyctis* : Boulenger, *Faun. Brit. India* : 439, 442-443.

Material examined : Delhi; 4 exs. (adult 2, 27, 40 mm, snout to vent, tadpoles 2), Masudabad, ca 38 km. from IARI, Najafgarh road, 5.vi.1993; 2 exs. (26,30 mm), Dhaulakuan Ridge, Cantonment area, 10.vi.1993, coll. Vinod Khanna & party; 4 exs. (30-38 mm), Horse-shoe Lake, Water Sport Complex, vill. Bhalswa, 26.x.1993; 3 exs. (25-58 mm), Najafgarh, 27.x.1993; 2 exs. (33, 35 mm), Swampy area, Wazirabad area, 28.x.1993; 5 exs. (42-48 mm), Bawana, 30.x.1993; 6 exs. (35-49 mm), Auchandi, 30.x.1993, coll. N.K.Sinha & party; 20 exs. (adult 13, 36-46 mm, tadpoles 7), Park Lake, Dhaulakuan, 12.v.1994; 1 ex. (36 mm), River Yamuna, Wazirabad, 14.v.1994; 16 exs. (adult 7, 20-22 mm, tadpoles 9), Okhla Dam site, 15.v.1994, coll. Akhlaq Husain & party; 3 exs.(21-24 mm, juveniles), nr.Palam Air Port, Gurgaon Road, 9.ix.1994; 1 ex. (15 mm, juvenile), IARI Campus, 11.ix.1994; 1 ex. (58 mm), Asola-Bhatti Wildlife Sanctuary, 12.ix.1994, coll. J.P.Sati & party; 3 exs. (31-36 mm), Sabhaypur, Ghaziabad road, Wazirabad area, 17.xii.1994; 1 ex. (55 mm), Nala, Piggery Farm, Uri Enclave, 18.xii.1994; 1 ex. (27 mm), Nala across, Okhla reservoir, nr. U.P.Border, 18.xii.1994; 15 exs. (tadpoles), Tank, Lodhi Garden, Lodhi road, 19.xii.1994; 1 ex. (45 mm), Pond, Nagli-Sakraoti nr. Dham, Najafgarh

area, 29.xii.1994, coll. Akhlaq Husain & party; 4 exs. (31-40 mm), Yamuna barrage side,Wazirabad, 11.ii.1995; 3 exs. (adult 2, 23-24 mm, tadpole 1), Okhla reservoir, 14.ii.1994; 3 exs. (35-36 mm), Jheel Park, Ranibagh area, 18.ii.1995; 1 ex. (30 mm), Tank, Lodhi Garden, 25.vii.1995, coll. J.P.Sati & party.

Diagnostic characters : Tympanum distinct, more than half of eye diameter. Fingers pointed; 1st not extending beyond 2nd, with swollen tips. Toes completely webbed; 4th toe not much longer than 2nd or 5th, inner metatarsal tubercle small, concial and like rudimentary toe. Skin with small tubercles and warts above and with rows of pores. Colour olive or brownish above, dark spotted or marbled; two blackish streaks on hinder side of thighs; speckled with black below. Male with two slit-like openings of vocal sacs. Snout to vent lengtth 63.5 mm, males smaller.

Distribution : India : Delhi and throughout. *Elsewhere* : Iran; S. Arabia; Afghanisatn; Pakistan; Nepal; Bangladesh; Sri Lanka; Thailand; Malaysia.

First record from Delhi.

Remarks : Commonly found in ponds, ditches and rivers. Occurs up to 2743 m altitude (Waltner, 1974). May tolerate salinity and even extremly polluted water around sewage system. When disturbed, skips over the surface of water and submemerges for a while to come up again. Feeds on aquatic insects. Tadpoles were found in the months of February, May, June, and December in Delhi. Most common frog of Delhi.

5. *Rana limnocharis* Boie
Cricket Frog

1829. *Rana limnocharis* Boie in Gravenhorst *Delic. zool. vrat.*, 41 (type-locality : not mentioned).
1890. *Rana limnocharis* : Bolenger, *Faun. Brit. India* : 52.

Material examined : Delhi; 3 exs. (19-33 mm), River Yamuna, Okhla barrage side, 10.v.1994; 1 ex. (27 mm), Pond, Indira Gandhi Indoor Stadium Complex, 11.v.1994, coll. Akhlaq Husain & party; 1 ex. (30 mm), Kamla Nehru Ridge area, Rajpur road, 14.ix.1994, coll. J.P.Sati & party; 6 exs. (15-26 mm), Nala, Piggery Farm, Uri Enclave, 18.xii.1994, coll. Akhlaq Husain & party; 2 exs. (13, 18 mm, juveniles), Kamla Nehru Ridge, 17.ii.1995, coll. J.P.Sati & party.

Diagnostic characters : Tympanum half of eye diameter. Fingers with slightly swollen tips; 1st a little longer than 2nd; toes pointed, almost half webbed, about three phalenges of 4th toe free; inner metatarsal tubercle small, oblong and compressed. Skin rough with warts and longitudinal ridges. Colour grey or brownish above with prominent dark spots and usually with a yellowish vertebral line; sides of thighs marbled; throat of male with two large black blotches which may be connected. Snout to vent lenght 63.5 mm, males smaller.

Distribution : India : Delhi and throughout (including Andaman and Nicobar Islands). *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar; Thailand; Hong Kong; China; Taiwan; Malaysia; Indonesia; Philippines, Japan.

First record from Delhi.

Remarks : Commonly found in water edges or understones near water bodies. Occurs up

to 2473 m altitude (Waltner, 1974). Feeds both on aquatic and terrestrial insects. Juveniles were found in the month of February.

This species is very much allied to *R. cyanophlyctis* but can easily be separated from it by its 4th toe which is free from web anteriorly whereas the fourth and all other toes are completely webbed in *R. cyanophlyctis*.

6. *Rana tigerina* Daudin
Bull Frog

1803. *Rana tigerina* Daudin, *Hist. Rain. gren. crap.* : 64, pl. 20.
1890. *Rana tigerina* : Boulenger, *Faun. Brit. India* : 440, 449-450, fig.132.
1964. *Ran tigerina* : Raj and Sehgal, *Census of India 1961, Delhi* : 11.
1976. *Rana tigerina* : Raza et al., In : *Delhi Gazetteer* : 29.
1991. *Rana tigerina* : Kalpavriksh, *The Delhi Ridge Forest* : 32.
1994. Indian Bull Frog : Malik et al., *Saving the Delhi Ridge* : 37.

Material examined : Delhi : 1 ex. (66 mm), Horse-shoe Lake, Water Sport Complex, vill. Bhalswa, 26.x.1993, coll. N.K.Sinha & party; 4 exs. (adult 1, 76 mm; tadpoles 3), River Yamuna, Nizamuddin bridge, 11.v.1994, coll. Akhlaq Husian & party; 2 exs. (58, 84 mm), Majnu-Ka-Tila along River Yamuna, Ring road, 8.ix.1994; 1 ex. (90 mm), Asola-Bhatti Wildlife Sanctuary, 12.ix.1994, coll. J.P.Sati & party.

Diagnostic characters : Tympanum circular, almost two-thirds of eye diameter. Fingers short, stout with nodular tips, 1st longer than 2nd; toes obtuse almost completely webbed, a membranous fringe along 5th toe; inner metatarsal tubercle elongated, blunt. Skin of back with warts and 5-6 incomplete longitudinal folds; a prominent fold above tympanum. Colour yellowish above with olive green patches and often a golden vertebral line, whitish below. Males with two subgular vocal sacs and a nuptial pad on first finger during breeding season. 165 mm in length from snout to vent.

Distribution : India : Delhi and throughout. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar; Thailand; China; Taiwan; Malaysia; Philippines; Indonesia; Japan.

Remarks : Inhabits ponds, ditches, lakes canals etc. Occurs up to 2743 m altitude (Waltner, 1974). Feeds mostly on insects. Breeds during rainy season; mating call sounding loud "quonk". Tadpoles were found in the month of May in Delhi. Not common in Delhi, Its population appears depleted due to various reasons particularly for demand of froglegs.

Status : Appendix II, CITES.

Genus *Tomopterna* Dumeril and Bibron

1840. *Tomopterna* Dumeril and Bibron, *(Roret's Suite a Buffon) Erepet,* 8 : 443.

Diagnostic characters : Fingers completely free, toes with reduced webbing; metatatsal bounded by muscles; inner metatarsal tubercle distinctly shovel-shaped.

7. *Tompoterna breviceps* (Schneider)
Burrowing Frog

1799. *Rana breviceps* Schenider, *Hist. Amph.*, 1 140.

1987. *Tomopterna breviceps* : Inger and Dutta, *J. Bombay nat.Hist. Soc.* 83 (Suppl.) : 184.

Material examined : Delhi : 1 ex. (45 mm), Jahanpanah Park, 23.vii.1995, coll. J.P.Sati & party.

Diagnostic characters : Tympanum distinct about two-thirds diameter of eye. Finger tips swollen, 1st much longer than 2nd with distinct subarticular tubercles; toes obtuse, slightly webbed, more than three phalanges of 4th toe free; inner metatarsal tubercle large, shovel-shaped, outer one absent. Skin smooth or granulate with scattered tubercles or short folds, a strong fold between eye and shoulder, underparts granulate. Colour Brownish or olive above with dark spots or marblings, often with light vertebral line; whitish below; throat of males blackish and of females brown-spotted. Male with two well developed internal subsgular vocal sacs. Snout to vent length 63.5 mm.

Distribution : India : Delhi and throughout. *Elsewhere* : Pakistan; Nepal; Sri Lanka; Myanmar.

First record from Delhi.

Remarks : Burrowing and nocturnal in habit. Occurs up to 2743 m altitude (Waltner, 1974). Hind limbs are strong and equiped with shovel-shaped inner metatarsal tubercles which help in digging burrows in ground. Feeds on insects. Breeding takes place during onset of monsoon months. Least common frog of Delhi, may be due to its burrowing habit. The species may be protected under Wildlife (Protection) Act, 1972.

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REFERENCES

Kalpavriksh, 1991. *The Delhi Ridge Forest* : 12, 33.

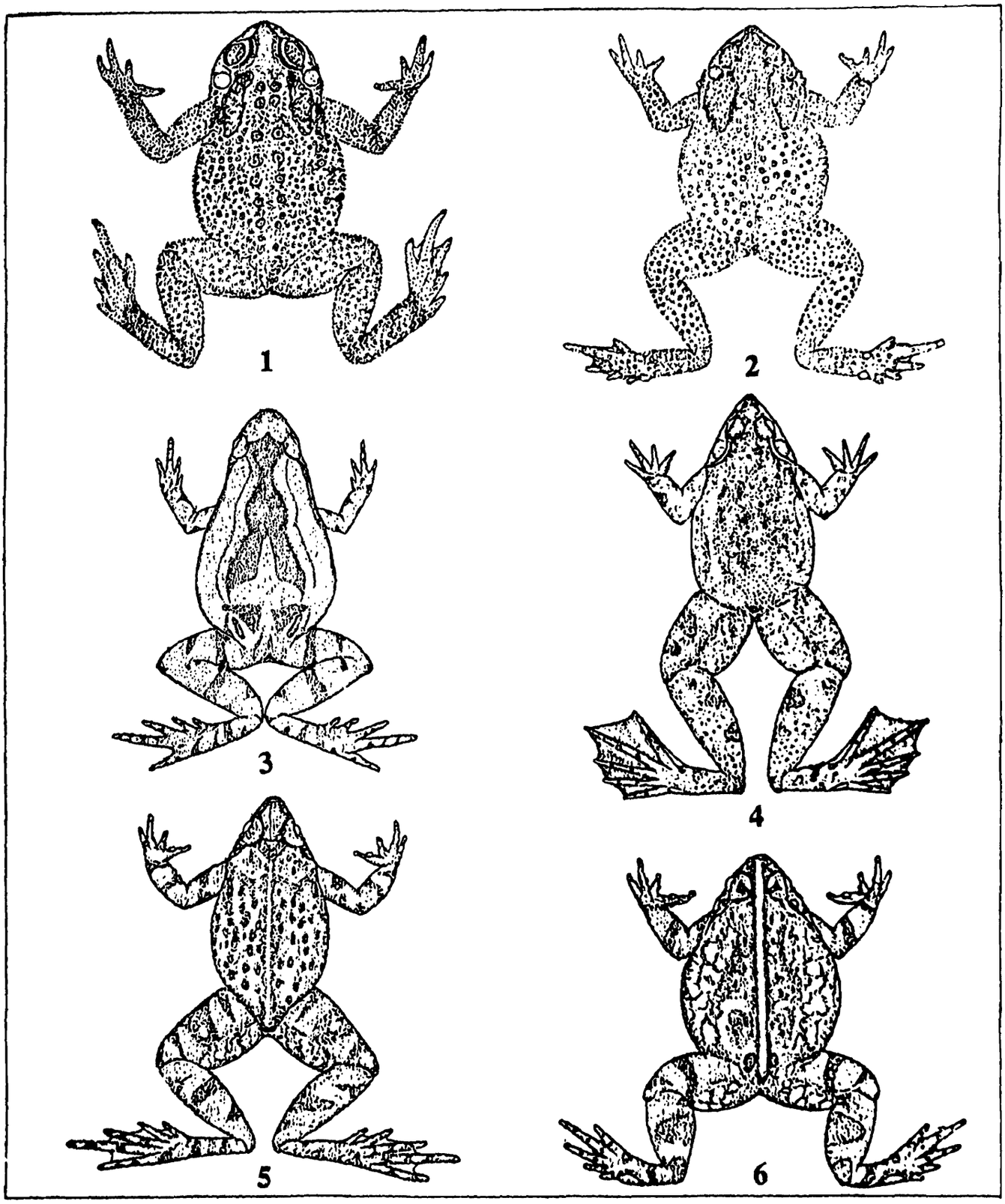
Malik, I., Amenita, I., Agarwal, R. and Menon, V., 1994. *Saving the Delhi Ridge : One year Conservation Action : A Srishti Report* : 37.

Raj, B. and Sehgal, K.C. 1964. *Census of India 1961, Delhi* : 11.

Ray, P. and Tilak, R. 1995. Fauna of Rajaji National Park : Amphibia.*Fauna of conservation Areas* 5 : 55-75.

Raza, M., Dey, A.K., Joshi, B.M., Rangaswami, N.S. and Desai, J.H., 1976. In :*Delhi Gazetteer* : 29.

Waltner, R.C., 1974. Geographical and altitudinal distribution of amphibians and reptiles in Himalayas, *Cheetal* : **16**(1) : 22, 23.



Figs. : 1. *Bufo melanostictus* Schneider; 2. *Bufo stomaticus* Lutken; 3. *Microhyla ornata* (Dumeril & Bibron); 4. *Rana cyanophlyctis* Schneider, 5. *Rana limnocharis* Boie; 6. *Tomopterna breviceps* (Schneider) (after Ray and Tilak, 1995).

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REPTILIA

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INTRODUCTION

The reptilian fauna of Delhi has not drawn enough attention of herpetologists during the past except Smith (1943) and some general references in Delhi Gazetteers (1883-84, 1912, 1976) and booklets on Delhi. The oldest available reference on the occurrence of *Gharial* and *Magar*, once plentiful in river Yamuna between Old Fort and Okhla and three snakes (*Kala, Pila* and *Chitkauria* as known by the natives) in `A Gazetteer of the Delhi District (1883-4)' Latter Cobra (as *Naja tripudians*), Krait (*Bungarus caeruleus*) and Checkered Snake and turtles (species not mentioned) in general sense besides crocodiles both Gharial and Magar were reported in `Gazetteer of the Delhi District part A-1912' There is no report of *Gharial* in `Cenus of India 1961, Delhi' (Raj and Sehgal, 1964) and `Delhi Gazetteer, 1976' but besides *Crocodilus palustris*, the *Magar*, *Naja tripudians (= Naja naja)*, the Cobra, *Bungarus caeruleus*, the Krait and *Tropidonotus piscator (= Xenochrophis piscator)*, the Checkered Snake, five species of lizards, seven species of non-venomous snakes and two species of turtles were listed. Raj and Sehgal (1964) repeated 1976 Gazetteer list. Kalpavriksh (1991) also repeated the 1976 Gazetteer list except for Checkered Snake (*Xenochrophis piscator)* and Banded Rat Snake (*Argyrogena fasciolatus)* and two turtles in "The Delhi Ridge Forest" booklet. Malik et al. (1994) mentioned the occurrence of Spiny-tailed Lizard and Indian Monitor in their " Saving the Delhi Ridge : One year of Conservation Action : A Srishti Report" Gaur (1995) referred to "several kinds of snakes, including cobras, pythons" "monitor lizard, or a turtle" in Najafgarh drain area. As per Newsl. IZDA/CZA, 4(1-2), 1996 report Cobra, Krait, water snakes, Python etc. are a common sight as non-captive stock inside the park. Smith (1943) was the first renowned herpetologist who recorded two species of snakes viz. *Enhydris sieboldi*, the Smooth Water Snake and *Spalerosophis atriceps* (as *Coluber diadema atriceps*), the Royal Snake from Delhi and have shown the distribution of two others viz. *Bungarus caeruleus*, and *Naja naja naja* in Maps (figs. 134 and 139 respectively). Tikader and Sharma (1985, 1992) have shown the distribution of four species each of turtles (*Geoclemys hamiltoni, Hardella thurgi, Kachuga smithi* and *Kachuga tecta*) and lizards (*Acanthodactylus cantoris, Mabuya macularia, Varanus flavescens* and *Varanus griseus*) respectively in Maps covering Delhi but without definite records from the territory. Moll (1986, 1987) recorded three terrapins (*Kachuga dhongoka, Kachuga tecta* and *Kachuga tentoria circumdata*) from the vicinity of Delhi (Hindon river, Ghaziabad).

During the present study various aquatic and terrestrial localities (gardens, parks, ridge, I.P. Wildlife Sanctuary, ponds, lakes, reservoirs, Yamuna river at various points, monument buildings and other localities) in different seasons were surveyed for its reptilian fauna which made

it possible to add three species viz *Sitana ponticeriana*, the Fan-throated Lizard, *Hemidactylus brooki*, the Spotted Brook's Gecko and *Riopa punctata*, the Striped Skink, all saurians belonging to three different genera and families, to the reptilian fauna of Delhi, totalling twenty five species. *Riopa punctata*, *Hemidactylus brooki*, *H.flaviviridis*, *Calotes versicolor* and *Ramphotyphlops braminus*, the Worm Snake are the commonest and found every where.

Out of twenty five species recorded from Delhi six (*Crocodylus palustris*, *Gavialis gangeticus*, *Aspideretes gangeticus*, *Lissemys punctatus*, *Varanus monitor*, and *Python molurus*) have been declared endangered/vulnerable and protected under Wildlife (Protection) Act, 1972 and included in `The Red Data Book on Indian Animals, 1994 (Zoological Survey of India)' and of these, three species (*Crocodylus palustris*, *Gavialis gangeticus and Python molurus*) have been classified under Endangered or Vulnerable categories in `1993 I U C N Red list of Threatened Animals'. Eleven species (above mentioned six species and *Uromastix hardwickii*, *Eryx johnii*, *Ptyas mucosus*, *Xenochrophis piscator*, *Naja naja*, *and Vipera russelli*) have been included in Appendices of `Convention for International Trade in Endangered Species (CITES)' as a safeguard measure for their conservation. This may surely help in conserving these species if followed strictly.

SYSTEMATIC ACCOUNT

Class : REPTILJA

Key to orders

1. Body serpentine; devoid of limbs; mouth opening flexible (cloacal opening transverse.....Serpentes
- Body not serpentine; with limbs; mouth opening flexible.....2

2. Body oval, enclosed in a shell of bony plates; teeth absent (except in embroyonic stage of some Trionychids) (cloaca opening longitudinal or circular .....Testudines
Body elongated, not enclosed in a shell; teeth present.....3

3. Quardrate movably articulated with skull; openign of cloaca transverse (body snake-like and without limbs in *Ophisaurus*).....Sauria
- Quardrate movably united to skull; opening of cloaca elongated.....Crocodylia

Order : CROCODYILIA

Key to families

Snout very long, slender dilated at tip (3.33-5.50 times as long as broad at base); 27-29

teeth on each side in upper jaw; 1st, 2nd and 3rd mandibular teeth fitting into notches in upper jaw; nasals widely separated from premaxillaries; dorsal shield formed of 4 longitudinal series of juxtapored keeled bony scutes.....Gavialidae
Snout short, more or less elongate and obtuse (1.33-2.17 times as long as broad at base); 17-19 teeth on each side in upper jaw; 4th mandibular tooth fitting into a notch, open on outer side (laterally closed pit Alligatoridae) in upper jaw; dorsal shield formed of 4-8 longitudinal series of keeled bony scutes.....Crocodylidae

Family : CROCODYLIDAE

Genus *Crocodylus* Gronovius

1763. *Crocodylus* Gronovius, *Zoophyl.*, **1** : 10.

1. *Crocodylus palustris* (Lesson)
Snub-nosed or Marsh Crocodile

1834. *Crocodilus palustris* Lesson, In : *Belong. Voy. Ind. or., Zool.*, : 305 (type-locality : Ganges).
1884. *Muggur* (Snub-nosed) : Anonymous, *A Gazetteer of the Delhi District (1883-4)* : 21.
1890. *Crocodilus palustris* : Boulenger, *Faun. Brit. India* : 5.
1913. *Magar* (Blunt-nosed) : Anonymous, *Gazetteer of the Delhi District Part A-1912* : 18.
1931. *Crocodilus palustris* : Smith, *Faun. Brit. India*, **1** : 42, 47-48.
1964. *Crocodilus palustris* : Raj and Sehgal, *Census of India 1961, Delhi* : 10.
1976. *Crocodilus palustris* : Raza et al., In : *Delhi Gazetteer* : 28.

Local name : Magar.

Material examined : From literature.

Diagnostic characters : Snout somewhat elongate, 1.33-1.50 times as long as broad at base, usually without distinct ridges in front of eyes, when present extnending a short distance only. 19 teeth on each side of upper jaw; 4th mandibular tooth fitting into a notch in upper jaw; premaxillo-maxillary suture on palate, directed nearly straight across. Four large nuchals forming squares, with smaller one on each side; two pairs of sharply raised post occipital scutes arranged in a transverse series. Dorsal scutes in 16-17 transverse and 4 or 6 longitudinal series, bony portions of scutes in contact with one another in transverse series; smaller scutes not so regularly placed, outside. Fingers webbed at base; toes deeply webbed. Outer edge of limbs with serrated fringe. Tail with two series of flattened vertical scutes merging and continued as a single row near tip. Colour dark olive or brownish above, whitish or yellowish below. Young with specklings of black. Attains a maximum length of 5.5 m. (normally up to 3.5 m).

Distribution : India : Delhi (as per reocrds) and throughout. *Elsewhere* : Iran; Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar; Malaysia; Indo-China,

Remarks : Inhabits large rivers, marshes, reservoirs, lakes and other water bodies (upto 600 m in hills). Basks on sandy or rocky banks, usually facing water, ready to slip in on the slightest danger. Main food consists of fishes but larger ones may attack any animal within their reach. Young ones feed on aquatic insects, molluscs, frogs and small fishes. Breeding occurs after winter when female lays 3 to 40 or more spherical eggs in a clutch in a deep hole dug by her in sand usually at night and protects them. Territorial fighting between males, specially during breeding season, sometimes results in serious or fatal injuries. Large males dominate sub-adults and females.

Formerly it was available in plenty throughout its range, but presently its population has been greatly declined in nature due to various reasons, natural and man made and hence is being reared or cultured in some states to conserve its gene pool. Once they were commonly met plentyful in river Yamuna at Delhi as per the old Gazetteer reports (1884, 1912, 1976). The present status of its occurrence in Yamuna river or reservoirs at Delhi is to be ascertained. However a few spcimens have been kept in National Zoological Park for general awareness.

Status : Protected species under :-

i. Schedule I, Wildlife (Protection) Act, 1972.
ii. Vulnerable category under 1993 IUCN Red List of Threatened Animals.
iii. Endangered category, The Red Data Book on Indian Animals, 1994 (Z.S.I).
iv. Appendix I, CITES.

Family : GAVIALIDAE

Genus *Gavialis* Oppel

1811. *Gavialis* Oppel, *Die Ordn. Rept.*, : 19 (type-species : *Crocodylus gangeticus* Cuvier).

2. *Gavialis gangeticus* (Gmelin)
Long-snouted Crocodile

1978. *Lacerta gangetica* Gmelin, *Syst. Nat* ., **1** : 1057.
1931. *Gavialis gangeticus* : Smith, *Faun. Brit. India*, **1** : 39-40, figs. 2A, B.
1884. *Gurryal* : Anonymous, *A Gazetteer of the Delhi District (1883-4)* : 21.
1913. *Gharial* Anonymous, *Gazetteer of the Delhi District Part A-1912* : 18.

Local name : Gharial.

Material examined : From literature.

Diagnostic characters : Snout long, narrow, 3.33(adult) 5.50 (young) times as long as broad at base, dilated at end; adult males with a large pot-like hollow, cartilaginous protuberance on snout tip. 27-29 teeth in upper jaw of each side; 1st, 2nd and 3rd mandibular teeth fitting into notches in the upper jaw. Nuchal and dorsal scutes forming a continuous series, in 21 or 22 transverse rows; another row of smaller scutes not so regular, may be present; two small post -

occipital scutes. Dorsal shield formed of four longitudinal series. Median fingers one-third, outer toes two-thirds webbed. Outer edge of limbs with a strong serrate fringe. Tail with two series of flattened, vertical scutes merging and continued as single row before tip. Colour dark olive or brownish above, interspersed with yellow; whitish or yellowish below. Young ones greyish brown, with dark spots or cross bars on body and tail. Attains a maximum length of 6.75 m and believed to attain upto 8 m (Daniel, 1983).

Distribution : India : Delhi (as per records), Ganga, Brahamaputra and Mahanadi river systems. *Elsewhere* : Pakistan; Nepal; Bangladesh; Myanmar.

Remarks : Inhabits reservoirs, deep pools formed at river junctions and bends or `Kunds' Islands and sandy banks, ideal basking sites particularly during winter season. Facile swimmer but clumsy on land. Feeds chiefly on fish, also takes turtles, birds or small mammals. Like other crocodiles its stomach contains stones. Matures at the age of 13-14 years, mating takes place in water. Female lays 10 to 96 eggs in a clutch in a nest deep in sand during early summer. Both parents take care of nest and young ones.

Ones they were occurring in plenty in Yamuna between Old Fort and Okhla as per Gazetteer reports (1884, 1912). The present status of its occurrence in Delhi waters is to be ascertained.

Status : Protected species under :-

i. Schedule I, Wildlife (Protection) Act, 1972.
ii. Endangered category 1993 IUCN Red List of Threatened Animals.
iii. Endangered category, The Red Data Book on Indian Animals, 1994 (Z.S.I).
iv. Appendix I, CITES.

Order : TESTUDINES
Family : TRIONYCHIDAE

Diagnostic characters : Head and neck completey retractile. Neck exceedingly long, flexible, bending in a sigmoid curve in a vertical plane. Jaws concealed under fleshy lips. Snout ending in a proboscis. Carapace and plastron covered with soft skin, without epidermal shields; carapace and plastron united by ligamentous tissue; edge of carapace flexible. Fore - limbs semi-paddle-shaped, three inner digits clawed. Phalanges elongate, 4th digit with four or more phalanges.

Last cervical vertebra articulating with first dorsal by a double facet on centrum and by zygapophyses. Pterygoids separated from each other; basisphenoid joining palatines. Epiplastra separated from hypoplastra by a ▲-shaped entoplastron; marginal bones absent or forming incomplete series, not connected with ribs. Pelvics not anchylosed to carapace and palstron.

Key to genera

Marginal bones present; palstron with seven callosities in adult; carapace without definite pattern; snout short.....*Lissemys* Smith
Marginal bones absent; plastron with four callosities in adult; carapace with definite pattern; snout long.....*Aspideretes* Hay

Genus ***Aspideretes*** Hay

1904. *Aspideretes* Hay, *Proc. Amer. philos. Soc.*, **42** : 274.

3. *Aspideretes gangeticus* (Cuvier)
Softshell or Box Turtle

1824. *Trionyx gangeticus* Cuvier, *Oss. Foss.*, **5** : 186, 203, 206, pls. 11,12 (type-locality : Ganges).
1835. *Gymnopus duvaucelli* Dumeril and Bibron, *Erp. Gen.* **2** : 487 (type-locality : Ganges).
1931. *Trionyx gangeticus* Smith, *Faun. Brit. India* **1** : 166, 167-168, fig. 38 (Indus, ganges and Mahanadi and their tributaries).
1964. *Trionyx gangeticus* : Raj and Sehgal, *Census of India 1961, Delhi* : 11.
1976. *Trionyx gangeticus* : Raza et al., In : *Delhi Gazetteer* : 29.
1985. *Trionyx gangeticus* : Tikader and Sharma, *Handbook Indian Testudines* : 126, 127-129, pls. 35, 36, 47, figs. 78, 79, Map.

Local name : Kachua.

Material examined : From literature.

Diagnostic characters : Snout as long as diameter of eye. Mandible with raised inner edges which meet at symphysis to form a short, median projection. Two neural plates between first pair of costals; costal plates well developed, usually last two pairs in contact in mid-line; all the plates of carapace coarsely pitted and vermiculate. Anterior limbs of epiplastra long and slender, in contact with or narrowly separated from one another; four plastral callosities, hyo-hypoplastral and xiphiplastral well developed in the adult. Occasionally 5th one upon entaplastron. Colour olive-green above, sometimes vermiculated with yellowish; juveniles with fine black reticulations; whitish below. Head with a black longitudinal streak between eyes and nape and three oblique black streaks on either side diverging from it, another streak behind eye. Markings on head and body may fade away with age. Carapace 7.2 cm in length.

Distribution : India : Delhi; Indus, Ganga, Brahmaputra and Mahanadi river systems, Rajasthan, Madhya Pradesh. *Elsewhere* : Pakistan; Nepal; Bangladesh.

Remarks : Inhabits deep and turbid waters. Generally seen basking on sandy banks or resting in shallow waters with its head out. Feeds both on animal and plant matter. Breeds after rainy season when its female lays 25-35 spherical eggs on sandy river banks.

Status : Protected species under :

i. Schedule I, Wildlife (Protection) Act, 1972.

ii. Vulnerable category, The Red Data Book on Indian Animals, 1994 (Z.S.I).

iii. Appendix I, CITES.

Genus ***Lissemys*** Smith

1931. *Lissemys* Smith, *Faun. Brit. India*, 1 : 154-157.

4. ***Lissemys punctatus punctatus*** (Bonnaterre)

Flap-shell or Pond Turtle

1789. *Testudo punctata* Bonnaterre, In : *Daubenton's Tab-Encycl. Meth. Erept* : 30, pl. 6 (type-locality : "Les grandes indes").

1831. *Emyda punctata punctata* : Gray, *Syn. Rept.* : 49 (type-locality : Ganges).

1931. *Lissemys punctata* : Smith, *Faun. Brit. India*, 1 : 157-158 (Ganges and Indus and their tributaries).

1964. *Lissemys punctata* : Raj and Sehgal, *Census of India 1961, Delhi* : 11.

1976. *Lissemys punctata* : Raza et al., In : *Delhi Gazetteer* : 29.

1985. *Lissemys punctata punctata* : Tikader and Sharma, *Handbook Indian Testudines* : 117-120, pl. 31, figs. 72, 73, Map (Ganga and Sind river systems, Sikkim, Nepal).

Local name : Kachua.

Material examined : From literature.

Diagnostic characters : Head moderate. Snout short and broad, its length less than length of eye-opening. Carapace and plastral callosities finely granulate; two neural plates between first pair of costals; first marginal bone in adult very large, much larger than others; seven plastral callosities in adult, namely paired hyo-hypoplastral, xiphiplastral and epiplastral and a single entoplastral, later usually small in size in adult. Colour olive-brown above with numerous dark-edged yellow spots; head and snout also spotted with yellow; yellowish below. Spots tend to disappear with age. Carapace 35 cm in length, smaller in males.

Distribution : India : Delhi; Indus and Ganga river systems; Sikkim; Andaman Is. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar.

Remarks : Inhabits ponds and ditches, rarely leaving its habitat. Fond of basking on exposed surfaces. Carnivorous, feeding on frogs, fishes etc. Female lays about 12 spherical eggs in a clutch.

Status : Protected species under :-

i. Schedule I, Wildlife (Protection) Act, 1972.

ii. Vulnerable category, The Red Data Book on Indian Animals, 1994 (Z.S.I).

iii. Appendix I, CITES.

Order : SAURIA

Key to families

1. Head with symmetrical shields.....2
- Head without symmetrical shields.....3

2. Eyes with movable eyelids.....Scincidae
- Eyes without movable eylids (eyes covered with transparent membrane).....Gekkonidae

3. Tongue short, broad and entire.....Agamidae
- Tongue long, slender and bifid.....Varanidae

Family : AGAMIDAE

Diagnostic characters : Body depresed or compressed, covered with scaels mostly imbricate; head without symmetrical shields. Eyes with movable eyelids. Nasals paired. Tongue short, broad, smooth or covered with villose papillae, not protrusible. Teeth on both jaws, acrodont. Premaxillary single. Skull strongly ossified; orbit completely surrounded by bone; temporal fossa bridged over by an arch, formed mainly of squamosal and well-developed jugal bone. Some times a supraorbital arch present.

Key to genera

1. Four toes.....*Sitana* Cuvier
- Five toes.....2

2. Femoral pores present; body depressed, without crest.....*Uromastix* Merrem
- Femoral pores absent; body not depressed, with crest.....*Calotes* Cuvier

Genus *Calotes* Merrem

1815. *Calotes* Rafinesque, *Anal. Nat.* : 75 *(nom. nud.)*.
1817. *Calotes* Cuvier, *Regne Anim.*, **2** : 35 (type-species : *Lacerta calotes* Linneaus).

5. *Calotes versicolor* Daudin
Garden Lizard

1802. *Agama versicolor* Daudin, *Hist. Nat., Rept.*, **3** : 395, pl. 44 (type-locality : India).
1835. *Calotes versicolor* : Smith, *Faun. Brit. India*, **2** : 181, 189-193, fig. 54.

1964. *Calotes versicolor* : Raj and Sehgal, *Census of India 1961, Delhi* : 10.

1976. *Calotes versicolor* : Raza et al.,In : *Delhi Gazetteer* : 29.

1991. *Calotes versicolor* : Kalpavriksh, *The Delhi Ridge Forest* : 33.

1992. *Calotes versicolor* : Tikader and Sharma, *Handbook Indian Lizards* : 94, 97-98, pl. 12-B, Map 28.

Local name : Girgit.

Material examined : Delhi : 1 ex. (222 mm, from snout tip to tail tip), IARI Campus, 3.vi.1993; 1 ex. (305 mm), Masudabad, Najafgarh road, coll. Vinod Khanna & party; 1 ex. (275 mm), Pond side, nr. IFC Building, Naraina area, 9.v.1994; 1 ex. (230 mm), River Yamuna site, Wazirabad area, 14.v.1994, coll. Akhlaq Husain & party; 1 ex. (85 mm), Majnu-Ka-Tila nr. River Yamuna, Ring road, 8.ix.1994; 2 exs. (125, 130 mm), IARI Campus, 11.ix.1994; 2 exs. (1, 166 mm, 2, 120 mm, tail broken), Priya District Park, Munirika, Vasant Vihar, 13.ix.1994; 1 ex. (295 mm), Tughlaqabad Park, 12.ii.1995; 1 ex. (230 mm), Budha Jayanti Park, 15.ii.1995; 1 ex. (225 mm), Hauz Khas Park, 15.ii.1995; 1 ex. (70 mm), Lake Garden, Dhaula Kuan, 16.ii.1995; 1ex. (295 mm), Jahanpanah Park, 23.vii.1995, coll. J.P.Sati & party.

Diagnostic characters : Body compressed. Head large, with two spines on each side behind tympanum. Eyes prominent, anterior. Scales keeled, side scales pointing backwards and upwards, 35-52 scales round the body. Fold in front of shoulder absent. Tail very long, cylindrical. A crest of lance-shaped scales from nape to above vent, more prominent in males. Males with swollen cheeks and a small gular pouch during breeding season. Colour greyish or muddy, changable as per habitat. Size 8.6-14 cm. from snout to vent; tail 29-35 cm, females smaller in size.

Distribution : : India : Delhi and throughout. *Elsewhere* : Afghanistan; Pakistan; Sri Lanka; Malaysia; Indonesia; China; Hong Kong; Indo-Chinese countries.

Remarks : An arboreal lizard, living on garden hedges, bushes, shrubs etc. in plains and hills up to 2134 altitutde. Feeds primarily on insects particularly ants, spiders, centipedes, conchostracan crustaceans; small birds, nestlings, frogs, rodents, plant leaves, seeds etc. also taken. Breeding season extends from summer to rainy season and 6-25 eggs are laid in different clutches in a hole dug by the female itself in soft soil or flower bed.

Genus *Sitana* Cuvier

1829. *Sitana* Cuvier, *Regne. Anim*, ed 2., 2 : 43 (type-species : *Sitana ponticeriana* Cuvier).

6. *Sitana ponticeriana* Cuvier
Fan-throated Lizard

1844. *Sitana ponticeraina* Cuvier, *L.C.S.* (type-locality : Pondichery).

1935. *Sitana ponticeraina* : Smith, *Faun. Brit. India*, 2 : 144-146.

1992. *Sitana ponticeraina* : Tikader and Sharma, *Handbook Indian Lizards* : 83--84, pl. 3 A, Map 24.

Local name : Jungli Chipkali.

Material examined : Delhi : 1 ex. (40+103 mm), Asola-Bhatti Wildlife Sanctuary, 26.vii.1995, coll. J.P.Sati & party.

Diagnostic characters : Body compressed, covered with regular keeled scales. 5th toe absent. Male with low nuchal crest and very large folding gular appendage extending backwards up to belly. Colour brownish abvoe, with a series of darker black-edged, rhomboidal vertebral spots; whitish below. Throat-fan of male brilliantly coloured (blue, black and red) during breeding season. Size from snout to vent 4-8 cm, tail 6-17 cm.

Distribution : India : Delhi and throughout except east of Ganges and above Himalayan foot hills. *Elsewhere* : Sri Lanka.

First record from Delhi.

Remarks : Inhabits scrub and sandy areas. Fast runner. Food consists of ants and other insects; records of feeding on lizards of its own or other kinds also available. Breeding takes place during summer period when female lays 6-14 eggs in a cluth and burries under the soil.

Genus *Uromastix* Merrem

1820. *Uromastix* Merrem, *Tent. Syst. Amphib.* : 12(as *Uromastyx* : 56) (type-species : *spinips*).

7. *Uromastix hardwickii* Gray
Spiny-tailed Lizard

1827. *Uromastix hardwickii* Gray, *Zool. J.*, 3 : 219 (type-locality : Kanauj district, U.P).
1935. *Uromastix hardwickii* : Smith, *Faun. Brit. India*, 2 : 244-247, fig. 63.
1964. *Uromastix hardwickii* : Raj and Sehgal, *Census of India 1961, Delhi* : 10.
1976. *Uromastix hardwickii* : Raza et al., In : *Delhi Gazetteer* : 29.
1991. *Uromastix hardwickii* : Kalpavriksh ,*The Delhi Ridge Forest* : 12,33.
1992. *Uromastix hardwickii* : Tikader and Sharma, *Handbook Indian Lizards* : 117-118. pl. 36-B, Map 21.
1994. Spiny-tailed Lizard : Malik et al., *Saving the Delhi Ridge* : 37.

Local names : Salma, Sanda.

Material examined : From literature.

Diagnostic characters : Body depressed. Head small, broad; upper labials 12-14, denticulated. Eyes small. Ear opening a vertical slit, deeply sunk, anterior margin slightly denticulate. Tail thick at base, depressed, characterstic with whorls of enlarged spinose scales. Head-scales unequal, smooth or obtusely keeled; dorsal scales very small, subequal, mostly smooth with or without scattered larger ones; ventrals squarish, smooth; gular scales rounded, much smaller; a series of enlarged scales on each side of jaw parallel with-intralabials, separated from them by 3-8 rows of smaller scales. Skin of neck and sides very loose, having wrinkled appearance. Limbs strong, short, hind limb with spinose tubercles. Preano-femoral pores (12-18, on each sides)

present. Colour sandy, yellowish-brown or olive with black spots and vermiculations; thigh with a distinctive black spot. 41.5 cm in total length, females shorter; males bear comparatively longer tail.

Distribution : India : Delhi, Uttar Pradesh, Rajasthan, Gujarat, Andhra Pradesh. *Elsewhere* : Pakistan.

Remarks : Inhabits arid or semi-arid areas and lives in burrows dug by itself; generally seen basking near the entrance of burrow. Herbivorous, feeding on grasses, tender leaves, flowers, fruits etc.; hatchlings also take small insects. Breeds during summer months when female lays 8-20 oval eggs in the burrow itself. Excessively killed for its alleged medicinal properties and hence its population has been depleted alarmingly during the past and may be included in Wildlife (Protection) Act, 1972.

Status : Protected species under :-

Appendix II, CITES.

Family : GEKKONIDAE

Diagnostic characters : Body depressed, covered with soft skin, with granules or tubercles, rarely imbricate scales above, with imbricate scales below; regular osteoderms absent. Symphysial shields on head absent. Eyes usually without movable eyelids. Teeth pleurodont; tongue moderately elongate, broad, covered with villose papillae, protrusible. Tail fragile. Skull wihtout bony temporal or post orbital arches; mandible composed of fine bones; clavicle usually dilated.

Genus *Hemidactylus* Oken

1817. *Hemidactylus* Oken *Isis* : 1183 (type-species : *Gecko tuberculosus* Daudin).

Key to species

Back with large keeled or sub-trihedral tubercles, arranged in longitudinal rows; 6-10 lamellae under 4th toe, male with 7-16 preano-femoral pores on each side.....*Hemidactylus brooki* Gray

Dorsal surface with minute, smooth tubercles, intermixed with larger feebly keeled tubercles; 11-14 lamellae under 4th toe; male with 5-7 femoral pores on each side.....*Hemidactylus flaviviridis* Ruppell

8. *Hemidactylus brooki* Gray

Spotted Brook's Gecko

1845. *Hemidactylus brookii* Gray, *Cat. Liz. Brit. Mus.*, : 153 (type-locality : *Borneo*).

1935. *Hemidactylus brooki* : Smith, *Faun. Brit. India*, 2 : 84, 89-91, fig. 28.

1992. *Hemidactylus brooki* : Tikadar and Sharma, *Handbook Indian Lizards* : 49, 53-54, pl. 28-B,

Map 17.

Local name : Jungli Chhipkali.

Material examined : Delhi : 1 ex. (62 mm with tail, tail broken), Najafgarh, 27.x.1993, coll. N.K.Sinha & party; 3 exs. (2, tail broken, SL 40 mm, 1 complete TL 95 mm, SL 43 mm), Nila Talab side nr. Qutubudin's Idgah, Mahrauli area, 12.v.1994, coll. Akhlaq Husain & party; 1 ex. (45 mm), Gurjar Ghat, Yamuna bridge, Wazirabad, 8.ix.1994; 2 exs. (75, 80 mm), IARI Campus, 11.ix.1994; 2 exs. (1, complete, 60 mm; 1, 38 SL, tail broken), Lodhi Garden, 15.ix.1994, coll. J.P.Sati & party; 1 ex. (35 mm SL), Humayun Tomb Complex, Mathura road, 14.xii.1994; 2 exs., along nala across Okhla barrage/reservoir, 18.xii.1994; 2 exs., A.N. Jha Deer Park, Hauz Khas area, 22.xii.1994; 2 exs., Jahanpanah Park, Chiragh Dilli, 22.xii.1994, coll. Akhlaq Husain & party; 1 ex., Yamuna barrage side, Wazirabad, 11.ii.1995; 2 exs., Tughlaqabad Park, 12.ii.1995; 1 ex., Asola-Bhatti Wildlife Santuary, 12.ii.1995; 1 ex., Budha Jayanti Park; 15.ii.1995; 2 exs., Hauzkhas Park, 15.ii.1995; 2 exs. Jahanpanah Park, 15.ii.1995; 2 exs., Piggery Farm, Dhaulakuan area, 16.ii.1995; 2 exs., Kamla Nehru Ridge, 17.ii.1995; 6 exs., IARI Campus, 19.ii.1995; 1 ex. (60 mm), Jahanpanah Park, 23.vii.1995, coll. J.P.Sati & party.

Diagnostic characters : Upper labials 8-12, lower labials 7-9. 5-6 lamellae under 1st toe and 6-10 under 4th toe. Male with 6-12 (rarely 16) preano - femoral pores on each side. Tail much longer than combined head and body length, depressed, swollen at base, with series of 6-8 long, pointed and keeled tubercles on its upper surface. Back granular with conical and keeled tubercles arranged in 16-20 longitudinal rows. Colour brownish or greyish above with dark brown spots; a dark streak on side of head; dirty whitish below. Maximum length from snout to vent 6 cm; tail 7.5 cm.

Distribution : India : Delhi and throughout. *Elsewhere* : Pakistan; Sri Lanka; Myanmar; China; Indonesia; Singapore; East Indian Archipelago; northern half of Africa; West Indies.

First record from Delhi.

Remarks : Lives under and stones and bark of dead tree trunks, in crevices and old deserted buildings etc. Feeds on insects, spiders and their nymphs, land molluscs, seeds of wild bushes etc. Breeding takes place during summer months when female lays two small spherical eggs in a single clutch which hatch out in about 40 days time.

9. *Hemidactylus flaviviridis* Ruppell
Yellow-bellied House Gecko

1835. *Hemidactylus flaviviridis* Ruppell, *Neue Wirb. Faun. Abyss.* : 18, pl. 6, fig. 2 (type-locality : Massaua Is., Eritrea).
1935. *Hemidactylus flaviviridis* : Smith, *Faun. Brit. India*, **2** : 85-95.
1964. *Hemidactylus flaviviridis* : Raj and Sehgal, *Census of India 1961, Delhi* : 10.
1976. *Hemidactylus flaviviridis* : Raza et al., In : *Delhi Gazetteer* : 29.
1991. *Hemidactylus flaviviridis* : Kalpavriksh, *The Delhi Ridge Forest* : 12, 33.
1992. *Hemidactylus flaviviridis* : Tikadar and Sharma, *Handbook Indian Lizards* : 50, 60-61, pl.

29-B, Map.

Local name : Chhipkali.

Material examined : Delhi : 1 ex. (95 mm), Farmer's Hostel Compound, IARI, 16.xii.1994, coll. Akhlaq Husain & party and seen several other specimens at night on light.

Diagnostic characters : Body moderate, depressed. Upper labials 12-15, lower labials 10-12. Pupil vertical. 7-10 lamellae under 1st toe and 11-14 under 4th toe. Male with 5-7 femoral pores on each side. Tail almost equal to combined head and body length, depressed, swollen at base, series of elongated tubercles on its upper surface. Dorsal surface finely granular with some prominent, feebly keeled tubercles. Colour pale-grey or greenish-grey above, may be with dark transverse undulating bands; yellowish below. Maximum length from snout to vent 9 cm; tail as long as length.

Distribution : : India : Delhi, northern India (north of latitude 20° N). *Elsewhere* : Iran; Arabia; Pakistan; Bangladesh; shores of Red Sea.

Remarks : Commonly found inside human habitations. Nocturnal in habit and feeds on insects found in the area of its habitat, attracted on light of various kinds. Breeds during summer, female lays two small spherical eggs in a clutch in a crevice or hole. Hatching period varies from 53 to 57 days.

Family : SCINCIDAE

Diagnostic characters : Body cylindrical, covered with cycloid, imbricate scales, with osteodermal plates, each provided with regular system of channels; head with symmetrical shields above; tongue moderately long, covered with imbricate scale-like papillae, feebly nicked anteriorly; teeth pleurodont; eyes with movable eyelids, round pupil; limbs present or absent; tail fragile, no femoral or preanal pores. Premaxillary double or united anteriorly; preorbital arch complete (except in degenerate forms); post-fronto-squamosal arch complete. Skull with bony dermal plates roofing over supratemporal opening.

Key to genera

Pterygoid bones separated from one another; palatal notch extending forwards to level of middle of eye; limbs well developed.....*Mabuya* Fitzinger
Pterygoid bones usually in contact anteriorly; palatal notch not reaching level of middle of eye; limbs short or vestigial.....*Riopa* Gray

Genus *Mabuya* Fitzinger

1815. *Mabuya* Refinesque, *Anal. Nat.* : 76 (*nom. nud.*).
1826. *Mabuya* Fitzinger, *Neue Class. Rept.*, : 23, 52 (type-species *Lacertus mabouya* de la Cepede).

10. *Mabuya dissimilis* (Hallowell)

Striped Grass Skink

1857. *Euprepis dissimilis* Hallowell, *Trans. Amer. Phil. Soc.*, (2) 11 : 78 (type-locality : Bengal).

1935. *Mabuya dissimilis* : Smith, *Faun. Brit. India*, 2 : 261-262.

1964. *Mabuya dissimilis* : Raj and Sehgal, *Census of India 1961, Delhi* : 10.

1976. *Mabuya dissimilis* : Raza et al., In : *Delhi Gazetteer* : 29.

1991. *Mabuya dissimilis* : Kalpavriksh, *The Delhi Ridge Forest* : 12,33.

1992. *Mabuya dissimilis* : Tikader and Sharma, *Handbook Indian Lizards* : 121, 123, pl. 17-B, Map 25.

Local name : Lotan.

Material examined : From literature.

Diagnostic characters : Supranasals in contact with each other; fronto-nasal broader than long; prefrontals in contact with each other. Ear-opening oval; temporal scales keeled. Lower eylids with a semi-transparent disc. Digits short with 12-16 smooth lamellae under 4th toe. 34-38 scales round the body; dorsal scales with 2-3 keels. Colour light brown with 3 or more greenish - white stripes on back; lighter below.

Distribution : India : Delhi, Rajasthan, Uttar Pradesh, Himachal Pradesh, Bihar, West Bengal, Madhy Pradesh. *Elsewhere* : Pakistan.

Remarks : Lives under and around bushy areas. Diurnal in habit. Insectivorous. Oviparous,laying 6-7 eggs.

Genus ***Riopa*** Gray

1839. *Riopa* Gray. *Ann. nat. Hist.*, 2 : 332 (type-species : *Lygosoma punctata* Boulenger).

11. ***Riopa punctata*** Gray

Striped Skink

1799. *Scincus punctatus* Gmelin, *Hist. Amphb.* : 197 (based on seba's fig.2, pl. 12, fig. 6).

1935. *Riopa punctata* : Smith, *Faun. Brit. India*, 2 : 313, 318-319.

1992. *Riopa punctata* : Tikader and Sharma, *Handbook Indian Lizards* : 145, 147, pl. 39-B, Map 43.

Local name : Lal-punchwali.

Material examined : Delhi : 1 ex. (juvenile), Dhaulakuan, Lake Garden, 10.vi.1993, coll. Vinod Khanna & party; 1 ex. IARI Campus, 24.x.1993, coll. N.K.Sinha & party; 1 ex. (76 mm), Gurjar Ghat, Yamuna bridge, Wazirabad, 8.ix.1994; 1 ex. (65mm SL), Municipality Nursery, Punjabi Bagh, 14.ix.1994; 1 ex. (100 mm), Kamla Nehru Ridge area, Rajpur road, 14.ix.1994; coll. J.P.Sati & party; 1 ex. (40 mm SL; tail broken), Humayun Tomb, Mathura road, 14.xii.1994; 1 ex. (35 mm SL, tail broken); Majnu-kal-Tila nr. Wazirabad Water Works, 15.xii.1994; 1 ex. (108 mm), Farmer's Hostel Compound, IARI, 16.xii.1994; 3 exs., Ramghat, Yamuna reservoir,

Wazirabad area, 17.xii.1994; 3 exs., Okhla area, 18.xii.1994; 1 ex. (100 mm), nr. Nala across Okhla barrage/reservoir, 18.xii.1994, 1 ex. (34 mm SL, tail regenerated), Qutub Minar Complex, 21.xii.1994; 5 exs., Jahanpanah Park, Chiragh Dilli, 22.xii.1994; 6 exs., Asiad Village, Hawa Singh Block, 23.xii.1994, coll. Akhlaq Husain & party; 6 exs., Zoological Park, 10.ii.1995; 1 ex., Yamuna barrage side, Wazirabad, 11.ii.1995, 1 ex., Bhalswa Lake side, 11.ii.1995; 15 exs., Tughlaqabad Park, 12.ii.1995; 4 exs,, Lodhi Garden, 13.ii.1995; 5 exs., Humayun Tomb Complex, 14.ii.1995; 1 ex., Okhla reservoir site., 14.ii.1995; 9 exs., Budha Jayanti Park, 15.ii.1995; 32 exs., Hauzkhas Park, 15.ii.1995; 5 exs., Jahanpanah Park, 15.ii.1995; 159 exs., Piggery Farm, Dhaulakuan area, 16.ii.1995; 6 exs., Lake Garden, Dhaulakuan, 16.ii.1995; 6 exs., Kamla Nehru Ridge, 17.ii.1995; 2 exs., (1, 27 mm SL, 2, 63 mm TL), Humayun Tomb, 28.vii.1995; 1 ex. (70 mm), Kamla Nehru Ridge, 28.vii.1995, coll. J.P.Sati & party.

Diagnostic characters : : Snout obtuse, supralabials 7, 5th below eye. Supranasals in contact with each other behind rostral, frontal longer than fronto-parietals and inter-parietals together, a pair of nuchals (rarely absent); an enlarged temporal scale bordering outer marign of parietal. Ear-opening with 1-2 minute lobules anteriorly. Lower eyelid with semitransparent disc. 24-28 smooth scales round the body. 11-14 keeled lamellae under 4th toe. Colour brownish above, scales having a dark based spot which in juveniles confluent into 4-6 lines; a pale dorso-lateral stripe present on each side; yellowish-white below; tail mostly orange. Size from snout to vent 8.5 cm, tail a little longer.

Distribution : India : Delhi and widely distributed (up to Subathu, Shimla Hills). *Elsewhere* : Sri Lanka; Vietnam.

First record from Delhi.

Remarks : Lives in moist soil and under stones, old bricks and logs or debris. Food consists of insects etc. Eggs, after laying, covered under the soil by female.

Family : VARANIDAE

Diagnostic characters : Body stout, somewhat depressed, covered with smal scales, back with roundish or oval scales, surrounded by rings of granules (except in young ones); ventral scales squarish, arranged in transverse series. Tongue smooth-slender, very long, bifid, retractile into a sheath at base as in snakes. Teeth pleurodont, palate toothless. Eyelids well-developed; pupil round. Tail long, not fragile, preanal pores present, a single pair, opening just in front of vent. Postorbital arch incomplete; temporal arch complete; supratemporal fossa not roofed over; premaxillary single, narrow; nasals narrow, united; intraorbital vacuity bounded by pterygoid; palatine and ectopterygoid bones, maxillary excluded; epipterygoid present; clavicle slender; inter-clavicle anchor-shaped.

Genus *Varanus* Merrem

1815. *Varanus* Refinesque, *Anal. Nat.* : 75 (*nom. nud.*).

1820. *Varanus* Merrem, *Tent. Syst. Amph.*, : 13, 58 (type-species : *Lacerta varia* Shaw).

12. *Varanus monitor* (Linnaeus)
Common Monitor

1758. *Lacerta monitor* Linnaeus, *Syst. Nat.* ed.10 : 201 (type-locality : India).
1802. *Tupinambis bengalensis* Daudin, *Hist. Nat. Rept.*, 3 : 67 (type-locality : Bengal).
1935. *Varanus monitor* : Smith, *Faun. Brit. India*, : 2 : 400, 402-403.
1964. *Varanus monitor* : Raj and Sehgal, *Census of India 1961, Delhi* : 10.
1976. *Varanus monitor* : Raza et al., In : *Delhi Gazetteer* : 29.
1983. *Varanus bengalensis* : Daniel, *The Book of Indian Reptiles* : 58-60.
1991. *Varanus bengalensis* : Kalpavriksh, *The Delhi Ridge Forest*, : 12,33.
1992. *Varanus bengalensis* : Tikader and Sharma *Handbook Indian Lizards* : 179, 180-181, pl. 40-B, Map 48.
1994. Indian Monitor Lizard : Malik et al., *Saving the Delhi Ridge* : 37.
1995. Monitor Lizard : Gaur, *Srishti*, 2(1) : 36 (Najafgarh drain, Delhi).

Local name : Goh.

Material examined : From literature.

Diagnostic characters : Snout long, obtusely rounded at its tip. Nostrils, oblique slits nearer to eye than tip of snout. Characteristically, scales on crown larger than those on neck region and those of anterior part rounded and keeled posteriorly. Tongue very long, forked and prostrusible. Teeth long, pointed, slightly compressed. Tail strongly compressed with a low double-toothed crest above, lateral scales keeled. Colouration brown or olive above with blackish dots, yellowish below. Young dark olive, with transver rows of pale ocellei alternating with blackish bars. Size head and body 75 cm and tail 1 m.

Distribution : India : Delhi and throughout and Great Nicobar. *Elsewhere* : Iran; Afghanisatan; Uzbekistan; Pakistan; Nepal; Bangladesh; Sri Lanka; Myanmar.

Remarks : Lives in all types of biotopes from forests to deserts occupying burrows, hollows of old trees, crevices, clumps of vegetation etc. Good climber and swimmer. Carnivorous, feeding on small mammals, birds and their eggs, crocodile eggs, lizards, snakes, turtles, fishes, crustaceans insects, arachnids, etc. Breeding takes place during and around monsson months when female lays 8-30 eggs in a clutch in holes and later covers with leaves, debris etc.

"*V. monitor* is the correct name for this species, usually called *bengalensis*. It was first described by Linnaeus in 1758, his description being based upon some beautiful coloured figures in Seba's Illustrations of Natural History. The drawings are very accurate and there can be no doubt as to the identity of the species. Daudin's *bengalensis* was not published until 1802" Smith (1932).

Status : Protected species under :

i. Schedule I, Wildlife (Protection) Act, 1972.
ii. Endangered Category, The Red Data Book on Indian Animals, 1994 (Z.S.I).

iii. Appendix I, CITES.

Order : SERPENTES

Key to families

1. Eyes vestigial; body worm-like; teeth in upper jaw.....Typhlopidae
- Eyes not vestigial; teeth in both jaws.....2

2. Vestiges of hind limbs present.....Boidae
- Vestiges of hind limbs absent.....3

3. Poison fangs present.....4
- Poison fangs absent.....Colubridae

4. Teeth present behind poision fangs; pupil rounded.....Elapidae
- Teeth absent behind poision fangs; pupil vertical.....Viperidae

Family : BOIDAE

Diagnostic characters : Palato-maxillary arch movable; premaxillary teeth present or absent; pterygoid extending to the quadrate; prefrontal in contact with the nasal; supratemporal attached scale-like to cranium, supporting quadrate; dentary firmly attached to articular; coronoid bone present. Vestiges of pelvics and hind limbs, terminating in a claw-like spur, usually visible on each side of vent, longer in male than in female.

Key to genera

Suborbital bone present; teeth on premaxilla present; head covered with large shields; labials pitted.....*Python* Daudin
Suborbital bone absent; teeth on premaxilla absent; head covered with small shields; labials not pitted.....*Eryx* Daudin

Genus *Eryx* Daudin

1803. *Eryx* Daudin, *Mag. Encyclop, An.*, 8, 5(20) : 437 (type-species : *turcicus* Daudin).

13. *Eryx johnii* (Russell)
John's Sand Boa

1801. *Boa johnii* Russell, *Ind. Serp.*, 2 : 18,20, pls. 16,17 (type-locality : Tranquebar).
1943. *Eryx johni johni* : Smith, *Faun. Brit. India*, 3 : 112, 113-114, fig. 35.
1964. *Eryx johnii* : Raj & Sehgal, *Census of India 1961, Delhi* : 11.
1976. *Eryx johnii* : Raza et al., In : *Delhi Gazetteer* : 29.
1991. *Eryx johni* : Kalpavriksh, *The Delhi Ridge Forest* : 12, 33.

Local names : Domui, Dumaii.

Material examined : From literature.

Diagnostic characters : D.53-67, V.190-210, S.C.20-34.

Body thick. Upper jaw overhangs chin. Supralabials 9-12, infralabials 13-18. Nostrils high, slit-like and placed between two enlarged shields. Eyes small, pupil vertical. Mental groove present. Tail short, stumpy. Scales small, more or less slightly keeled; head scales a little longer. Colour sandy or brownish above, whitish below mottled with brown. 1.25 m in length, males shorter.

Distribution : India : Delhi, Uttar Pradesh, Punjab, Rajasthan, Andhra Pradesh, Tamil Nadu. *Elsewhere* : Afghanistan; Pakistan.

Remarks : Generally confined to drier parts. Burrowing and nocturnal in habit. Feeds on rats, mice, squirrels, lizards and other snakes. Ovo-viviparous, 6-8 young are born at a time. Non-venomous.

Status : Protected species under :-
Appendix II, CITES.

Genus *Python* Daudin

1803. *Python* Daudin, *Mag. Encyclop. An.*, 8, 5(20) : 434 (type-species : *molurus*).

14. *Python molurus molurus* (Linnaeus)
Indian Python or Rock Python

1758. *Coluber molurus* Linnaeus, *Syst. Nat.*, 10th ed : 225 (type-locality : India).
1943. *Python molurus molurus* : Smith, *Faun. Brit. India*, 3 : 106-109.
1964. *Python molurus* : Raj & Sehgal, *Census of India 1961, Delhi* : 11.
1976. *Python molurus* : Raza et al., In : *Delhi Gazetteer* : 29.
1991. *Python molurus* : Kalpavriksh, *The Delhi Ridge Forest*, : 12, 33.
1995. Python : Gaur, *Srishti*, 2(1) : 36 (Najafgarh drain area, Delhi).
1996. Python : Anonymous, *Newsl. IZDA/CZA*, 4(1-2) : 7 (non-captive, National Zoological Park, Delhi).

Local name : Ajgar

Material examined : : From literature.

Diagnostic characters : D.50-75, V.245-270, S.C. 58-73.

Head depressed, covered with large shields; snout long. Nostrils large, directed upwards. Rostral and first two labials with sensory pits; 11-13 supralabials, 6th or 7th touching eye. Eyes small, pupil vertical. Chin with mental groove. Tail short, prehensile, tapering abruptly. Colour sandy-yellowish above with brownish rhomboidal dark edged patches on body and a spear-shaped mark on head, light yellowish below. 7 m. in length (normally 2.5-4.5 m).

Distribution : India : Delhi, Peninsular India to extreme limit of Punjab in north-west and West Bengal in north-east and Andaman and Nicobar Is. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka.

Remarks : Inhabits forested areas and in the vicinity of water sources. A good climber. Nocturnal, resting during day and hunting at nigh. Feeds mainly on warm-blooded animals (mammals, birds), but also occasionally on monitor lizards. It can even over come a Chinkara (Jasdan, 1953) depending on its size and food available, killing prey by constriction. Females (depending on its size) lays 8-107 elongated eggs in a clutch, coils round and incubates. Non-venomous but dangerous.

Status : Protected species under :

i. Schedule I, Wildlife (Protection) Act, 1972.

ii. Vulnerable category, under 1993 IUCN Red List of Threatened Animals.

iii. Endangered category, The Red Data Book on Indian Animals, 1994 (Z.S.I).

iv. Appendix I, CITES.

Family : COLUBRIDAE

Diagnostic characters : Facial bones movable; prefrontal not in contact with nasal; supratemporal attached loosely to skull, suspending guadrate; mandible without coronoid bone; teeth solid or posterior 2-3 grooved; hypapophyses present or absent on posterior dorsal vertebrae.

Key to genera

1. All teeth solid; hypapophyses present throughout vertebral column.....2
- All teeth not solid; hypapohyses absent on posterior vertebrae.....*Psammophis* Fitzinger

2. Head deperessed; pupil vertical 3
- Head not depressed; pupil round.....4

3. Head not or slightly deistiinct from neck; dorsal scales in 15-19 rows.....*Lycodon* Fitzinger
- Head scarcely distinct from neck; dorsal scales in 19-33 rows.....*Enydris* Latreille

4. Maxillary teeth 12-18.....5
- Maxillary teeth 20-28.....6

5. Maxillary teeth 12-14; dorsal scales in 21-23 rows, smooth.....*Argyrogena* Werner
- Maxillary teeth 16-18; dorsal scales in 27-33 rows, more or less keeled.....
.....*Spalerosophis* Jan

6. Maxillary teeth 20-28; dorsal scales in 13-17 rows, smooth (or median row more or less keeled).....*Ptyas* Fitzinger

- Maxillary teeth 22-28; dorsal scales in 19 rows, keeled with apical pits (outer 1-2 rows smooth).....*Xenochrophis* Gunther

Genus *Argyrogena* Werner

1924. *Argyrogena* Werner, *Sitz. Ber. Akad. Wiss, Wien,* 133 : 50 (type-species : *rostrata*).

15. *Argyrogena fasciolatus* (Shaw)
Banded Racer or Banded Ratsnake

1802. *Coluber fasciolatus* Shaw, *Gen. Zool.*,3 : 528.
1943. *Colober fasciolatus* : Smith, *Faun. Brit. India,* 3 ; 167, 170-171.
1964. *Zamenis fasciolatus* : Raj & Sehgal, *Census of India 1961, Delhi* : 11.
1976. *Zamenis fasciolatus* : Raza et al., *In : Delhi Gazetteer* : 29.

Local names : Pattidar, Kauria Sanp.

Material examined : : From literature.

Diagnostic characters : D.21 or 23, V.197-225, A.2, S.C.77-92.

Body robust. Head somewhat distinct from neck, depressed. Upper jaw projecting. Supraorbitals 8, 4th, 5th & 6th touching eye. Scales smooth. Colour olive brown above with dark brown or black narrow cross bars on anterior part of body. Head with two white spots; older individuals uniform brown in colour; whitish or yellowish below. Lenght 1.27 m, female shorter.

Distribution : India : Delhi, Uttar Pradesh, Madhya Pradesh, Bihar, West Bengal, Karnataka, Maharashtra; Gujarat. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka.

Remarks : Prefers forested areas, occasionally open and urban areas. Feeds on rat, frogs, insects etc. depending on age. Female lays 2-6 eggs in ground during winter. Non-venomous.

In Konkan (Maharashtra) it is believed to be the female of Cobra, probably because of its plucky and vicious nature and erecting the forebody with flattening the part behind the neck like a Cobra, when molested (Daniel, 1983).

Genus ***Enhydris*** Latreille

1801. *Enhydris* Latreille, *Suite a Deterville ed. Buffon, Rept.*, **4** : 200 (type-species : *caerulea* = *enhydris*).

16. ***Enhydris sieboldi*** (Schlegel)
Smooth Water Snake

1837. *Homalopsis sieboldii* Schlegel, *Phys. Serp.*, **2** : 349, pl. 13, figs. 4-5, (type-locality : Bengal).

1943. *Enhydris sieboldi* : Smith, *Faun. Brit.India*, **3** : 389-390 (Delhi).

Local name : Pani ka Sanp.

Material examined : From literature.

Diagnostic characters : D.29(rarely 31), V.147-158, A.2, S.C. 48-56.

Body stout. Snout blunt, squarish. Internasals longitudinally divided, touching or just separated from loreal. Supralabials 7-8, 4th touching eye. Anterior pair of genials much larger than posterior pair. Scales smooth. Colour buff or greenish above with rhomboidal dark transverse spots on back and a series of roundish spots on sides alternating with dorsal spots. Head with three dark brown longitudinal stripes, confluent between eyes. Lower surface whitish, checkered with black. 89 cm in length.

Distribution : India : Delhi, Uttar Pradesh, Bihar, Bengal, Assam, excepting arid zones. *Elsewhere* : Bangladesh; Myanmar.

Remarks : Aquatic. Feeds on frogs, fishes, crustaceans,etc.

Genus ***Lycodon*** Fitzinger

1826. *Lycodon* Fitzinger, *Neuc Classif. Rept.*, : 29, 57.

1826. *Lycodon* Boie, In : *Ferussac's Bull. Sci. Nat.*, **9** : 238 (*partim*).

17. ***Lycodon aulicus*** (Linnaeus)
Common Wolf Snake

1874. *Coluber aulicus* Linnaeus, *Mus. Adolph. Frider,* **1** : 29, pl. 12, figs. 2 (type-locality :not known).

1943. *Lycodon aulicus* : Smith, *Faun. Brit. India*, **3** : 257, 263 - 266, fig. 89.

1964. *Lycodon aulicus* : Raj & Sehgal, *Census of India 1961, Delhi* : 11.

1976. *Lycodon aulicus* : Raza et al., In : *Delhi Gazetteer* : 29.

1991. *Lycodon aulicus* : Kalpavriksh, *The Delhi Ridge Forest* : 12, 33.

Local name : Kauriwala Sanp.

Material examined : From literature.

Diagnostic characters : D.17, V.172-214, S.C.57-80, A.2.

Head pear-shaped, depressed; neck constricted. Snout more or less spatulate projecting beyond lower jaw. Anterior and posterior nasals sub-equal, touching first and second labials. Loreal in contact with internasal, not touching eye. Supralabials 9, 3rd to 5th touching eye. Anterior pair of genials little longer than posterior. Scales smooth; ventrals angulate laterally. Colour greyish-brown or brown above with whitish cross bars enclosing triangular patches; whitish below. 90.5 cm in length (over 61 cm rare), females shorter.

Distribution : India : Delhi and throughout including Andaman and Nicobar Islands. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka; Maldives Is; Mauritius (introduced); Myanmar; Malaysia; Hong Kong; China; Indonesia; Philippines.

Remarks : Lives near and in human dwellings in plains and hills up to 2743 m (Waltner, 1975). Noctrunal. Climbs well on bushes, small trees, ceilings etc. Food consists of frogs, lizards, small birds, mice etc. Mostly breeds twice a year when female lays 3-11 eggs in a clutch. Non-venomous but often confused with Common Krait for its almost identical colour pattern and long teeth on upper and lower jaws, mistaken for fangs and hence any fatality resulting from its bite is purely due to fright and shock.

Smith (1943) recognised two colour forms *L. aulicus aulicus* (India, Nepal, Sri Lanka and Myanmar, north of lat. 17°) and *L. aulicus capucinus* (rest of range and Myanmar south of lat. 24°). Since the distribution of both the forms is overlapping in Myanmar and in occasional individuals of both forms markings are lost entirely and specimens become uniform brown above and whitish below, the two colour forms appear to be the synonyms.

Genus *Psammophis* Fitzinger

1826. *Psammophis* Fitzinger, *Neue Classif. Rept.* : 29, 59 (type-species : *Sibilanas*).

18. *Psammophis leithi* Gunther
Leith's Sand Snake

1869. *Psammophis leithi* Gunther, P.Z.S. : 505, pl. 39 (type-locality : Sind).
1943. *Psammophis leithi* : Smith, *Faun.Brit. India*, 3 : 363, 366-367, fig. 115.
1964. *Psammophis leithi* : Raj & Sehgal, *Census of India 1961, Delhi* : 11.
1976. *Psammophis leithi* : Raza et al., In : *Delhi Gazetteer* : 29.
1991. *Psammophis leithi* : Kalpavriksh, *The Delhi Ridge Forest* : 12, 33.

Local name : Dhariwala Sanp.

Material examined : From literature.

Diagnostic characters : D.17, V.159-185, A.1, S.C.92-100.

Head elongate. Snout obtuse. Eyes large. Supralabials 8, 4th and 5th touching eye.

Colour light yellowish-brown above with four dark brown longitudinal stripes, two each on either side of vertebral line, also a dark streak on top of head. 1 m in length.

Distribution : India : Delhi, Jammu & Kashmir, Punjab, Rajasthan, Uttar Pradesh, Gujarat, Maharashtra. *Elsewhere :* Pakistan.

Remarks : Lives in bushy areas in plains and hills up to 914 m (Waltner, 1975). Timid in disposition. Feeds on frogs, lizards, rodents etc. Non-venomous.

Genus ***Ptyas*** Fitzinger

1843. *Ptyas* Fitzinger, *Syst. Rept.*, : 26 (type-species : *Coluber blumenbachii*).

19. ***Ptyas mucosus*** (Linnaeus)
Rat Snake

1758. *Coluber mucosus* Linnaeus, *Mus. Ad. Frid.* **1** : 37. pl. 23 & *Syst. Nat. ed.* **10** : 226 (type-locality : India).
1943. *Ptyas mucosus* : Smith, *Faun. Brit. India,* **3** : 159-162, fig.49.
1964. *Zamenis mucosus* : Raj & Sehgal, *Census of India 1961, Delhi* : 11.
1976. *Zamenis mucosus* : Raza et al., In : *Delhi Gazetteer* : 29.
1991. *Ptyas mucosus* : Kalpavriksh, *The Delhi Ridge Forest,* 12, 13.
1996. Rat Snake : Anonymous, *Newsl. IZDA/CZA,* 4 (1-2) : 7 (non-captive, National Zoological Park, Delhi).

Local names : Dhaman, Dhamin.

Material examined : : From literature.

Diagnostic characters : D.16-17, V.190-213, A.2, S.C.100-146.

Body robust, tapering towards both ends. Head elongate; neck distinctly constricted. Eyes large; pupil rounded. Nostrils large. Supralabials 8, 4th and 5th touching eye. Scales smooth, median row more or less keeled. Colour olive-green or brownish above with irregular or reticulate dark cross bars on posterior part of body; young ones with more or less distinct light and dark-edged cross bars on anterior part of body also; light yellowish below. Labials and ventrals and subcaudals edged with black. 3.75 m in length (generally 1.65 to 2 m), females shorter

Distribution : India : Delhi and widely distributed including Andaman Islands. *Elsewhere* : Turkey; Afghanisatn; Pakistan; Nepal; Bangladesh; Sri Lanka; China; Indo-Chinese region; Myanmar; Indonesia.

Remarks : Mainly inhabitant of plains but recorded up to 3658 m in hills (Waltner, 1974) Frequents open country often in the vicinity of human habitations. Good swimmer and climber. Active during day time. Feeds mainly on rats, also preying on bats, birds, lizards, snakes, turtles, frogs etc. Breeds during summer when female lays 6-16 elongated eggs in a clutch. Non-venomous but often mistaken for Cobra for its enormous size and killed. When caught struggles and strikes with vigour, making a low growling sound, inflating its body and hence feared. `Combat Dance'

between males (where they twine around each other half erecting on ground) is an unusual behaviour of this species. (McCann, 1935; Abdulali, 1941, Morris, 1958; Sethna, 1958; Imam, 1993). The species may be protected under Wildlife (Protection) Act, 1972 as its is excessively killed, being mistaken for Cobra.

Status : Protected speceis under :
Appendix II, CITES.

Genus ***Spalerosophis*** Jan

1865. *Spalerosophis* Jan, In : *Fillipi, Note Viaggio. Persia,* : 356.

20. *Spalerosophis atriceps* (Fischer)
Royal Snake

1885. *Zamenis diadema* var. *atriceps* Fischer, *Jahrb. Hamburg Wiss. Anst.*, **2** : 102 (type-locality : Himalaya).

1943. *Coluber diadema atriceps* : Smith, *Faun. Brit. India*, **3** : 174, 175, fig. 52 (Delhi).

Local names : Ghora-pachar, Rajitbans, Rajitbansar.

Material examined : From literature.

Diagnostic characters : D.29-31 (rarely 27 or 33). V.216-278, A.2, S.C.82-112.

Body strout. Head elongate, distinct from neck. Eyes small, pupil round. Supralabials 10-13, not touching eye. Prefrontals in double rows of small scales, instead of a pair usual in other snakes. Posterior genials usually shorter than anterior. Scales more or less obtusely keeled. Colour pale-brownish above with irregularly scattered dark brown or black spots (scarlet when live); lighter below. 2 m. in length.

Distribution : India : Delhi, Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, Rajasthan.

Remarks : Inhabits semi-arid or arid areas. Feeds largely on rodents but occasional prey includes small birds and lizards, climbing trees if required for the purpose. Breeds during summer season.

Genus ***Xenochrophis*** Gunther

1864. *Xenochrophis* Gunther, *Rept. Brit. India,* : 273 (type-species : *cerasogaster).*

21. *Xenochrophis piscator* (Schneider)
Checkered Keelback

1799. *Hydrus piscator* Schneider, *Hist. Amph.*, **1** : 249 (type-locality : East Indies).

1913. Chequered Snake : Anonymous, *Gazetteer of the Delhi District Part A-1912* : 17.

1943. *Natrix piscator piscator* : Smith, *Faun. Brit. India*, 3 : 293-296, fig.96, A-D.

1964. *Tropidonotus piscator* : Raj & Sehgal, *Census of India 1961, Delhi* : 11.

1976. *Tropidonotus piscator* : Raza et al., In : *Delhi Gazetteer* : 29.

Local name : Pani ka Sanp.

Material examined : : From literature.

Diagnostic characters : D.19, V.122-158, A.2, S.C.6-97.

Body robust. Head oval. Nostrils slit-like, directed slightly upwards. Supralabials 9, 4th 5th touching eye. Eyes small, directed upwards; pupil round. Scales strongly keeled. Colour yellowish or olivaceous above with five rows of black spots, arranged in chess-board-like pattern; head with two oblique streaks, one below and other behind eye; belly whitish. Largest recorded 2 m, male shorter.

Distribution : India : Delhi and throughout. *Elsewhere* : Pakistan; Nepal; Myanmar; Malaysia; China; Taiwan; Indo-chinese region.

Remarks : Most common water snake of rivers, lakes, pond and paddy fields in plains and low hills up to 2743 m (Waltner 1975). Hibernates during winter but on warm days often seen basking on grassy banks. Diurnal in habit. Feeds on frogs and their tadpoles, fish etc. Most prolific breeder in greater part of the year, female lays 8 to 91 elongated eggs in a clutch in a nest hole in the ground near water. Non-venomous but very vicious and bites readily when stepped on or molested.

Interesting behaviour of this snake is the habit of `shamming death' by turning motionless on its back, when attacked by a predator, mongoose etc. (Macdonald, 1947). Smith (1943) recognised four colour forms. Since the species has been included in CITES, it may be protected under Wildlife (Protection) Act, 1972 also.

Status : Protected species under :

Appendix III, CITES.

Family : ELAPIDAE

Diagnostic characters : Poison fangs attached to anterior end of maxillary bone, usually followed by one or more small solid teeth. Head shields normal, loreal absent. Pupil round. Hypapophyses developed throughout vertebral column.

Key to genera

Maxillary bone extending forward beyond palatine; dorsal scales in 13-19 rows; vertebral series of scales generally enlarged (except in *B. lividus*).....*Bungarus* Daudin

Maxillary bone not extending forwards beyond palatine; dorsal scales in 19-25 rows; vertebral

series of scales not enlarged.....*Naja* Laurenti

Genus ***Bungarus*** Daudin

1803. *Bungarus* Daundin, *Mag. Encyclop*, An. 8, 5(20) : 434.

22. *Bungarus caeruleus* (Schneider)
Common Krait

1801. *Pseudoboa caerulea* Schneider, *Hist. Amphib.*, 2 : 284 (type-locality : Vishakhapatnam).
1884. *Chitkauria* : Anonymous, *A Gazetteer of the Delhi District 1883-4* : 21.
1913. *Bungarus caeruleus* : Anonymous, *Gazeetter of the Delhi District Part A-1912* : 17.
1943. *Bungarus caeruleus* : Smith, *Faun. Brit. India*, 3 : 409, 413-415, fig, 134 (Map).
1964. *Bungarus caeruleus* : Raj & Sehgal, *Census of India 1961, Delhi* : 11.
1976. *Bungarus caeruleus* : Raza et al., In : *Delhi Gazetteer* : 29.
1991. *Bungarus caeruleus* : Kalpavriksh, *The Delhi Ridge Forest* : 33.
1996. Krait, Anonymous, *Newsl. IZDA/CZA*, 4 (1-2) : 7 (non-captive, National Zoological Park, Delhi).

Local names : Karait, Karet, Suraj-mukhi.

Material examined : From literature.

Diagnostic characters : D.15 or 17, V.194-234, S.C.42-52 (entire).

Neck not distinct. Eyes small, pupil indistinguishable. Supralabials 7, 3rd and 4th touching eye. Loreal absent. Scales shiny, vertebrals enlarged, hexagonal; subcaudals entire. Colour bluish-black above with narrow white cross bands arranged more or less in pairs, more prominent posteriorly, white vertebral spots may be present; whitish below. 2 m in length, tail short; female shorter. Specimens over 1.2 m not common.

Distribution : India : Delhi, Rajasthan, Uttar Pradesh, Madhya Pradesh, Bihar, West Bengal, Orissa, Andhra Pradesh, Andaman Is. *Elsewhere* : Pakistan; Nepal; Bangladesh; Sri Lanka.

Remarks : Inhabits a wide range of biotopes up to 1646 m in hills (Waltner, 1975), met in termite mounds, rat holes, ruins, piles of bricks or stones, cultivated fields, scrub jungles, vicinity of human habitations etc. Frequently found near water. Feeds on rats, mice, lizards, frogs, and snakes including its own kind. Young ones feed more or less exclusively on blind or worm snakes. Female lays 6-15 elongated eggs in a clutch during summer season and stays with eggs. During breeding season 2-3 males often seen performing the vertical territorial dance, a ritual wrestling bout that is often mistaken for mating (vide Encyclopedia of Indian Natural History by BNHS, 1986 : 346). Venomous, the venom is more toxic than that of Cobra and acts both as a neurotoxin and haemotoxin paralysing respiratery centre and destroying red blood corpuscles. It is one of the deadliest snakes of the world (Haast and Werner, 1953) whose bite is fatal. Polyvalent serum should be injected intravenously as soon as possible after the bite.

Bungarus fasciatus (Schneider), the Banded Krait is also known as Chitkauria (Bedi, 1982). This.speceis may not occur in Delhi as per its distributional range.

Genus *Naja* Laurenti

1768. *Naja* Laurenti, *Syn. Rept*, : 90 (type-species : *Coluber naja* Linnaeus).

23. *Naja naja* (Linnaeus)
Common Cobra

1758. *Coluber naja* Linnaeus, *Syst.Nat.*, 10th ed : 221 (based on 1734, Seba, *Thes.* 1, pl. 44, figs. 1-2, pls. 85, fig. 1, and 89, fig. 1-4, and 90, figs. 1-2 and 97, figs. 1-4; type-locality : India).
1884. *Kala* (Cobra) : Anonymous, *A Gazetteer of the Delhi District 1883-4* : 21.
1913. *Naja tripudians* : Anonymous, *Gazetteer of the Delhi District Part A-1912* : 17.
1943. *Naja naja naja* : Smith, *Faun.. Brit. India*, 3 : 427-431, figs, 136,137, 138 A-E, 139 (Map).
1964. *Naja tripudians* : Raj & Sehgal, *Census of India 1961, Delhi* : 10.
1976. *Naja tripudians* : Raza et al., In : *Delhi Gazetteer* : 29.
1991. *Naja naja* : Kalpavriksh, *The Delhi Ridge Forest* : 33, fig.
1995. Cobra : Gaur, *Srishti*, 2(1) : 36 (Najafgarh drain area, Delhi).
1996. Cobra : anonymous, *Newsl. IZDA/CZA*, 4(1-2) : 7 (non-captive, National zoological park, Delhi).

Local names : Nag(male), Nagin(female), Phaniar.

Material examined : From literature and seen with charmer outside Humayun Tomb on 12.xii.1994, the specimens was said collected from Delhi area.

Diagnostic characters : D.21-25, V.176-200, A.1, S.C.48-75.

Head depressed, not distinct from neck, deflatable. Snout short, rounded. Eyes moderate; pupil round. Nostrils vertically elliptical, between anterior and posterior nasals. Supralabials 7, 3rd and 4th touching eye. Loreal absent. A small triangular cuneate scale wedged between 4th and 5th infralabials. Anterior genial a little longer than posterior. Scales smooth, outer 2-3 rows larger. Colour yellowish-brown or blackish above with or without a black and white `spectacle' mark on back of hood, two black spots on ventral side of hood and 2-3 broad black cross-bars below. Whitish below. 2.25 m in length (usually from 1.371 to 1.625 m), female shorter.

Distribution : India : Delhi and throughout including Andamans (except north-east). *Elsewhere* : Pakistan; Sri Lanka.

Remarks : Found almost everywhere in plains and hills up to 3658 m (Waltner, 1975) (forested areas, agricultural fields, hollows of old trees, termite mounds, ruined buildings, holes in embarkments, piles of loose building material, thatched roofs in villages etc.). Frequently found near water during summer. More active and alert at night though hunts for foods during late

atternoon or early evening. Feeds on rodents, birds, other reptiles, amphibians, eggs etc. Young ones subsist on insect diet and with age, they gradually switch over to the diet of their adults. Breeding take place during summer when female lays 8-45 (normally 12-30) spherical eggs in a clutch in the hollows, holes or mounds etc. Mating pair mostly live together and share in guarding eggs till their hatching out; venom glands are active from birth. It is one of the most dangerously venomous snakes. The venom is both neurotoxic and haemotoxic affecting nervous system and destroying red blood corpuscls and clotting power of blood. Polyvalent serum is fully effective in its bite. Bite may not be fatal all times, depending on the quantity of venom injected during the bite and resistance by the victim during the act. Since Cobra skins are very popular abroad thousands of Cobras are killed every year for skin-trade. Agriculturally also, this is a disaster as they are efficient controllers of rodents which destroy large quantities of food grain. The species needs protection under Wildlife (Protection) Act, 1972 and IUCN.

Status : Protected speceis under :

Appendix II, CITES.

Family : TYPHLOPIDAE

Diagnostic characters : Body cylindrical of equal diameter throughout, covered with uniform minute scales. Eyes more or less distinct, under shields. Palato-maxillary arch incomplete, no ectopterygoid; maxilla more or less transverse, loosly attached to skull. Teeth directed backwards; prefrontal forming a suture with nasal; no supratemporal. Mandible with coronoid bone, toothless; quadrate elongate, directed horizontally forwards. Plevics reduced to a single bone or absent.

Genus *Ramphotyphlops* Fitzinger

1943. *Ramphotyphlops* Fitzinger, *Syst. Rept.* : 24.

24. *Ramphotyphlops braminus* (Daudin)
Common Worm Snake

1803. *Eryx braminus* Daudun, *Hist. Nat Rept.*, **7** : 279 (type-locality : Vishakhapatam).
1943. *Typhlops braminus* : Smith, *Faun. Brit.India*, **3** : 45, 46-48 fig. 14.
1964. *Typhlops braminus* : Raj & Sehgal, *Census of India 1961, Delhi* : 11.
1976. *Typhlops braminus* : Raza et al., In : *Delhi Gazetteer* : 29.
1985. *Ramphotyphlops braminus*, Murthy, *The Snake*, **17** : 58+.
1991. *Typhlina bramina*, Kalpavriksh, *The Delhi Ridge Forest* : 33.

Local names : Andha Sanp, Telia Sanp.

Material examined : Delhi : ex. (88mm, broken), Rocky area, Lado Sarai, Mehrauli road, 7.ix.1994; 1 ex. (100 mm), Gurjar ghat, Yamuna bridge, Wazirabad, 8.ix.1994, coll. J.P.Sati &

party; 1 ex. (115 mm), Majnu Ka Tila nr. Wazirabad Water Works, 15.xii.1994; 1 ex. (135 mm), Chhawala Pul, Najafgarh-Bijwasan road, 20.xii.1994; coll. Akhlaq Husain & party; 1 3x. (95 mm), Bhalaswa Lake, 11.ii.1995; 1 ex. (90 mm), Lodhi Garden, 13.ii.1995; 2 exs. (110, 140 mm), Humayun Tomb, 14.ii.1995; 1 ex. (105 mm), Lake Garden, Dhaulakuan, 16.ii.1995; 2 exs. (67, 120 mm), Humayun Tomb, 28.vii.1995, coll. J.P.Sati & party.

Diagnostic characters : Body worm-like, uniformly cylindrical. Tail very short, ending in a small sharp stiff point. Head bluntly rounded. Nasal shield completely divided. Rostral large. Supralabials 4, last two touching ocular. Eyes indistinct. Head and body covered with minute, shinning scales. 20 scales round body, 290-320 transverse rows of scales. Colour blackish-brown above, lighter below. Snout, anal region and tip of tail whitish. 20.3 cm in length.

Distribution : India : Delhi and throughout including Andaman & Nicobar Islands, Lakshadweep Islands(introduced). *Elsewhere* : Sri Lanka; South Asia from S. Arabia; Iran in the west to south China in the east and Philippines in the south; Indo-Australian Islands; Africa(south of equator); Madagascar; southern Maxico; New Guinea; Introduced in Hawai (USA) by human agency.

Remarks : Lives beneath soil around roots and decayed logs of wood; burrower. Nocturnal in habit. Food consist of insect larvae and pupae; oviparous, female lays 2-8 tiny, elongate white eggs during summer and rainy seasons. Preyed upon by other snakes particularly Kraits.

Family : VIPERIDAE

Diagnostic characters : Maxillary bone vertically elongated, movably attached to prefrontal and ectopterygoid and bearing a very large poision fang on its posterior extremity; no other maxillary teeth. Loreal pit pressent or absent. Hypapophyses developved throughout vertebral column.

Genus *Vipera* Gronovius

1763. *Vipera* Gronovius, *Zooph.*, **1** : 25.

25. *Vipera russelli* (Shaw)
Russell's Viper

1797. *Coluber russelli* Shaw, *Nat. Misc.*, **8** : pl. 291.
1884. *?Pila :* Anonymous, *A Gazetteer of the Delhi District (1883-4)* : 21.
1943. *Vipera russelli* : Smith, *Faun. Brit. India*, **3** : 482-485.
1964. *Vipera* sp. Raj & Sehgal, *Census of India 1961, Delhi* : 11.
1976. *Vipera sp.* : Raza et al., In : *Delhi Gazetteer* : 29.
1991. *Vipera* (Russell's) : Kalpavriksh, *The Delhi Ridge Forest* : 33.

Local names : Daboia, Ghonus, Kauder, Peela.

Material examined : From literature.

Diagnostic characters : D.27-33, V.153-180, S.C.41-64 (paired).

Body massive, narrowing at both ends; tail short. Head depressed, triangular, covered with small imbricate and strongly keeled scales. Neck constricted. Eyes large; pupil vertical. Nostrils large. Supranasals strongly crescentic. Supralabials 10-12, none touching eye. Colour yellowish with three longitudinal rows of reddish-brown or dark brown spots with black or black and white-edges which form a chain-like pattern above; whitish below. Maximum size record 2 m, usually 1.25 m.

Distribution : India : Delhi and widely distributed. *Elsewhere* : Pakistan; Bangladesh; Sri Lanka; Myanmar; Malaysia; Indo-Chinese region; China; Taiwan.

Remarks : Occurs in plains and hills up to 2743 m (Waltner, 1975). Prefers open country and not uncommon in and around human habitation. Slow in movement. Mainly nocturnal. Feeds on small mammals like mice and rats and also on birds, lizards or frogs. Viviparous, female gives birth to 20-63 young ones at a time, being most prolific (Wall, 1906) during late summer months. Venomous, venom haematoxic and acts as a depresser of the vasomotor centre and a destroyer of the blood and fatal. Polyvalent serum is an effective antidote to the venom. Heavily exploited by the skin industry for its beautifully marked skin, may be protected under Wildlife (Protection) Act, 1972 and IUCN.

Status : Protected species under :

Appendix III, CITES.

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REFERENCES

Abdulali, H., 1991. Rat snakes fighting. *J. Bombay nat. Hist. Soc.*, **42** : 666.

Anonymous, 1884. *A Gazetteer of the Delhi District (1883-4)* : 21.

Anonymous, 1913. *Gazetteer of the Delhi District Part A - 1912* : 17-18.

Anonymous, 1996. Know your Zoo ; National Zoological Park, New Delhi - 110003. *Newsl. IZDA/CZA*, 4(1-2) : 7.

Bedi, R. 1982. *Corbett National Park* : 181 (In Hindi).

Daniel, J.C., 1983. *The Book of Indian Reptiles* : 1-141, pls.

Gaur, S. 1995. Bird Haven (in a drain !), *Srishti,* 2(1) : 36.

Haast, W.E. and Werner, M.C., 1953. The second most posionous snakes in the world. *Amer. J. Trop. Med. & Hygiene* 4(6) : 1135-1137.

Hawkins, R.E., Norden, D. and Sahgal, B. eds., 1986. *Encyclopedia of Indian Natural History.* Centenary Publication of the Bombay Natural History Society 1883-1983 : 346.

Imam, B., 1993. Dancing snakes (An eyewitness account of the occurrence).*Cheetal,* 31(3-4) : 51-55.

Jasdan, R., 1953, Python capturing Chinkara. *J. Bombay nat. Hist. Soc.,* **51** : 945-946.

Macdonald, A.G., 1947. `Shamming Death' - Snakes. *J. Bombay nat. Hist. Soc.* **47** : 173.

McCann, C., 1935. Male Rat Snakes (*Zamenis mucosus* Boulenger) fighting. *J. Bombay nat. Hist. Soc.,* **38** : 409.

Malik, I., Ivan, M., Agarwal, R. and Menon, V., 1994. *Saving the Delhi Ridge : One year of Conservation Action : A Srishti Report* W.W.F. India : 37.

Moll, E.O., 1986. Survey of the Freshwater turtles of India. Part I : The genus Kachuga. *J. Bombay nat. Hist. Soc.,* 83(3) : 538-552.

Moll. E.O., 1987. Survey of the freshwater turtles of India. Part II : the genus Kachuga. *J. Bombay nat. Hist. Soc.,* 84(1) : 7-25, figs 9-12, pl. 2-3.

Morris, R.C., 1958. Rat Snakes `mating'. *J. Bombay nat. Hist. Soc.,* **55** : 366.

Raj, B. and Sehgal, K.C. 1964. *Census of India 1961, Delhi* : 10-11.

Raza, M., Dey, A.K., Johri, B.M., Rangaswami, N.S. and Desai, J.H., 1976. In : *Delhi Gazetteer* : 28-29.

Sethna, K.R., 1958, Rat-snakes mating. *J.Bomaby nat. Hist. Soc.,* **55** : 173-174.

Smith, M.A. 1932. Some notes on the monitors. *J. Bombay nat. Hist. Soc.*, **35**(3) : 615-619, figs. 1-5.

Smith, M.A. 1943. *The Fauna of British India, Ceylon and Burma including the whole of the Indo-Chinese sub-region.* Reptilia and Amphiblia. Vol. III. Sepentes : xii + 1-503. London.

Tikader, B.K. and Sharma, R.C., 1985. *Handbook Indian Testudines* : 1-156, pls. 1-47.

Tikader, B.K. and Sharma, R.C. 1992. *Handbook Indian Lizards* : 1-241, pls. 1-42.

Wall, F., 1906. The breeding of Russell's Viper (*Vipera russelli*). *J. Bombay nat. Hist. Soc.*, **16** : 374-375.

Waltner, R.C., 1975. Geographical and altitudinal distribution of amphibians and reptiles in Himalayas (Part III). *Cheetal*, **16**(3) : 14-19 (Continued).

Waltner, R.C., 1975. Geographical and altitudinal distribution of amphibians and reptiles in Himalayas (Part IV). *Cheetal*, **16**(4) : 12-17.

Table - Systematic list of species with records

Classification & names of species	RECORDS						
	Delhi Gazett. 1884	1912	Smith 1943	Delhi Cens. 1961 Delhi Gazett. 1976	Kalp. 1991	Malik et al. 1994	Present Study 1993-1995
Class : Reptilia							
I.Order : Crocodylia							
i.Family : Crocodylidae							
(1)Genus : *Crocodylus* Gronovius							
1.*Crocodylus palustris* Lesson	+	+		+			+
ii.Family : Gavialidae							
(2)Genus : *Gavialis* Oppel							
2.*Gavialis gangeticus* (Gmelin)	+	+					
II.Order : Testudines		+			+*		
iii.Family : Trionychidae							
(3)Genus : *Aspideretes* Hay							
3.*Aspideretes gangeticus* (Cuvier)				+			
(4)Genus : *Lissemys* Smith							
4.*Lissemys punctatus punctatus*(Bonnaterre)				+			
III.Order : Sauria							
iv.Family : Agamidae							
(5)Genus : *Calotes* Cuvier							
5.*Calotes versicolor* (Daudin)				+	+		+
(6)Genus : *Sitana* Cuvier							
6.*Sitana ponticeriana* Cuvier							+
(7)Genus : *Uromastix* Merrem							
7.*Uromastix hardwickii* Gray				+	+	+	
v.Family : Gekkonidae							
(8)Genus : *Hemidactylus* Oken							
8.*Hemidactylus brooki* Gray							+
9.*Hemidactylus flaviviridis* Ruppell				+	+		+
vi.Family : Scincidae							
(9)Genus : *Mabuya* Fitzinger							
10.*Mabuya dissimilis* (Hallowell)				+	+		
(10)Genus : *Riopa* Gray							
11.*Riopa punctata* (Gmelin)							+
vii.Family : Varanidae							
(11)Genus : *Varanus* Merrem							

12. *Varanus monitor* (Linnaeus)						+	+	+		
IV.Order : Serpentes										
viii.Family : Boidae										
(12)Genus : *Eryx* Daudin										
13.*Eryx johnii* (Russell)						+	+			
(13)Genus : *Python* Daudin										
14.*Python molurus molurus* (Linnaeus)						+	+			
ix.Family : Colubridae										
(14)Genus : *Argyrogena* Werner										
15.*Argyrogena fasciolatus* (Shaw)						+				
(15)Genus : *Enhydris* Latreille										
16.*Enhyris sieboldi* (Schlegel)				+						
(16)Genus : *Lycodon* Boie										
17.*Lycodon aulicus* (Linnaeus)						+	+			
(17)Genus : *Psammophis* Fitzinger										
18.*Psammophis leithi* Gunther						+	+			
(18)Genus : *Ptyas* Fitzinger										
19. *Ptyas mucosus* (Linnaeus)						+	+			
(19)Genus : *Spalerosophis* Jan										
20.*Spalerosophis atriceps* (Fischer)				+						
(20)Genus : *Xenochrophis* Gunther										
21.*Xenochrophis piscator* (Schneider)			+			+				
x.Family : Elapidae										
(21)Genus : *Bungarus* Daudun										
22.*Bungarus caeruleus* (Schneider)	+	+				+	+			
(22)Genus : *Naja* Laurenti										
23.*Naja naja* (Linnaeus)	+	+				+	+			+
xi.Family : Typhlopidae										
(23)Genus : *Ramphotyphlops* Fitzinger										
24.*Ramphotyphlops braminus* (Daudin)						+	+			+
xii.Family : Viperidae										
(24)Genus : *Vipera* Laurenti										
25.*Vipera russelli* (Shaw)	+					+	+			

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AVES

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INTRODUCTION

A reconnoitre of the existing ornithological literature pertaining to Delhi area reveals that about seventy years ago there was no readily available literature dealing specifically with the birds of Delhi. Basil-Edwardes (1926), perhaps, for this reason, first of all made a small collection of birds (230 specimens) and accumulated a number of notes during the winter of 1924-25. This resulted into an article titled 'A contribution to the ornithology of Delhi', covering 204 species (spp.) and subspecies (sspp.). Thereafter a large number of ornithologists have contributed to our knowledge of the birds of Delhi. The comprehensive being : Frome, 1947 ; Alexander, 1949 ; Hutson, 1954 ; Donahue, 1967 ; Ganguli, 1975 ; Abdulali and Panday, 1978 ; Gaston, 1973, 1976, 1978; Singh & Basu, 1990; Kalpavriksh (Kv), 1991, 1991a ; Menon & Gandhi, 1992; Satya Sri, 1993; Tikader, undated; Urfi, 1993, 1995; Varma, 1994 and Gaur, 1995.

The First checklist of Delhi birds (1950) was prepared by the Delhi Birdwatching Society in collaboration with General Williams and Horace Alexander. This was followed by three more revised editions between 1963 and 1967, with the contributions of General Williams, Joseph Gorge (Roorkee), Julian Donahue, Peter Jackson and Usha Ganguli. The area covered was the same as in Frome's paper i.e. approximately 48 km radius around the city. The first checklist (1950) contained 356 species, while the last listed 393 spp. Three more species were added in 1969 to the bird fauna of Delhi and several more between 1969 and 1970.

Detailed notes on range of distribution, field identification, status and behaviour of each bird species have been provided by Ganguli (l.c.). The publication deals with a total of 408 species in Delhi and environs. While Gaston (1978) reported 167 spp. from Ridge alone. Kalpavriksg (1991) updated the 'Checklist of Birds of Delhi and Surrounds', containing 444 spp. and sspp. The 'Effect of Urbanization on Avifaunal Diversity in Delhi' was studied by Satya Sri., (1993). She reports that 101 spp. have been markedly affected, i.e. 34 positively and 67 negatively by the urbanization. Recently, Varma (1994) has also made an important contribution to the ornithology of Delhi.

The present systematic account is primarily based on the above cited literature and the field observations made by the authors during faunistic surveys of Delhi in 1994-95. A total of 434 spp. & sspp. belonging to 205 genera, 59 families and 17 orders are listed from Delhi. Of these 113 taxa have been sighted by the authors during the above surveys. These taxa are

prefixed with an asterik (*). The number within bracket, suffixing serial number of each taxa, denotes the serial number of Ali & Ripley's (1969-78) Handbook. The classification and nomenclature used here are adopted after Ali & Ripley (1969-78). Wherever possible distribution of each taxa within Delhi has been provided. The known habitat preference of some spp. have been included. Winter population counts of migratory water fowls in major wetlands of Delhi have been studied and presented here which may provide useful information with regard to conservation strategies. Threefold status terminology, *viz.*, residential, abundance and breeding (further divisible into various categories and subcategories) has been used to determine the status of each taxa as follows :

		Nos. of spp. & sspp.
I.	*Residential status* :	
1.	Resident	164
2.	Resident ?	8
3.	Resident migrant	6
4.	Local migrant	3
5.	Winter visitor	121
6.	Summer visitor	10
7.	Monsoon visitor	5
8.	Passage migrant	50
9.	Vagrant	54
10.	Unknown	13
	Total	434
II.	*Abundance status* : (In terms of decreasing numerical abundance)	
1.	Abundant	15
2.	Common	120
3.	Less common	72
4.	Uncommon	111
5.	Rare	74
6.	Not known	42
	Total	434
III.	*Breeding status* :	
	Known to breed	158

Note : ? = lack of definite information.

SYSTEMATIC ACCOUNT

Class : **AVES**
I Order : **PODICIPEDIFORMES**
1 Family : PODICIPEDIDAE (Grebes)
1 Genus ***Podiceps*** Latham
*1 (3) ***Podiceps cristatus cristatus*** (Linnaeus)
Great Crested Grebe

1758. *Colymbus cristatus* Linnaeus, *Syst. Nat.* ed. **10**, 1: 35 (Sweden).
1929. Baker, *FBI* No. 2290, **6** : 477.

Distribution : Delhi : Badshahpur, Najafgarh, Dasna & other jheels & occasionally in the Jamuna (Ganguli, 1975) ; Okhla (Kalpvriksh or Kv, 1991; Urfi, 1993, 1995); Bhalsawa lake, Ramghat & Okhla (present record).

Status : Winter visitor ; less common. Frome (1947) considered it very uncommon, but the recent sightings (including the present one) suggest that this bird is, at present, almost a regular winter visitor.

*2 (5) ***P. ruficollis capensis*** Salvadori
Little Grebe or Dabchick

1884. *Podiceps capensis* Salvadori, *Ann. Mus. Civ.* Genova (2), I : 252 (Shoa, Africa).
1929. Baker, *FBI* No. 2292, **6** : 481.

Local name : Pandubbi or Dubdubbi.

Distribution : Delhi : Okhla (Urfi, 1993); Raota, Jhatikra, & Kakraula along the Najafgarh drain (Varma, 1994) ; Chhawala along Najafgarh drain, Wazirabad & Okhla reservoirs, Lake park at Dhaulakuaon, Ramghat, Road-side pond at crossing on Palam-Gurgaon road (present record).

Status : Resident ; common ; breeds. Two to thirty birds have been observed on numerous occasions by various workers in all types of waters with or without floating vegetation.

II Order : **PELECANIFORMES**
2 Family : PELECANIDAE (Pelicans)
2 Genus ***Pelecanus*** Linnaeus
* 3 (20) ***Pelecanus onocrotalus*** Linnaeus
White or Rosy Pelican

1758. *Pelecanus onocrotalus* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 132 (Africa, Asia).
1929. Baker, *FBI* No. 2176, **6** : 270.

Local name : Hawasil (for all species under family-Pelicanidae).

Distribution : Delhi : Nuh, Najafgarh, Pindwala, Shamspur & other jheels (Ganguli, 1975; Okhla (Urfi, 1993, 1995); National Zoological Park/NZP (present record).

Status : Winter visitor ; less common.

*4 (21) *P. philippensis philippensis* Gmelin
Spottedbilled or Grey Pelican

1789. *Pelecanus philippensis* Gmelin, *Syst. Nat.* 1 (2) : 571 (Philippines = Manila, *vide* Stresemann 1952, Ibis 94 : 514).

1929. Baker, *FBI* No. 2179, 6 : 274.

Distribution : Delhi : NZP (present record).

Status : Winter visitor ; uncommon.

5 (22) *P. philippensis crispus* Bruch
Dalmatian Pelican

1832. *Pelecanus crispus* Bruch, Isis, col. 1109 (Dalmatia).

1929. Baker, *FBI* No. 2178, 6 : 273.

Distribution : Delhi : Near Najafgarh jheel (Ganguli, 1975).

Status : Winter visitor ; rare (Kv, 1991).

3 Family : PHALACROCORACIDAE (Cormorants, Shags, Darters)
3 Genus *Phalacrocorax* Brisson
*6 (26) *Phalacrocorax carbo sinensis* (Shaw)
Large Cormorant

1801. *Pelecanus sinensis* Shaw, *Nat. Misc.* 13 : pl. 529, text (China).

1929. Baker, *FBI* No. 2180, 6 : 277.

Local name : Bada Pankowwa or Bada Jal-Kowwa.

Distribution : Delhi : Edges of jheels, river bank or canal, or sitting on bare *keekar* trees around jheels (Ganguli, 1975) ; Bhalsawa lake, Najafgarh drain (present record).

Status : Resident ; common ; breeds. Not recorded in 1920s-30s (Kv, 1991). One to 25 individuals have been seen during the present study.

*7 (27) *P. fuscicollis* Stephens
Indian Shag

1826. *Phalacrocorax fuscicollis* Stephens, *in.* Shaw's *Gen. Zool.* 13 (1) : 91 (Bengal).

1929. Baker, *FBI* No. 2181, 6 : 279.

Local name : Pan-Kowwa or Jal-Kowwa.

Distribution : Delhi : National Zoological Park (Ganguli, 1975 ; Satya Sri, 1993 & present record) ; Okhla (Satya Sri, 1993).

Status : Resident ; common ; breeds (Kv, 1991).

*8 (28) ***P. niger*** (Vieillot)
Little Cormorant

1817. *Hydrocorax niger*, Vieillot, *Nouv. dict. Hist. Nat.* **8** : 88 (East Indies = Bengal).

1929. Baker, *FBI* No. 2182, **6** : 280.

Local name : Chhota Pan-Kowwa or Chhota Jal-Kowwa.

Distribution : Delhi : Any tank or large water-sheet (Ganguli, 1975) ; Old Delhi Ridge/ODR (Kv, 1991a) ; Raota, Jhatikra & Kakraula along Najafgarh drain, (Varma, 1994); NZP (Urfi, 1995); Bhalsawa lake, Wazirabad & Okhla reservoirs, NZP (present record).

Status : Resident ; abundant ; breeds. One to fifty individuals have been sighted at localities mentioned above.

4 Genus ***Anhinga*** Brisson
*9 (29) ***Anhinga rufa melanogaster*** Pennant
Darter or Snake-bird

1769. *Anhinga melanogaster* Pennant, *Indian Zool.* : **13**, p. 12 (Ceylon and Java).

1929. Baker, *FBI* No. 2183, **6** : 282.

Local name : Panwa or Pandubi.

Distribution : Delhi : Any large sheet of deep water (Ganguli, 1975) ; Bhalsawa lake and Ramghat (present record).

Status : Resident ; common ; breeds.

III Order : **CICONIIFORMES**
4 Family : ARDEIDAE (Herons, Egrets, Bitterns)
5 Genus ***Ardea*** Linnaeus
10 (33) ***Ardea insignis*** Hume
Great Whitebellied Heron

1928. *Ardea imperialis* Baker, *Bull. Brit. Orn. Cl.* **49** : 40 (Sikkim terai, Bhutan duars).

1929. Baker, *FBI* No. 2220, **6** : 342.

Distribution : Delhi : Shamspur jheel (Ganguli, 1975).

Status : Resident ; rare.

*11 (36) *A. cinerea rectirostris* Gould
Eastern Grey Heron

1843. *Ardea rectirostris* Gould, *Proc. Zool. Soc.* London : 22 (New South Wales `= India ?', Stone, 1913, Austral. *Av. Rec.*; **1** : 142 restricted by Ripley 1961, Synopsis : 12 to India).

1929. Baker, *FBI* No., 2218, **6** : 340.

Local name : Anjan.

Distribution : Delhi : Village Burari on the Jamuna ; Najafgarh jheel, Dasna (Ganguli, 1975) ; ODR (Kv, 1991a); Okhla (Urfi, 1993, 1995); Raota & Jhatikra along Najafgarh drain (Varma, 1994) ; and Bhalsawa lake (present record).

Status : Resident ; common ; breeds.

*12 (37) *A. purpurea manilensis* Meyen
Eastern Purple Heron

1834. *Ardea purpurea* var. *manilensis* Meyen, *Nova Acta Acad. Caes, Leop, Carol.* **16**, suppl. : 102-103 (Philippines).

1929. Baker, *FBI* No. 2216, **6** : 337.

Local name : Lal anjan.

Distribution : Delhi : Riverain tract beyond Coronation Pillar in north Delhi, South of Okhla (Ganguli, 1975); Okhla (Urfi, 1993); Raota, Jhatikra along Najafgarh drain (Varma, 1994) ; At Chhawala-Najafgarh (present record).

Status : Resident ; less common ; breeds. Uncommon before 1958, may have increased subsequently (Kv, 1991). This bird has suffered due to the absence of reed cover in recent years (Satya Sri, 1993). Recent sightings by Varma & the present record suggest that this species is mainly confining to Najafgarh area where it is breeding also.

6 Genus *Butorides* Blyth

13 (38) *Butorides striatus javanicus* (Horsfield)
Little Green Heron

1857. *Ardea chloriceps* 'Hodgs'. = Bonnaparte, *Consp. Gen. Av.*, **2** : 129 Nepal. (Restricted to Hitaura, Chisapani Garhi dist. by Biswas, 1959, *Curr. Sci.*, **28** : 288).

1929. Baker, *FBI* No., 2231, **6** : 357.

Local name : Kancha bagla.

Distribution : Delhi : Noted only at Okhla (Kv, 1991).

Status : Resident ; uncommon ; breeds.

7 Genus ***Ardeola*** Boie

*14 (42) ***Ardeola grayii grayii*** (Sykes)

Indian Pond Heron or Paddybird

1832. *Ardea Grayii* Sykes, *Proc. Zool. Soc.* London : 158 (Dukhun).

1929. Baker, *FBI* No. 2229, **6** : 354.

Local name : Andha bagla or Bagala.

Distribution : Delhi : Any sheet of water, also a *neem* tree in front of the author's house (Ganguli, 1975) ; New Delhi ridge (Gaston, 1978) ; ODR (North ridge), New Delhi Ridge/NDR (South ridge) (Kv, 1991a) ; Raota, Jhatikra & Kakraula along Najafgarh drain (Varma, 1994); NZP (Urfi, 1995); River Yamuna or Jamuna, Bhaleswa lake, Wazirabad & Okhla reservoirs, Najafgarh drain, Ramghat, Piggery farm, IARI campus, Lodhi garden, Ranibag & road side ponds (present record).

Status : Resident ; common ; breeds.

8 Genus ***Bubulcus*** Bonaparte

*15 (44) ***Bubulcus ibis coromandus*** (Boddaert)

Cattle Egret

1783. *Cancroma coromanda* Boddaert, Table *Pl. enlum.* : 54 (Coromandel).

1929. Baker, *FBI* No. 2226, **6** : 349.

Local name : Gai bagla.

Distribution : Delhi : Roshanara gardens, Okhla (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR & NDR (Kv, 1991a) ; Raota, Jhatikra, Kakraula & Mall road along Najafgarh drain (Varma, 1994); NZP (Urfi, 1995); Bhalsawa lake, Wazirabad & Okhla resevoirs, NZP, Ramghat, Najafgarh drain at Chhawala (present record).

Status : Resident ; common ; breeds. One to fifty individuals were seen at above mentioned localities during the present surveys.

9 Genus ***Egretta*** Forster

*16 (46) ***Ardea alba modesta*** J.E. Gray

Eastern Large Egret

1831. *Ardea modesta* J.E. Grey, *Zool. Misc.* : 19 (India).

1929. Baker, *FBI* No.2223, **6** : 346.

Local name : Bada bagla.

Distribution : Delhi : Near water (Ganguli, 1975) ; Raota & Jhatikra along Najafgarh drain (Varma, 1994) ; Bhalsawa lake, Yamuna at 'Majnu-ka-tila', NZP, Chhawala-Najafgarh road, Okhla reservoir (present record).

Status : Resident, less common ; breeds. Numerically less common, compared with other

egrets. One to five birds were seen amongst groups of the two smaller species.

17 (47, 48) ***Egretta intermedia intermedia*** (Wagler)
Smaller or Median Egret

1829. *Ardea intermedia* Wagler, *Isis von Oken, col.* 659 (Java).
1929. Baker, *FBI* No. 2224, **6** : 347.
Local name : Karachi bagla.
Distribution : Delhi : Roshanara gardens, Delhi zoo, river Jamuna (Ganguli, 1975).
Status : Resident ; common ; breeds. Nest seen at Delhi zoo (Kv, 1991).

*18 (49) ***E. garzetta garzetta*** (Linnaeus)
Little Egret

1766. *Ardea Garzetta* Linnaeus, *Syst. Nat.*, ed.**12**, 1 : 237. ('Oriente' = northeast Italy).
1929. Baker, *FBI* No. 2225, **6** : 348.
Local name : Kilchia bagla.
Distribution : Delhi : Roshanara gardens, Delhi zoo (Ganguli, 1975) ; ODR & NDR (Kv, 1991) ; Raota, Jhatikra & Kakraula along Najafgarh drain (Varma, 1994); NZP (Urfi, 1995); Bhalsawa lake, Wazirabad & Okhla reservoirs, Chhawala - Najafgarh, NZP, Ranibag, Lodhi garden, Road side ponds (Present record).
Status : Resident ; common ; breeds.

19 (50) ***E. gularis schistacea*** (Hemprich & Ehrenberg)
Indian Reef Heron

1832. *Ardea (Lepterodas) schistacea* Hemprich & Ehrenberg, *Symb. Phys. Aves*, (p. 12), pl. 6 (Red sea).
1929. Baker, *FBI* No. 2228, **6** : 353.
Local name : Kala bagla.
Distribution : Delhi : Mudflats behind Humayun's tomb, Jamuna bed at Okhla (Ganguli, 1975).
Status : Vagrant ; Rare (Kv, 1991). First recorded for Delhi on 7 November 1963 (Ganguli, 1975).

10 Genus ***Nycticorax*** T. Forster
20 (52) ***Nycticorax nycticorax nycticorax*** (Linnaeus)
Night Heron

1758. *Ardea Nycticorax* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 142 (Southern Europe).
1929. Baker, *FBI* No. 2233, **6** : 359.

Local name : Kwaak.

Distribution : Delhi : Delhi zoo (Ganguli, 1975; Urfi, 1995).

Status : Resident ; common ; breeds (Kv, 1991).

11 Genus ***Ixobrychus*** Billberg

21 (55) ***Ixobrychus minutus minutus*** Linnaeus

Little Bittern

1766. *Ardea minuta* Linnaeus, *Syst. Nat.*, ed. 12, 1 : 240 (Switzerland).

1929. Baker, *FBI* No. 2236, 6 : 364.

Distribution : Delhi : Reed-beds near Coronation pillar and beyond Wazirabad bridge (Ganguli, 1975).

Status : Resident ; uncommon ; breeds (Kv, 1991).

22 (56) ***I. cinnamomeus*** (Gmelin)

Chestnut Bittern

1789. *Ardea cinnamomea* Gmelin, *Syst. Nat.*, 1 (2) : 643 (China).

1929. Baker, *FBI* No. 2238, 6 : 367.

Local name : Lal bagla.

Distribution : Delhi : In swamps beyond Coronation pillar in north Delhi and south of Okhla (Ganguli, 1975); Okhla (Urfi, 1993).

Status : Resident ; uncommon (Kv, 1991).

23 (57) ***I. sinensis*** (Gmelin)

Yellow Bittern

1789. *Ardea sinensis* Gmelin, *Syst. Nat.* 1 (2) : 642 (China).

1929. Baker, *FBI* No. 2237, 6 : 365.

Local name : Jun bagla.

Distribution : Delhi : 9th mile stone on Mathura road (Alexander, 1949) ; 5 km south of Okhla (Donahue, 1967); Okhla (Urfi, 1995).

Status : Resident ? ; uncommon (Kv, 1991).

24 (58) ***I. flavicollis flavicollis*** (Latham)

Black Bittern

1790. *Ardea flavicollis* Latham, *Index Orn.*, 2 : 701 (India).

1929. Baker, *FBI* No. 2239, 6 : 368.

Local name : Kala bagla.

Distribution : Delhi : South of Okhla (Ganguli, 1975).

Status : Resident ? ; uncommon (Kv, 1991).

5 Family : CICONIIDAE (Storks)

12 Genus ***Mycteria*** Linnaeus

*25 (60) ***Mycteria leucocephala*** (Pennant)

Painted Stork

1769. *Tantalus leucocephalus* Pennant, *Indian Zool.* : **11**, pl. 10 (Ceylon).

1929. Baker, *FBI*, No. 2214, **6** : 331.

Local name : Dhok.

Distribution : Delhi : Delhi zoo (Ganguli, 1975) ; NDR (Kv, 1991a) ; Okhla (Urfi, 1993); Bhalsawa lake, NZP (Urfi, 1995; present record).

Status : Resident ; common ; breeds. More than 400 birds have been observed nesting & breeding at National Zoological Park, while only two birds were sighted flying over Bhalsawa lake (present find).

13 Genus ***Anastomus*** Bonnaterre

* 26 (61) ***Anastomus oscitans*** (Boddaert)

Openbill Stork

1783. *Ardea oscitans* Boddaert, *Table Pl. enlum.* : 55 (Pondicherry).

1929. Baker, *FBI* No. 2215, **6** : 333.

Local name : Ghonghila.

Distribution : Delhi : North & east Delhi (Frome, 1947) ; Just beyond the new Wazirabad bridge, Okhla & a pool in south Delhi (Ganguli, 1975); Okhla (Urfi, 1993; present record).

Status : Resident ; common ; breeds. Perhaps more common now than before 1950 (Kv, 1991).

14 Genus ***Ciconia*** Brisson

27 (62) ***Ciconia episcopus episcopus*** (Boddaert)

Whitenecked Stork

1783. *Ardea episcopus* Boddaert, *Table Pl. enlum.* : 54 (Coromandel Coast).

1929. Baker, *FBI* No. 2210, **6** : 342.

Local name : Laglag.

Distribution : Delhi : On road to Najafgarh (Ganguli, 1975); Okhla (Urfi, 1993); Raota along Najafgarh (Varma, 1994).

Status : Resident ; common ; breeds (Kv, 1991).

28 (63) ***C. ciconia ciconia*** (Linnaeus)
White Stork

1758. *Ardea Ciconia* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 142 (Sweden).
1929. Baker, *FBI* No. 2207, **6** : 321.
Local name : Ujli or Haji laglag.
Distribution : Delhi : Najafgarh & Shamspur jheels, Jamuna at Okhla & flooded fields at Kingsway camp in north Delhi (Ganguli, 1975).
Status : Winter visitor ; Uncommon (Ganguli 1975).

15 Genus ***Ephippiorhynchus*** Bonaparte
*29 (66) ***Ephippiorhynchus asiaticus asiaticus*** (Latham)
Blacknecked Stork

1790. *Mycteria asiatica* Latham, *Index Orn.*, **2** : 670 (India).
1929. Baker, *FBI* No. 2211, **6** : 326.
Local name : Loharjang.
Distribution : Delhi : Najafgarh & Shamspur jheels (Ganguli, 1975) ; Raota along Najafgarh drain (Varma, 1994); Okhla (Urfi, 1993, 1995); NZP (present record).
Status : Resident ; uncommon ; breeds. Sightings much rarer than in past (Kv, 1991).

16 Genus ***Leptoptilos*** Lesson
*30 (67) ***Leptoptilos dubius*** (Gmelin)
Adjutant Stork

1789. *Ardea dubia* Gmelin, *Syst. Nat.*, **1** (2) : 624 (India).
1929. Baker, *FBI* No. 2212, **6** : 327.
Local name : Garur.
Distribution : Delhi : Najafgarh (Ganguli, 1975) ; Okhla (Kv, 1991a) ; NZP (present record).
Status : Local Migrant ; uncommon. From 1959 to 1968 Ganguli recorded large flocks (40-50 & one flock of 250 birds) at Najafgarh & Pindwala jheels.

31 (68) ***L. javanicus*** (Horsfield)
Lesser or Haircrested Adjutant

1821. *Ciconia Javanica* Horsfield, *Trans. Linn. Soc.* London, **13** (1) : 188 (Java).
1929. Baker, *FBI* No. 2213, **6** : 329.
Local name : Chhota garur.
Distribution : Delhi : Recorded occasionally in company with *L. dubius* (Ganguli, 1975);

Okhla (Urfi, 1993, 1995).

Status : Local migrant; Rare (Kv, 1991).

6 Family : THRESKIORNITHIDAE (Ibises, Spoonbill)

17 Genus ***Threskiornis*** G.R. Gray.

*32 (69) ***Threskiornis aethiopica melanocephala*** (Latham)

White Ibis

1790. *Tantalus melanocephalus* Latham, *Index. Orn.*, **2** : 709 (India).

1929. Baker, *FBI* No. 2203, **6** : 314.

Local name : Safed baza.

Distribution : Delhi : Najafgarh (Ganguli, 1975); NZP (Present record).

Status : Resident ; common ; breeds (Kv, 1991). As it feeds on vegetable matter in addition to animal food, it has fared well. Pollution, mainly due to agricultural fertilizers, has contributed to growth of algae into the wet land areas providing food to this species. Thus, helping this bird to flourish (Satya Sri, 1993).

18 Genus ***Pseudibis*** Hodgson

33 (70) ***Pseudibis papillosa papillosa*** (Temminck)

Indian Black Ibis

1824. *Ibis papillosa* Temminck, *Pl. Col., livr.* **51**. *pl.* 304 (India).

1929. Baker, *FBI* No. 2204, **6** : 316.

Local name : Kala baza.

Distribution : Delhi : Pindwala jheel, Okhla, a few kilometre east of Delhi (Ganguli, 1975) ; Raota along Najafgarh drain (Varma, 1994).

Status : Resident ; less common ; breeds (Kv, 1991).

19 Genus ***Plegadis*** Kaup

34 (71) ***Plegadis falcinellus falcinellus*** Linnaeus

Glossy Ibis

1766. *Tantalus Falcinellus* Linnaeus, *Syst. Nat.*, ed. **12** : 241 (Austria and Italy).

1929. Baker, *FBI* No. 2206, **6** : 318.

Local name : Chhota buza.

Distribution : Delhi : Pindwala jheel, Najafgarh (Ganguli, 1975).

Status : Winter visitor ; uncommon ; (Kv, 1991). 60-150 birds were seen during 1958-1964. Since then, they have been seen much less frequently and in much smaller numbers (Ganguli, 1975).

20 Genus ***Platalea*** Linnaeus

35 (72) ***Platalea leucorodia major*** Temminck & Schlegel

Spoonbill

1849. *Platalea major* Temminck & Schlegel, in Siebold, *Fauna. Jap., Aves* : **119**, pl. 73 (Japan).

1929. Baker, *FBI* No. 2202, **6** : 311.

Local name : Chamcha.

Distribution : Delhi : Najafgarh, Shamspur and Pindwala jheels (Ganguli, 1975).

Status : Migrant-Resident i.e. partly resident & nomatic, partly winter visitor ; less common. No breeding record for Delhi (Kv, 1991). There has been a reduction in number of spoonbills, in recent time (Satya Sri, 1993).

7 Family : PHOENICOPTERIDAE (Flamingos)

21 Genus ***Phoenicopterus*** Linnaeus

36 (73) ***Phoenicopterus roseus*** Pallas

Flamingo

1811. *Phoenicopterus roseus* Pallas, *Zoogr. Russo-Asiat.*, **2** : 207 (Mouth of Volga river, south Russia).

1929. Baker, *FBI* No. 2241, **6** : 373.

Local name : Rajhans.

Distribution : Delhi : Dasna, Najafgarh, a jheel close to Shamspur (Ganguli, 1975); Okhla (Urfi, 1993, 1995).

Status : Winter visitor, common (Kv, 1991). In the past (1947) Flamingo was uncommon, but has increased in recent times. The shallow wet lands provide the animal food as well as *Scirpus*, contributing to the increase in their number (Satya Sri, 1993).

IV Order : **ANSERIFORMES**

8. Family : ANATIDAE (Ducks, Geese, Swans)

22 Genus ***Anser*** Brisson

37 (79) ***Anser albifrons albifrons*** (Scopoli)

Whitefronted Goose

1789. *Branta albifrons* Scopoli, *Annus I, Hist. Nat.* : 69 (North Italy).

1929. Baker, *FBI* No. 2253, **6** : 399.

Distribution : Delhi : Jamuna, Najafgarh jheel (Ganguli, 1975).

Status : Winter visitor ; Sparse & rare. No record after 1957 (Kv, 1991).

38 (81) ***A. anser rubrirostris*** Swinhoe
Eastern Greylag Goose

1871. *Anser cinereus* var. *rubrirostris* Swinhoe, P.Z.S. : 416, *ex.* Gray, 1846, *Cat. Bds.* Nepal, **144**, *nom. nud., ex.* Hodgson, 1844, *Zool. Misc.* : **86**, *nom. nud.* (Shanghai).
1929. Baker, *FBI* No. 2252, **6** : 398.
Local name : Hans.
Distribution : Delhi : Sandbanks of Jamuna & edges of jheels like Najafgarh, Hasanpur etc. (Ganguli, 1975).
Status : Winter visitor ; common. Rare earlier, commoner now (Kv, 1991).

*39 (82) ***A. indicus*** (Latham)
Barheaded Goose

1790. *Anas indicus* Latham, *Index Orn.*, **2** : 839 (Taimyr = India *vide* Ticehurst 1930, *JBNHS.* 34 : 489).
1929. Baker, *FBI* No. 2258, **6** : 405.
Local name : Kakreyee hans.
Distribution : Delhi : Badli (north Delhi), Badshahpur & Najafgarh (Ganguli, 1975) ; NZP (present record).
Status : Winter visitor ; uncommon.

23 Genus ***Cygnus*** Bechstein
40 (84) ***Cygnus columbianus bewickii*** Yarrell
Bewick's or Western Whistling Swan

1850. *Cygnus bewickii* Yarrell, *Trans. Linn. Soc.* London, **16** : 453 (Yarmouth, England)
1929. Baker, *FBI* No. 2244, **6** : 381.
Distribution : Delhi : Rajpur (Ali & Riplay, 1978).
Status : Winter visitor ; uncommon (Kv, 1991).

24. Genuys ***Dendrocygna*** Swainson
*41 (88) ***Dendrocygna javanica*** (Horsfield)
Lesser Whistling Teal or Tree Duck

1821. *Anas javanica* Horsfield, *Trans. Linn. Soc.* London, **13** : 199, pl. 1 (Java).
1929. Baker, *FBI* No. 2260, **6** : 411.
Local name : Seelhi.
Distribution : Delhi : Shahdara (Benthall, 1949) ; Dasna jheel on road to Najafgarh (Ganguli, 1975); Okhla (Urfi, 1993, 1995; present recrod).

Status : Winter visitor/Resident ; uncommon. Very uncommon, no recent records (Kv, 1991).

25 Genus ***Tadorna*** von Oken

*42 (90) ***Tadorna ferruginea*** (Pallas)

Ruddy Shelduck or Brahminy Duck

1764. *Anas (ferruginea)* Pallas, *in Vroeg, Cat. d'Ois., Adumbr.* : 5 (Tartary).

1929. Baker, *FBI* No. 2263, 6 : 416.

Local name : Surkhab or Chakwa.

Distribution : Delhi : Sandbanks of the Jamuna & rarely on some jheels (Ganguli, 1975) ; NZP (local enquiries), Okhla (Urfi, 1993, 1995; present record).

Status : Winter visitor ; common (as per local enquaries, they were regular visitors to the NZP, but none was seen there during our visits in winters of 1994 & 1995). But a pair was sighted at Okhla on 13th Feb. & 20th December, 1995.

43 (91) ***T. tadorna*** Linnaeus

Common Shelduck

1758. *Anas tadorna* Linnaeus, *Syst. Nat.*, ed. 10, 1 : 122 (Sweden).

1929. Baker, *FBI* No. 2262, 6 : 414.

Local name : Safed surkhab or Shah chakwa.

Distribution : Delhi : Dankaur jheel (Frome, 1947) ; Dasna (Ganguli, 1975).

Status : Winter visitor ; uncommon.

26 Genus ***Marmaronetta*** Reichenbach

44 (92) ***Marmaronetta angustirostris*** (Menetries)

Marbled Teal

1832. *Anas angustrirostris* Menetries, *Cat. Rais. Obj. Zool.* Caucase : 58 (Lenkoran, Transcaspia).

1929. Baker, *FBI* No. 2277, 6 : 445.

Distribution : Delhi : Horse-shoe jheel (Benthall, 1949) ; Delhi zoo (Ganguli, 1975).

Status : Winter visitor ; rare. Very few records, none since 1967 (Kv, 1991).

27 Genus ***Anas*** Linnaeus

*45 (93) ***Anas acuta*** Linnaeus

Pintail

1758. *Anas acuta* Linnaeus, *Syst. Nat.*, ed. 10, 1 : 126 (Sweden).

1929. Baker, *FBI* No. 2274, **6** : 437.

Local name : Seenkh par.

Distribution : Delhi : Every jheel & also on the river, Shamspur jheel & Delhi zoo (Ganguli, 1975) ; Raota & Kakraula along Najafgarh drain (Varma, 1994); Okhla (Urfi, 1993, 1995); Bhalsawa lake, Wazirabad & Okhla reservoirs, NZP (present record).

Status : Winter visitor ; abundant. The largest concentration observed at Wazirabad in December, 1994 was worked out to be 2000 birds. The male to female sex ratio, as worked out in the field, was 1 : 2.5 (for 140 individuals at NZP) and again 1 : 2.5 (for 35 birds at Okhla) (present find).

*46 (94) *A. crecca crecca* Linnaeus
Common Teal

1758. *Anas Crecca* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 126 (Sweden).

1929. Baker, *FBI* No. 2271, **6** : 431.

Local name : Chhoti murghabi.

Distribution : Delhi : Jheels, swamps & the river (Ganguli, 1975); Okhla (Urfi, 1993); Raota & Kakraula along Najafgarh drain (Varma, 1994) ; Ramghat, NZP & Okhla (present record).

Status : Winter visitor ; common. Two to 30 individuals were seen during the present surveys.

47 (95) *A. formosa* Georgi
Baikal, Clucking or 'Formosa' Teal

1775. *Anas formosa* Georgi, Bemerk. *Reise Russ. Reich*, **1** : 168 (Lake Baikal, Siberia).

1929. Baker, *FBI* No. 2272, **6** : 433.

Distribution : Delhi : 48 km. south-west of Delhi, Jamuna sandbank below Humayun's Tomb (Ganguli, 1975).

Status : Winter visitor ; Rare. Very few records, none since 1947 (Kv, 1991).

*48 (97) *A. poecilorhyncha poecilorhyncha* J.R. Forster
Spotbill Duck

1781. *Anas poecilorhyncha* J.R. Forster, *Indian Zool.*, **23**, pl. 13 f. 1 (Ceylon).

1929. Baker, *FBI* No. 2265, **6** : 421.

Local name : Gujral.

Distribution : Delhi : Sandbanks of Jamuna, Flooded pits beyond Wazirabad bridge, Najafgarh & other jheels & Delhi zoo (Ganguli, 1975) ; ODR (Kv, 1991a); Okhla (Urfi, 1993, 1995); Raota, Jhatikra. & Kakraula along Najafgarh drain (Varma, 1994) ; Lake-park at

Daulakuaon, NZP & Okhla reservoir (present record).

Status : Resident ; common ; breeds. Common in 1920's, declined in 50's perhaps increased recently again (Kv, 1991). Two to twenty individuals were seen (present find), while as many as 86 individuals were recorded at Raota by Varma (1994).

*49 (100) *A. platyrhynchos* Linnaeus
Mallard

1758. *Anas platyrhynchos* Linnaeus *Syst. Nat.*, ed. **10**, 1 : 125 (Sweden).

1929. Baker, *FBI* No. 2264, **6** : 419.

Local name : Nilsir.

Distribution : Delhi : Suitable jheels (Basil-Edwardes, 1926) ; Hindon river (Frome, 1947) ; Badshahpur, Hasanpur & Horse-shoe jheels (Ganguli, 1975); Okhla (Urfi, 1993); Okhla reservoir & NZP (present record).

Status : Winter visitor ; uncommon. This dabbling duck was common in 1920s and uncommon since 50's onward. Its excellency for the table, large scale persecution in the past, and disappearance of shallow reedy jheels & marshes in the wake of development, collectively have been responsible for its uncommonness (present find). Only eight males & eight females were counted at Okhla on 14th February, 1995.

50 (101) *A. strepera strepera* Linnaeus
Gadwall

1758. *Anas strepera* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 125 (Sweden).

1929. Baker, *FBI* No. 2269, **6** : 426.

Local name : Beykhur.

Distribution : Delhi : Jheels & the river (Basil-Edwardes, 1926) ; Jamuna (Ganguli, 1975); Okhla (Urfi, 1993, 1995).

Status : Winter visitor, less common (Kv, 1991).

51 (102) *A. falcata* Georgi
Falcated or Bronzecapped Teal

1775. *Anas falcata* Georgi, Bemerk. *Reise Russ. Reich.* **1** : 167 (Asiatic Russia).

1929. Baker, *FBI* No. 2268, **6** : 424.

Local name : Kala sinkhur.

Distribution : Delhi : North of Delhi (Frome, 1947) ; Badshahpur jheel (Ganguli, 1975).

Statu : Winter visitor ; rare. Very few records (Kv, 1991).

*52 (103) ***A. penelope*** Linnaeus
Wigeon

1758. *Anas penelope* Linnaeus, *Syst. Nat.*, ed., **10**, 1 : 126 (Sweden).
1929. Baker, *FBI* No. 2270, **6** : 429.
Local name : Chhota lalsir.
Distribution : Delhi : Jheels and the Jamuna (Ganguli, 1975); Okhla reservoir (Urfi, 1993; present record).
Status : Winter visitor ; common.

53 (104) ***A. querquedula*** Linnaeus
Garganey or Bluewinged Teal

1758. *Anas querquedula* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 126 (Sweden).
1929. Baker, *FBI* No. 2275, **6** : 439.
Local name : Chaita.
Distribution : Delhi : Swamps, jheels and also by the river (Ganguli, 1975); Okhla (Urfi, 1993, 1995); Raota along Najafgarh (Varma, 1994).
Status : Passage migrant ; less common. Recently, Varma sighted four birds at Raota in 1994.

*54 (105) ***A. clypeata*** Linnaeus
Shoveller

1758. *Anas clypeata* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 124 (Sweden).
1929. Baker, *FBI* No. 2276, **6** : 442.
Local name : Tidari.
Distribution : Delhi : Shamspur jheel & Delhi zoo (Ganguli, 1975); Okhla (Urfi, 1993, 1995); Jhatikra, Kakraula along Najafgarh (Varma, 1994) ; Chhawala on Najafgarh drain, NZP, Road side pond at Palam-Gurgaon crossing, Okhla reservoir (present record).
Status : Winter visitor ; abundant. The largest concentration of this duck as observed recently, was 300 birds at Kakraula (Varma, 1994) and 4000 pairs at Okhla reservoir on 14th February, 1995 (present find).

28 Genus ***Netta*** Kaup
*55 (107) ***Netta rufina*** (Pallas)
Redcrested Pochard

1773. *Anas rufina* Pallas, *Reise Russ. Reichs*, **2** : 713 (Caspian Sea).
1929. Baker, *FBI* No. 2278, **6** : 448.

Local name : Lal sir or lal chonch.

Distribution : Delhi : Larger lakes and the Jamuna (Ganguli, 1975); Okhla (Urfi, 1993, 1995); Wazirabad & Okhla reservoirs (present record).

Status : Winter visitor ; common. In this species males and females are found in almost equal numbers (Ganguli, 1975). A minimum of 250 males were counted at Wazirabad & 500 males at Okhla on 17th and 18th December, 1994 respectively.

29 Genus ***Aythya*** Boie

*56 (108) ***Aythya ferina*** (Linnaeus)

Common Pochard

1758. *Anas ferina* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 126. (Sweden).

1929. Baker, *FBI* No. 2279, **6** : 450.

Local name : Lal sir.

Distribution : Delhi : Badshahpur, Najafgarh & Dasna etc. (Ganguli, 1975); Okhla (Urfi, 1993, 1995); Bhalsawa lake, Wazirabad & Okhla reservoirs (present record).

Status ; Winter visitor, abundant. A total of 250 males were recorded at each Bhalsawa lake & Wazirabad reservoir, while 500 males were recorded at Okhla in December, 1994 and 100 males in February, 1995.

57 (109) ***A. nyroca*** (Guldenstadt)

White-eyed Pochard or Ferruginous Duck

1770. *Anas nyroca* Guldenstadt, *Novi Comm. Sci. Petropol.*, **14** : 403 (' ..... regionibus Tanaicensibus inter gradum 54° - 55°...' = S. Russia).

1929. Baker, *FBI* No. 2280, **6** : 453 (=*Nyroca rufa*).

Local name : Kurchiya.

Distribution : Delhi : Open jheels, reedy swamps & the Jamuna (Ganguli, 1975); Okhla (Urfi, 1993, 1995).

Status : Winter visitor ; common (Kv, 1991).

58 (111) ***A. fuligula*** (Linnaeus)

Tufted Duck

1758. *Anas fuligula* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 128 (Sweden).

1929. Baker, *FBI* No. 2283, **6** : 458.

Local name : Ablak.

Distribution : Delhi : Open jheels & the Jamuna (Ganguli, 1975).

Status : Winter visitor ; common (Kv. 1991).

59 (112) ***A. marila marila*** Linnaeus
Scaup Duck

1761. *Anas marila* Linnaeus, *Fn. svec.*, ed. **2** : 39. (Lapland).
1929. Baker, *FBI* No. 2282, **6** : 456.
Distribution : Delhi (Ali & Ripley, 1978).
Status : Winter visitor ; uncommon (Kv, 1991). Ganguli (1975) did not mention it.

30 Genus ***Nettapus*** Brandt
*60 (114) ***Nettapus coromandelianus coromandelianus*** (Gmelin)
Cotton Teal or Quacky-duck

1789. *Anas coromandelianus* Gmelin, *Syst. Nat,*. **1** (2) : 522 (Coromandel, India).
1929. Baker, *FBI* No. 2250, **6** : 392.
Local name : Girria.
Distribution : Delhi : Jamuna, Hindan, north Delh & Najafgarh (Ganguli, 1975); Okhla (Urfi, 1993); Ramghat & Okhla (present record).
Status : Resident, less common ; breeds (Kv, 1991). It was scarce till 1954 but has become more numerous since 1957 (Ganguli, 1975).

31 Genus ***Sarkidiornis*** Eyton
61 (115) ***Sarkidiornis melanotos melonotos*** (Pennant)
Nakta or Comb Duck

1769. *Anas melanotos* Pennant, *Ind. Zool.* : 12, pl. 11 (Ceylon).
1929. Baker, *FBI* No. 2247, **6** : 385.
Local name : Nakta.
Distribution : Delhi : Delhi zoo (Ganguli, 1995) ; NDR (Kv, 1991a).
Status : Resident ; uncommon. Presumably resident, no breeding record for Delhi (Kv, 1991).

32 Genus ***Bucephala*** Baird
62 (118) ***Bucephala clangula clangula*** Linnaeus
Goldeneye Duck

1758. *Anas Clangula* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 125 (Sweden).
1929. Baker, *FBI* No. 2284, **6** : 460 (=*Glaucionetta c. clangula*).
Distribution : Delhi : Dasna, Jamuna (Ganguli, 1975).
Status : Vagrant ; uncommon. Seen twice in 1952 and 1963 (Kv, 1991).

33 Genus ***Mergus*** Linnaeus
62 (119) ***Mergus albellus*** Linnaeus
Smew

1758. *Mergus Albellus* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 129 (Mediterranean Sea near Smyrna).
1929. Baker, *FBI* No. 2286, **6** : 466.
Local name : Nikenne.
Distribution : Delhi : Najafgarh jheel, (Ganguli, 1975) ; Delhi (Ali & Ripley, 1978).
Status : Vagrant ; uncommon (Kv, 1991). Occurrence of this diving duck in Delhi needs confirmation (present find).

34 Genus ***Oxyura*** Bonaparte
64 (123) ***Oxyura leucocephala*** (Scopoli)
Whiteheaded Stifftailed Duck

1769. *Anas leucocephala* Scopoli, *Annus I Hist. Nat.* : **65** (probably from northern Italy).
1929. Baker, *FBI* No. 2285, **6** : 463.
Distribution : Delhi : (Ali & Ripley, 1978).
Status : Winter visitor ; rare. Three records in 1882, none subsequently (Kv, 1991).

V Order : **FALCONIFORMES**
9 Family : ACCIPITRIDAE (Hawks, Vultures etc.)
35 Genus ***Elanus*** Savigny
*65 (124) ***Elanus caeruleus vociferus*** (Latham)
Blackwinged Kite

1790. *Falco vociferus* Latham, *Index Orn.*, **1** : 46 (India = coromandel Coast, *ex* Sonnerat, *apud* Hartert).
1928. Baker, *FBI* No. 1789, **5** : 125.
Local name : Kapassi.
Distribution : Delhi : Sunder nursery, road to Palam, areas behind Hymayun's tomb & NDR (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR & NDR (Kv, 1991a) ; Okhla towards Gaziabad (present record).
Status : Resident ; less common ; breeds (Kv, 1991). The absence of open scrub land has affected the species adversely (Satya Sri, 1993). But according to Gaston (1978) it is a winter visitor on New Delh Ridge.

36 Genus ***Pernis*** Cuvier
66 (130) ***Pernis ptilorhynchus ruficollis*** Lesson
Crested Honey Buzzard

1830. *Pernis ruficollis* Lesson, *Traite d' Orn., livr.* **1** : 77 ('Patrie inconnue' = Bengal).

1928. Baker, *FBI* No. 1819, **5** : 167.

Local name : Madkare.

Distribution : Delhi : Roadside trees, parks like Okhla, Lodhi gardens and Golf link (Ganguli, 1975) ; NDR (Gaston, 1978).

Status : Resident ; less common ; breeds.

37 Genus *Milvus* Lacepede

*67 (133) ***Milvus migrans govinda*** Sykes

Pariah Kite

1832. *Milvus Govinda* Sykes, *Proc. zool. Soc.* London : 81 (Dukhun).

1928. Baker, *FBI* No. 1787, **5** : 122.

Local name : Cheel.

Distribution : Delhi : Throughout (present record).

Status : Resident ; abundant ; breeds.

68 (134) ***Milvus migrans lineatus*** (Gray)

Blackeared or Large Indian Kite

1831. *Haliaetus lineatus* J.E. Gray, in Hardwicke, *Ill. Ind. Zool.* **1** (8) : 1, pl. 18 (China) *Ill. Ind. Zool.*, 1 (8) : 1, pl. 18 (China).

1928. Baker, *FBI* No. 1788, **5** : 124.

Local name : Cheel.

Distribution : Delhi : New Delhi Ridge (Kv, 1991a).

Status : Winter visitor ; uncommon (Kv, 1991).

38 Genus *Haliastur* Selby

69 (135) ***Haliastur indus indus*** (Boddaert)

Brahminy Kite

1783. *Falco Indus* Boddaert, Table *Pl. enlum.* : 25. (Pondicherry *ex* Daubenton, pl. 416 and Buffon 1 : 490).

1928. Baker, *FBI* No. 1784, **5** : 118.

Local name : Dhobia cheel.

Distribution : Delhi (Kv, 1991).

Status : Migratory/Resident ; uncommon (Kv, 1991).

39 Genus ***Accipiter*** Brisson

70 (138) ***Accipiter badius dussumieri*** (Temminck)

Indian Shikra

1824. *Falco dussumieri* Temminck, *Pl. Col. Livr.* **52**, text to pl. 308 (adult), pl. 336 (immature). (India, type from Bengal).

1928. Baker, *FBI* No. 1803, **5** : 149.

Local name : Shikra (female), Chipka (male).

Distribution : Delhi : Lodhi golf links, old Aliganj nursery near Safdarjang (Hutson, 1954) ; gardens, cultivated tracts with large trees & light-wooded country (Ganguli, 1975 ; NDR - 2 Km^2 immediately west of Willington crescent (Gaston, 1978) ; ODR & NDR (Kv, 1991a).

Status : Resident ; common ; breeds (Kv, 1991). Ganguli (1975) reported it as fairly common, while Gaston (1978) recorded it during every week of the study.

71 (148) ***A. nisus melaschistos*** Hume

Indian Sparrow - Hawk

1869. *Accipiter Melaschistos* Hume, Rough Notes, March : 128 (Interior of the Himalayas).

1928. Baker, *FBI* No. 1812, **5** : 158.

Local name : Basha (female), Bashin (male).

Distribution : Delhi : NDR (Gaston, 1978) ; Raota (Varma, 1994).

Status : Winter visitor, uncommon. Hutson (1954) saw single bird on two to three occasions. Possibly goes unrecorded (Kv, 1991). Gaston (1978) records it on New Delhi ridge in February, March & April months as passage migrant mainly spring, but he did not mention the subspecies.

40 Genus ***Buteo*** Lacepede

72 (153) ***Buteo rufinus rufinus*** (Cretzschmar)

Longlegged Buzzard

1826. *Falco rufinus* Crestzchmar, *in* Ruppell's Atlas *Vog.* **40**, pl. 27 (Upper Nubia, Schendi and Sennar, and Ethiopia).

1928. Baker, *FBI* No. 1796, **5** : 137.

Local name : Chuhamar (for all buzzards).

Distribution : Delhi : Najafgarh, Sunder nursery and the riverian belt (Ganguli, 1975) ; NDR (Gaston, 1978 ; Kv, 1991a).

Status : Winter visitor ; less common (Kv, 1991). The species was seen at NDR area in March & April months, as Passage migrant mainly spring, by Gaston (1978). Absence of habitat has adversely affected its population (Satya Sri, 1993).

73 (154) ***B. hemilasius*** Temminck & Schlegel
Upland Buzzard

1845 (1844). *Buteo hemilasius* Temminck & Schlegel, *in.* Siebold, *Fauna Jap., Aves* : **18**, pl. 7 (Japan).

1928. Baker, *FBI* No. 1797, **5** : 140.

Local name : Chuhamar.

Distribution : Delhi : Tughlaqabad (Alexander, 1949) ; NDR (Gaston, 1978 ; Kv, 1991a).

Status : Vagrant ; Uncommon (Kv, 1991).

41 Genus ***Butastur*** Hodgson
74 (157) ***Butastur teesa*** (Franklin)
White-eyed Buzzard-Eagle

1832. (1831) *Circus Teesa* Franklin, *Prov. zool. Soc. Lond.*, pt. 1 : 115 (Farther India = Ganges *apud* Baker).

1928. Baker, *FBI* No. 1774, **5** : 104.

Local name : Tisa.

Distribution : Pindwala (Ganguli, 1975) ; NDR (Gaston, 1978 ; Kv, 1991a).

Status : Summer visitor ; common (Gaston, 1978).

42 Genus ***Spizaetus*** Vieillot
75 (161) ***Spizaetus cirrhatus cirrhatus*** (Gmelin)
Indian Crested Hawk-Eagle

1788. *Falco cirrhatus* Gmelin, *Syst. Nat.*, **1** (1) : 275 (Ceylon).

1928. Baker, *FBI* No. 1756, **5** : 85.

Local name : Shah baaz.

Distribution : Delhi : New Delhi (Alexander, 1949).

Status : Vagrant. Seen once prior to 1954 by H. Alexander (Ganguli, 1975).

43 Genus ***Hieraaetus*** Kaup
76 (163) ***Hieraaetus fasciatus fasciatus*** (Vieillot)
Bonelli's or Slender Hawk-Eagle

1822. *Aquila fasciata* Vieillot, *Mem. Soc. Linn.* Paris, **2** (2) : 152 (Montpellier, France).

1928. Baker, *FBI* No. 1752, **5** : 77.

Local name : Morangi.

Distribution : Delhi : Tughlaqabad, river sandbank near Okhla (Hutson, 1954).

Status : Resident ? Very few records (Kv, 1991).

77 (164) ***H. pennatus*** (Gmelin)
Booted Hawk-Eagle

1788. *Falco pennatus* Gmelin, *Syst. Nat.*, **1** (1) : 272 (No type locality given).
1928. Baker, *FBI* No. 1753, **5** : 79.
Local name : Baghati.
Distribution : Delhi : Over open country, fields or gardens (Ganguli, 1975).
Status : Winter visitor ; uncommon (Ganguli, 1975). Very few records (Kv, 1991).

44 Genus ***Aquila*** Brisson
78 (166) ***Aquila chrysaetos daphanea*** Severtzov
Himalayan Golden Eagle

1888. *Aquila daphanea* Severtzov, *Nouv. Mem. Soc. Imp. Nat.* Moscou, **15** (livr. 5) : 190 (Russian Turkestan, Mongolia, Himalayas, Transbaikalia and Ala-shan Mountains).
1928. Baker, *FBI* No. 1746, **5** : 68.
Distribution : Delhi : Quaidpur (Hutson, 1954).
Status : Vagrant. Hutson mentions a female seen near Quaidpur on 31st December (Ganguli, 1975).

79 (167) ***A. heliaca heliaca*** Savigny
Imperial Eagle

1809. *Aquila heliaca* Savigny, *Descr. Egypte, Ois.*, **82**, pl. 12 (Upper Egypt).
1928. Baker, *FBI* No. 1747, **5** : 69.
Local name : Buta jumiz.
Distribution : Delhi : On road to Najafgarh (Ganguli, 1975) ; NDR (Gaston, 1978 ; Kv, 1991).
Status : Winter visitor ; uncommon (Kv, 1991).

80 (168) ***A. rapax vindhiana*** Franklin
Tawny Eagle

1831. *Aquila Vindhiana* Franklin, *Proc. zool. Soc.* Lond. pt. **1** : 114 (Vindhya Hills, central India).
1928. Baker, *FBI* No. 1749, **5** : 72.
Local name : Okaab.
Distribution : Delhi : Qudsia garden in north Delhi, Rly. bridge close to Red Fort

(Ganguli, 1975) ; NDR (Gaston, 1978 ; Kv, 1991a) ; Mall Road along Najafgarh (Varma, 1994).

Status : Resident ; less common ; breeds.

81 (169) *A. rapax nipalensis* Hodgson
Eastern Steppe Eagle

1833. *Aquila nipalensis* Hodgson, *Asiat. Res.* **18** (2) : 13, pl. 1 (Nepal).

1928. Baker, *FBI* No. 1748, **5** : 70.

Local name : Jumiz.

Distribution : Delhi : Open country, refuse dumps & occasionally sandbanks of the Jamuna (Ganguli, 1975) ; NDR (Kv, 1991a).

Status : Winter visitor ; less common (Kv, 1991). As it prefers wooded country in the vicinity of garbage dumps, the absence of such suitable sites through out the area has contributed to its localised & uncommon distribution (Satya Sri, 1993).

82 (170) *A. clanga* Pallas
Greater Spotted Eagle

1811. *Aquila clanga* Pallas, *Zoogr. Rosso-Asiat.*, **1** : 351 (Russia and Siberia).

1928. Baker, *FBI* No. 1750, **5** : 74.

Local name : Kaljanga.

Distribution : Delhi : Najafgarh & Pindwala (Ganguli, 1975) ; NDR (Gaston, 1978 ; Kv, 1991a).

Status : Winter visitor ; less common (Kv, 1991).

83 (171) *A. pomarina hastata* (Lesson)
Lesser Spotted Eagle

1834. *Morphnus hastatus* Lesson, *in* Belanger, *Voy. Ind. - Orient, Zool.* : 217 (Bengal).

1928. Baker, *FBI* No. 1751, **5** : 75.

Local name : Pahari teesa.

Distribution : Delhi : Najafgarh (Ganguli, 1975) ; NDR (Gaston, 1978 ; Kv, 1991a).

Status : Resident ? ; uncommon (Kv, 1991).

45 Genus *Ictinaetus* Blyth

84 (172) *Ictinaetus malayensis perniger* (Hodgson)
Black Eagle

1836. *Aquila Pernigra* Hodgson, *Jour. Asiat. Soc.*, Bengal, **5** : 227 (Nepal).

1928. Baker, *FBI* No. 1755, **5** : 83.

Distribution : Kingsway (Basil-Edwardes, 1926).

Status : Vagrant. Basil-Edwardes (1926) writes "In the winter of 1920-21 I saw an undoubted specimen of this fine Eagle on the river-banks at Kingsway". No subsequent records.

46 Genus ***Haliaeetus*** Savigny

85 (174) ***Haliaeetus leucoryphus*** (Pallas)

Ringtailed or Pallas's Fishing Eagle

1771. *Aquila leucorypha* Pallas, *Reise, Versch. Prov. Russ. Reichs,* 1 : 454 (Lower Ural river).

1928. Baker, *FBI* No. 1779, 5 : 112.

Local name : Machharang.

Distribution : Delhi : Okhla, Najafgarh, Shamspur & Dasna jheels (Ganguli, 1975).

Status : Resident ; uncommon ; breeds (Kv, 1991). Loss of wetlands in addition to polluted waters has dimnished their main source of food restricting their population (Satya Sri, 1993).

47 Genus ***Icthyophaga*** Lesson

86 (175) ***Icthyophaga ichthyaetus ichthyaetus*** (Horsfield)

Greyheaded Fishing Eagle

1821. *Falco Ichthyaetus* Horsfield, *Trans Linn. Soc.* London, 13 (1) : 136 (Java).

1928. Baker, *FBI* No. 1780, 5 : 114.

Local name : Madhuya.

Distribution : Delhi : Sandbanks of the Jamuna at Okhla (Frome, 1947).

Status : Resident ; uncommon. Very few records, none recently (Kv, 1991).

48 Genus ***Sarcogyps*** Lesson

87 (178) ***Sarcogyps calvus*** (Scopoli)

Black or King Vulture

1786. *Vultur calvus* Scopoli, *Del. Faun. et. Flor. Insubr.*, 2 : 85 (Pondicherry, *ex*, Sonnerat).

1928. Baker, *FBI* No. 1706, 5 : 9.

Local name : Raj gidh.

Distribution : Delhi : Open country, refuse dumps, sandbanks of the Jamuna, Lodi gardens, Golf links (Ganguli, 1975) ; NDR (Gaston, 1978; Kv, 1991a).

Status : Resident ; less common ; breeds (Kv, 1991).

49 Genus ***Aegypius*** Savigny

88 (179) ***Aegypius monachus*** (Linnaeus)

Cinereous Vulture

1766. *Vultur Monachus* Linnaeus, *Syst. Nat.*, ed. 12, 1 : 122 (Arabia, *ex* Edwards, pl. 290).
1928. Baker, *FBI* No. 1705, 5 : 7.
Local name : Kala gidh.
Distribution : Delhi : Refuse dump in New Delhi, road side in S. Delhi (Ganguli, 1975).
Status : Winter visitor; uncommon. Only five records between 1960s & 1970s (Ganguli, 1975).

50 Genus *Gyps* Savigny
89 (180, 183) *Gyps fulvus fulvescens* Hume
Indian Griffon Vulture

1869. *Gyps fulvescens* Hume, Rough Notes I : 15, 19 (Punjab).
1928. Baker, *FBI* No. 707, 5 : 11.
Distribution : Delhi : Wazirabad, open country (Ganguli, 1975).
Status : Winter visitor ; rare (Kv, 1991).

90 (182) *G. indicus indicus* (Scopoli)
Indian Longbilled Vulture

1786. *Vultur indicus* Scopoli, *Del. Faun. et. Flor. Insubr.*, 2 : 85 (India, *ex* Sonnerat).
1928. Baker, *FBI* No. 1710 5 : 16.
Local name : Gidh.
Distribution : Delhi (Ganguli, 1975).
Status : Migrant ; less common. Not recorded till 1960 (Kv, 1991). But sightings by H. Alexendar & Peter Jackson along with that of the author are mentioned in Ganguli (1975).

*91 (185) *G. bengalensis* (Gmelin)
Indian Whitebacked Vulture

1788. *Vultur bengalensis* Gmelin, *Syst. Nat.*, 1 (1) : 245 (Bengal).
1928. Baker, *FBI* No. 1713, 5 : 19.
Local name : Gidh.
Distribution : Delhi : Throughout (present record).
Status : Resident ; abundant ; breeds.

50 Genus *Neophron* Savigny
*92 (186) *Neophron percnopterus percnopterus* Linnaeus
Egyptian Vulture

1758. *Vultur Perenopterus* [*sic*] Linnaeus, *Syst. nat.*,ed. 10 1 : 87 (Egypt).

1928. Baker, *FBI* No. 1714 **5** : 22.

Local name : Safed gidh.

Distribution : Delhi : NDR (Gaston, 1978) ; ODR & NDR (Kv, 1991a) ; Bhalsawa lake environ (present record).

Status : Resident ; common ; breeds (Kv, 1991). The Egyptian race *N. p. percnopterus* and Indian race *N. p. ginginianus* (which has a yellow bill instead of horny as in the fomer) may both be seen in Delhi (Ganguli, 1975).

51 Genus *Circus* Lacepede

93 (189) *Circus cyaneus cyaneus* (Linnaeus)

Hen Harrier

1766. *Falco cyaneus* Linnaeus, *Syst. Nat.*, ed. **12**, 1 : 126 (Europe, Africa = vicinity of London, England, *ex.* Edwards, pl. 225).

1928. Baker, *FBI* No. 1792, **5** : 131.

Local name : Dastmal.

Distribution : Delhi : Badshahpur, Najafgarh (Ganguli, 1975) ; NDR (Gaston, 1978 ; Kv, 1991a).

Status : Winter visitor ; uncommon. Gaston recorded two birds in February & March, 1978.

*94 (190) *C. macrourus* (S.G. Gmelin)

Pale Harrier

1770. *Falco macrourus* S.G. Gmelin, *Reise d. Russl, th.* **1** : 48 (Voronezh, southern Russia).

1928. Baker, *FBI* No. 1790, **5** : 129.

Local name : Girgit mar.

Distribution : Delhi : Over open rocky country, waste land, cultivated fields and also near jheels (Ganguli, 1975) ; near Wazirabad reservoir (present record).

Status : Winter visitor ; uncommon.

95 (191) *C. pygargus* Linnaeus

Montagu's Harrier

1758. *Falco Pygargus* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 89 (Europe = England, *ex.* Albin).

1928. Baker, *FBI* No. 1791, **5** : 130.

Local name : Girgit mar.

Distribution : Delhi : Najafgarh (Ganguli, 1975) ; NDR (Gaston, 1978 ; Kv, 1991a)

Status : Winter visitor ; uncommon. Least common harrier, few records (Kv, 1991).

96 (193) ***C. aeruginosus aeruginosus*** Linnaeus
Marsh Harrier

1758. *Falco aeruginosus* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 91 (Europe, restricted type locality, Sweden).

1928. Baker, *FBI* No. 1794, **5** : 134.

Local name : Safed sira.

Distribution : Delhi : Marshes, swamps & lakes (Ganguli, 1975) ; NDR (Gaston, 1978 ; Kv, 1991a); Okhla (Urfi, 1993).

Status : Passage migrant (Gaston, 1978) ; Common (Kv, 1991).

52 Genus ***Circaetus*** Vieillot
97 (195) ***Circaetus gallicus gallicus*** (Gmelin)
Short-toed Eagle

1771. *Accipiter ferox*, S.G. Gmelin, *Novi Comm. Acad. Petrop.*, **15** : 422, pl 10 (Astrakan, S.Russia). (Unidentifiable *vide* Mayr. E., 1944, Emu, 43 : 303).

1928. Baker, *FBI* No. 1764, **5** : 93.

Local name : Saampmaar.

Distribution : Delhi : Tilpatha village near Dadri about 35 km. east of Delhi (Ganguli, 1975) ; Raota & Jhatikara (Varma, 1994).

Status : Resident ; less common ; breeds (Kv, 1991).

53 Genus ***Spilornis*** G.R. Gray
98 (196) ***Spilornis cheela cheela*** (Latham)
Crested Serpent Eagle

1790. *Falco cheela* Latham, *Index Orn.*, **1** : 14 (India = Lucknow).

1928. Baker, *FBI* No. 1765 **5** : 96.

Local name : Dogra cheel.

Distribution : Delhi : New Delhi, 31 km. from Delhi on G.T. Road (Ganguli, 1975) ; NDR (Gaston, 1978 ; Kv, 1991a) ; Okhla (Kv, 1991a).

Status : Resident ; uncommon. Few records, one in 1989 at Okhla by Kv. But, Gaston recorded this bird every month (except January & June) from 1971 to 1974.

54 Genus ***Pandion*** Savigny
99 (203) ***Pandion haliaetus haliaetus*** Linnaeus
Osprey

1758. *Falco Haliaetus* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 91 (Europe, restricted type locality,

Sweden *ex.* Fn. Suec.).

1928. Baker, *FBI* No. 1704, **5** : 3.

Local name : Machhlimar.

Distribution : Delhi : Around jheels or any large sheet of water (Ganguli, 1975).

Status : Winter visitor ; uncommon (Kv, 1991).

10 Family : FALCONIDAE (Falcons)

55 Genus : ***Falco*** Linnaeus

100 (206) ***Falco biarmicus cherrug*** J.E. Gray

Saker or Cherrug Falcon

1834. *Falco cherrug* J.E. Gray, *Ill. Ind. Zool.*, **2** : pl. 25 (India).

1928. Baker, *FBI* No. 1722, **5** : 39.

Local name : Charg (female), Chargela (male).

Distribution : Delhi (Frome, 1947 ; Alexander, 1949).

Status : Winter visitor ; uncommon. Seen twice, no record since 1948 (Kv, 1991).

101 (208) ***F. biarmicus jugger*** J.E. Gray

Laggar Falcon

1834. *Falco Jugger* J.E. Gray, *in* Hardwicke's *Ill. Ind. Zool.* **2** : pl. 26 (India).

1928. Baker, *FBI* No. 1721 **5** : 37.

Local name : Laggar (female), Jaggar (male).

Distribution : Delhi : Wooded country around New Delhi (Frome, 1947) ; Lodi gardens, field near Okhla (Hutson, 1954) ; Tughlaqabad ; Badshahpur & Pindwala jheel (Ganguli, 1975).

Status : Resident ; uncommon ; breeds (Kv, 1991). No recent sighting.

102 (209/11?) ***F. peregrinus*** Tunstall

Peregrine Falcon

1788. *Falco japonensis* Gmelin, *Syst. Nat.*, **1** (1) : 257, No. 44, *ex.* 'Japanese Hawk', Latham, J., Gen. Syn. Bds., 1 : 33 No. 7 b ('flew on board of Japan'). *Falco calidus* Latham, 1790. *Index Orn.*, **1** : 41 (India).

1928. Baker, *FBI* No. 1718/19, **5** : 32/34.

Local name : Bhyri (female), Bhyri bacha (male).

Distribution : Delhi : Old Secretariat (Basil-Edwardes, 1926) ; riverain tract (Frome, 1947) ; Horse-shoe jheel, Dasna, Badshahpur & Najafgarh jheels (Ganguli, 1975) ; NDR (Gaston, 1978 ; Kv, 1991a).

Status : Winter visitor ; uncommon (Kv, 1991).

103 (212) *F. subbuteo subbuteo* Linnaeus
Hobby

1758. *Falco Subbuteo* Linnaeus, *Syst. Nat.* ed., **10**, 1 : 89 (Europe, restricted type locality, Sweden).

1928. Baker, *FBI* No. 1724, **5** : 42.

Local name : Morassani.

Distribution : Delhi : Okhla (Ganguli, 1975) ; NDR (Gaston, 1978 ; Kv, 1991a).

Status : Passage migrant-mainly autumn (Gaston, 1978). Not recorded before 1953, rarely seen (Kv, 1991).

104 (219) *F. chicquera chicquera* Daudin
Redheaded Merlin

1800. *Falco chiquera* Daudin, *Traite d'Orn.*, **2** : 121 (Bengal).

1928. Baker, *FBI* No. 1730, **5** : 47.

Local name : Turumti.

Distribution : Delhi : One of the gates of Delhi (Ganguli, 1975) ; around rivers & large jheels (Frome, 1947) ; ridge (Alexander, 1949) ; riverain belt (Hutson, 1954) ; *neem* tree near Najafgarh (Ganguli, 1975) ; NDR (Gaston, 1978 ; Kv, 1991a).

Status : Resident ; uncommon ; breeds. Very few records, one by Kv in 1975.

105 (222) *F. tinnunculus tinnunculus* Linnaeus
European Kestral

1758. *Falco Tinnunculus* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 90 (Europe, restricted type locality, Sweden, *apud* Hartert).

1928. Baker, *FBI* No. 1740, **5** : 61.

Local name : Karontia.

Distribution : Delhi : Pindwala jheel (Ganguli, 1975) ; NDR (Gaston, 1978 ; Kv, 1991) ; Raota (Varma, 1994).

Status : Winter visitor, less common. Commonest falcon (Kv, 1991). Loss of suitable habitat has affected it adversely (Satya Sri, 1993).

VI Order : GALLIFORMES
11 Family : PHASIANIDAE (Pheasants, Partridges, Quails).
56 Genus *Francolinus* Stephens

106 (238) ***Francolinus francolinus asiae*** Bonaparte
Indian Black Partridge

1856. *Francolinus asiae* Bonaparte, *Compt. Rend. Acad. Sci.* Paris **42** : 882 (Asia. Restricted to Gurgaon by Baker, 1922, *Jour. Bom. nat. Hist. Soc.* **28** : 202.

1928. Baker, *FBI* No. 1976, **5** : 408.

Local name : Kala teetar.

Distribution : Delhi : Low bushes, long grass or cultivation near water (Ganguli, 1975) ; National Zoological Park and Indira Priyadarshani Wildlife Sanctuary (IPWLS) (Local enquaries).

Status : Resident ; common ; breeds. Common in scrublands and fields (Kv, 1991). Its number is considerably less with highly localised distribution, due to habitat loss & persecution.

*107 (245) ***F. pondicerianus interpositus*** Hartert
North Indian Grey Partridge

1917. *Francolinus pondicerianus interpositus* Hartert, *Novit. Zool.* **24** : 288 (Oudh).

1928. Baker, *FBI* No. 1948, **5** : 421.

Local name : Teetar.

Distribution : Delhi : Old Delhi ridge, parks, cultivation & large gardens (Ganguli, 1975) ; New Delhi ridge (Gaston, 1978) ; ODR & NDR (Kv, 1991a) ; Raota, Jhatikra & Kakraula (Varma, 1994) ; NZP, KN ridge, Okhla-environs & IPWLS (present record).

Status : Resident ; common ; breeds (Kv, 1991). Three to fifteen brids have been observed at the localities mentioned above by Varma (1994) & the present find. Ganguli (1975) described it is plentiful.

57 Genus ***Coturnix*** Bonnaterre
108 (250) ***Coturnix coturnix coturnix*** (Linnaeus)
Grey Quail

1758. *Tetrao Coturnix* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 161 (Europe, Asia, Africa, Restricted type locality, Sweden, *ex.* Fn. Svec.).

1928. Baker, *FBI* No. 1950 **5** : 372.

Local name : Bater or Bada bater.

Distribution : Delhi : Standing crop-especially sugarcane (Ganguli, 1975) ; NDR (Kv, 1991a).

Status : Passage migrant ; uncommon (Kv, 1991).

109 (252) ***C. coromandelica*** (Gmelin)
Blackbreasted or Rain Quail

1789. *Tetrao coromandelicus* Gmelin, *Syst. Nat.* **1** (2) : 764 (Coromandel Coast).
1928. Baker, *FBI* No. 1952, **5** : 375.
Local name : China Bater.
Distribution : Delhi : Overgrown grassland (Frome, 1947) ; Lodi golf links (Hutson, 1954) ; Okhla (Ganguli, 1975) ; NDR (Kv, 1991a).
Status : Migrant/Resident ; less common (Kv, 1991).

58 Genus ***Perdicula*** Hodgson
110 (256) ***Perdicula asiatica punjaubi*** Whistler
Punjab Jungle Bush Quail

1939. *Perdicula asiatica punjaubi* Whistler, *Bull. Brit. Orn. Cl.* **59** : 76 (Ambala, Punjab).
1928. Baker, *FBI* No. 1953 (part) **5** : 377.
Local name : Lowwa.
Distribution : Delhi : Sohna (Benthall, 1949).
Status : Vagrant ; rare. Two birds shot in 1940's, no subsequent records (Kv, 1991).

59 Genus ***Pavo*** Linnaeus
*111 (311) ***Pavo cristatus*** Linnaeus
Indian Peafowl

1758. *Pavo cristatus* Linnaeus *Syst. Nat.*, ed. **10**, 1 : 156. (`India orientali, Zeylona' = India).
1928. Baker, *FBI* No. 1897, **5** : 282.
Local name : Mor (male), Morni (female).
Distribution : Delhi : Cultivated areas, light woodland near Qutab minar, Eastern Jamuna canal areas specially ODR & gardens near ridge (Ganguli, 1975) ; NDR (Gaston, 1978 ; Kv, 1991a) ; ODR (Kv, 1991a) ; Raota, Jhatikra & Kakaraula (Varma, 1994) ; Jahapana PF, Hauzkhas woodland, Deer park, Humayun's tomb, NZP & IARI campus (present record).
Status : Resident ; common ; breeds.

VII Order : **GRUIFORMES**
12 Family : TURNICIDAE (Bustard-Quails)
60 Genus ***Turnix*** Bonnaterre
112 (313) ***Turnix sylvatica dussumier*** (Temminck)
Little Bustard-Quail

1828. *Hemipodius Dussumier* Temminck, *Pl. Col. livr.* **76**, pl. 454, f. 2 (Bengale).
1928. Baker, *FBI* No. 2003, **5** : 450.
Local name : Dabki.
Distribution : Delhi : Near the Jamuna (Alexander, 1949).

Status : Unknown. Very few records (Kv, 1991).

113 (314) ***T. tanki tanki*** Blyth
Indian Yellowlegged Button Quail

1843. *Turnix tanki* Blyth, *Jour. Asiat. Soc.*, Bengal **12** : 180. No Locality : Bengal, based on drawing by Buchanan Hamilton [Not *Turnix maculatus* Vieillot = synonym of *Turnix maculosa* (Temminck)].

1928. Baker, *FBI* No. 2005, **5** : 454.

Local name : Lowwa.

Distribution : Delhi : Okhla (Ganguli, 1975).

Status : Unknown. Seen only once, other records doubtful (Kv, 1991).

114 (318) ***T. suscitator taigoor*** (Sykes)
Indian Bustard-Quail

1832. *Hemipodius Taigoor* Sykes, *Proc. Zool. Soc.* London : 155 (Dukhun).

1928. Baker, *FBI* No. 1988 **5** : 447.

Local name : Gundlu.

Distribution : Delhi : Golf links in New Delhi (Frome, 1947) ; Six km south of Okhla (Donahue, 1967 & Ganguli, 1975).

Status : Resident ; less common ; breeds (Kv, 1991).

13 Family : GRUIDAE (Cranes)
61 Genus *Grus* Pallas
*115 (320) ***Grus grus lilfordi*** Sharpe
Eastern Common Crane

1894. *Grus lilfordi* Sharpe, *Cat. Bds. Brit. Mus.* **23** : 250 (Type locality fixed by Whistler & Kinnear, 1936, *Jour. Bomb. nat. Hist. Soc.* **38** : 695, Jhelum River near Jelapur, Punjab).

1929. Baker, *FBI* No. 2034, **6** : 50.

Local name : Kurch.

Distribution : Delhi : Jamuna & Hindan rivers (Frome, 1947) ; Okhla (Hutson, 1954) ; south of Delhi (Ganguli, 1975) ; NZP (present record).

Status : Winter visitor ; common. Perhaps declining (Kv, 1991). This crane has suffered due to habitat loss in recent times (Satya Sri, 1993).

116 (323) ***G. antigone antigone*** (Linnaeus)
Indian Sarus Crane

1758. *Ardea antigone* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 142 (Asia = Farther India, as restricted by Hartert, 1921).

1929. Baker, *FBI* No. 2038, **6** : 55.

Local name : Sarus.

Distribution : Delhi : Najafgarh (Ganguli, 1975); Okhla (Urfi, 1993, 1995); Raota (Varma, 1994).

Status : Resident ; less common ; breeds (Kv, 1991). A comparison of data collected in 1961 by Ganguli (70 birds) & in 1994 by Varma (one or two birds) along Najafgarh drain clearly indicates that this crane, like common crane, also has suffered due to habitat loss in recent times.

117 (325) ***G. leucogeranus*** Pallas
Siberian or Great White Crane

1773. *Grus Leucogeranus* Pallas, *Reise Russ. Reichs* **2** : 714 (Swamps bordering the Ischim, Irthych, and Ob rivers).

1929. Baker, *FBI* No. 2037, **6** : 53.

Local name : Chini Kulang.

Distribution : Delhi : Najafgarh lake (Ganguli, 1975).

Status : Winter visitor ; uncommon. Recorded once in 1910, one doubtful overhead record in 1979 (Kv, 1991). Visit of this winter viistor in Delhi needs confirmation.

62 Genus ***Anthropoides*** Vieillot
118 (326) ***Anthropoides virgo*** (Linnaeus)
Demoiselle Crane

1758. *Ardea virgo* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 141 ('In Oriente' = India).

1929. Baker, *FBI* No. 2040, **6** : 57.

Local name : Kunj or Karkarra.

Distribution : Delhi : Near the Jamuna (Frome, 1947).

Status : Passage migrant. No subsequent records.

14 Family : RALLIDAE (Rails, Coots)
63 Genus ***Rallus*** Linnaeus
119 (329) ***Rallus striatus albiventer*** Swainson
Indian Bluebreasted Banded Rail

1838. *Rallus albiventer* Swainson, Animals in Menageries : 337 (India).

1929. Baker, *FBI* No. 2008, **6** : 7.

Distribution : Delhi : Reed-fringed pools (Hutson, 1954).

Status : Unknown. Seen only once, no records since 1960 (Kv, 1991).

64 Genus ***Porzana*** Vieillot

120 (337) ***Porzana pusilla pusilla*** (Pallas)

Eastern Baillon's Crake

1776. *Rallus pussilus* Pallas, *Reise Russ. Reichs* **3** : 700 (Dauria).

1929. Baker, *FBI* No. 2013, **6** : 14.

Distribution : Delhi : Okhla (Frome, 1947) ; a jheel (Hutson, 1954) ; beyond Coronation pillar, north Delhi (Ganguli, 1975).

Status : Unknown, No recent record (Kv, 1991).

65 Genus ***Amaurornis*** (Reichenbach)

121 (339) ***Amaurornis fuscus bakeri*** (Hartert)

Northern Ruddy Crake

1917. *Porzana fusca bakeri* Hartert, *Nov. Zool.* **24** : 272 (Bhim Tal, Kumaon).

1929. Baker, *FBI* No. 2019, **6** : 21.

Distribution : Delhi : 5.6 km south of Okhla (Donahue, 1967).

Status : Resident ? ; rare ; breeds ? (Kv, 1991).

122 (342) *A. akool akool* (Sykes)

Brown Crake

1832. *Rallus Akool* Sykes, *Proc. zool. Soc.* London : 164 (Dukhun).

1929. Baker, *FBI* No. 2024, **6** : 25.

Distribution : Delhi : South of Okhla (Donahue, 1967).

Status : Resident ? ; rare. First recorded in 1962 (Kv, 1991).

*123 (343) ***A. phoenicurus chinensis*** (Boddaert)

Chinese Whitebreasted Waterhen

1783. *Fulica chinensis* Boddaert, *Table Pl. enlum.* : 54 (China, *ex* Daubenton, pl. 896, restricted to Hongkong by Stresemann, 1913, *Nov. Zool.* **20** : 304).

1929. Baker, *FBI* No. 2022, **6** : 24.

Local name : Dawak, Dauk.

Distribution : Delhi : Okhla, India international centre (Ganguli, 1975); Okhla (Urfi, 1993); Raota, Jhatikra & Kakraula along the Najafgarh drain (Varma, 1994) ; Near Chhawala at Najafgarh drain, NZP, & roadside ditches (present record).

Status : Resident ; common ; breeds. One to 19 birds have been sighted by Varma (1994). This bird being less sensitive to human beings has adapted to parks & woodlands adjoining to streams & nullahs which are available all over the city thereby increasing their

population (Satya Sri, 1993).

66 Genus ***Gallicrex*** Blyth

124 (346) ***Gallicrex cinerea cinerea*** (Gmelin)

Kora or Watercock

1789. *Fulica cinerea* Gmelin, *Syst. Nat.* **1** (2) : 702 (China *ex.* Latham).

1929. Baker, *FBI* No. 2027, **6** : 29.

Local name : Kora.

Distribution : Delhi : Dense reedy swamps beyond the Coronation pillar, north Delhi, below Madanpur (Ganguli, 1975).

Status : Monsoon visitor ; rare (Kv, 1991).

67 Genus ***Gallinula*** Brisson

*125 (347) ***Gallinula chloropus indica*** Blyth

Indian Moorhen

1842. *Gallinula chlorophus* ? var. *indicus* Blyth, *Jour. Asiat. Soc.* Bengal **11** : 887 (Calcutta).

1929. Baker, *FBI* No. 2026, **6** : 28.

Local name : Jal murghi or Pani Murghi.

Distribution : Delhi : Any large weedy reed-fringed sheet of water, swamps near the railway bridge in Muradnagar, around a culvert on road to Najafgarh (Ganguli, 1975) ; NDR (Gaston, 1978 ; Kv, 1991a) ; ODR (Kv, 1991a); Okhla (Urfi, 1993); Raota, Jhatikra & Kakraula Varma, 1994) ; Bhalsawa lake, Wazirabad & Okhla reservoirs, Ranibag, a pond in Ramghat, NZP & Najafgarh drain at Chhawla bridge (present record).

Status : Resident ; abundant ; breeds. This bird has adopted roadside ditches and nullahs with the hyacinth shelter (Satya Sri, 1993). As many as 83, 42 & 89 birds were counted by Varma, in 1994, at the three above mentioned localities respectively. Sighting & counting of 50 birds was a common sight during the present surveys.

68 Genus ***Porphyrio*** Brisson

*126 (349) ***Porphyrio porphyrio poliocephalus*** (Latham)

Indian Purple Moorhen

1801. *Gallinula poliocephala* Latham, *Index Orn., Suppl.* : 68 (India).

1929. Baker, *FBI* No. 2028, **6** : 32.

Local name : Kalim.

Distribution : Delhi : Horse-shoe jheel (Benthall, 1940) ; Najafgarh, jheels or swamps both in north & south Delhi (Ganguli, 1975); Okhla (Urfi, 1993); Jhatikra (Varma, 1994) ; Chhawala bridge along Najafgarh drain & Ramghat (present record).

Status : Resident ; less common ; breeds (Kv, 1991). It has become uncommon in recent times with a localised distribution along depressions near Hindan & Yamuna rivers (Satya Sri, 1993).

69 Genus ***Fulica*** Linnaeus
*127 (350) ***Fulica atra atra*** Linnaeus
Coot

1758. *Fulica atra* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 152 (Europe, restricted type locality Sweden, *ex.* ref. to Fn. Svec.).

1929. Baker, *FBI* No. 2029, **6** : 34.

Local name : Dasari.

Distribution : Delhi : Najafgarh & Pindwala jheels (Ganguli, 1975) ; Raota, Jhatikra & Kakraula along the Najafgarh drain (Varma, 1994) ; Bhalsawa lake, Wazirabad & Okhla reservoirs, Najafgarh at Chhawla bridge & Ramghat (present record).

Status : Winter visitor ; abundant. 50, 2000, 600, 250 & 90 coots were seen, respectively, on the above mentioned localities during the present surveys. More than 2000 birds were seen in 1961-62 in Najafgarh and Pindwala jheels (Ganguli, 1975).

15 Family : OTIDIDAE (Bustards)
70 Genus ***Choriotis*** G.R. Gray
128 (354) ***Choriotis nigriceps*** (Vigors)
Great Indian Bustard

1831. (2 March), 1830-31. *Otis nigriceps* Vigors, *Proc. zool. Soc.* London : 35 (Himalayas = Foothills & NW India *vide* Ticehurst, 1930, *J. Bombay nat. Hist. Soc.* **34** : 482-3).

1929. Baker, *FBI* No. 2043, **6** : 64.

Local name : Hukna.

Distribution : Delhi (Ganguli, 1975).

Status : Migrant - Resident ; rare. Last seen over a century ago (Kv, 1991).

71 Genus ***Chlamydotis*** Lesson
129 (355) ***Chlamydotis undulata macqueenii*** (J.E. Gray)
Houbara Bustard

1832. *Otis Macqueenii* J.E. Gray, *in* Hardwicke's *Ill. Indian Zool.* **2** (12) : pl. 47 (Himalayas = foothills of NW, India *vide* Ticehurst, 1930, *J. Bom. nat. Hist. Soc.* **34** : 482).

1929. Baker, *FBI* No. 2044, **6** : 67.

Local name : Tiloor.

Distribution : Delhi (Basil-Edwardes, 1926).

Status : Vagrant ; uncommon. Very few records (Kv, 1991).

VIII Order : **CHARADRIIFORMES**
16 Family : JACANIDAE (Jacanas)
72 Genus ***Hydrophasianus*** Wagler
*130 (358) ***Hydrophasianus chirurgus*** (Scopoli)
Pheasant-tailed Jacana

1786. *Tringa Chirurgus* Scopoli, *Del. Flor. et. Faun. Insubr., fasc.* **2** : 92 ('In nova Guiana' = Luzon *ex* Sonnerat).
1929. Baker, *FBI* No. 2032, **6** : 42.
Local name : Pihuya.
Distribution : Delhi : Najafgarh, Model town (Ganguli, 1975); Okhla (Urfi, 1993, 1995); Raota, Jhatikra & Kakuraula (Varma, 1994) ; Najafgarh at Chhawla bridge, Ramghat (present record).
Status : Resident ; common ; breeds (Kv, 1991). This species has suffered due to habitat loss (Satya Sri, 1993). One to ten birds were seen at above said localities by Varma (1994) and the present survey parties.

73 Genus ***Metopidius*** Wagler
*131 (359) ***Metopidius indicus*** Latham
Bronzewinged Jacana

1790. *Parra indica* Latham, *Index Orn.* **2** : 765 (India).
1929. Baker, *FBI* No. 2031, **6** : 40.
Distribution : Delhi : Dasna, swamps beyond Coronation pillar in north Delhi (Ganguli, 1975) ; near Yamuna at Okhla (Kv, 1991); Okhla (Urfi, 1993, 1995) Ramghat (present record).
Status : Resident ; rare (Kv, 1991). Seen only at Ramghat locality during the present surveys.

17 Family : CHARADRIIDAE (Plovers, Sandpipers, Snipe)
Subfamily : CHARADRIINAE (Plovers)
74 Genus ***Vanellus*** Brisson
132 (362) ***Vanellus leucurus*** (Lichtenstein)
Whitetailed Lapwing

1823. *Charadrius leucurus* Lichtenstein, *in* Eversmann's *Reise von Orenburg nach Buchara* : 137 (Between the Kuwan and Jan Daria, Turkestan).
1929. Baker, *FBI* No. 2123, **6** : 183.
Distribution : Delhi : Near water, jheels, swamps, and occasionally on the edge of the

river (Ganguli, 1975); Okhla (Urfi, 1993).

Status : Winter visitor ; less common (Kv, 1991).

133 (363) *V. gregarius* (Pallas)
Sociable Lapwing

1771. *Charadrius gregarius* Pallas, *Reise Russ. Reichs* **1** : 456 (Volga, Jaiku, and Samara).

1929. Baker, *FBI* No. 2122, **6** : 182.

Distribution : Delhi (Frome, 1947) ; Okhla marshes (Hutson, 1954) ; field near Horse-shoe lake ; Najafgarh lake (Ganguli, 1975).

Status : Winter visitor ; rare (Kv, 1991). Not sighted recently.

134 (364) *V. vanellus* (Linnaeus)
Peewit, Lapwing or Green Plover

1758. *Tringa Vanellus* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 148 (Europe, Africa. Restricted type locality, Sweden).

1929. Baker, *FBI* No. 2121, **6** : 180.

Distribution : Delhi : Dasna, Badshahpur & Najafgarh jheels, also on the edge of the Jamuna (Ganguli, 1975).

Status : Winter visitor ; rare (Kv, 1991).

135 (365) *V. cinereus* (Blyth)
Greyheaded Lapwing

1842. *Pluvianus cinereus* Blyth, *Jour. Asiat. Soc.* Bengal **11** : 587 (Calcutta).

1929. Baker, *FBI* No. 2129, **6** : 191.

Distribution : Delhi (Kv, 1991).

Status : Vagrant (Kv, 1991).

*136 (366) *V. indicus indicus* (Boddaert)
Redwattled Lapwing

1783. *Tringa Indica* Boddaert, Table *Pl. enlum.* : 150 (Goa, *ex.* Daubenton, pl. 807).

1929. Baker, *FBI* No. 2125, 2126, **6** : 189.

Local name : Titeeri.

Distribution : Delhi : Open cultivation and grassy fields in the riverain belt, edge of swamps and also in gardens and parks (Ganguli, 1975) ; NDR (Gaston, 1978 ; Kv, 1991a) ; ODR (Kv, 1991a); Okhla (Urfi, 1993); Raota, Jhatikra, Kakraula & Mall road along the Najafgarh drain (Varma, 1994) ; Bhalsawa, Wazirabad, NZP, Okhla, Humayun's tomb, BJ park,

Lake park at Dhaulakuaon & IARI campus (present record).

Status : Resident ; common ; breeds.

137 (369) *V. spinosus duvaucelli* (Lesson)
Spurwinged Lapwing

1826. *Charadrius Duvaucelli* Lesson, *Dict. Sci. Nat.*, ed. Levrault, **42** : 38 (Calcutta).

1929. Baker, *FBI* No. 2124, **6** : 184.

Distribution : Delhi : Sandbanks of the Jamuna and Hindan rivers, fields and edges of pools (Ganguli, 1975); Okhla (Urfi, 1993).

Status : Resident, common ; breeds (Kv, 1991).

138 (370) *V. malabaricus* (Boddaert)
Yellow-wattled Lapwing

1783. *Charadrius malabaricus* Boddaert, *Table Pl. enlum.* : 53 (Malabar Coast, *ex.* Daubenton, pl. 880).

1929. Baker, *FBI* No. 2128, **6** : 190.

Local name : Zirdi.

Distribution : Delhi : Najafgarh area, Central Vista in New Delhi, Pindwala jheel & Diplomatic Enclave (Ganguli, 1975).

Status : Resident ; uncommon ; breeds. Certain decline (Kv, 1991).

75 Genus *Pluvialis* Brisson

139 (371) *Pluvialis squatarola* (Linnaeus)
Blackbellied or Grey Plover

1758. *Tringa Squatarola* Linnaeus, *Syst. Nat.* ed. **10**, 1 : 49 (in Europe = Sweden).

1929. Baker, *FBI* No. 2102, **6** : 156.

Local name : Bada batan.

Distribution : Delhi : The Jamuna (Alexander, 1949).

Status : Winter visitor ; rare. Seen four times in 1940's, and only once subseqently (Kv, 1991).

140 (373) *P. dominica fulva* (Gmelin)
Eastern Golden Plover

1789. *Charadrius fulvus* Gmelin, *Syst. Nat.*,**1** (2) : 687 (Tahiti).

1929. Baker, *FBI* No. 2120, **6** : 178.

Local name : Chhota batan.

Distribution : Delhi : Sewage settling beds (Ganguli, 1975).

Status : Winter visitors ; rare. One seen in 1964, two in 1970 (Kv, 1991).

76 Genus ***Charadrius*** Linnaeus

141 (374) ***Charadrius leschenaultii*** Lesson

Large Sand Plover

1826. *Charadrius Leschenaultii* Lesson, *Dict. Sci. Nat.*, ed. Levrault, **42** : 36 (Pondicherry, India).

1929. Baker, *FBI* No. 2118, **6** : 175.

Distribution : Delhi : The Jamuna (Alexander, 1949) ; Shamspur jheel, southwest of Delhi (Ganguli, 1975).

Status : Passage migrant, rare (Kv, 1991).

142 (379) *C. dubius curonicus* Gmelin

European Little Ringed Plover

1789. *Charadrius curonicus* Gmelin, *Syst. Nat.* **1** (2) : 692 (Kurland).

1929. Baker, *FBI* No. 2114, **6** : 171.

Local name : Zirrea.

Distribution : Delhi : Okhla (Ganguli, 1995).

Status : Winter visitor ; common (Kv, 1991).

143 (380) ***C. d. jerdoni*** (Legge)

Indian Little Ringed Plover

1880. *Aegialitis jerdoni* Legge, *Proc. zool. Soc.* London : 39 (Ceylon and middle India). New name for *Aegialitis minuta* Jerdon, *nec Charadrius minutus* Pallas.

1929. Baker, *FBI* No. 2115, **6** : 171.

Local name : Merwa.

Distribution : Delhi : Okhla (Ganguli, 1975).

Status : Resident ; common ; breeds (Kv, 1991).

144 (381) ***C. alexandrinus alexandrinus*** Linnaeus

Kentish Plover

1758. *Charadrius alexandrinus* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 150 (Egypt, *ex.* Hasselquist).

1929. Baker, *FBI* No. 2106, **6** : 161.

Distribution : Delhi : A refuse dump in north Delhi, and culvert on the road to Najafgarh (Ganguli, 1975).

Status : Passage migrant (Kv, 1991).

145 (384) ***C. mongolus atrifrons*** Wagler
Pamirs Lesser Sand Plover

1829. *Charadrius atrifrons* Wagler, *Isis von Oken, col.* 650 (Bengal).
1929. Baker, *FBI* No. 2117, **6** : 174.
Distribution : Delhi : The river Jamuna (Alexander, 1949) ; Najafgarh (Ganguli, 1975).
Status : Passage migrant (kv, 1991).

Subfamily : SCOLOPACINAE (Curlews, Sandpipers, Snipe, Woodcock)
77 Genus ***Numenius*** Brisson
146 (388) ***Numenius arquata orientalis*** C.L. Brehm
Eastern Curlew

1831. *Numenius orientalis* C.L. Brehm, *Handb. Naturg. Vog., Deutschl.* : 610 (East Indies).
1929. Baker, *FBI* No. 2134, **6** : 202.
Local name : Bada gulinda.
Distribution : Delhi : Edge of the Jamuna, around large jheels, flooded areas but always in the open, away from cover (Ganguli, 1975); Okhla (Urfi, 1993, 1995).
Status : Passage migrant ; uncommon (Kv, 1991).

78 Genus ***Limosa*** Brisson
147 (389) ***Limosa limosa limosa*** (Linnaeus)
Blacktailed Godwit

1758. *Scolopax Limosa* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 147 (in Europa = Sweden).
1929. Baker, *FBI* No. 2137, **6** : 205.
Local name : Jangral.
Distribution : Delhi : Pindwala jheel close to Najafgarh (Ganguli, 1975).
Status : Winter visitor ; common (Kv, 1991).

79 Genus ***Tringa*** Linnaeus
148 (392) ***Tringa erythropus*** (Pallas)
Spotted or Dusky Redshank

1764. *Scolopax erythropus* Pallas, *in Vroeg's Cat., Adumbr.* : 6 (Holland).
1929. Baker, *FBI* No. 2149, **6** : 223.
Local name : Gatni.
Distribution : Delhi : Badshahpur, Dasna, Najafgarh, Shamspur and other jheels

(Ganguli, 1975).

Status : Winter visitor ; less common (Kv, 1991).

149 (394) ***T. totanus eurhinus*** (Oberholser)
Eastern Redshank

1900. *Totanus totanus eurhinus* Oberholser, *Proc. U.S. Nat. Mus.* **22** : 207 (Tso Moriri Lake, 15,000 ft. Ladakh).

1929. Baker, *FBI* No. 2148, **6** : 222.

Local name : Chhota batan.

Distribution : Delhi : Edges of jheels, flooded fields, borrow-pits, muddy pools and edges of Hindan and Jamuna rivers (Ganguli, 1975) ; Kakraula (Varma, 1994).

Status : Winter visitor ; common (Kv, 1991).

150 (395) ***T. stagnatilis*** (Bechstein)
Marsh Sandpiper or Little Greenshank

1803. *Totanus stagnatilis* Bechstein, *Orn. Taschenb. Deutschl* **2** : 292, pl. 29 (Germany).

1929. Baker, *FBI* No. 2144, **6** : 216.

Distribution : Delhi : Najafgarh jheel, swamp in north Delhi (Ganguli, 1975).

Status : Winter visitor (Ganguli, 1975) ; common (Kv, 1991).

151 (396) ***T. nebularia*** (Gunnerus)
Greenshank

1767. *Scolopax nebularia* Gunnerus, *in* Leem, *Beskr. Finm.* Lapper : 251 (District of Trondhjem, Norway).

1929. Baker, *FBI* No. 2150, **6** : 225.

Local name : Timtima.

Distribution : Delhi : Around jheels, flooded borrow-pits, swamps and edges of Hindan and Jamuna (Ganguli, 1975).

Status : Winter visitor ; less common (Kv, 1991).

152 (397) ***T. ochropus*** Linnaeus
Green Sandpiper

1758. *Tringa Ochropus* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 149 (in Europa=Sweden)[Name emended to *ochropus*].

1929. Baker, *FBI* No. 2143, **6** : 215.

Distribution : Delhi : Sewage beds, canals, flooded pits, muddy pools and edges of

jheels (Ganguli, 1975) ; NDR (Gaston, 1978).

Status : Passage migrant (Gaston, 1978) ; common (Kv, 1991).

153 (398) ***T. glareola*** Linnaeus
Wood or Spotted Sandpiper

1758. *Tringa Glareola* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 149 (in Europa = Sweden).

1929. Baker, *FBI* No. 2146, **6** : 219.

Local name : Chupka.

Distribution : Delhi : Jheels, mudflats, pools, flooded borrow - pits and edges of canals and rivers (Ganguli, 1975) ; NDR (Gaston, 1978).

Status : Winter visitor ; common (Kv, 1991).

154 (400) ***T. terek*** (Latham)
Terek Sandpiper or Arocet - Sandpiper

1774. *Scolopax cinerea* Guldenstadt, *Novi Comm. Sci. Petropol.* **19** : 437, pl. 19, pre-occupied in genus *Tringa* by *Tringa cinerea* Brunnich, 1764 (Shores of the Caspian Sea about the mouth of the Terek river).

1929. Baker, *FBI* No. 2141, **6** : 212.

Distribution : Delhi : Okhla (Ganguli, 1975).

Status : Vagrant ; rare. One record in 1968 (Kv, 1991).

*155 (401) ***T. hypoleucos*** Linnaeus
Common Sandpiper

1758. *Tringa hypoleucos* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 149 (in Europa = Sweden).

1929. Baker, *FBI* No. 2145, **6** : 217.

Distribution : Delhi : The edges of pools, tanks, pits, canals & rivers (Ganguli, 1975) ; Raota, Kakraula & Mall road (Varma, 1994), Yamuna river, Najafgarh, roadside ponds (present record).

Status : Winter visitor ; less common (Kv, 1991).

80 Genus ***Arenaria*** Brisson
156 (402) ***Arenaria interpres interpres*** (Linnaeus)
Turnstone

1758. *Tringa Interpres* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 148 (Europe and North America = Gotland, Sweden).

1929. Baker, *FBI* No. 2101, **6** : 154.

Distribution : Delhi : Najafgarh jheel (Ganguli, 1975).

Status : Vagrant ; rare. This bird of the seashore has been recorded once in 1957, no subsequent record (Kv, 1991).

81 Genus ***Capella*** Frenzel

157 (406) ***Capella stenura*** (Bonaparte)

Pintail Snipe

1830. *Scolopax stenura* 'Kuhl' = Bonaparte, *Ann. Stor. Nat.* Bologna. **4** : 335 (Sunda Islands).

1929. Baker, *FBI* No. 2173, **6** : 263.

Local name : Chaha.

Distribution : Delhi (Only in 'Shikar' records - Ganguli, 1975).

Status : Unknown. Only in 'shikar' records (Kv, 1991).

158 (409) ***C. gallinago gallinago*** (Linnaeus)

Common or Faintail Snipe

1758. *Scolopax Gallinago* Linnaeus, *Syst. Nat.*, ed. **10** 1 : 147 (in Europa = Sweden).

1929. Baker, *FBI* No. 2170, **6** : 259.

Local name : Chaha.

Distribution : Delhi : Weedy swamps, edges of flooded borrow-pits and grassy margins of jheels (Ganguli, 1975).

Status : Winter visitor ; less common (Kv, 1991).

159 (410) ***C. minima*** (Brunnich)

Jack Snipe

1764. *Scolopax Minima* Brunnich, *Orn. Boreal.* : 49 (E. Christianso, Denmark).

1929. Baker, *FBI* No. 2175, **6** : 265.

Local name : Chhota chaha.

Distribution : Delhi : Coarse grass at marshy edges of jheel, Madanpur swamps (Ganguli, 1975).

Status : Winter visitor ; rare (Kv, 1991).

82 Genus ***Scolopax*** Linnaeus

160 (411) ***Scolopax rusticola rusticola*** Linnaeus

Woodcock

1758. *Scolopax Rusticola* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 146 (Europe, restricted type locality, Sweden).

1929. Baker, *FBI* No. 2167, **6** : 252.
Local name : Simteetar.
Distribution : Delhi (Alexander, 1949).
Status : Vagrant ; uncommon. Only one record (Kv, 1991).

83 Genus ***Calidris*** Merrem

161 (416) ***Calidris minutus*** (Leisler)

Little Stint

1812. *Tringa minuta* Leisler, *Nachtrage zu Bechstein's Naturg. Deutschl.* : 74 (Hanau am Main, Germany).
1929. Baker, *FBI* No. 2155, **6** : 234.
Local name : Chhota panlowwa.
Distribution : Delhi : Edges of jheels, swamps, and Jamuna & Hindan rivers (Ganguli, 1975).
Status : Passage migrant ; common (Kv, 1991).

162 (417) ***C. temminckii*** (Leisler)

Temminck's Stint

1812. *Tringa Temminckii* Leisler, *Nachtrage Zu Bechstein's Naturg. Deutschl* : 64 (Hanau am Main, Germany).
1929. Baker, *FBI* No. 2158, **6** : 237.
Distribution : Delhi : As that if the little stint (Ganguli, 1975).
Status : Winter visitor ; common (Kv, 1991).

163 (420/1?) ***C. alpinus*** (Linnaeus)

Dunlin

1758. *Tringa alpina* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 149 (Lapland).
1929. Baker, *FBI* No. 2161, **6** : 241.
Distribution : Delhi : Pools, marshes, jheels or river (Ganguli, 1975).
Status : Winter visitor ; common. Locally common on Yamuna (kv, 1991).

164 (422) ***C. testaceus*** (Pallas)

Curlew-Sandpiper

1764. *Scolopax testacea* Pallas, *in Vroeg's Cat. Adumbr.* : 5 (Holland).
1929. Baker, *FBI* No. 2160, **6** : 240.
Distribution : Delhi : Najafgarh jheel, shallows by the river, jheels of Shamspur and

Pindwala (Ganguli, 1975).

Status : Passage migrant ; rare (Kv, 1991).

84 Genus ***Limicola*** Koch

165 (424/5?) ***Limicola falcinellus*** (Pontoppidan)

Broadbilled Sandpiper

Distribution : Delhi : Marshes & mudflats at 9 mile on Mathura road (Alaxander, 1949).

Status : Vagrant ; rare. Only one record prior to 1960 (Kv, 1991).

85 Genus ***Philomachus*** Merrem

166 (426) ***Philomachus pugnax*** (Linnaeus)

1758. *Tringa Pugnax* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 148(In Europa minus boreali = Southern Sweden).

1929. Baker, *FBI* No. 2152, **6** : 228.

Local name : Bagbad.

Distribution : Delhi : Jheels, swamps, pits and the river (Ganguli, 1975).

Status : Passage migrant ; common (Kv, 1991).

Subfamily : PHALAROPINAE (Phalaropes)

86 Genus ***Phalaropus*** Brisson

167 (428) ***Phalaropus lobatus*** Linnaeus

1758. *Tringa tobata* [*sic*] Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 148 (In America septentrionali = Hudson Bay).

1929. Baker, *FBI* No. 2166, **6** : 249.

Distribution : Delhi : Horse-shoe lake (Alexander, 1949).

Status : Passage migrant ; rare. Seen only thrice, twice in 1951 ? - (Kv, 1991).

18 Family : ROSTRATULIDAE (Painted Snipe)

87 Genus ***Rostratula*** Vieillot

168 (429) ***Rostratula benghalensis benghalensis*** (Linnaeus)

Painted Snipe

1758. *Rallus benghalensis* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 153 (Asia).

1929. Baker, *FBI* No. 2033, **6** : 45.

Local name : Rajchaha.

Distribution : Delhi : Najafgarh roadsides ; flooded borrow-pits beyond Wazirabad bridge (Ganguli, 1975).

Status : Resident ; uncommon ; breeds (Kv, 1991).

18 Family : RECURVIROSTRIDAE (Stilts, Avocets, Ibisbill).

88 Genus ***Himantopus*** Brisson

*169 (430) ***Himantopus himantopus himantopus*** (Linnaeus)

Indian Blackwinged Stilt

1758. *Charadrius Himantopus* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 151 (Southern Europe).

1929. Baker, *FBI* No. 2130, **6** : 193.

Local name : Gaz paon.

Distribution : Delhi : Rivers, flooded borrow-pits, pools & jheels (Ganguli, 1975) ; Jhatikra & Kakraula (Varma, 1994) ; Yamuna, Bhalsawa, Okhla, Najafgarh and roadside drains (present record).

Status : Resident ; common ; breeds. One to 38 birds were seen by Varma (1994) and the present survey parties.

89 Genus ***Recurvirostra*** Linnaeus

170 (432) ***Recurvirostra avosetta*** Linnaeus

Avocet

1758. *Recurvirostra Avosetta* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 151 (in Europa australiore = Italy).

1929. Baker, *FBI* No. 2131, **6** : 195.

Local name : Kusya chaha.

Distribution : Delhi : Najafgarh jheel, the Jamuna (Ganguli, 1975).

Status : Resident ; less common. Numbers may have increased since early 1960s (Kv, 1991).

20 Family : BURHINIDAE (Stone Curlews, Great Stone Plover)

90 Genus ***Burhinus*** Illiger

*171 (436) ***Burhinus oedicnemus indicus*** (Salvadori)

Indian Stone Curlew

1865. *Oedicnemus indicus* Salvadori *Atti. Soc. Ital. Sci. Nat.* Milano **8** : 381 (India).

1929. Baker, *FBI* No. 2047, **6** : 77.

Local name : Karwanak.

Distribution : Delhi : Riverain tracts, fields, dry areas, with low scrub, parks, Delhi zoo and large private gardens (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; NZP (present record).

Status : Resident ; less common ; breeds (Kv, 1991). Gaston (1978) recorded it on New

Delhi Ridge throughout the year. This bird is known to inhabit woodland parks which Delhi provides but disturbances in these regions have restricted its population & reducing its number considerably (Satya Sri, 1993).

91 Genus ***Esacus*** Lesson

172 (437) ***Esacus magnirostris recurvirostris*** (Cuvier)

1829. *Oedicnemus recurvirostris* Cuviver, *Regne. Anim.*, ed. **2**, 1 : 500, note 2 (No locality = Nepal, *fide* Baker).

1929. baker, *FBI* No. 2049, **6** : 80.

Local name : Bada karwanak.

Distribution : Delhi : River Jamuna, field bordering Okhla and Wazirabad waterworks (Ganguli, 1975).

Status : Resident ; uncommon ; breeds (Kv, 1991). This bird has also suffered due to human disturbances (Satya Sri, 1993).

21 Family : GLAREOLIDAE (Coursers,Pratincoles)

92 Genus ***Cursorius*** Latham

173 (440) ***Cursorius coromandelicus*** (Gmelin)

Indian Courser

1789. *Charadrius coromandelicus* Gmelin, *Syst. Nat.*, **1** (2) : 692 (Coromandel Coast).

1929. Baker, *FBI* No. 2052, **6** : 86.

Local name : Nukri.

Distribution : Delhi : Open country near Najafgarh and Pindwala jheels, rocky areas near Qutab and Tughlaqabad (Ganguli, 1975).

Status : Resident ; uncommon ; breeds (Kv, 1991).

93 Genus ***Glareola*** Brisson

174 (442) ***Glareola pratincola pratincola*** (Linnaeus)

Collared Prantincole or Swallow-Plover

1766. *Hirundo Pratincola* Linnaeus, *Syst. Nat.*, ed. **12**, 1 : 345 (Shores of southern Europe and in Austria ; restricted type locality, Austria, BOU Committee).

1929. Baker, *FBI* No. 2054, **6** : 89.

Distribution : Delhi : Okhla, Jamuna (Frome, 1947) ; behind Humayun's tomb (Ganguli, 1975).

Status : Resident ; less common ; breeds. Increased since 1950s (Kv, 1991).

175 (444) ***G. lactea*** Temminck

Small Indian Prantincole or Swallow-Plover

1820. *Glareola lactea* Temminck, *Mem. d'Orn.*, ed. **2**, 2 : 503 (Bengal).

1929. Baker, *FBI* No. 2056, **6** : 92.

Distribution : Delhi : Sandbanks of the Jamuna, occasionally about swamps or jheels such as Dasna and Najafgarh (Ganguli, 1975).

Status : Resident ; less common ; breeds (Kv, 1991).

22 Family : LARIDAE (Gulls, Terns)

94 Genus ***Larus*** Linnaeus

176 (450) ***Larus argentatus heuglini*** Bree

Yellowlegged Herring Gull

1876. *Larus Heuglini* Bree, *Bds., Eur.*, ed. **2**, 5 : 58 and pl. (New name for *Larus cachinnans* Pallas, not of Pallas, Heuglin, 1873, Orn. Nord. Ost. Afr. 2, Abth. 2, no. 892, part ; type from Zeyla, Somaliland).

1929. Baker, *FBI* No. 2065, **6** : 107.

Distribution : Delhi : The Jamuna (Frome, 1947) ; Okhla and Pindwala jheel (Hutson, 1954) ; The Jamuna (Ganguli, 1975).

Status : Winter visitor ; uncommon (Kv, 1991).

177 (453) ***L. ichthyaetus*** Pallas*

Great Blackheaded Gull

1773. *Larus Ichthyaetus* Pallas, *Reise Russ. Reich*, **2** : 713 (Caspian Sea).

1929. Baker, *FBI* No. 2060, **6** : 101.

Local name : Dhomra (for all gulls).

Distribution : Delhi : The Jamuna at Wazirabad and Okhla (Ganguli, 1975).

Status : Winter visitor ; uncommon (Kv, 1991).

*178. (454) ***L. brunnicephalus*** Jerdon

Brownheaded Gull

1840. *Larus brunnicephalus* Jerdon, *Madras Jour. Lit. & Sci.* **12** : 225 (West coast of Indian peninsula).

1929. Baker, *FBI* No. 2062, **6** : 103.

Local name : Dhomra.

Distribution : Delhi : The Jamuna (Alexander, 1949) ; mostly about the river but also in all jheels, swamps and flooded borrow pits and fields (Ganguli, 1975) ; The Mall road along Najafgarh (Varma, 1994) ; Yamuna, Bhalsawa, Okhla and Najafgarh (present record).

Status : Winter visitor ; common. Possibly increased since 1960s (Kv, 1991). Positively affected (Satya Sri, 1993). This is supported by the present surveys.

*179 (455) *L. ridibundus ridibundus* Linnaeus
Blackheaded Gull

1766. *Lorus ridibundus* Linnaeus, *Syst. Nat.*, ed. **12**, 1 : 225 (European seas = England).
1929. Baker, *FBI* No. 2061, **6** : 102.

Local name : Dhomra.

Distribution : Delhi : The Jamuna, a large sheet of water behind the Ladakh temple on ring road in north Delhi (Ganguli, 1995) ; Raota, Jhatikra, Kakraula and Mall road along the Najafgarh drain (Varma, 1994) ; Bhalsawa, Najafgarh, Okhla and the Yamuna at Majnu-ka-tila (present record).

Status : Winter visitor, common. Positively increased since 1960s (Kv, 1991). Positively affected species (Satya Sri, 1993). About 90 to 5000 birds (both the Brownheaded & the Blackheaded Gulls) were seen at the river Yamuna and Okhla reservoir during the present surveys. But due to the identification problems, in field, seperate data for these two species i.e. Brown and Blackheaded could not be collected.

95 Genus *Chlidonias* Rafinesque
180 (458) *Chlidonias hybrida indica* (Stephens)
Indian Whiskered Tern

1826. *Viralva Indica* Stephens, *in Shaw's Gen. Zool.* **13** (1) : 169 (Cawnpore, India).
1929. Baker, *FBI* No. 2067, **6** : 111.

Local name : Ganga cheel (for all terns).

Distribution :Delhi : The Jamuna, Najafgarh jheel (Ganguli, 1975) ; Jhatikra (Varma, 1994).

Status : Resident ; common ; breeds. Possibly increased since 1960s, first breeding record in 1962 (Kv, 1991).

181 (459) *C. leucoptera* (Temminck)
Whitewinged Black Tern

1815. *Sterna leucoptera* Temminck, *Man. d'Orn. : 483* (Coasts of the Mediterranean).
1929. Baker, *FBI* No. 2070, **6** : 114.

Distribution : Delhi : Pindwala jheel near Najafgarh (Ganguli, 1975).

Status : Vagrant ; rare. Only one record in 1968 (Kv, 1991).

182 (459a) ***C. niger niger*** (Linnaeus)
Black Tern

1758. *Sterna nigra* Linnaeus, *Syst. Nat.*, ed., **10** : 137 (near Upsala, Sweden).
Not in Baker, *FBI*.
Distribution : Delhi : The Jamuna (Alexander, 1949).
Status : Vagrant. Doubtful record from Yamuna river in 1949 (Kv, 1991).

96 Genus ***Gelochelidon*** Brehm
183 (460) ***Gelochelidon nilotica nilotica*** (Gmelin)
Gullbilled Tern

1789. *Sterna nilotica* Gmelin, *Syst. Nat.* **1** (2) : 606 (Egypt).
1929. Baker, *FBI* No. 2072, **6** : 117.
Distribution : Delhi : The river, jheels, flooded nullahs and fields (Ganguli, 1975).
Status : Resident ; less common (Kv, 1991).

97 Genus ***Hydroprogne*** Kaup
184 (462) ***Hydroprogne caspia caspia*** (Pallas)
Caspian Tern

1770. *Sterna caspia* Pallas, *Novi. Comm. Acad. Sci. Petropol.* **14** (1) : 582, pl. 22 (Caspian Sea).
1929. Baker, *FBI* No. 2071, **6** : 115.
Distribution : Delhi : The river Jamuna behind Humayun's tomb (Ganguli, 1975).
Status : Vagrant ; rare. Only one record in 1963 (Kv, 1991).

98 Genus ***Sterna*** Linnaeus
*185 (463) ***Sterna aurantia*** J.E. Gray
Indian River Tern

1831. *Sterna aurantia* J.E. Gray, *in Hardwicke's Ill. Ind. Zool.* **1** (5) : pl. 69, f. 2 (India).
1929. Baker, *FBI* No. 2080, **6** : 125.
Distribution : Delhi : Sandbanks of the Jamuna (Ganguli, 1975) ; Jhatikra (Varma, 1994) ; Okhla (present record).
Status : Resident ; common ; breeds (Kv, 1991).

186 (464) ***S. hirundo hirundo*** Linnaeus
European Common Tern

1758. *Sterna Hirundo* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 137 (in Europa = Sweden).

1929. Baker, *FBI* No. 2083, **6** : 129.

Distribution : Delhi : Over flooded water north of Delhi (Alexander, 1949) ; over a swamp near Najafgarh and on a mud-spit about the flooded borrow-pits beyond Wazirabad bridge (Ganguli, 1975).

Status : Passage migrant ; rare (Kv, 1991).

187 (470) ***S. acuticauda*** J.E. Gray

Blackbellied Tern

1831? (1830-1832). *Sterna acuticauda* J.E. Gray, *in* Hardwicke's *Ill. Ind. Zool.* **1** (6) : pl. 70, f.3 (Cawnpore, India).

1929. Baker, *FBI* No. 2081, **6** : 127.

Distribution : Delhi : The river Jamuna, over swamps and jheels (Ganguli, 1975).

Status : Resident ; less common ; breeds (Kv, 1991).

188 (475/7?) ***S. albifrons*** Pallas

Little Tern or Ternlet

1929. Baker, *FBI* No. 2087, 2088, 2090, **6** : 135, 136, 138.

Distribution : Delhi : Okhla (Frome, 1947) ; Sandbanks of the Jamuna (Hutson, 1954) ; Najafgarh (Ganguli, 1975).

Status : Resident ; uncommon ; breeds (Kv, 1991).

99 Genus ***Rynchops*** Linnaeus

189 (484) ***Rynchops albicollis*** Swainson

Indian Skimmer or Scissorbill

1837 (1838).*Rynchops albicollis* Swainson, *Anim. in Menag.* : 360 (India).

1929. Baker, *FBI* No. 2100, **6** : 150.

Local name : Panchira.

Distribution : Delhi : The Jamuna, Dasna Jheel (Ganguli, 1975).

Status : Resident ; rare ; breeds. Certain decline, possibly disappeared (Kv, 1991).

IX Order : **COLUMBIFORMES**

23 Family : PTEROCLIDIDAE (Sandgrouse)

100 Genus ***Pterocles*** Temminck

190 (487) ***Pterocles exustus erlangeri*** (Neumann)

Indian Sandgrouse

1909. *Pteroclurus exustus erlangeri* Neumann, *Orn. Monatsb.* **17** : 154 (El Hota, Lahej, southern Arabia).

1928. Baker, *FBI* No. 1893, **5** : 271.

Local name : Bhat teetar.

Distribution : Delhi : The outskirts of newly built new Delhi (Frome, 1947) ; A rocky knoll near Rajput dam (Hutson, 1954) ; Badshahpur jheel, near the ruins of a tomb close to Qutab (Ganguli, 1975).

Status : Resident ; less common ; breeds (Kv, 1991).

191 (489) ***P. orientalis orientalis*** (Linnaeus)

Imperial or Blackbellied Sandgrouse

1758. *Tetrao orientalis* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 161 ('In Oriente' = Anatolia *ex* Hasselquist).

1928. Baker, *FBI* No. 1888, **5** : 262.

Local name : Bhat titir

Distribution : Delhi : South and south-west Delhi (Basil-Edwardes, 1926 ; Frome, 1947 and Alexander, 1949) ; near Najafgarh culvert ; edge of the river at Okhla (Ganguli, 1975).

Status : Winter visitor ; Uncommon (Kv, 1991).

192 (492) *P. indicus indicus* (Gmelin)

Painted Sandgrouse

1789. *Tetrao indicus* J.F. Gmelin, *Syst. Nat.* **1** (2) : 735 (Coromandel, India).

1928. Baker, *FBI* No. 1889, **5** : 264.

Local name : Bhat ban.

Distribution : Delhi : Waste country to the west of Delhi (Alexander, 1949) ; In low rocky hills (Donahue, 1967) ; at the foot of Tughlaqabad (Ganguli, 1975).

Status : Resident ; rare (Kv, 1991).

24 Family : COLUMBIDAE (Pigeons, Doves)

101 Genus ***Treron*** Vieillot

*193 (503) ***Treron phoenicoptera phoenicoptera*** (Latham)

Bengal Green Pigeon

1790. *Columba phoenicoptera* Latham, *Index Orn.* **2** : 597 (India).

1928. Baker, *FBI* No. 1826, **5** : 181.

Local name : Harial (General for all green pigeons).

Distribution : Delhi : Fruit-bearing trees such as *Ficus* and mulberry (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; Humayun's tomb (presen record).

Status : Resident ; common ; breeds (Kv, 1991). With the avenue trees and large number of woodland areas, Green Pigeon has suitable habitat, and has fared well in recent time (Stya Sri, 1993). A total of 20 birds were observed and photographed at Humayun's tomb on 14th February 1995.

102 Genus ***Columba*** Linnaeus

*194 (517) ***Columba livia intermedia*** Strickland

Indian Blue Rock Pigeon

1844. *Columba intermedia* Strickland, *Ann. and Mag. Nat. Hist.* **13** : 39 (India = Calcutta).

1928. Baker, *FBI* No. 1856, **5** : 221.

Local name : Kabutar.

Distribution : Delhi : Old ruins, gardens, tall modern buildings, and trees (Ganguli, 1975) ; NDR (Gaston, 1978) ; Raota, Jhatikra, Kakraula and Mall road along the Najafgarh drain (Varma, 1994) ; practically, throughout the Delhi's environ right from admist of the busiest Connaught place to the pause NZP and IPWL (present record).

Status : Resident ; abundant ; breeds.

103 Genus ***Streptopelia*** Bonaparte

195 (531) ***Streptopelia orientalis meena*** (Sykes)

Western Turtle Dove

1833 (1832).*Columba meena* Sykes, *Proc. Zool. Soc.* London, pt. **2** : 149 (Dukhun).

1928. Baker, *FBI* No. 1871, **5** : 239.

Local name : Pahari fakhta.

Distribution : Delhi : Old Delhi (Frome, 1947) ; NDR (Gaston, 1978 ; Kv, 1991a).

Status : Passage migrant ; rare (Kv, 1991).

*196 (534) ***S. decaocto decaocto*** (Frivaldszky)

Indian Ring Dove

1758. *Columba risoria* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 65 (India). [Based on a pale domesticated bird].

1928. Baker, *FBI* No. 1879, **5** : 248.

Local name : Fakhta or Gugi.

Distribution : Delhi : Cultivation, parks, roadside and gardens (Ganguli, 1975) ; ODR and NDR (Kv, 1991a); Raota, Jhatikra, Kakraula and Mall road along the Najafgarh drain (Varma, 1994) ; Environs of Okhla, Najafgarh at Chhawla, Lake-park at Dhaulakuaon, Jahapanah PF, Lodi gardens, Humayun's & Safdarjung tombs, NZP, BJ park, KN ridge, IARI campus, Ramghat and roadsides (present record).

Status : Resident ; common ; breeds.

197 (535) *S. tranquebarica tranquebarica* (Hermann)
Indian Red Turtle-Dove

1804. *Columba tranquebarica* Hermann, *Obs. Zool.* : 200 (Tranquebarica, India).

1928. Baker, *FBI* No. 1881, **5** : 250.

Local name : Girwi fakhta.

Distribution : Delhi : Woodland, parkland, open cultivation and gardens (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a).

Status : Resident ; less common ; breeds (Kv, 1991). Gaston (1978), it is a summer visitor, as he recorded it only from March to Septmeber on NDR. This bird has suffered due to human disturbances (Satya Sri, 1993).

198 (537) *S. chinensis suratensis* (Gmelin)
Indian Spotted Dove

1789. *Columba suratensis* Gmelin, *Syst. Nat.* **1** (2) : 778 (Surat, Gulf of Cambay, India).

1928. Baker, *FBI* No. 1873, **5** : 242.

Local name : Chitta fakhta.

Distribution : Delhi : Old Aliganj nursery (near Safdarjung's tomb) and south of Lodhi golf links (Hutson, 1954) ; north Delhi (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a).

Status : Passage migrant ; uncommon (Kv, 1991).

*199 (541) *S. senegalensis cambayensis* (Gmelin)
Indian Little Brown or Senegal Dove

1789. *Columba cambayensis* Gmelin, *Syst. Nat.* **1** (2) : 779 ('Cambaya', i.e. Golf of Cambay, NW. India).

1928. Baker, *FBI* No. 1877, **5** : 246.

Local name : Chhota fakhta.

Distribution : Delhi : Gardens, cultivation, telegraph wires, roadsides and also varandahs of houses (Ganguli, 1975) ; ODR and NDR (Kv, 1991a) ; Raota, Jhatikra, Kakraula and Mall road along Najafgarh drain (Varma, 1994) ; NZP, Humayun's tomb, JNU south campus, Tughlaqabad, IPWLS, Piggery farm, KN ridge, IARI campus, Lodi gardens, Jahapanah PF, road sides (present record).

Status : Resident ; abundant ; breeds.

X Order : **PSITTACIFORMES**
25 Family : PSITTACIDAE (Parrots)
104 Genus ***Psittacula*** Cuvier
*200 (545) ***Psittacula eupatria nipalensis*** (Hodgson)
Large Indian Parakeet

1836. *Palaeornis Nipalensis* Hodgson, *Asiat. Res.* **19** (1) : 117 (Nepal).
1927. Baker, *FBI* No. 1498, **4** : 199, 200.
Local name : Rai tota.
Distribution : Delhi : Gardens and parks in old Delhi ; New Delhi (Frome, 1947) ; Humayun's tomb and Qudsia gardens (Alexander, 1949); Okhla (Hutson, 1954 & Ganguli, 1975) ; NDR (Gaston, 1978); ODR and NDR (Kv, 1991a) ; Humayun's tomb (present record).
Status : Resident ; less common; breeds.

*201 (549) ***P. krameri borealis*** (Neumann)
Northern Roseringed Parakeet

1915. *Palaeornis krameri borealis* Neumann, *Orn. Monatsb.* **23** : 178 (Assam).
1927. Baker, *FBI* No. 1501, **4** : 204.
Local name : Tota.
Distribution : Delhi : Gardens, parks, crops, cultivation (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; Raota, Jhatikra, Kakraula and Mall road (Varma, 1994) ; Najafgarh, Lake park at Dhaulakuaon, BJ park, Deer park, Jahanpanah, Lodi gardens, Humayun's & Safdarjung tombs, JNU south campus, Piggery farm, KN ridge, IARI campus and road sides (present record).
Status : Resident ; abundant ; breeds.

202 (557) ***P. cynaocephala bengalensis*** (Forster)
Northern Blossomheaded Parakeet

1781. *Psittacus bengalensis* Forster, *in* Penant's *Indian Zool.* : 40 (Bengal ; restricted to Calcutta By Whistler & Kinnear).
1927. Baker, *FBI* No. 1503, **4** : 206.
Local name : Tui tota.
Distribution : Delhi : Away from human habitation (Basil-Edwardes, 1926) ; Lodi gardens (Hutson, 1954) ; Okhla (Ganguli, 1975) ; BJ park, Lodi tomb (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a).
Status : Resident ; common ; breeds (Kv, 1991).

XI Order : **CUCULIFORMES**

26 Family : CUCULIDAE (Cuckoos)

105 Genus ***Clamator*** Kaup.

203 (570) ***Clamator jacobinus serratus*** (Sparrman)

Pied Crested Cuckoo

1786. *Cuculus serratus* Sparrman, *Mus. Carls., fasc.* 1, no. 3 and pl (Cape of Good Hope = Cap Peninsula, Cape Province, S. Africa).

1927. Baker, *FBI* No. 1472, **4** : 167.

Local name : Kala papiya, Chatak.

Distribution : Delhi : Gardens, woods and scrub country e.g.,Golf links, Lodi gardens (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; Raota (Varma, 1994).

Status : Monsoon visitor ; less common ; breeds (Kv, 1991).

106 Genus ***Cuculus*** Linnaeus

*204 (573) ***Cuculus varius varius*** Vahl

Common Hawk-Cuckoo or Brainfever Bird

1797. *Cuculus varius* Vahl, *Skriv. Naturhist. - Selsk.*, Kjobenhavn **4** (1) : 60 (Tranquebar).

1927. Baker, *FBI* No. 1458, **4** : 148.

Local name : Papiya.

Distribution : Delhi : Gardens, parks, road side trees, Lodi golf links, Lodi gardens, Sunder nursery, Old fruit gardens and old parks in New Delhi (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; Lodi garden and Najafgarh at Chhawla (present record).

Status : Summer visitor ; less common ; breeds (Kv, 1991).

205 (576) ***C. micropterus micropterus*** Gould

Indian Cuckoo

1837. *Cuculus micropterus* Gould, *Proc. zool. Soc.* London : 137 (Himalayas).

1927. Baker, *FBI* No. 1456, **4** : 144.

Local name : Kyphal pakka.

Distribution : Delhi (Frome, 1947).

Status : Vagrant ; uncommon. Only one record, before 1948 (Kv, 1991).

206 (578) ***C. canorus canorus*** Linnaeus

Cuckoo

1758. *Cuculus canorus* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 110 (Europa=Sweden, *ex* Fn. Suec.).

1927. Baker, *FBI* No. 1451, **4** : 135.

Local name : Phuphu.

Distribution : Delhi : South Delhi only (Frome, 1947 ; Alexander, 1949) ; NDR (Gaston, 1978 and Kv, 1991a).

Status : Summer visitor ; uncommon ; breeds ? (Kv, 1991).

207 (580) ***C. saturatus saturatus*** Blyth

Himalayan Cuckoo

1843. *Cuculus saturatus* `Hodgson' = *Blyth, Jour. Asiat. Soc.* Bengal **12**(2) : 942 (Nepal).

1927. Baker, *FBI.* 1454, **4** : 140.

Distribution : Delhi (Kv, 1991).

Status : Vagrant ? ; uncommon (Kv, 1991).

107 Genus ***Cacomantis*** S.Muller

208 (584) ***Cacomantis merulinus passerinus*** (Vahl)

Indian Plaintive Cuckoo

1797. *Cuculus passerinus* Vahl, *Skriv. Naturhist. - Selsk.*, Kjobenhavn, **4** (1) : 57 (Tranquebar).

1927. Baker, *FBI* No. 1462. **4** : 154.

Distribution : Delhi : JNU scrubland (Kv, 1991).

Status : Resident/migrant (Ali & Ripley, 1969) ; less common. Regular records at Jawaharlal Nehru University scrubland (Kv, 1991).

108 Genus ***Eudynamys*** Vigors & Horsfield

*209 (590) ***Eudynamys scolopacea scolopacea*** (Linnaeus)

Indian Koel

1758. *Cuculus scolopaceus* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 111 (Malabar).

1927. Baker, *FBI* No. 1475. **4** : 172.

Local name : Koel.

Distribution : Delhi : Gardens, parks and woodlands (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; Raota, Jhatikra, Kakraula and Mall road along the Najafgarh drain (Varma, 1994) ; Lodi gardens, BJ park (present record).

Status : Summer visitor ; common ; breeds (Kv, 1991).

109 Genus ***Taccocua*** Lesson

210 (596) ***Taccocua leschenaultii sirkee*** (J.E. Gray)

Western Sirkeer Cuckoo

1831. *Centropus sirkee* J.E. Gray, *in Hardwicke's Ill. Ind. Zool.* **1** (6), pl. 28 (No locality = Cawnpore).

1927. Baker, *FBI* No. 1487. **4** : 187.

Local name : Jangli tota.

Distribution : Delhi : Thick cover in gardens of old and new Delhi and the canal banks (Ganguli, 1975) ; NDR (Gaston, 1978 ; Kv, 1991a).

Status : Resident ; uncommon ; breeds. Nesting observed over a century ago by Bingham (Ganguli, 1975), not subsequently (Kv, 1991).

110 Genus ***Centropus*** Illiger

*211. (600) ***Centropus sinensis sinensis*** (Stephens)

Common Crow-Pleasant or Coucal

1815. *Polophilus sinensis* Stephens, *in Shaw's Gen. Zool.* **9** (1) : 51 ('Said to inhabit China' = Ning Po, China, by designation of Stressmann, 1913, *Nov. Zool.* **20** : 321).

1927. Baker, *FBI* No. 1490. **4** : 189.

Local name : Mahoka.

Distribution : Delhi : Gardens, parkland, grassland, cultivation, also reed-beds and tamarisks (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; Raota, Jhatikra, and Kakraula (Varma, 1994) ; Najafgarh at Chhawla, KN ridge and Ramghat (present record).

Status : Resident ; common ; breeds.

XII Order : **STRIGIFORMES**

27 Family : STRIGIDAE (Owls)

Subfamily : TYTONINAE (Barn Owls).

111 Genus ***Tyto*** Billberg

212 (606) ***Tyto alba stertens*** Hartert

Indian Barn Owl

1929. *Tyto alba stertens* Hartert, *Nov. Zool.* **35** : 98 (Cachar).

1927. Baker, *FBI* No. 1636. **4** : 385.

Local name : Ullu.

Distribution : Delhi : Thick tree growths and old building, eg., Lodi tomb (Frome, 1947 ; Hutson, 1954) ; Raota (Varma, 1994).

Status : Resident ; less common ; breeds (Kv, 1991).

Subfamily : STRIGINAE (Owls)

112 Genus ***Otus*** Pennant

213 (616) ***Otus scops sunia*** (Hodgson)

North Indian Scops Owl

1836. *Scops sunia* Hodgson, *Asiat. Res.* **19** : 175 (Nepal).

1927. Baker, *FBI* No. 1680, **4** : 435.

Distribution : Delhi : Qudsia gardens (Ganguli, 1975) ; Babool (keekar) jungle at Raisina (Basil-Edwardes, 1926).

Status : Unknown (Ganguli, 1975). No records since 1926 (Kv, 1991).

214 (621) ***O. bakkamoena gangeticus*** Ticehurst

Gangetic Collared Scops Owl

1922. *Otus bakkamoena gangeticus* Ticehurst, *Bull. Brit. Orn. Cl.* **42** : 122 (Fatehgarh, U.P.).

1927. Baker, *FBI* No. 1668, **4** : 425.

Local name : Tharkavi choghad.

Distribution : Delhi : Scrub and mango tops, semi-cultivation and gardens (Ganguli, 1975) ; Lodi golf links (Hutson, 1954) ; Ratendon road and old Delhi (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a).

Status : Resident ; less common ; breeds ? (Kv, 1991).

113 Genus ***Bubo*** Dumeril

*215 (627) ***Bubo bubo bengalensis*** (Franklin)

Indian Great Horned or Eagle-Owl

1831, (1830-31). *Otus Bengalensis* Franklin, *Proc. zool. zoc.* London : 115 (The Ganges between Calcutta and Benares and in the Vindhyan Hills between the latter place and Gurra Mundela).

1927. Baker, *FBI* No. 1660, **4** : 414.

Local name : Ghughu.

Distribution : Delhi : Ravines of eroded and broken ground (Frome, 1947) ; along Okhla canal and ruined tower south of Humayun's tomb (Hutson, 1954) ; Tughlaqabad fort (Ganguli 1975) ; NDR (Kv, 1991a) ; Raota (Varma, 1994) ; Humayun' tomb (presen record).

Status : Resident ; uncommon ; breeds (Kv, 1991).

216 (630) ***B. coromandus coromandus*** (Latham)

Dusky Horned Owl

1790. *Strix coromanda* Latham, *Index, Orn.* **1** : 53 (Coromandel Coast).

1927. Baker, *FBI* No. 1661, **4** : 416.

Local name : Jangli ghughu.

Distribution : Delhi : The Ridge on the riverside (Basil-Edwardes, 1926) ; Old parks and gardens (Frome, 1947) ; Lodi golf links (Hutson, 1954) ; Zoo (Ganguli, 1975) ; NDR (Gaston, 1978 and Kv, 1991a).

Status : Resident ; uncommon ; breeds (Kv, 1991).

217 (631) ***B. zylonensis leschenault*** (Temminck)
Brown Fish Owl

1820. *Strix leschenault* Temminck, *Pl. col. livr.* **4**, pl. 20 (Eastern provinces of India = Chandernagore).

1927. Baker, *FBI* No. 1653, 1654, **4** : 408, 409.

Local names : Amrai ka ghughu, Ullu.

Distribution : Delhi : A thorny tree of canal avenue (Frome, 1947) ; Okhla (Hutson, 954).

Status : Resident ? ; uncommon ; breeds. Seen before 1955, one doubtful subsequent record (Kv, 1991).

114 Genus ***Athene*** Boie
*218 (650) ***Athene brama indica*** (Franklin)
Northern Spotted Owlet

1831. *Noctua indica* Franklin, *Proc. zool. Soc.* London : 115 (Banks of Ganges and in the mountain chain of upper Hindoostan, i.e. Uttar Pradesh).

1927. Baker, *FBI* No. 1684, **4** : 440.

Local name : Chughad.

Distribution : Delhi : Lodi gardens (Hutson, 1954) ; parks, roadside trees and woodland (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a); Raota (Varma, 1994) ; IARI campus (present record).

Status : Resident ; common ; breeds. Commonest owl (Kv, 1991).

115 Genus ***Strix*** Linnaeus
219 (655-7) ***Strix ocellata*** (Lesson)
Mottled Wood Owl

Distribution : Delhi : (Hutson, 1954).

Status : Vagrant ; uncommon. Recorded only once, before 1960 (Kv, 1991).

116 Genus ***Asio*** Brisson
220 (664) ***Asio flammeus flammeus*** (Pontoppidan)
Shorteared Owl

1763. *Strix Flammea* Pontoppidan, *Dansk, Atlas.* **1** : 617, Pl. 25 (Sweden).

1927. Baker, *FBI* No. 1643, **4** : 394.

Distribution : Delhi : Long grass (Frome, 1947) ; reed beds near Okhla (Hutson, 1954).
Status : Winter visitor ; uncommon (Kv, 1991).

XIII Order : CAPRIMULGIFORMES
28 Family : CAPRIMULGIDAE (Nightjars)
117 Genus *Caprimulgus* Linnaeus
221 (671) *Caprimulgus indicus indicus* Latham
Indian Jungle Nightjar

1790. *Caprimulgus indicus* Latham, *Index Orn.* **2** : 588 (India).
1927. Baker, *FBI* No. 1625, **4** : 366.
Local name : Chhippak (for all nightjars).
Distribution : Delhi : Sunder nursery (Donahue, 1967 ; Ganguli, 1975), NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a).
Status : Resident ; uncommon (Kv, 1991).

222 (674) *C. mahrattensis* Sykes
Sykes's or Sind Nightjar

1832. *Cprimulgus Mahrattensis* Sykes, *Proc. zool. Soc.* London : 83 (Mahrattas [?]).
1927. Baker, *FBI* No. 1628, **4** : 369.
Distribution : Delhi : Old Delhi (Alexander, 1949).
Status : Passage migrant ; rare. Only two sight records (Kv, 1991).

223 (675) *C. macrurus albonotatus* Tickell
Indian Longtailed Nightjar

1833. *Caprimulgus Albonotatus* Tickell, *Jour. Asiat. Soc. Bengal* **2** : 580 (Dampara, Dholbhum, Bengal) [Now in Chaibasa dist., Bihar].
1927. Baker, *FBI* No. 1623-4, **4** : 364-5.
Distribution : Delhi : Sunder nursery (Donahue, 1967).
Status : Unknown.

224 (680) *C. asiaticus asiaticus* Latham
Indian Little Nightjar/Common Indian Nightjar

1790. *Caprimulgus asiaticus* Latham, *Index Orn.* **2** : 588 (India = Bombay).
1927. Baker, *FBI* No. 1630, **4** : 372.
Distribution : Delhi : Lodi golf links, Lodi gardens (Hutson, 1954) ; ODR (Ganguli, 1975) ; NDR (Gaston, 1978 and Kv, 1991a).

Status : Unknown (Kv, 1991a).

225 (682) ***C. affinis monticola*** Franklin
Franklin's or Allied Nightjar

1831. *Caprimulgus monticolus* Franklin, *Proc. zool. Soc.* London : 116 (Ganges between Calcutta and Benares).

1927. Baker, *FBI* No. 1629, **4** : 370.

Distribution : Delhi : (Frome, 1947 and Donahue, 1967) ; Timarpur pumping station - Wazirabad (Alexander, 1949) ; garden (Ganguli, 1975) ; NDR (Gaston, 1978 and Kv, 1991a).

Status : Unknown (Kv, 1991).

XIV Order : **APODIFORMES**
29 Family : APODIDAE (Swifts)
Subfamily : APODINAE (Swifts)
118 Genus ***Apus*** Scopoli
226 (693) ***Apus melba melba*** (Linnaeus)
Alpine Swift

1758. *Hirundo Melba* Linnaeus, *Syst. Nat.* ed., **10**, 1 : 192 (Gibraltar).

1927. Baker, *FBI* No. 1589 (part), **4** : 324.

Local name : Badi ababeel.

Distribution : Delhi : 2 King George's Avenue (Ganguli, 1975).

Status : Unknown. Very few records (Kv, 1991).

*227 (703) ***A. affinis affinis*** (J.E. Gray).
Indian House Swift

1830. *Cypselus affinis* J.E. Gray, *in* Gray and Hardwicke's *Ill. Ind. Zool.* **1** (2), pl. 35 f. **2** (No locality = Ganges).

1927. Baker, *FBI* No. 1596, **4** : 332.

Local name : Ababeel.

Distribution : Delhi : Lodi golf links, Lodi gardens, Sunder nursery, Purana quila, Lodi tomb, near Mehrauli (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; Bhalsawa environ, Lake park at Dhaulakuaon and Ranibag (present record).

Status : Resident ; common ; breeds.

119 Genus ***Cypsiurus*** Lesson
*228 (707) ***Cypsiurus parvus batasiensis*** (J.E. Grey)
Indian Palm Swift

1829. *Cyp. (selus) Balasiensis [sic]* J.E. Gray, *in Griffith's Anim. Kingdom* **7** : 60 (India, restricted to Calcutta by Baker, 1927, Fauna **4** : 336).

1927. Baker, *FBI* No. 1600, 1601, **4** : 336 ; 338.

Local name : Tadi ababeel.

Distribution : Delhi : Qudsia gardens in Old Delhi (Ganguli, 1975).

Status : Unknown. Last seen in 1952 (Kv, 1991).

XV Order : **CORACIIFORMES**

30 Family : ALCEDINIDAE (Kingfishers)

120 Genus ***Ceryle*** Boie

*229 (719) ***Ceryle rudis leucomelanura*** Reichenbach

Indian Pied Kingfisher

1851. *Ceryle leucomelanura* Reichenbach, *Handb. spec. Orn.* : **21**, pl. ccix b, f. 3488 (Ceylon).

1927. Baker, *FBI* No. 1531, **4** : 246.

Local name : Kilkila.

Distribution : Delhi : The river, jheels, flooded swamps, even roadside ditches (Ganguli, 1975) ; NDR (Kv, 1991a) ; Raota, Jhatikra (Varma, 1994) ; Ramghat (present record).

Status : Resident ; common ; breeds.

121 Genus ***Alcedo*** Linnaeus

230 (722) ***Alcedo atthis pallasii*** Reichenbach

Contral Asian Small Blue Kingfisher

1851. *Central Pallasii* Reichenback, *Handb. spec. Orn.* : 3, pl. cccxcii, figs. 3043 6 (Siberia).

1927. Baker, *FBI* No. 1535, **4** : 253.

*231 (723) ***A. a. bengalensis*** Gmelin

Indian Small Blue Kingfisher

1788. *Alcedo bengalensis* Gmelin, *Syst. Nat.* **1** (1) : 450 (Bengal).

1927. Baker, *FBI* No. 1533, **4** : 250.

Local name : Chhota kilkila.

Distribution : Delhi (for both the races, viz., *pallasii and bengalensis*) : Kingsway, north Delhi (Basil-Edwardes, 1926) ; Okhla-water channels on the south side of Delh Zoo, flooded borrow pits beyond Wazirabad bridge (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; Raota, Jhatikra (Varma, 1994) ; Najafgarh at Chhawla bridge, Ramghat, NZP, and Piggery farm (present record).

Status : The race *pallasii* seems to be winter visitor ; common. While the later *bengalensis* being Resident ; common ; breeds.

122 Genus ***Halcyon*** Swainson

*232 (735) ***Halcyon smyrnensis smyrnensis*** Linnaeus

Whitebreasted Kingfisher

1758. *Alcedo smyrnensis* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 116 (Africa and Asia = Smyrna, *ex* Albin).

1927. Baker, *FBI* No. 1550, **4** : 268.

Local name : Bada kilkila.

Distribution : Delhi : Pools, tanks, gardens, fields, occasionally - rivers and decidous forest (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; Raota, Jhatikra, Kakraula and Mall road along the Najafgarh drain (Varma, 1994) ; Okhla, NZP, Ramghat, Ranibagh, Lodi garden, Piggery farm, IARI campus (present record).

Status : Resident ; common ; breeds. Gaston (1978) reported it as summer visitor on the NDR.

31 Family : MEROPIDAE (Bee-eaters)

123 Genus ***Merops*** Linnaeus

233 (747) ***Merops superciliosus persicus*** Pallas

1773. *Merops persica* Pallas, *Reise Russ. Reich* **2** : 708 (Shores of the Caspian Sea).

1927. Baker, *FBI* No. 1527, **4** : 239.

Local name : Bada patringa.

Distribution : Delhi : Sandbanks of Jamuna at Jayatpur, north Delhi (Ganguli, 1975) ; NDR (Gaston, 1978 and Kv, 1991a) ; Raota (Varma, 1994).

Status : Summer visitor, less common ; breeds.

234 (748) ***M. philippinus philippinus*** Linnaeus

Bluetailed Bee-eater

1766. *Merops philippinus* Linnaeus, *Syst. Nat*, ed. **12**, 1 : 183, errata at end of volume ; name for *Merops* 5th sp. (Philippine Islands).

1927. Baker, *FBI* No. 1526, **4** : 237.

Local name : Bada patringa.

Distribution : Delhi : Around jheels (Frome, 1947) ; woodlands (Hutson, 1954) ; flooded borrow-pits behind Humayun's tomb (Ganguli, 1975).

Status : Monsoon visitor (Ganguli, 1975) ; less common and breeds (Kv, 1991). It was common in the past and has become uncommon in recent times becaue of loss of habitat, that is

wooded country along the water front (Satya Sri, 1993).

*235 (750) ***M. orientalis orientalis*** Latham
Indian Small Green Bee-eater

1952. *Merops orientalis* Latham, *Index Orn., Suppl.* : xxxiii (India = Pondichery *vide* Stresemann, Ibis **94** : 515).

1927. Baker, *FBI* No. 1523, **4** : 234.

Local name : Patringa.

Distribution : Delhi : Gardens, cultivation, river and jheels (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; Raota, Jhatikra, Kakraula and Mall road along the Najafgarh drain (Varma, 1994) ; KN ridge, NZP, Lodi gardens, Piggery farm and IARI campus (present record).

Status : Resident ; common ; breeds.

32 Family : CORACIIDAE (Rollers or Blue Jays)
124 Genus : ***Coracias*** Linnaeus
236 (754) ***Coracias garrulus semenowi*** Loudon & Tschudi
Kashmir Roller

1902. *Coracias garrulus semenowi* Loudon & Tschudi, *Orn. Jahrb.* **13** : 148 (Transcaspia).

1927. Baker, *FBI* No. 1516, **4** : 222.

Distribution : Delhi : Road to Najafgarh, Mehrauli, Kalkaji and the wasteland south-west of Delhi (Ganguli, 1975).

Status : Vagrant ? ; rare ?. Probably accidental, or rare passage migrant (Kv, 1991).

237 (755) ***C. benghalensis benghalensis*** (Linnaeus)
Northern Roller or Blue Jay

1758. *Corvus benghalensis* Linnaeus, *Syst. Nat.*, ed. **10**, 1: 106 (Benghala, i.e. Madras *fide* Biswas, *Bull. zool. Nomencl.* **18** : 217-18 ; fixed at Tulin, Purulia district, West Bengal by Biswas's Neotype designation as per ICZN Ruling [opinion 663] ; see Bull. zool. Nomencl. **20** : 195-6, April, 1963).

1927. Baker, *FBI* No. 1517, **4** : 224.

Local name : Nilkant.

Distribution : Delhi : Open and cultivated country, parks and large gardens (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; Raota, Jhatikra and Kakraula (Varma, 1994).

Status : Resident ; common ; breeds (Kv, 1991). Absence of open grassland and cultivated areas has reduced the food supply, mainly crickets and grasshoppers, forcing this

species to city fringes (Satya Sri, 1993).

33 Family : UPUPIDAE (Hoopoes)
125 Genus ***Upupa*** Linnaeus
238 (763) ***Upupa epops epops*** Linnaeus
European Hoopoe

1758. *Upupa Epops* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 117 (Europae *sylvis* = Sweden).
1927. Baker, *FBI* No. 1579, **4** : 308.
Local name : Hudhud (for all the races).
Distribution : Delhi (Basil-Edwardes, 1926 ; Kv, 1991).
Status : Migrant ; common (Kv,1991).

239 (764) ***U. epops saturata*** Lonnberg
Tibetan Hoopoe

1909. *Upupa epops saturata* Lonnberg, *Ark. Zool. 5, no.* **9** : 29 (Kjachta, southern Transbaicalia).
1927. Baker, *FBI* No. 1580, **4** : 310.
Distribution : Delhi (Kv, 1991a).
Status : Migrant ; common (Kv, 1991).

*240 (765) ***U. epops ceylonensis*** Reichenbach
Ceylon Hoopoe

1853. *Upupa ceylonensis* Reichenbach, *Handb. spec Orn., Scansoriae* : 320, pl. DXCV, f. 4036 (Ceylon).
1927. Baker, *FBI* No. 1581, 1582, **4** : 311, 312.
Distribution : Delhi : Gardens, open fields, cultivation and thin scrub forest (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; Kakraula & Mall road (Varma, 1994) ; Lake Garden/Park at Dhaulakuaon, Ranibag, Jahapanah PF, Lodi garden, Humayun's & Safdarjung tombs, NZP, BJ park, Piggery farm, IARI campus, Okhla and roadsides (present record).
Status : Resident ; common ; breeds (Kv, 1991).

34 Family : BUCEROTIDAE (Hornbills)
126 Genus ***Tockus*** Lesson
*241 (767) ***Tockus birostris*** (Scopoli)
Grey Hornbill

1786. *Buceros birostris* Scopoli, *Del. Flor. et. Faun. Insubr., fasc.* **2** : 87 (Coromandel, India).

1927. Baker, *FBI* No. 1575, **4** : 301.

Local name : Dhanmar.

Distribution : Delhi : Wooded plains, deciduous forests, large parks and gardens (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; NZP, IARI campus and on a roadside tree on curzon road Govt. Hostel (present record).

Status : Resident ; common ; breeds. More common than often thought (Kv, 1991). Huge trees with hollows provide them nesting places and their number has gone up (Stya Sri, 1993).

127 Genus ***Anthracoceros*** Reichenbach

242 (774) ***Anthracoceros malabaricus malabaricus*** (Gmelin)

Indian Pied Hornbill

1788. *Buceros malabaricus* Gmelin, *Syst. Nat.* **1** (1) : 359 (India = Chandernagor, *apud* Baker).

1927. Baker, *FBI* No. 1565, **4** : 288.

Local name : Dhan churi.

Distribution : Delhi : New Delhi gardens (Frome, 1947) ; NDR (Gaston, 1978 and Kv, 1991a).

Status : Vagrant ? ; rare. Gaston (1978) reported it as occasional.

XVI Order : **PICIFORMES**

35 Family : CAPITONIDAE (Barbets)

128 Genus ***Megalaima*** G.R. Gray

*243 (780) ***Megalaima zeylanica caniceps*** (Franklin)

Northern Green Barbet

1831 (1830-31). *Bucco caniceps* Franklin, *Proc. zool. Soc.* London (1) : 121 (`On the ganges between Calcutta and Benares, and the Vindhiyan hills between the latter place and Gurrah Mundela on the Nerbudda').

1927. Baker, *FBI* No. 1430, **4** : 110.

Local name : Bada basanta.

Distribution : Delhi : Old fruit gardens, parks, tree-bordered gardens with thick tree growth, both in Old and New Delhi (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; Jahapanah PF, Hauzkhas woodland, Lodi gardens, Humayun's tomb, NZP, BJ park, Tughlaqabad, KN ridge, and IARI campus (present record).

Status : Resident ; common ; breeds.

*244 (792) ***M. haemacephala indica*** (Latham)
Crimsonbreasted Barbet or Coppersmith

1788. *Bucco indicus* Latham, *Index Orn.I* (1) : 205 (India).
1927. Baker, *FBI* Nos. 1446, 1447, **4** : 127, 128.
Local name : Chhota basanth.
Distribution : Delhi : Gardens, orchards, parks, tree-bordered roads (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; BJ park, Piggery farm and KN ridge (present record).
Status : Resident ; common ; breeds. Both the species of this family capitonidane have been benefitted due to urbanisation in Delhi (Satya Sri, 1993).

36 Family : PICIDAE (Wryneck, Woodpeckers)
Subfamily : JYNGINAE
129 Genus ***Jynx*** Linnaeus
245 (796) ***Jynx torquilla torquilla*** Linnaeus
European Wryneck

1758. *Jynx Torquilla* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 112 (Europe=Sweden).
1927. Baker, *FBI* No. 1423, **4** : 99.
Local name : Gardan eyengtha.
Distribution : Delhi : Light *babul*, wasteland, grass thickets and gardens (Ganguli, 1975) ; NDR (Gaston, 1978 and Kv, 1991a).
Status : Winter visitor (Gaston, 1978) ; less common (Kv, 1991).

Subfamily : PICINAE
130 Genus ***Dinopium*** Rafinesque
*246 (819) ***Dinopium benghalense benghalense*** (Linnaeus)
Northern Goldenbacked Woodpecker

1758. *Picus benghalensis* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 113 (Benghala = Chandernagor *vide* Stresemann, 1952, Ibis **94** : 517).
1927. Baker, *FBI* No. 1394, **4** : 67.
Local name : Katphora (for all woodpeckers).
Distribution : Delhi : Gardens, parkland and roadside avenues of tall trees (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; Kakraula (Varma, 1994) ; Humayunu's tomb, Hauzkhas woodland, Piggery farm and NZP (present record).
Status : Resident ; common ; breeds.

131 Genus ***Picoides*** Lacepede

*247 (847) ***Picoides mahrattensis mahrattensis*** (Latham)

Yellowfronted Pied or Mahratta Woodpecker

1801. *Picus Mahrattensis* Latham, *Index Orn., Suppl.*, xxxi (India = Mahratta country *ex. Gen. syn., Suppl.* **2** : 142, No. 7).

1927. Baker, *FBI* No. 1374, **4** : 46.

Distribution : Delhi : Gardens light woodland, parks and canal avenues (Ganguli, 1975); NDR (Kv, 1991a); Kakraula (Verma, 1994); Lake-park at Dhaulakuaon (present record).

Status : Resident; common; breeds (Kv, 1991).

XVII Order : **PASSERIFORMES**

37 Family : PITTIDAE (Pittas)

132 Genu ***Pitta*** Vieillot

248 (867) ***Pitta brachyura brachyura*** (Linnaeus)

Indian Pitta

1766. *Corvus brachyurus* Linnaeus, *Syst. Nat.*, ed. **12** (1): 158 (Moluccas = Ceylon).

1926. Baker, *FBI* No. 1323, **3** : 453.

Local name : Naorang.

Distribution : Delhi : Gardens in New Delhi (Ganguli, 1975).

Status : Vagrant; rare. Only one, possibly two, records in 1950s, one uncertain in 1970s (Kv, 1991).

38 Family : ALAUDIDAE (Larks)

133 Genus ***Mirafra*** Horsfield

249 (875, 6) ***Mirafra erythroptera sindiana*** Ticehurst

Sind Redwinged Bush lark

1920. *Mirafra erythroptera sindianus* Ticehurst, *Bull. Brit. Orn. Cl.* **41** : 56 (Karachi, Sind).

1926. Beker, *FBI No.* 1236, **3** : 342.

Local name : Agiya.

Distribution : Delhi : Dry desert areas with thorn bushes, stoy scrub jungle, also in cultivation (Ganguli, 1975); NDR (Gaston, 1978 and Kv, 1991a).

Status : Resident; common; breeds (Kv, 1991).

134 Genus ***Eremopterix*** Kaup

250 (878) ***Eremopterix grisea*** (Scopoli)

Ashycrowned Finch-Lark

1786. *Aluda grisea* Scopoli, *Del. Flor. et. Faun. Insubr.* **2** : 95 (Gingee, S. Acrot. Dist., India).

1926. Baker, *FBI* No. 1245, **3** : 353.

Local name : Diyora, Duri.

Distribution : Delhi : Tughlaqabad, Najafgarh & Pindwala jheels, Badshapur, also north Delhi (Ganguli, 1975).

Status : Resident ; common; breeds (Kv, 1991).

251 (879) ***E. nigriceps affinis*** (Blyth)

Blackcrowned Finch-Lark

1867. *Pyrrhulauda affinis* Blyth, *Ibis* : 185 (Madras, emended to Karachi, Ticehurst, 1921, *Jour. Bombay nat. Hist. Soc.*, **28** : 235).

1926. Baker, *FBI* No. 1246, **3** : 355.

Local name : Duri.

Distribution : Delhi : grassland near Najafgarh (Frome, 1947).

Status : Vagrant; uncommon seen only once, before 1947 (Kv, 1991).

135 Genus ***Ammomanes*** Cabanis

252 (882) ***Ammomanes phoenicurus phoenicurus*** (Franklin)

Indian Rufoustailed Finch-Lark

1831. *Mirafra phoenicura* Franklin, *Proc. zool. Soc.* London : 119 (Between Calcutta and Benares).

1926. Baker, *FBI* No. 1242 (part) **3** ; 350.

Local name : Aggia.

Distribution : Delhi : Tughlaqabad (Alexander, 1949; Ganguli, 1975).

Status : Resident ?; rare (Kv, 1991).

136 Genus ***Calandrella*** Kaup

253 (885) ***Calandrella cinerea longipennis*** (Eversmann)

Yarkand Short-toed Lark

1848. *Alauda longipennis* Eversmann, *Bull. Soc. Imp. Sci. Nat.* Moscow **21** : 219 (Sangara, Dzungaria).

1926. Baker, *FBI* No. 1221, **3** : 325.

Local name : Bagheri, Pullak.

Distribution : Delhi : (Ali & Ripley, 1972); Open country, ploughed fields, waste country (Ganguli, 1975).

Status : Winter visitor; uncommon (Kv, 1991).

254 (891) ***C. raytal raytal*** (Blyth)
Ganges Sand Lark

1845. *Alauda raytal* `Buch.-Hamilton' = Blyth, *Jour. Asiat. Soc.* Bengal : **13** : 962 (Lucknow).
1926. Baker, *FBI*, No. 1225, **3** : 329.
Local name : Retal.
Distribution : Delhi (Ali & Ripley 1972). Sandbanks of the river, in tamarisk, scrub and the ploughed fields (Ganguli, 1975).
Status : Resident; common; breeds (Kv, 1991).

137 Genus ***Melanocorypha*** Boie
255 (892) ***Melanocorypha bimaculata torquata*** Blyth
Eastern Calandra Lark

1847. *Melanocorypha torquata* Blyth, *Jour. Asiat. Soc.* Bengal **16** : 476 (Afghanistan).
1926. Baker, *FBI* No. 1210, **3** : 312.
Distribution : Delhi : Near Madanpur (Ganguli, 1975).
Status : Vagrant ? ; uncommon ?. First seen in 1970 (Kv, 1991).

138 Genus ***Galerida*** Boie
256 (898) ***Galerida cristata magna*** Hume
Baluchistan Crested Lark

1871. *Galerida magna* Hume, Ibis : 407 (Yarkand).
1926. Baker, *FBI* No. 1238, **3** : 345.
Local name : Chandul.
Distribution : Delhi : Open semi-cultivation and dry country; also in riverian tract (Ganguli, 1975).
Status : Vagrant ?; uncommon (Kv, 1991).

257 (899) ***G. cristata chendoola*** (Franklin)
Indian Crested Lark

1831. *Alauda Chendoola* Franklin, *Proc. zool. Soc.* London : 119 (Between Calcutta and Benares).
1926. Baker, *FBI* No. 1237, **3** : 343.
Local name : Chandul (For all Crested Larks).
Distribution : Delhi (Basil - Edwardes, 1926; Ali & Ripley, 1972); NDR (Kv, 1991a).
Status : Resident; common; breeds (Kv, 1991).

139 Genus ***Alauda*** Linnaeus

258 (903) ***Alauda arvensis dulcivox*** Brooks

West Siberian Skylark

1873. *Alauda Dulcivox* Brooks, *Stray Feathers* **1** : 484 (`Himalayas and plains of North-Western Punjab', emended to Djarkent, Russian Turkestan by Vaurie, 1951, *loc. cit.* : 511).

1926. Baker, *FBI* No. 1211, **3** : 315.

Local name : Bharat.

Distribution : Delhi : Open, dry, semi-cultivated areas (Ganguli, 1975).

Status : Winter visitor; uncommon (Ganguli, 1975; Kv, 1991).

259 (907) ***A. gulgula gulgula*** Franklin

Indian Small Skylark

1831. *Alauda gulgula* Franklin, *Proc. zool. Soc.* London : 119 (The Ganges between Calcutta and Benares).

1926. Baker, *FBI.* No. 1215, **3** : 319.

Local name : Bharat.

Distribution : Delhi: The grassy fields south of Najafgarh lake (Ganguli, 1975).

Status : Resident; common; breeds (Kv, 1991).

39 Family : HIRUNDINIDAE (Swallows)

140 Genus ***Riparia*** Forster

260 (910) ***Riparia riparia diluta*** (Sharpe & Wyatt)

Siberian Collared Sand Martin

1893. *Cotile diluta* Sharpe & Wyatt, *Monogr. Hirund.* **1** : 63 (Chimkent north of Tashkent).

1926. Baker, *FBI* No. 1145, **3** : 232.

Distribution : Delhi : On power lines near a wheat field 16 km south-west of New Delhi (Donahue, 1967); near Najafgarh (Ganguli, 1975).

Status : Winter visitor; rare (Kv, 1991). First seen in Delhi on 28th Dec., 1961 by Donahue. H.G. Alexander (unpublished notes) first seen it on 15th Feb. 1960 (Donahue, 1967).

261 (912) ***R. paludicola chinensis*** (J.E. Gray)

Indian Greythroated Sand Martin

1830. *Hirundo chinensis* J.E.Gray, *Ill. Indian Zool.* **1**(2), pl. 35, fig. 3 (China).

1926. Baker, *FBI* No. 1148, **3** : 235.

Local name : Ababil.

Distribution : Delhi : Usually flocks fly over rivers, swamps, jheels and water channels (Ganguli, 1975); NDR (Kv, 1991a).

Status : Resident; common; breeds (Kv, 1991).

141 Genus ***Hirundo*** Linnaeus

262 (913) ***Hirundo rupestris*** Scopoli

Crag Martin

1796. *Hirundo rupertris* Scopoli, *Annus. I, Hist. Nat.* : 167 (Tyrol).

1926. Baker, *FBI* No. 1149, **3** : 236.

Distribution : Delhi (Ganguli, 1975).

Status : Winter visitor. Doubtfully observed by Lav Kumar in winter (Ganguli, 1975; Kv, 1991). Occurrence of this species in Delhi needs confirmation.

263 (914) ***H. concolor concolor*** Sykes

Dusky Crag Martin

1833. *Hirundo concolor* Sykes, *Proc. zool. Soc.* London : 83 (Dukhun).

1926. Baker, *FBI* No. 1150, **3** : 236.

Local name : Chatan ababil.

Distribution : Delhi : Old buildings, ruins, etc. (Ganguli, 1975).

Status : Resident; common; breeds.

264 (916) ***H. rustica rustica*** Linnaeus

Western Swallow or Common Swallow

1758. *Hirundo rustica* Linnaeus, *Sys. Nat.*, ed. **10,1** : 191 (Sweden).

1926. Baker, *FBI* No. 1152, **3** : 240.

Local name : Ababil (also for 917).

Distribution : Delhi : Over jheels, river and refuse dumps (Ganguli, 1975); NDR (Gaston, 1978; Kv, 1991a).

Status : Winter visitor; common (Kv, 1991).

265 (917) ***H. rustica gutturalis*** Scopoli

Eastern Swallow

1786. *Hirundo gutturalis* Scopoli, *Del. Flor. et. Faun. Insubr.* **2** : 96 (New Guinea, *errore*, Panay = Philippines, Hartert, 1910).

1926. Baker, *FBI* No. 1153, **3** : 241.

Distribution : Delhi : As for 916.

Status : Winter visitor; uncommon. Easily confused with *H. r. rustica* (Kv, 1991).

266 (921) *H. smithii filifera* Stephens
Indian Wiretailed Swallow

1825. *H. (irundo) filifera* Stephens, *in Shaw's Gen. Zool.* **13** : 78 (India, *ex* Latham).
1926. Baker, *FBI* No. 1157, **3** : 245.
Distribution : Delhi : Near water, telegraph wires, parapets of bridges and sandbanks of river (Ganguli, 1975).
Status : Resident; common; breeds (Kv, 1991).

*267 (922) *H. fluvicola* Blyth
Indian Cliff Swallow

1855. *Hirundo fluvicola* Blyth, *Jour Asiat. Soc.* Bengal **24** : 470 (Bundelkund *ex* Jerdon).
1926. Baker, *FBI* No. 1158, **3** : 246.
Local name : Nahar ababil.
Distribution : Delhi : Arch of a bridge over a canal at Madanpur; Rly. bridge over Hindan river (Hutson, 1954); Under a culvert on the road to Najafgarh (Ganguli, 1975); NDR (Gaston, 1978; Kv, 1991a); Okhla, Najafgarh and roadsides (present record).
Status : Resident; common; breeds.

268 (925) *H. daurica nipalensis* Hodgson
Himalayan Striated or Redrumped Swallow

1836. *Hirundo Nipalensis* Hodgson, *Jour. Asiat. Soc.* Bengal **5** : 780 (Nepal).
1926. Baker, *FBI* No. 1161, **3** : 250.
Distribution : Delhi: Old ruins, mosques, and usually away from water (Ganguli, 1975).
Status : Winter visitor; less common (Kv, 1991).

269 (926) *H. daurica japonica* Temminck & Schlegel
Japanese Striated or Redrumped Swallow

1847. *Hirundo alpestris japonica* Temminck & Schelegel, *in* Siebold's fauna *Jap., Aves,* pl. 11 : 33 (Japan). Not in Baker, *FBI cf. H. d. daurica,* **3** : 248.
Distribution : Delhi : (Kv, 1991).
Status : Winter visitor; less common (Kv, 1991).

270 (927) *H. daurica erythropygia* Sykes
Indian Striated or Redrumped Swallow

1832. *Hirundo erythropygia* Sykes, *Proc. zool. Soc.* London : 83 (Dukhun, Poona).
1926. Baker, *FBI* No. 1162, **3** : 251.
Local name : Masjid ababil.
Distribution. : Delhi (Kv, 1991).
Status : Resident; less common; breeds (Kv, 1991).

40 Family : LANIIDAE (Shrikes or `Butcher Birds')
142 Genus ***Lanius*** Linnaeus
*271 (933) ***Lanius excubitor lahtora*** (Sykes)
Indian Grey Shrike

1832. *Collurio Lahtora* Sykes, *Proc. zool. Soc.* London : 86 (Dukhun).
1924. Baker, *FBI* No. 706, **2** : 285.
Local name : Safed latora.
Distribution : Delhi : Dry open country with a few shrubs of *Acacia* and other thorny trees or bushes (Ganguli, 1975); NDR (Gaston, 1978); ODR and Piggery farm (present record).
Status : Resident; common; breeds (Kv, 1991). Out of the six species, three were recorded as uncommon or rare whereas, of the remaining three, Grey Shrike being more aggressive has occupied the limited open scrubland habitat affecting the population of other two shrikes (Satya Sri, 1993).

272 (940) ***L. vittatus vittatus*** Valenciennes
Indian Baybacked Shrike

1826. *Lanius vittatus* Valenciennes, *Dict. Sci. Nat.*, ed. Levrault **40** : 227 (Pondicherry).
1924. Baker, *FBI* No. 710, **2** : 289.
Local name : Pachanak.
Distribution : Delhi : Parks, open country, *babul*-lined canal roads and cultivation, and occasionally gardens (Ganguli, 1975); NDR (Gaston, 1978); ODR and NDR (Kv, 1991a); Jhatikra (Varma, 1994).
Status : Resident; common; breeds (Kv, 1991).

273 (943) ***L. collurio isabellinus*** Hemprich & Ehrenberg
Pale Brown Shrike

1833. *Lanius isabellinus* Hemprich & Ehrenberg, *Symb. Phys. Avium fol. e.* (Kunfuda, Arabia).
1924. Baker, *FBI* No. 721, **2** : 302.
Distribution : Delhi : Okhla, Pindwala jheel, near Najafgarh, north Delhi and the author's garden (Ganguli, 1975); NDR (Gaston, 1978; Kv, 1991a).

Status : Winter visitor; uncommon (Kv, 1991).

274 (944/5?) ***L. tephronotus*** (Vigors)
Greybacked Shrike

1939. *c.f.* Dunajewski, A. *Jour. f. Orn.* **87** : 38 ; Mayr, E., 1947, *JBNHS* **47** : 125-7.
1950. Biswas, B., *ibid.* **49** : 444-55.
Distribution : Delhi (Alexander, 1949).
Status : Winter visitor; rare. Few records (Kv, 1991).

*275 (946) ***L. schach erythronotus*** (Vigors)
Rufousbacked Shrike

1831. *Collurio erythronotus* Vigors, *Proc. zool. Soc.* London : 42 (Himalayas, restricted to Lucknow by Baker, 1924, *FBI* **2** : 295; re-restricted to Simla-Almora dist. by Ticehurst & Whistler, 1924, *Ibis.* : 468-73).
1924. Baker, *FBI* No. 714, **2** : 295.
Local name : Mattiya latora.
Distribution : Delhi: Reed-beds and areas of thin-thorn near the river at Okhla (Ganguli, 1975); NDR (Gaston, 1978); ODR and NDR (Kv, 1991a); Jhatikra, Kakraula and Mall road (Varma, 1994); Okhla, Najafgarh drain at Chhawla, and IPWLS (present record).
Status : Resident and winter visitor; common; breeds (Kv, 1991).

276 (949) ***L. cristatus cristatus*** Linnaeus
Brown Shrike

1758. *Lanius cristatus* Linnaeus, *Syst. Nat.*, ed.**10**, 1 : 93 (Benghala).
1924. Baker, *FBI* No. 719, **2** : 300.
Local name : Kerkheta.
Distribution : Delhi : Near water, bushes and reeds on the edge of jheels (Ganguli, 1975).
Status : Winter visitor; uncommon. Seen before 1955, no subsequent records (Kv, 1991).

41 Family : ORIOLIDAE (Orioles)
143 Genus ***Oriolus*** Linnaeus
277 (953) ***Oriolus oriolus kundoo*** Sykes
Indian Golden Oriole

1832. *Oriolus Kundoo* Sykes, *Proc. zool. Soc.* London : 87 (Dukhun).

1926. Baker, *FBI* No. 953, **3** : 6.

Local name : Peelak.

Distribution : Delhi: Leafy trees - gardens, parks and roadside trees (Ganguli, 1975); NDR (Gaston, 1978); ODR and NDR (Kv, 1991a); Raota (Varma, 1994).

Status : Summer visitor; less common; breeds (Kv, 1991).

278 (958/9?) ***O. xanthornus*** (Linnaeus)

Blackheaded Oriole

1758. *(Coracias) Xanthornus* Linnaeus, *Syst. Nat.*, ed. **10,1** : 108 (in America = Chandernagor, Bengal).

1926. Baker, *FBI* No. 958, **3** : 11.

Distribution : Delhi : Qudsia garden, north Delhi (Alexander, 1949); Lodi gardens (Ganguli, 1975); Raota (Varma, 1994).

Status : Vagrant; uncommon. recently, recorded at Raota along the Najafgarh drain by Varma (1994).

42 Family : DICRURIDAE (Drongos)

144 Genus ***Dicrurus*** Vieillot

*279 (962/3 ?) ***Dicrurus adsimilis*** (Bechstein)

Black Drongo or King Crow

Local name : Kotwal.

Distribution : Delhi : Any type of country, particularly in open cultivation, less commonly in gardens (Ganguli, 1975) NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); Raota, Jhatikra & Kakraula (Varma, 1994); Bhalsawa lake, Okhla, Najafgarh, Humayun's tomb, BJ park, Tughlaqabad, Ranibag, IARI campus & roadsides (present record).

Status : Resident; common; breeds.

280 (965) ***D. leucophaeus longicaudatus*** Hay

Indian Grey Drongo

1845. *(Dicrurus) longicaudatus* Lord Arthur Hay, *in* Jerdon, Madras *Jour. Lit. Sci.* **13** : 121 *nom. nud.*

1924. Baker, *FBI* No. 775, **2** : 362.

Local name : Nila kotwal.

Distribution : Delhi: Woodland north of old Delhi (Alexander, 1949); NDR (Gaston, 1978; Kv, 1991a).

Status : Passage migrant; rare.

281 (967) ***D. caerulescens caerulescens*** (Linnaeus)
Indian Whitebellied Drongo

1758. *Lanius caerulescens* Linnaeus, *Syst. Nat.*, ed. **10,** 1 : 95 (Benghala).
1924. Baker, *FBI* No. 777 (part),**2** : 365.
Local name : Pahari buchanga.
Distribution : Delhi : Light woodland (Frome, 1947); Lodi golf links and Okhla (Hutson, 1954); Okhla (Ganguli, 1975).
Status : Vagrant; rare. Few records (Kv, 1991).

282 (976) ***D. paradiseus grandis*** (Gould)
Northern Large Racket-tailed Drongo

1836. *Edolius grandis* Gould, *Proc. zool. Soc.* London : 5 (Nepalia).
1924. Baker, *FBI* No. 789, **2** : 378.
Local name : Bhimraj.
Distribution : Delhi : New Delhi (Ganguli, 1975).
Status : Vagrant. One doubtful record (Kv, 1991).

43 Family : ARTAMIDAE (Swallow-Shrikes or Wood Swallows)
145 Genus ***Artamus*** Vieillot
283 (982) ***Artamus fuscus*** Vieillot
Ashy Swallow - Shrike

1817. *Artamus fuscus* Vieillot, *Nouv. Dict. d'Hist. Nat.* **17** : 297 (Bengal).
1924. Baker, *FBI* No. 763, **2** : 348.
Local name : Tadi ababeel.
Distribution : Delhi (Ganguli, 1975).
Status : Vagrant. Two records in 1950s, none subsequently (Kv, 1991).

44 Family : STURNIDAE (Starlings, Mynas)
146 Genus ***Sturnus*** Linnaeus
284 (987) ***Sturnus malabaricus malabaricus*** (Gmelin)
Greyheaded Myna

1789. *Turdus malabaricus* Gmelin, *Syst. Nat.* **1** : 816 (Malabar Coast).
1926. Baker, *FBI* No. 982, **3** : 39.
Local name : Pawei.
Distribution : Delhi : New Delhi ridge (Frome, 1947); Old Delhi ridge (Alexander, 1949); In a nullah at Okhla (Ganguli, 1975).
Status : Vagrant; rare. Rarely seen (Kv, 1991).

*285 (994) ***S. pagodarum*** (Gmelin)
Blackheaded or Brahminy Myna

1789. *Turdus pagodarum* Gmelin, *Syst. Nat.* **1** : 816 (Malabar).
1926. Baker, *FBI* No. 991, **3**: 47.
Local name : Kalasir myna.
Distribution : Delhi : Scrub or wasteland, and open country with bushes and trees (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); Lodi garden, Humayun's tomb, NZP, Piggery farm and roadsides (present record).
Status : Resident; common; breeds.

286 (996) ***S. roseus*** (Linnaeus)
Rosy Starling or Rosy Pastor

1758. *Turdus roseus* Linnaeus, *Syst. Nat.*, ed. **10,1** : 171 (Lapland, Switzerland).
1926. Baker, *FBI* No. 972, **3** : 29.
Local name : Gulabi myna.
Distribution : Delhi: Najafgarh (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a).
Status : Passage migrant; less common (Kv, 1991).

*287 (997) ***S. vulgaris poltaratskyi*** Finsch
Finsch's or Common Indian Starling

1878. *St. (urnus) poltaratskyi* Finsch, *Proc. zool. Soc.* London : 713 (Marka-kul, Eastern Kazakhstan).
1926. Baker, *FBI* No. 976, **3** : 34.
Local name : Tilyer myna.
Distribution : Delhi : Stubbles, refuse dumps, edge of swamps, Delhi zool, fields following the plough (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); Okhla & Ranibag (present record).
Status : Winter visitor; common.

*288 (1002) ***S. contra contra*** Linnaeus
Indian Pied Myna

1758. *Sturnus Contra* Linnaeus, *Syst. Nat.*, ed. **10,** 1 : 167 (India, restricted to Chandernagor [Hoogly dist., W. Bengal] by Stresemann, 1952, *Ibis* **94** : 517).
1926. Baker, *FBI* No. 1005, **3** : 63.
Local name : Ablak.

Distribution : Delhi : Near water, flooded fields, pools, swamps and riverain belt (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); Jhatikra, Kakraula, & Mall road along the Najafgarh drain (Varma, 1994); Okhla, Najafgarh, Lake park at Dhaulakuan, Ramghat, Ranibag, Lodi garden, Humayun's & Safdarjung tombs, NZP, BJ park, Piggery farm, KN ridge, IARI campus and road sides (present record).

Status : Resident; common; breeds.

147 Genus ***Acridotheres*** Vieillot

*289 (1006) ***Acridotheres tristis tristis*** (Linnaeus)

Indian Myna

1766. *Paradisea tristis* Linnaeus, *Syst. Nat.*, ed. **12**,1 : 167 (Philippines, *errore* = Calcutta *vide* Baker `Fauna' **3** : 53 = Pondichery *vide* Stresemann, 1952, *Ibis* : 515.

1926. Baker, *FBI* No. 996, **3** : 53.

Local name : Desi myna.

Distribution : Delhi : Gardens, parks, cultivations and buildings (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); along the Najafgarh drain (Varma, 1994); throughout Delhi's environ (present record).

Status : Resident; abundant; breeds.

*290 (1008) ***A. ginginianus*** (Latham)

Bank Myna

1790. *Turdus ginginianus* Latham, *Index Orn.* **1** : 362 (Gingee).

1926. Baker, *FBI* No. 998, **3** : 55.

Local name : Ganga myna.

Distribution : Delhi : Cultivation and grazing land following cattle, or the plough, also human habitation & garbage points (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a), Kakraula and Mall road (Varma, 1994); Wazirabad, Okhla, Najafgarh, Ramghat, Lodi garden, NZP, Piggery farm, road sides (present record).

Status : Resident; common; breeds.

45 Family : CORVIDAE (Crows, Magpies, Jays, etc.)

148 Genus ***Dandrocitta*** Gould

*291 (1032) ***Dendrocitta vagabunda vagabunda*** (Latham)

Northeastern Tree Pie

1790. *Coracias vagabunda* Latham, *Index Orn.* **1** : 171 (India, restricted to Calcutta by Ticehurst, 1922, *Ibis* : 537.

1922. Baker, *FBI* No. 26, **1** : 48.

Local name : Mahalat.

Distribution : Delhi : Light woodland, parks, gardens (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); Raota, Jhatikra & Kakraula (Varma, 1994); Lake park at Dhaulakuan, Jahapanah PF, Hauzkhas woodland, NZP, Deer park & KN ridge (present record).

Status : Resident; common; breeds.

149 Genus ***Corvus*** Linnaeus

*292 (1049) ***Corvus splendens splendens*** Vieillot

Indian House Crow

1817. *Corvus splendens* Vieillot, *Nouv. Dict. d'Hist. Nat.* **8** : 44 (Bengal).

1922. Baker, *FBI* No. 11, **1** : 33.

Local name : Kowwa.

Distribution : Delhi : Inseparable from human habitation (Ali & Ripley, 1972); haunts of man (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); Raota, Jhatikra, Kakraula & Mall road along the Najafgarh drain (Varma, 1994); practically throughout Delhi's environ (present record).

Status : Resident; abundant; breeds.

293 (1052) ***C. frugilegus frugilegus*** Linnaeus

Rook

1758. *Corvus frugilegus* Linnaeus, *Syst. Nat.*, ed. **10,** 1 : 105 (Sweden).

1922. Baker, *FBI* No. 9, **1** : 30.

Distribution : Delhi : Okhla (Alexander, 1949).

Status : Vagrant. One doubtful record of five birds (Ganguli, 1975; Kv, 1991).

*294 (1057) ***C. macrorhynchos culminatus*** Sykes

Indian Jungle Crow

1832. *Corvus culminatus* Sykes, *Proc. zool. Soc.* London. 96 : (Dukhun = Poona *vide* Whistler & Kinnear, 1932, JBNHS **35** : 512).

1922. Baker, *FBI* No. 6,**1** : 28.

Local name : Jangli kowwa.

Distribution : Delhi: Hauzkhas (Basil-Edwardes,1926); Okhla, north Delhi (Ganguli, 1975); NDR (Gaston, 1978); Kakraula (Varma, 1994); Bhalsawa lake, Okhla, Ranibag, Humayun's tomb, NZP, IARI campus & roadsides (present record).

Status : Resident; less common.

295 (1059) ***C. corax subcorax*** Severtzov.
Raven

1872. *Corvus subcorax* Severtzov, *Vertik. Turkest. Zhivotn.* : 115 (NW. and SE. Turkestan).
1922. Baker, *FBI* No. 1, 1 : 21.
Local name : Domkak.
Distribution : Delhi : Hauz Khas (Frome, 1947).
Status : Vigrant; rare. Two records before 1947, none subsequently (Kv, 1991).

46 Family : CAMPEPHAGIDAE (Cuckoo-Shrikes and Minivets)
150 Genus ***Tephrodornis*** Swainson
296 (1069) ***Tephrodornis pondicerianus pallidus*** Ticehurst
Sind Wood Shrike

1920. *Tephrodornis pondicerianus pallidus* Ticehurst, *Bull. Brit. Orn. Cl.*, **41** : 56 (Larkhana, Sind).
1924. Baker, *FBI* No. 731, 2 : 314.
Local name : Keroula.
Distribution : Delhi : (Ali & Ripley, 1971); Scrubland, among roadside trees, groves, parks and gardens (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); Raota & Jhatikra (Varma, 1994).
Status : Resident; common; breeds (Kv, 1991).

151 Genus ***Coracina*** Vieillot
297 (1072/3?) ***Coracina novaehollandiae*** (Gmelin)
Large Cuckoo - Shrike

1924. Baker, *FBI* Nos. 758, 759, 2 : 343, 344.
Local name : Kasya.
Distribution : Delhi : North Delhi (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a).
Status : Vagrant?; rare? (Kv, 1991).

152 Genus ***Pericrocotus*** Boie
298 (1080) ***Pericrocotus flammeus speciosus*** (Latham)
North Indian Scarlet Minivet

1790. *Turdus speciosus* Latham, *Index Orn.*, 1 : 363 (India, restricted to Darjeeling by Baker).
1924. Bakes, *FBI* No. 733, 2 : 319.
Local name : Phari Bulalchashm.

Distribution : Delhi : Raota (Varma, 1994).
Status : Vagrant (Kv, 1991).

299 (1084) ***P. brevirostris brevirostris*** (Vigors)
Shortbilled Minivet

1830. *Muscipeta brevirostris* Vigros, *Proc. zol. Soc.* London : 43 (Himalayas = Sikkim foothills, *vide* Mayr, 1940).
1924. Baker, *FBI* No. 739, **2** : 324.
Local name : Choota pahari balal-chashm.
Distribution: Delhi : Gardens, groves, parks (Ganguli, 1975).
Status : Winter visitor, uncommon (Kv, 1991). It has suffered in absence of open deciduous forest and secondary growth along the cultivation (Satya Sri, 1993).

300 (1085) ***P. ethologus*** Bangs & Phillips
Longtailed Minivet

1924. Bakes, *FBI* No. 738, **2** : 323.
Distribution : Delhi : NDR (Gaston, 1978); ODR & NDR (Kv, 1991a).
Status : Summer visitor, less common. Most *P. brevirostris* records possibly *P. ethologus* (Kv, 1991).

301 (1089) ***P. roseus roseus*** (Vieillot)
Rosy Minivet

1818. *Muscicapa rosea* Vieillot, *Nouv. Dict. d'Hist. Nat., nouv.* ed., **21** : 486 (Bengal).
1924. Baker, *FBI* No. 744, **2** : 328.
Distribution : Delhi : Badli jheel in north Delhi (Frome, 1947), Horse-shoe jheel (Alexander, 1949).
Status : Winter visitor, uncommon. Only two records, none subsequently (Kv, 1991).

302 (1091) ***P. cinnamomeus peregrinus*** (Linnaeus)
Northern Small Minivet

1766. *Parus peregrinus* Linnaeus, *Syst. Nat.*, ed. **12**,1 : 342 (No locality, Ambala, Punjab, fixed by Baker,1920).
1924. Baker, *FBI* No. 745, **2** : 329.
Local name : Rajalal.
Distribution : Delhi : Parks, gardens, groves (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a).

Status : Resident; common; breeds (Kv, 1991).

303 (1096) ***P. erythropygius erythropygius*** (Jerdon)
Whitebellied Minivet

1840. *Muscicapa erythropygia* Jerdon, *Madras Jour. Lit. Sci.*, **11** : 17 (S. India = Ajanta).
1924. Baker, *FBI* No. 749, **2** : 332.

Local name : Safed rajalal.

Distribution : Delhi : At weeds (Basil-Edwardes, 1926); Parks & woodlands (Frome, 1947); Thin babool & cultivation (Hutson, 1954); Okhla & Qutab (Ganguli, 1975); ODR & NDR (Kv, 1991a).

Status : Winter visitor; uncommon. Possibly seriously declined (Kv, 1991). It has suffered in absence of open deciduous forest and secondary growth along the cultivation (Satya Sri, 1993).

47 Family : IRENIDAE (Fairy Bluebirds, Ioras, Leaf Birds)
153 Genus ***Aegithina*** Vieillot
304 (1102) ***Aegithina nigrolutea*** (Marshall)
Marshall's Iora

1876. *Iora nigrolutea* Marshall, *Stray Feathers*, **4** : 410 (Meerut).
1922. Baker, *FBI* No. 366, **1** : 344.

Local name : Shaubeegi.

Distribution : Delhi : Lodi gardens, Golf links, and New Delhi ridge (Ganguli, 1975); NDR (Gaston, 1978).

Status : Resident; uncommon; breeds. It is partial to human disturbance, hence, has localised distribution despite being a garden bird (Satya Sri, 1993).

154 Genus ***Chloropsis*** Jardine & Selby
305 (1103,4 ?) ***Chloropsis aurifrons*** (Temminck)
Goldfronted Chloropsis

1922. Baker, *FBI* No. 368, **1** : 348.

Local name : Harewa.

Distribution : Delhi : Aligunj Nursery near Safdarjang (Hutson, 1954).

Status : Vagrant; uncommon?. Seen only once in 1944, possibly escaped cage bird (Kv, 1991).

48 Family : PYCNONOTIDAE (Bulbuls)
155 Genus ***Pycnonotus*** Boie

306 (1119, 21?) ***Pycnonotus jocosus*** (Linnaeus)
Redwhiskered Bulbul

1922. Baker, *FBI* Nos. 410(part), 411(part) **1** : 394, 396.

Local name : Pahari bulbul.

Distribution : Delhi : Gardens, parks, orchards, groves and roadside trees (Ganguli, 1975); NDR (Gaston, 1978, Kv, 1991a).

Status :Resident; common; breeds (Kv, 1991).

*307 (1123) ***P. leucogenys leucotis*** (Gould)
White-eared Bulbul

1836. *Ixos leucotis* Gould, *Proc. zool. Soc.* London : 6 (Karachi, Sind).

1922. Baker, *FBI* No. 406, **1** : 390.

Local name : Kushandra.

Distribution : Delhi: Gardens, parks, etc. (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991); JNU south campus, Jahapanah (present record).

Status : Resident; less common; breeds. Possibly declined (Kv, 1991).

*308 (1127) ***P. cafer humayuni*** Deignan
Central Indian Redvented Bulbul

1951. *Pycnonotus cafer humayuni* Deignan, *Auk* **68** : 110 (Deesa).

1922. Baker, *FBI* No. 399, **1** : 385.

Local name : Bulbul.

Distribution : Delhi: Gardens, leafy trees, thick creepers or bushes (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); Raota, Jhatikra, Kakraula & Mall road (Varma, 1994); Okhla, Jahapanah, NZP, BJ park, JNU south campus, Tughlaqabad, Piggery farm, IARI campus, KN ridge and Lake park at Dhaulakuaon (present record).

Status : Resident; common; breeds.

309 (1138) ***P. luteolus luteolus*** (Lesson)
Whitebrowed Bulbul

1841. *Haematornis luteolus* Lesson, *Rev. Zool.* : 354 (Bombay).

1922. Baker, *FBI* No. 433 (part), **1** : 417.

Distribution : Delhi : Begumpuri mosque (Mr. & Mrs. Herbert, 1952). Delhi is much beyond the range of this bird (Ganguli, 1975).

Status : Vagrant. Seen only twice before, 1952, one doubtful record in 1984 (Kv, 1991).

156 Genus ***Hypsipetes*** Vigors

310 (1148) ***Hypsipetes madagascariensis*** (P.L.S. Muller)

Black Bulbul

1922. Baker, *FBI* No. 386, **1** : 369.

Distribution : Delhi : New Delhi Ridge/NDR (Gaston, 1978).

Status : Vagrant. First recorded in1972 by Gaston (Kv, 1991).

49 Family : MUSCICAPIDAE

Subfamily : TIMALIINAE (Babblers)

157 Genus ***Dumetia*** Blyth

311 (1219, 21?) ***Dumetia hyperythra*** (Franklin)

Rufousbellied Babbler

Distribution : Delhi : Golf links area, Lodi gardens (Ganguli, 1975 : 219).

Status : Vagrant. Seen only twice (Kv, 1991).

158 Genus ***Chrysomma*** Blyth

*312 (1230) ***Chrysomma sinense hypoleucum*** (Franklin)

Western Yellow-eyed Babbler

1831. *Timalia hypoleuca* Franklin, *Proc. zool. Soc.* London : 118 (between Calcutta and Banaras = U.P., restricted by Ticehurst, 1922, *Ibis* : 543).

1922. Baker, *FBI* No. 234(part), **1** : 233.

Local name : Balal chasm.

Distribution : Delhi : Thorn scrub, tall grass, thickets, ***babul*** trees, also gardens (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); Okhla, Jahapanah and Tughlaqabad (present record).

Status : Resident; less common; breeds. It is suffered mainly due to habitat loss and intolerance to human disturbance. It prefers tall grass and reed beds, along water fronts, and due to the reduction of such habitat, its population has gone down (Satya Sri, 1993).

159 Genus ***Turdoides*** Cretzschmar

*313 (1254) ***Turdoides caudatus caudatus*** (Dumont)

Common Babbler

1823. *Cossyphus caudatus* Dumont, *Dict. sci. nat.* (ed. Levrault) **29** : 268 (India).

1922. Baker, *FBI* No. 192, **1** : 198.

Local name : Dumri, Chilchil.

Distribution : Delhi : Open country, cultivation, parks, semi-desert areas, Delhi Ridge (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); practically throughout the Dehi's environ (present record).

Status : Resident; common; breeds.

314 (1256) *T. earlei earlei* (Blyth)
Striated Babbler

1844. *Malacocercus Earlei* Blyth, *Jour. Asiat. Soc.* Bengal **13** : 369 (vicinity of Calcutta).

1922. Baker, *FBI* No. 191 (part), **1** : 197.

Local name : Dumri, Bara-phenga.

Distribution : Delhi : About swamps & reed-beds at Okhla, Hindan and Wazirabad bridge (Ganguli, 1975).

Status : Resident; less common; breeds. Due to the reduction of its prefered habitat tall grass and reed beds, along the water fronts, its population has gone down (Satya Sri, 1993).

*315 (1258) *T. malcolmi* (Sykes)
Large Grey Babbler

1832. *Timalia malcolmi* Sykes, *Proc. zool. Soc.* London : 88 (Dukhun = Poona).

1922. Baker, *FBI* No. 195, **1** : 200.

Local name : Satbhai.

Distribution : Delhi : Open cultivation, parks, roadside trees and gardens (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); Najafgarh, BJ park, Tughlqabad (present record).

Status : Resident; common; breeds (Kv, 1991).

*316 (1261) *T. striatus sindianus* (Ticehurst)
Sind Jungle Babbler

1920. *Crateropus terricolor sindianus* Ticehurst, *Bull. Brit. Orn. Cl.* **40** : 156 (Karachi, Sind).

1922. Baker, *FBI* No. 185, **1** : 193.

Local name : Satbahai.

Distribution : Delhi : Gardens and groves, towns and villages (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); Najafgarh, Lake park at Dhaulakuon, Ramghat, Ranibag, Jahapanah, Hauzkhas, Lodi garden, Humayun's & Safdarjung tombs, NZP, Deer park, BJ park, KN ridge, IARI campus (present record).

Status : Resident; abundant; breeds.

Subfamily : MUSCICAPINAE (Flycatchers)

160 Genus ***Muscicapa*** Brisson

317 (1403,4) ***Muscicapa striata sarudnyi*** Snigirewski

Spotted Flycatcher

1928. *Muscicapa striata sarudnyi* Snigirewski, *Jour. of Orn.* **76** : 595, new name for ***Butalis griseola*** var. *pallida* Zarudny, 1903, *nec. Muscicapa pallida* Muller (Eastern Iran and Transcaspia).

1924. Baker, *FBI* No. 631, **2** : 202 (= *neumanni*).

Distribution : Delhi : New Delhi ridge (Gaston, 1978).

Status : Passage migrant, Gaston (1978).

318 (1407) ***M. latirostris*** Raffles

Brown Flycatcher

1822. *Muscicapa latirostris* Raffles, *Trans. Linn. Soc.* London **13** : 312 (Sumatra).

1924. Baker, *FBI* Nos. 674, 675,**2** : 248, 249.

Local name : Zakki.

Distribution : Delhi (Hutson, 1954).

Status : Vagrant; uncommon?; Seen only once, before 1960, no subsequent record (Kv, 1991).

319 (1409) ***M. ruficauda*** Swainson

Rufoustailed Flycatcher

1838. *Muscicapa ruficauda* Swainson, *Nat. Library, Flycatchers* : 251 (India = Kashmir).

1924. Baker, *FBI* No. 676, **2** : 250.

Distribution : Delhi : Near Qutub (Ganguli, 1975).

Status : Vagrant. Seen only twice, once in 1957, again in 1970 (Kv,1991).

320 (1411) ***M. parva parva*** Bechstein

Western Redbreasted Flycatcher

1794. *Muscicapa parva* Bechstein, *Allg. uber Vog.* **2** : 356 (Thuringerwald).

1924. Baker, *FBI* No. 638, **2** : 210.

Local name : Turra.

Distribution : Delhi : Okhla (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a).

Status : Winter visitor / Passage migrant; common (Kv,1991).

321 (1421) ***M. superciliaris superciliaris*** Jerdon
Whitebrowed Blue Flycatcher

1840. *M. (uscicapa) superciliaris* Jerdon, *Madras Jour. Lit. Sci.* **11** : 16 (Ajunta, N. Ghats).
1924. Baker, *FBI* No. 647, **2** : 221.
Distribution : Delhi (Ganguli, 1978); NDR (Gaston, 1978).
Status : Vagrant ?; rare; breeds. First seen in 1968 (Ganguli, 1975).

322 (1440) ***M. rubeculoides rubrculoides*** (Vigors)
Bluethroated Flycatcher

1831. *Phoenicurus rubeculoides* Vigors, *Proc. zool. soc.* London : 35 (Darjeeling).
1924. Baker, *FBI* No. 657, **2** : 231.
Distribution : Delhi : NDR (Gaston, 1978).
Status : Passage migrant. Only one record by Gaston in 1971.

323 (1445) ***M. thalassina thalassina*** Swainson
Verditer Flycatcher

1838. *Muscicapa thalassina* Swainson *Nat. Library, Flycatchers* **21** : 252 (India).
1924. Baker, *FBI* No. 665, **2** : 239.
Distribution : Delhi : `Kikar jungles' in New Delhi (Ganguli, 1975); gardens & parks (Frome, 1947) ; Okhla (Ganguli, 1975) ; NDR (Gaston, 1978).
Status : Passage migrant; less common (Kv, 1991).

161 Genus ***Culicicapa*** Swinhoe
324 (1448) ***Culicicapa ceylonensis calochrysea*** Oberholser
Northern Greyheaded Flycatcher

1848. *Cryptolopha cinereocapilla* (Vieillot)' Hutton, *Jour. Asiat. Soc.* Bengal **17** : 689 (Himalayas). *Nom. nud.*
1924. Baker, *FBI* No. 679 (part), **2** : 254.
Local name : Zard-phutki.
Distribution : Delhi : Okhla (Basil - Edwardes, 1926); fruit gardens and light woodland (Frome, 1947) ; Hutson, 1954) ; garden (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); Raota (Varma, 1994).
Status : Passage migrant (Gaston, 1978); less common (Kv, 1991).

162 Genus ***Rhipidura*** Vigors & Horsfild
*325 (1451) ***Rhipidura aureola aureola*** Lesson

Northern Whitebrowed Faintail Flycatcher

1830. *Rhipidura aureola* Lesson, *Traite d' Orn* : 290 (Bengal).

1924. Baker, *FBI* No. 700(part), **2** : 277.

Local name : Nachan, Chakdil.

Distribution : Delhi : *Babul* jungles along roadsides (Basil-Edwardes, 1926); Gardens, plantations and woodland (Frome, 1947) ; Garden north Delhi (Ganguli, 1975); NDR (Gaston, 1978) ; ODR & NDR (Kv, 1991a); Jahapanah PF (present record).

Status : Resident; uncommon; breeds (Kv, 1991). But Gaston (1978) reports it as Passage migrant on New Delhi ridge. Being partial to human disturbance and its preferance for open country, it has suffered and the population has gone down (Satya Sri, 1993).

163 Genus ***Terpsiphone*** Gloger

326 (1460, 61?) ***Terpsiphone paradisi*** Linnaeus

Paradise Flycatcher

Local name : Shah bulbul, Doodraj.

Distribution : Shady gardens, orchards, groves of leafy trees and *babul* groves on the ridge (Ganguli, 1975); NDR (Gaston, 1978); ODR and NDR (Kv, 1991a); Raota (Varma, 1994).

Status : Passage migrant; uncommon; breeds. (Kv, 1991).

Subfamily : SYLVIINAE (Warblers)

164 Genus ***Lusciniola*** Gray

327 (1495) ***Lusciniola malanopogon mimica*** Madarasz

Moustached Sedge Warbler

1903. *Lusciniola mimica* Madarasz, Vorläuf. *neuen Rohrsänger* [a leaflet] (Transcaspia and Persia = Tedjen in Transcaspia, and Khorasan and Seistan in Iran).

1924. Baker, *FBI* No. 821, **2** : 418.

Distribution : Delhi : Garden in New Delhi (Benthall, 1949); Reed-beds (Hutson, 1954).

Status : Resident ?. Very few records (Kv, 1991).

165 Genus ***Cisticola*** Kaup

328 (1498) ***Cisticola juncidis cursitans*** (Franklin)

Streaked Fantail Warbler

1831. *Prinia cursitans* Franklin, *Proc. zool. Soc.* London, 118 (between Calcutta and Benares).

1924. Baker, *FBI* No. 825 (part), **2** : 422.

Local name : Ghaski-phutki.

Distribution : Delhi : Thick grass and undergrowth at Okhla (Hutson, 1954); open

country with long grass, standing paddy fields, patches of reeds and tamarisk (Ganguli, 1975).

Status Resident; common; breeds (Kv, 1991).

166 Genus ***Prinia*** Horsfield

*329 (1503) ***Prinia hodgsonii hodgsonii*** Blyth

Franklin's Ashy-grey Wren-Warbler

1844. *Pr. (inia) Hodgsonii* Blyth, *Jour. Asiat. Soc.* Bengal **13** : 376 New name for *Prinia gracilis* Franklin, 1831, not *Sylvia (=Prinia) gracilis* Lichtenstein, 1823.

1924. Baker, *FBI* No. 827(part), **2** : 425.

Local name : Phutki.

Distribution : Delhi : Scrubland parks, groves and gardens (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); Jahapanah PF, NZP, BJ park, JNU south campus, Piggery farm (present record).

Status : Resident; less common; breeds (Kv, 1991).

330 (1506) ***P. buchanani*** Blyth

Rufousfronted Wren - Warbler

1844. *P. (rinia) Buchanani* Blyth, *Jour. Asiat. Soc.* Bengal **13** : 376, new name for *Prinia rufifrons* Jerdon, 1840, *nec Prinia rufifrons* Ruppell, 1835 *Prinia rufifrons* Jerdon, 1840, Madras *Jour. Lit. Sci.* **11** : 4 (neighbourhood of Jalna, northwestern Hyderabad).

1924. Baker, *FBI* No. 831, **2** : 429.

Distribution : Delhi : Hauzkhas (Hutson, 1954); Tughlaqabad, Mehrauli, Najafgarh and Hauzkhas (Ganguli, 1975); NDR (Gaston, 1978; Kv, 1991a).

Status : Resident; less common; breeds (Kv, 1991).

331 (1508) ***P. gracilis lepida*** Blyth

Indian Streaked Wren-Warbler

1844. *P. (rinia) lepida* Blyth, *Jour. Asiat. Soc.* Bengal **13** : 376 (Indus territories = Sind fide Whistler & Kinnear, 1933, *JBNHS* **36** : 579).

1924. Baker, *FBI* No. 931, **2** : 526.

Local name : Khar phutki.

Distribution : Delhi : Sarpat grass, thickets of tamarisks near the river, or pools and jheels edged with such vegetation (Ganguli, 1975).

Status : Resident; uncommon; breeds (Kv, 1991).

332 (1510) ***P. subflava terricolor*** (Hume)

Northwestern Plain Wren-Warbler

1874. *Drymoipus terricolor* Hume, *Nests and Eggs of Indian Birds* : 349 (N-W. India = Oudh, Agra).

1924. Baker, *FBI* No. 940 (part), **2** : 534.

Local name : Phutki.

Distribution : Delhi : Standing crops, *Erianthus* grass, tamarisk thickets and other bushes and *babul* trees (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a).

Status : Resident ; common ; breeds (Kv, 1991).

*333 (1515) ***P. socialis stewarti*** Blyth

Northern Ashy Wren-Warbler

1847. *Prinia Stewarti* Blyth, *Jour. Asiat. Soc.* Bengal **16** : 455 (near Agra).

1924. Baker, *FBI* No. 936 (part), **2** : 531.

Loal name : Phutki.

Distribution : Delhi : Gardens, fields of sugarcane or crops and other herbage (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; Jahapanah PF, NZP. BJ park, Piggery farm (present record).

Status : Resident ; common ; breeds (Kv, 1991).

334 (1520) ***P. sylvatica insignis*** (Hume)

Northwestern Jungle Wren-Warbler

1872. *Drymoipus Insignis* Hume, *Stray Feathers* **1** : 10 (Mount Aboo).

1924. Baker, *FBI* No. 939, **2** : 533. (= *P.s. rufescens*).

Local name : Tot-rungi.

Distribution : Delhi : Sarpat grass near New Delhi (Hutson, 1954); Scrub jungels dotted with grass (Ganguli, 1975).

Status : Resident; rare (Kv, 1991).

335 (1524) ***P. flaviventris*** (Delessert)

Yellowbellied Wren-Warbler

1924. Baker, *FBI* Nos. 933, 934, **2** : 528, 529.

Distribution : Delhi : Near milepost one on the canal road south of Okhla (Gaston, 1978).

Status : Resident; rare; breeds. First recorded in 1973 by Gaston (Kv, 1991). The HAND BOOK shows the distribution of the western race, *sindiana*, extending as far east as Ambala, Punjab and the Delhi birds must almost certainly be of that race (Gaston, 1978 : 124).

336 (1531, 32) ***P. burnesii*** (Blyth)

Longtailed Grass Warbler

Distribution : Delhi : At 14th km on the Mathura road (Alexander, 1949).

Status : Unknown. Recorded only once before 1970 (Kv, 1991).

167 Genus ***Orthotomus*** Horsfield

*337 (1535) ***Orthotomus sutorius guzuratus*** (Latham)

Indian Tailor Bird

1790. *Sylvia guzurata* Latham, *Index Orn.* : 554 (Guzerat).

1924. Baker, *FBI* No. 813 (part), **2** : 410.

Local name : Darzee.

Distribution : Delhi : Parks, woodlands and gardens (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); Raota, Jhatikra and Kakraula (Varma, 1994); Tughlaqabad and Piggery farm (present record).

Status : Resident; common; breeds (Kv, 1991).

168 Genus ***Locustella*** Kaup

338 (1544) ***Locustella lanceolata*** (Temminck)

Streaked Grasshopper Warbler

1840. *Sylvia lanceolata* Temminck, *Man d'Orn.* **4** : 614 (`Mayence' *errore* = Russia, *see* Ticehurst, *JBNHS* 31 : 497 and Dementiev *et al.*, Bds. Sov. Union **6** : 293).

1924. Baker, *FBI* No. 806, **2** : 401.

Distribution : Delhi : Sunder nursery (Donahue, 1967).

Status : Winter visitor ; rare. First recorded in 1962 (Kv, 1991).

339 (1545) ***L. naevia straminea*** Seebohm

Eastern Grasshopper Warbler

1881. *Locustella straminea* Seebohm, *Cat. Bds. Brit. Mus.* **5** : 117, *ex* Severtzov, 1872, *nom. nud.* (Turkestan).

1924. Baker, *FBI* No. 807, **2** : 402.

Distribution : Delhi : Undergrowth in marshy fields, reeds, also rice fields (Alxander, 1949; Hutson, 1954).

Status : Passage migrant; rare (Kv,1991).

169 Genus ***Chaetornis*** Gray

340 (1547) ***Chaetornis striatus*** (Jerdon)

Bristled Grass Warbler

1841. *Megalurus ? striatus* Jerdon, *Suppl. Cat. Bds.* : 88 (Nilgiris).

1924. Baker, *FBI* No. 838, **2** : 438.

Distribution : Delhi : Tall marsh grass beside Agra Canal road (mile post 2) (Donahue, 1967).

Status : Resident ? ; rare?. Recorded once in 1962 (Kv, 1991).

170 Genus *Megalurus* Horsfield
341 (1548) *Megalurus palustris toklao* (Blyth)
Striated Marsh Warbler

1843. *Turdus toklao* Blyth, *Jour. Asiat. Soc.* Bengal **12** : 179 (Calcutta), *ex* 1842, *Jour. Asiat. Soc.* Bengal **11** : 603, and 1843, *Ann. Mag. Nat. Hist.* **12** : 99; ibid. Blyth, 1844, *J.A.S.B.* **13** : 372.

1924. Baker, *FBI* No. 836, **2** : 435.

Local name : Takko.

Distribution : Delhi : First recorded in early 1970s, also recently by Kv (1991).

Status : Resident; rare (Kv, 1991).

171 Genus *Acrocephalus* Naumann
*342 (1550) *Acrocephalus stentoreus brunnescens* (Jerdon)
Indian Great Reed Warbler

1839. *A. (grobates) brunnescens* Jerdon, *Madras Jour. Lit. Sci.* **10** : 269 (Carnatic, near Trichinopoly).

1924. Baker, *FBI* No. 795 (part),**2** : 389.

Distribution : Delhi : Dense reeds at Najafgarh, thick reeds of swamps and flooded borrow-pits in north and south Delhi, busshes and *babul* trees at Okhla and riverian belt (Ganguli, 1975); NDR (Gaston, 1978; Kv, 1991a) ; Ramghat (present record).

Status : Resident; less common; breeds (Kv, 1991). According to Gaston (1978) it is a Passage migrant.

343 (1556) *A. dumetorum* Blyth
Blyth's Reed Warbler

1849. *Acrocephalus dumetorum* Blyth *Jour. Asiat. Soc.* Bengal **18** : 815 (No locality = Calcutta, *see* Biswas, 1962, *JBNHS* **59** : 410).

1924. Baker, *FBI* No. 799, **2** : 393.

Local name : Tiktiki.

Distribution : Delhi : Gardens, parks, *babul* groves, tamarisks and bushes in swampy areas (Ganguli, 1975); NDR (Gaston, 1978; Kv, 1991a).

Status : Passage migrant; less common (Kv, 1991).

344 (1557, 58?) ***A. agricola*** (Jerdon)
Paddyfield Warbler

1924. Baker, *FBI* No. 800 (part), **2** : 394.

Distribution : Delhi : Reeds, bushes and tamarisks by jheels and swamps (Ganguli, 1975); NDR (Gaston, 1978; Kv, 1991a).

Status : Passage migrant; less common (Kv, 1991).

172 Genus ***Hippolais*** Baldenstein
345 (1562, 63?) ***Hippolais caligata*** (Lichtenstein)
Booted Tree Warbler

1924. Baker, *FBI* Nos. 840, 842, **2** : 442, 444.

Distribution : Delhi : Dry open country, scrubland, *babul* groves and parks, also tamarisks and scrub near the Jamuna (Ganguli, 1975); NDR (Gaston, 1978; Kv, 1991a).

Status : Passage migrant; common (Kv, 1991).

173 Genus ***Sylvia*** Scopoli
346 (1565) ***Sylvia hortensis jerdoni*** (Blyth)
Eastern Orphean Warbler

1847. *C. (urruca) Jerdoni* Blyth, *Jour. Asiat. Soc.* Bengal **16** : 439 (Southern India).

1924. Baker, *FBI* No. 846, **2** : 448.

Distribution : Delhi : Riverain tract (Frome, 1947); Lodi golf links (Alexander, 1949); *babul* plantations (Hutson, 1954); *babul* grove at Okhla (Ganguli, 1975); NDR (Gaston, 1978 ; Kv, 1991a).

Status : Winter visitor; rare. Probably much rarer than before (Kv, 1991).

347 (1566) ***S. communis icterops*** Menetries
Indian Whitethroat

1832. *Sylvia icterops* Menetries, *Cat. Rais. Caucase* : 34 (Talych, eastern Transcaucasia).

1924. Baker, *FBI* No. 845, **2** : 447.

Distribution : Delhi : NDR (Gaston, 1978); Raota (Varma, 1994).

Status : Passage migrant, mainly autumn (Gaston, 1978); uncommon (Kv,1991).

348 (1567) ***S. curruca blythi*** Ticehurst & Whistler
Siberian Lesser Whitethroat

1933. *Sylvia curruca blythi* Ticehurst & Whistler, *Ibis* : 556 (Cawnpore).

1924. Baker, *FBI* No. 849, **2** : 45.

Distribution : Delhi : Gardens, parks, indigenous woodland, ridge, tall trees, bushes, ground, edges of lawns and flower - beds (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR & NDR (Kv, 1991a).

Status : Winter visitor ; common (Kv, 1991).

349. (1570) ***S.c. althaea*** Hume
Hume's Lesser Whitethroat

1878. *Sylvia althaea* Hume, *Stray Feathers* **7** : 60, 62 (Kashmir).

1924. Baker, *FBI* No. 848, **2** : 450.

Distribution : Delhi : Scrub area near the river (Alxander, 1949).

Status : Winter visitor; rare (Kv, 1991).

350 (1571) ***S. nana nana*** (Hemprich & Ehrenberg)
Desert Warbler

1833. *Curruca nana* Hemprich & Ehrenberg, *Symb. Phys. Avium,* fol. cc (Sinai).

1924. Baker, *FBI* No. 847, **2** : 449.

Distribution : Delhi.

Status : Winter visitor ; uncommon (Kv, 1991).

174 Genus ***Phylloscopus*** Boie
351 (1575) ***Phylloscopus collybita tristis*** Blyth
Brown Chiffchaff

1843. *P. (hylloscopus) tristis* Blyth, *Jour. Asiat. Soc.* **Bengal 12** : 966 (Calcutta).

1924. Baker, *FBI* No. 854, **2** : 456.

Distribution : Delhi : Crops, *babul* groves, low bushes, reed-beds, also gardens (Ganguli, 1975); NDR (Gaston, 1978); ODR and NDR (Kv, 1991a).

Status : Winter visitor; common (Kv, 1991).

352 (1577) ***P. neglectus*** Hume
Plain Leaf Warbler

1870. *Phylloscopus neglectus* Hume, *Ibis,* 143 (Punjab and Doab).

1924. Baker, *FBI* No. 856, **2** : 458.

Distribution : Delhi : *Babul* and tamarisk jungle near riverbank, swamps and lakes (Ganguli, 1975); NDR (Gaston, 1978).

Status : Passage migrant; uncommon (Kv, 1991).

353. (1578) ***P. tytleri*** **Brooks**
Tytler's Leaf Warbler

1872. *Phylloscopus tytleri* Brooks, *Ibis* : 23 (Kashmir and Simla).
1924. Baker, *FBI* No. 853, **2** : 455.
Distribution : Delhi : NDR (Gaston, 1978; Kv, 1991a).
Status :Winter visitor; rare (Kv, 1991).

*354 (1579) ***P. affinis affinis*** (Tickell)
Tickell's Leaf Warbler

1833. *Motacilla affinis* [*sic*] Tickell, *Jour. Asiat. Soc.* Bengal **2** : 576 (Borabhum and Dholbhum).
1924. Baker, *FBI* No. 852, **2** : 454.
Distribution : Delhi : South Delhi (Ganguli; 1975); NDR (Gaston, 1978); Okhla, NZP (present record).
Status : Passage migrant; rare (Kv, 1991).

355 (1581) ***P. griseolus*** **Blyth**
Olivaceous Leaf Warbler

1847. *Ph. (ylloscopus) griseolus* Blyth, *Jour. Asiat Soc.* Bengal **16** : 443 (banks of the Hoogly River, near Calcutta).
1924. Baker, *FBI* No. 858, **2** : 459.
Distribution : Delhi : North Delhi (Alexander, 1949); Tughlaqabad (Hutson, 1954); gardens, woodland, the ridge, trees and bushes (Ganguli, 1975); NDR (Gaston, 1978); NDR and ODR (Kv, 1991a).
Status : Passage migrant; uncommon (Kv, 1991).

356 (1587) ***P. pulcher kangrae*** **Ticehurst**
Western Orangebarred Leaf Warbler

1923. *Phylloscopus pulcher kangrae* Ticehurst, *Bull. Brit. Orn.* Cl. **44** : 29 (Simla).
1924. Baker, *FBI* No. 865, **2** : 465.
Distribution : Delhi : NDR (Gaston, 1978).
Status : Passage migrant (Gaston, 1978). Two records in early 1970's by Gaston.

357 (1590) ***P. inornatus humei*** (Brooks)
Hume's Yellowbrowed Leaf Warbler

1878. *Reguloides humei* Brooks, *Stray Feathers*. **7** : 131 (Northwest India).
1924. Baker, *FBI* No. 870, **2** : 469.
Distribution : Delhi : Gardens, groves and roadside trees (Ganguli, 1975); NDR (Gaston, 1978); ODR and NDR (Kv, 1991a).
Status : Winter visitor; less common (Kv, 1991).

358 (1593) ***P. subviridis*** (Brooks)
Brook's Leaf Warbler

1872. *Reguloides subviridis* Brooks, *Proc. Asiat.Soc.* Bengal : 148 (Etawah, U.P).
1924. Baker, *FBI* No. 869, **2** : 468.
Distribution : Delhi : (Alexander, 1949); NDR (Gaston, 1978; Kv, 1991a).
Status : Passage migrant (Gaston, 1978); uncommon (Kv, 1991).

359 (1601) ***P. magnirostris*** Blyth
Largebilled Leaf Warbler

1843. *Ph. (ylloscopus) magnirostris* Blyth, *Jour. Asiat. Soc.* Bengal **12** : 966 (Calcutta).
1924. Baker, *FBI* No. 878, **2** : 476.
Distribution : Delhi : NDR (Gaston, 1978).
Status : Passage migrant, mainly autumn (Gaston, 1978); rare (Kv, 1991). Two records in early 1970s by Gaston.

360 (1602/4?) ***P. trochiloides*** (Sundevall)
Greenish Leaf Warbler

1924. Baker, *FBI* No. 875, **2** : 474.
Distribution : Delhi : Gardens and wooded country (Ganguli, 1975); NDR (Gaston, 1978).
Status : Passage migrant (Ganguli, 1975; Gaston, 1978); uncommon (Kv, 1991).

361 (1605) ***P. trochiloides nitidus*** Blyth
Bright Green Leaf Warbler

1843. *Ph. (ylloscopus) nitidis* Blyth, *Jour. Asiat. Soc.* Bengal 12 : 965 (vicinity of Calcutta).
1924. Baker, *FBI* No. 874, **2** : 473.
Distribution : Delhi : *Babul* jungle on the outskirts of Raisina, New Delhi

(Basil-Edwardes, 1926) ; NDR (Gaston, 1978 ; Kv, 1991a).

Status : Passage migrant (Gaston, 1978) ; uncommon (Kv, 1991).

362 (1606) ***P. occipitalis occipitalis*** (Blyth)

Large Crowned Leaf Warbler

1845. *Ph. (yllopneuste) occipitalis* Blyth, *Jour. Asiat. Soc.* Bengal **14** : 593 (Southern India).

1924. Baker, *FBI* No. 881, **2** : 479.

Distribution : Delhi : Tree groves in riverain and canal areas (Frome, 1947) ; Okhla (Alexander, 1949); a thorn hedge in the riverian belt (Hutson, 1954); NDR (Gaston, 1978).

Status : Passage migrant (Gaston, 1978) ; uncommon (Kv, 1991).

Subfamily : TURDINAE (Chats, Wheatears, Thrushes)

175 Genus ***Erythropygia*** A. Smith

363 (1641) ***Erythropygia galactotes familiaris*** (Menetries)

Rufous Chat or Greybacked Warbler

1832. *Sylvia familiaris* Menetries, *Cat. Rais. Caucase.* : 32 (Kur, southern caucasus).

1924. Baker, *FBI* No. 794, **2** : 386.

Distribution : Delhi : NDR (Gaston, 1978).

Status : Passage migrant, mainly autumn (Gaston, 1978) ; rare (Kv, 1991).

176 Genus ***Erithacus*** Cuvier

364 (1643) ***Erithacus calliope*** (Pallas)

Rubythroat

1776. *Motacilla Calliope* Pallas, *Reise, Russ. Reichs* **3** : 697 (Yenisei).

1924. Baker, *FBI* No. 542, **2** : 91.

Distribution : Delhi : Scrub jungle in lightly wooded country (Frome, 1947).

Status : Vagrant ; rare. Seen thrice prior to 1952, no subsequent records (Kv, 1991).

*365 (1644, 45?) ***E. svecicus*** Linnaeus

Bluethroat

1924. Baker, *FBI* No. 536, 537 and 538, **2** : 83 and 85.

Local name : Nil Kanthi

Distribution : Delhi : Damp places, grass, reeds and bushes at edges of swamps and pools (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991) ; Piggery farm (present record).

Status : Winter visitor ; common (Kv, 1991).

177 Genus ***Copsychus*** Wagler

*366 (1661) ***Copsychus saularis saularis*** (Linnaeus)

Indian Magpie-Robin

1758. *Gracula Saularis* Linnaeus, *Syst. Nat.* **1** : 109 (Asia = Bengal).

1924. Baker, *FBI* No. 558 (part), **2** : 113.

Local name : Dhaiyal.

Distribution : Delhi : Parks, old fruit gardens and shady groves (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; Raota, Jhatikra & Kakraula (Varma, 1994) ; Lake park at Dhaulakuaon, Jahapanah, Humayun's tomb, Lodi gardens, NZP, Deer park, BJ park, JNU south campus, Tughlaqabad, Piggery farm, and KN ridge (present record).

Status : Resident ; common ; breeds.

178 Genus ***Phoenicurus*** Forster

*367 (1671) ***Phoenicurus ochruros phoenicuroides*** (Moore)

Kashmir Black Redstart

1854. *Ruticilla phoenicuroides* Moore, in Horsfield & Moore, *Cat. Bds. Mus. E.I. Co.* **1** : 301 (Shikarpore).

1924. Baker, *FBI* No. 531, **2** : 76.

Local name : Thirthira.

Distribution : Delhi : Gardens, parks, *babul* groves, and also stone-stream open country (Ganguli, 1975) ; NDR (Gaston, 1978) ; ODR and NDR (Kv, 1991a) ; Raota, Jhatikra, Kakraula & Mall road (Varma, 1994) ; Lake park at Dhaulakuan (present record).

Status : Winter visitor ; common (Kv, 1991).

179 Genus ***Rhyacornis*** Blanford

368 (1679) ***Rhyacornis fuliginosus fuliginosus*** (Vigors)

Plumbeous Redstart

1831. *Phoenicura fuliginosa* vigors, *Proc. zool. Soc.* London : 35 (Himalays, restricted to Simla - Almora area by Ticehurst & Whistler, 1924, *Ibis* : 471).

1924. Baker, *FBI* No. 535, **2** : 81.

Distribution : Delhi (Kv, 1991a).

Status : Vagrant ; uncommon. New record by Kv, possibly stray (Kv, 1991).

180 Genus ***Cercomela*** Bonaparte

369 (1692) *Cercomela fusca* (Blyth)

Brown Rock Chat

1851. *Saxicola fusca* Blyth, *Jour. Asiat. Soc.* Bengal **20** : 52 (Muttra).
1924. Baker, *FBI* No. 516, **2** : 54.
Local name : Dauma.
Distribution : Delhi : Rocky places, ruined forts, scrubland and sometimes near human habitation - Tughlaqabad, AIMS, Willingdon Hospital (Ganguli, 1975).
Status : Resident ; Common ; breeds (Kv, 1991).

181 Genus ***Saxicola*** Bechstein
370 (1697) ***Saxicola torquata indica*** (Blyth)
Indian Collared Bush Chat

1847. *Pratincola indica* Blyth, *Jour. Asiat. Soc.* Bengal **16** :129 (India = Calcutta).
1924. Baker, *FBI* No. 495 (part), **2** : 28.
Local name : Kharpidda.
Distribution : Delhi : Corn area close to the Jamuna (Hutson, 1954); open country, dry cultivation, also edges of reed-beds (Ganguli, 1975); NDR (Gaston, 1978; Kv, 1991a).
Status : Summer visitor; less common (Kv, 1991).

* 371 (1701) ***S. caprata burmanica*** Baker
Burmese Pied Bush Chat

1923. *Saxicola caprata burmanica* Baker, *Bull. Brit. Orn. Cl.* **43** : 9 (Pegu).
1924. Baker, *FBI* No. 492, **2** : 24.
Distribution : Delhi : Kingsway (Basil-Edwardes, 1926); open country with a preference for the riverain tract, also away from water in scrub country (Ganguli, 1975); NDR (Gaston, 1978; Kv, 1991a); Okhla, Tughlaqabad, JNU-south campus, IARI campus, Kv ridge, Lodi gardens and Ramghat (present record).
Status : Resident; Common; breeds.

372 (1705) ***S. ferra*** Gray
Dark-grey Bush Chat

1846. *Saxicola ferra* Gray, *Cat. Mamms. Bds.* Nepal : 71, 153 (Nepal).
1924. Baker, *FBI* Nos. 502 and 503, **2** : 36, 38.
Distribution : Delhi (Hutson, 1954).
Status : Vagrant ? Two doubtful records, before 1955 (Kv, 1991).

182 Genus ***Oenanthe*** Vieillot
373 (1706) ***Oenanthe isabellina*** (Temminck)
Isabelline Chat

1829. *Saxicola isabellina* Temminck, *Pl. Col.* (79), pl. 472, fig. 1 (Nubia, Africa).

1924. Baker, *FBI* No. 512, **2**: 49.

Distribution : Delhi : Near Hauzkhas and Kingsway (Basil Edwardes, 1926); south-west of Tughlaqabad (Alexander, 1949); Tughlaqabad (Ganguli, 1975).

Status : Winter visitor; rare (Kv, 1991).

374 (1707) ***O. xanthoprymna kingi*** (Hume)
Redtailed Chat

1871. *Saxicola kingi* Hume, *Ibis* : 29 (Jodhpur).

1924. Baker, *FBI* No. 515, **2** : 53.

Distribution : Delhi : Stony waste ground on which New Delhi was being built (Holmes in her book *Bird study in India* : Ganguli, 1975 : 248).

Status : Vagrant ?. Only recorded in 1920s not subsequently (Kv, 1991).

375 (1710) ***O. deserti deserti*** (Temminck)
Central Asian Desert Wheatear

1825. *Saxicola deserti* Temminck, *Pl. col.* (60), pl. 359, fig. 2 (Egypt).

1924. Baker, *FBI* No.513, **2** : 51.

Distribution : Delhi : open waste country near Najafgarh, Tughlaqabad, also sandy scrub country in the riverain tract near Wazirabad barrage in north Delhi, and near Pindwala jheel (Ganguli, 1975).

Status : Winter visitor (Ganguli, 1975); uncommon (Kv, 1991).

376 (1712) ***O. picata*** (Blyth)
Pied Chat

1847. *Saxicola picata* Blyth, *Jour. Asiat. Soc.* Bengal **16** : 131 (Scinde).

1924. Baker, *FBI* Nos. 506, 507 and 508, **2** : 42-4.

Distribution : Delhi : The stony bare wastes south-west of Delhi-Tughlaqabad, Motibagh (Ganguli, 1975).

Status : Winter visitor (Ganguli, 1975); rare (Kv, 1991).

183 Genus ***Saxicoloides*** Lesson
*377 (1717) ***Saxicoloides fulicata cambaiensis*** (Latham)
Brownbacked Indian Robin

1790. *Sylvia cambaiensis* Latham, *Index Orn.* **2** : 554 (Guzerat, India).

1924. Baker, *FBI* No. 557 (part), **2** : 111.

Local name : Kalchuri.

Distribution : Delhi : Garden, outskirts of villages and dry open county (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); Raota, Jhatikra & Kakraula (Varma, 1994); Okhla, Lake park at Dhaulakuaon, Jahapanah, Hauzkhas, NZP, JNU south campus, Tughlaqabad and Piggery farm (present record).

Status : Resident; common; breeds.

184 Genus ***Monticola*** Boie

378 (1723) ***Monticola cinclorhynchus*** (Vigors)

Blueheaded Rock Thrush

1832. *Petrocincla cinclorhyncha* Vigors, *Proc. zool. Soc.* London : 172 (Himalayan Mountains = Simla).

1924. Baker, *FBI* No. 606, **2** : 171.

Distribution : Delhi : Gardens of 24 Rajpur road, and 32 Chhatra marg (Ganguli, 1975); NDR (Gaston, 1978; Kv, 1991a).

Status : Vagrant (Kv, 1991). Seen thrice, once each in 1950, 1967 and 1974.

379 (1726) ***M. solitarius pandoo*** (Sykes)

Indian Blue Rock Thrush

1832. *Petrocincla Pandoo* Sykes, *Proc. zool. Soc.* London : 87 (Ghauts, Dukhun).

1924. Baker, *FBI* Nos. 608 and 609, **2** : 175.

Distribution : Delhi : Piles of stones and bricks, New Secretariat buildings (Basil-Edwardes, 1926); old ruins (Hutson, 1954); brick ruins (Donahue, 1967); mosque of Makhdum Sahib (Hauzkhas), old ruins and rocky areas, near Humayun's tomb, Tughlaqabad, Qutab etc. (Ganguli, 1975).

Status : Summer visitor ; rare (Kv. 1991).

185 Genus ***Zoothera*** Vigors

380 (1733) ***Zoothera citrina citrina*** (Latham)

Orangeheaded Ground Thrush

1790. *Turdus citrinus* Latham, *Index Orn.* **1** : 350 (India, Cachar).

1924. Baker, *FBI* No. 587, **2** : 148.

Distribution : New Delhi gardens (Frome, 1947 ; Alexander, 1949); author's garden, *babul* plantation at Okhla and `green house' of Sunder nursery (Ganguli, 1975); NDR (Gaston, 1978; Kv, 1991a).

Status : Winter visitor ; rare (Kv, 1991).

186 Genus ***Turdus*** Linnaeus
381 (1748) ***Turdus unicolor*** Tickell
Tickell's Thrush

1833. *T.(urdus) Unicolor* T.(ickell), *Jour. Asiat. Soc.* Bengal **2** : 577 (Bansigar in Borabhum = Barahabhum, Purulia dist., W. Bengal).

1924. Baker, *FBI* No. 579, **2** : 138.

Local name : Desi pawai.

Distribution: Delhi : New Delhi gardens (Frome, 1947); old Delhi gardens (Ganguli, 1975); NDR (Gaston, 1978).

Status : Passage migrant; uncommon (Kv. 1991).

382 (1763) ***T. ruficollis atrogularis*** Jarocki
Blackthroated Thrush

1819. *Turdus atrogularis* Jarocki, *Spis. Ptakow Krol.* Warszawa : 14 (Poland).

1924. Baker, *FBI* No. 578, **2** : 137.

Distribution : Delhi : *Babul* clump (Basil-Edwardes, 1926); gardens and parks in New Delhi (Frome, 1947) ; Qudsia park in north Delhi (Alexander, 1949); Sunder nursery (Ganguli, 1975); NDR (Gaston, 1978; Kv, 1991).

Status : Winter visitor ; uncommon (Kv, 1991).

50 Family : PARIDAE (Tits or Titmice)
Subfamily : PARINAE (True Tits)
187 Genus ***Parus*** Linnaeus
383 (1794) ***Parus major stupae*** Koelz
Indian Grey Tit

1939. *Parus major stupae* Koelz, *Proc. Biol. Soc.* Washington **52** : 61 (Sanchi, Bhopal).

1922. Baker, *FBI* No. 55 (Part), **1** : 77.

Distribution : Delhi (Kv, 1991).

Status : Resident ? ; uncommon. Seen a few times in 1950s & 60s, and recently on Delhi outskirts (Kv, 1991).

Subfamily : REMIZINAE (Penduline Titmice)
188 Genus ***Cephalopyrus*** Bonaparte
384 (1815) ***Cephalopyrus flammiceps flammiceps*** (Burton)
Western Firecapped Tit

1836 (1835). *Aegitalus [sic] flammiceps* Burton, *Proc. zool. Soc.* London : 153 (*apud* Montes

Himalayensis, restricted to Mussoorie by Whistler, 1924, *Bull. Brit. Om. cl.* 45 : 15).

1924. Baker, *FBI* No. 949 (part), 2 : 545.

Distribution : Delhi : At Dasna (Ganguli, 1975).

Status: Vagrant; rare (Kv, 1991). A small flock of this hill bird was seen by Ganguli in 1957.

51 Family : SITTIDAE (Nuthatches and Creepers)

Subfamily : SITTINAE (Nuthatches)

189 Genus *Sitta* Linnaeus

385 (1830) ***Sitta castanea castanea*** Lesson

Peninsular Chestnutbellied Nuthatch

1830. *Sitta castanea* Lesson, *Traite d' Orn* : 316 (Bengale).

1922. Baker, *FBI* No. 110 (part), 1 : 123.

Local name : Siri.

Distribution : Delhi : Tree avenues along canals (Frome, 1947); Woodland and Parkland (Hutson, 1954); *Babul* trees in a parkland (Ganguli, 1975); NDR (Gaston, 1978; Kv, 1991a).

Status : Resident ; rare (Kv, 1991).

Subfamily : TICHODROMADINAE (Wall Creepers)

190 Genus *Tichodroma* Illiger

386 (1839) ***Tichodroma muraria nepalensis*** Bonaparte

Wall Creeper

1850 *T.(ichodroma) nepalensis* Bonaparte, *Consp. Gen. Av.* 1 : 225 (Central Asia).

1922. Baker, *FBI* No. 475, 1 : 441.

Distribution : Delhi : New Delhi secretariat building (Frome, 1947); Qutab Minar and Tughlaqabad fort (Ganguli, 1975).

Status : Winter visitor (Ganguli, 1975); uncommon (Kv, 1991).

Subfamily : SALPORNITINAE (Spotted Creepers)

191 Genus *Salpornis* Gray

387 (1841) ***Salpornis spilonotus spilonotus*** (Franklin)

Indian Spotted Grey Creeper

1831. *Certhia spilonota* Franklin, *Proc. zool. Soc.* London : 125 (Vindhyan Hills).

1922. Baker, *FBI* No. 456 (part), 1 : 439.

Distribution : Delhi : Woodland and country district (Frome, 1947); woodland strip on the west edge of Lodi golf links (Hutson, 1954; Okhla (Ganguli, 1975).

Status : Resident ; rare; breeds (Kv. 1991).

52 Family : CERTHIIDAE (Tree Creepers)
192 Genus ***Certhia*** Linnaeus
388 (1847) ***Certhia himalayana himalayana*** Vigors
Himalayan Tree Creeper

1832 (1831).*Certhia Himalayana* Vigors, *Proc. zool. Soc.* London : 174 (Himalayan Mountains, restricted to Kumaon or Garhwal by Meinertzhagen, 1922, *Bull. Brit. Orn. Cl.* **42** : 140).

1922. Baker, *FBI* No. 444 (part), **1** : 430.

Distribution : Delhi : Woodland (Hutson, 1954).

Status : Vagrant ?. Seen only once before 1954 (Kv, 1991).

53 Family : MOTACILLIDAE (Pipits and Wagtails)
193 Genus ***Anthus*** Bechstein
389 (1852,3?) ***Anthus hodgsoni*** Richmond
Indian Tree Pipit

1926. Baker, *FBI* Nos. 1186, 1187 & 1188, **3** : 281, 282 and 283.

Local name : Musarichi.

Distribution : Delhi : Light woodland, open country and open grassy area near Tughlaqabad (Ganguli, 1975); NDR (Gaston, 1978; Kv, 1991a).

Status : Winter visitor (Ganguli, 1975) ; uncommon (Kv, 1991).

390 (1854,5?) ***A. trivialis*** (Linnaeus)
Tree Pipit

1926. Baker, *FBI* Nos. 1184, 1185, Vol. **3** : 279, 280.

Distribution : Delhi : Grassland, under trees, damp meadows and ***babul*** grove at Okhla (Ganguli, 1975) ; NDR (Gaston, 1978; Kv, 1991a).

Status : Winter visitor (Ganguli, 1975); uncommon (Kv, 1991).

391 (1857) ***A. novaeseelandiae richardi*** Vieillot
Richard's Pipit

1818. *Anthus Richardi* Vieillot, *Nouv, Dict. d'Hist. Nat.* **26** : 491 (France).

1926. Baker, *FBI* No. 1193, **3** : 288.

Local name : Charchari.

Distribution : Delhi : Short grass near rivers, edges of jheels, cultivation, wasteland, field near Pindwala jheel and grassy meadows south of Najafgarh jheel (Ganguli, 1975).

Status : Resident (Ganguli, 1975) ; rare (Kv, 1991).

*392 (1858) ***A. n. waitei*** Whistler
Northwestern Paddyfield Pipit

1936. *Anthus rufulus waitei* Whistler, *J. Bombay nat. Hist. Soc.* **38** : 766 (Jhelum, Punjab).
1926. Baker, *FBI* No. 1195 (part), **3** : 290.
Local name : Charchari.
Distribution : Delhi (Kv, 1991); IARI campus (present record).
Status : Resident; common; breeds (Kv, 1991).

393 (1861,2?) ***A. campestris*** (Linnaeus)
Tawny Pipit

1926. Baker, *FBI* Nos. 1197 (part) and 1198, **3** : 292, 293.
Local name : Chillu.
Distribution : Delhi : The lawns of Purana Qila (Basil-Edwardes, 1926); open ground of riverain areas (Frome, 1947); the plough (Hutson, 1954).
Status : Winter visitor (Ganguli, 1975); less common (Kv, 1991).

394 (1864) ***A. cervinus*** (Pallas)
Redthroated Pipit

1811. *Motacilla cervina* Pallas, *Zoogr. Rosso-Asiat.* **2** : 511 (Siberia).
1926. Baker, *FBI* No. 1199, **3** : 294.
Local name : Lal gala Chillu.
Distribution : Delhi : Okhla (Alexander, 1949; Ganguli, 1975).
Status : Passage migrant; rare (Kv, 1991).

395 (1865) ***A. roseatus*** Blyth
Vinaceousbreasted Pipit

1847. *Anthus roseatus* Blyth, *Jour. Asiat. Soc.* Bengal **16** : 439 (Nepal).
1926. Baker, *FBI* No. 1200, **3** : 295.
Distribution : Delhi : Near a muddy pool north of Delhi (Alexander 1949).
Status : Winter visitor ; rare. Seen in 1950s, not subsequently (Kv, 1991)

396 (1866,7?) ***A. simlis*** Jerdon
Brown Rock Pipit

1926. Baker, *FBI* Nos. 1191, 1192, **3** : 286, 287.
Distribution : Delhi : Stony and arid country, open grass-covered stretch interspersed

with *babul* jungle (Basil-Edwardes, 1926) ; open rocky country (Frome, 1947 ; Alexandar, 1949) ; Tughlaqabad (Hutson, 1954) ; near old tomb close to Qutab (Ganguli, 1975) ; NDR (Gaston, 1978 ; Kv, 1991a).

Status : Winter visitor (Ganguli, 1975) ; uncommon (Kv, 1991).

397 (1871,2) *A. spinoletta* (Linnaeus)
Water Pipit

1926. Baker, *FBI* Nos, 1201, 1202 and 1203, **3** : 297, 298 & 299.

Distribution : Delhi : At Dasna and near Horse-shoe jheel (Alexander, 1949); near Pindwla jheel (Ganguli, 1975).

Status : Winter visitor (Ganguli, 1975); uncommon (Kv, 1991).

194 Genus ***Motacilla*** Linnaeus
398 (1874) ***Motacilla indica*** Gmelin
Forest Wagtail

1789. *Motacilla indica* Gmelin, *Syst. Nat.* **1** : 962 (India, *ex* Sonnerat, restricted to Malabar by Ripley, 1961, *Synopsis* : 574).

1926. Baker, *FBI* No. 1183, **3** : 276.

Distribution : Delhi : Okhla (Alexander, 1949).

Status : Vagrant ? ; uncommon (Kv, 1991).

399 (1875) ***M. flava thunbergi*** Billberg
Greyheaded Yellow Wagtail

1828 *(Motacilla) Thunbergi* Billberg, *Synops. Faun. Scand.* **1** (2) : 50 (Lapland).

1926. Baker, *FBI* No. 1176, **3** : 269.

Local name : Pilkya.

Distribution : Delhi : Roadside mud puddle *ca* 15 km SW of New Delhi (Donahue, 1967); Delhi (Ganguli, 1975).

Status : Winter visitor; common (Kv, 1991).

400 (1876) ***M. f. beema*** (Sykes)
Blueheaded Yellow Wagtail

1832. *Budytes Beema* Sykes, *Proc. zool. Soc.* London : 90 (Dukhun).

1926. Baker, *FBI* No. 1175, **3** : 267.

Distribution : Delhi (Ganguli, 1975).

Status : Winter visitor (Ganguli, 1975); common (Kv, 1991).

401 (1878) ***M. f. melanogrisea*** (Homeyer)
Turkestan Blackheaded Wagtail or Blackheaded Yellow Wagtail

1878. *Budytes melonogriseus* Homeyer, *Jour. f. Orn.* **26** : 128 (India).
1926. Baker, *FBI* No. 1180, **3** : 272.
Local name : Pila mamola.
Distribution : Delhi (Ganguli, 1975).
Status : Winter visitor ; uncommon (Kv, 1991).

402 (1879) ***M. f. leucocephala*** (Przevalski)
Whiteheaded Yellow Wagtail

1887. *Budytes leucocephala* Przevalski, *Zap. Imp. Acad. St. Petersb.* **55** : 85 (Altai).
1926. Baker, *FBI* No. 1178, **3** : 270.
Local name : Pilkya.
Distribution : Delhi : South of Okhla (Ganguli, 1975).
Status : Passage migrant; rare? (Kv, 1991).

403 (1881) ***M. citreola citreola*** Pallas
Northern Yellowheaded Wagtail

1776. *Motacilla citreola* Pallas, *Reise Russ. Reichs* **3** : 696 (Siberia).
1926. Baker, *FBI* No. 1181 (part), **3** : 273.
Local name : Pilkya, Pani-ka-pilkya.
Distribution : Delhi (Ganguli, 1975).
Status : Winter visitor; less common (Kv, 1991).

404 (1883) ***M. c. calcarata*** Hodgson
Blackbacked Yellowheaded Wagtail

1836. *Motacilla* (Budytes) *Calcarata* Hodgson, *Asiat. Res.* **19** : 190 (Nepal).
1926. Baker, *FBI* No. 1182, **3** : 274.
Local name : Pani-ka-pilkya.
Distribution : Delhi (Ganguli, 1975).
Status : Winter visitor; less common (Kv, 1991). Gaston, (1978) did not mention the race.

*405 (1884) ***M. caspica caspica*** (Gmelin)
Grey Wagtail

1774. *Parus Caspicus* Gmelin, *Reise d. Russ.* **3**, pl. 20, fig 2:104 (southern shore of Caspian sea).

1926. Baker, *FBI* No. 1174, **3** : 265.

Distribution : Delhi : Gardens and Okhla (Ganguli, 1975); NDR (Gaston, 1978); Bhalsawa lake, Ramghat, Okhla Ranibag, NZP, Deer park, IARI campus and roadsides (present record).

Status : Winter visitor ; common (Kv, 1991).

406 (1885) ***M. alba dukhunensis*** Sykes
Indian White Wagtail

1832. *Motacilla Dukhunensis* Sykes, *Proc. zool. Soc.* London : **91** (Dukhun).

1926. Baker, *FBI* No. 1166, **3** : 257.

Local name : Dhoban.

Distribution : Delhi (Ganguli,1975); NDR (Gaston, 1978 - the author has not mentioned the race).

Status : Winter visitor; common (Kv, 1991).

407. (1886) ***M. a. personata*** Gould
Masked Wagtail

1861. *Motacilla personata* Gould, *Bds. Asia* **4** pl. 63 (Bengal).

1926. Baker, *FBI* No. 1168, **3** : 259.

Distribution : Delhi (Ganguli, 1975).

Status : Winter visitor; uncommon (Kv, 1991).

* 408 (1891) ***M. maderaspatensis*** Gmelin
Large Pied Wagtail

1789. *(Motacilla) maderaspatensis* Gmelin, *Syst. Nat.* **1** : 961 (India = Madras *vide* Whistler & Kinnear, 1933, *JBNHS* **36** : 842).

1926. Baker, *FBI* No. 1172, **3** : 263.

Local name : Khanjan.

Distribution : Delhi : Near water at Okhla, at Badshahpur tanks, river and flooded borrow-pits in north Delhi (Ganguli, 1975); Yamuna river at Majnu-ka-tila, Bhalsawa lake, Ramghat, Okhla and Najafgarh at Chhawala bridge (present record).

Status : Resident; common; breeds.

54 Family : DICAEIDAE (Flowerpeckers)
195 Genus ***Dicaeum*** Cuvier

409 (1892,4) ***Dicaeum agile agile*** (Tickell)
Indian Thickbilled Flowerpecker

1833. *Fringilla Agilis* Tickell, *Jour. Asiat. Soc.* Bengal **2** : 578 (Borabhum and Dholbhum).
1926. Baker, *FBI* No. 1311 (part), **3**: 435.
Distribution : Delhi : North Delhi Ridge (Alexander, 1949).
Status : Vagrant?. Seen twice in 1950, not subsequently (Kv, 1991).

410 (1899). ***D. erythrorhynchos erythrorhynchos*** (Latham)
Tickell's Flowrpecker

1790. *Certhia erythrorhynchos* Latham, *Index Orn.* **1** : 299 (India, restricted to Bombay by Baker, 1926, `Fauna' ed. 2, Vol 3 : 432).
1926. Baker, *FBI* No. 1308, **3** : 432.
Local name : Phoolchuki.
Distribution : Delhi : Qudsia park, north Delhi, Lodi gardens and other localities (Alexander, 1949).
Status : Unknown (Kv, 1991).

55 Family : NECTARINIIDAE (Sunbirds)
196 Genus ***Nectarinia*** Illiger
*411 (1917) ***Nectarinia asiatica asiatica*** (Latham)
Indian Purple Sunbird

1790. *Certhia asiatica* Latham, *Index Orn.* **1** : 288 (India = Gurgaon).
1926. Baker, *FBI* No. 1278, **3** : 396.
Local name : Shakar khora, Phul soongni.
Distribution : Delhi : Gardens, parks, almost everywhere except in grassland (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); Okhla, NZP, Hauzkhas, Tughlaqabad, Lodi garderns, Piggery farm and IARI campus (present record).
Stauts : Resident; common; breeds.

56 Family : ZOOSTEROPIDAE (White-eyes)
197 Genus ***Zosterops*** Vigors & Horsfield
*412 (1933) ***Zosterops palpebrosa palpebrosa*** (Temminck)
Indian White-eye

1824. *Sylvia palpebrosa* Temminck, *Pl. Col. d'Ois* **49**, pl. 293, fig 3 (Bengale).
1926. Baker, *FBI* Nos. 1247 (part), 1248, 1249 and 1250, **3** : 358-61.
Local name : Baboona.

Distribution : Delhi : Gardens, parks, roadside trees and shrubs (Ganguli; 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); Jahapanah, Lodi gardens, Piggery farm and KN ridge (present record).

Stauts : Resident ; common; breeds.

57 Family : PLOCEIDAE (Weaver Birds)

Subfamily : *PASSERINAE* (House and Rock Sparrow)

138 Genus ***Passer*** Brisson

* 413 (1938) ***Passer domesticus indicus*** Jardine & Selby

Indian House Sparrow

1835. *Passer indicus* Jardine & Selby, *Ill. Orn.* **3**, pl. 118 (India, restricted to Bangalore by Kinnear, 1925, Ibis : 751).

1926. Baker, *FBI* Nos. 1096 and 1097 (part), **3** : 170, 172.

Local name : Gouriya.

Distribution : Delhi : Human habitation (Ganguli, 1975) ; NDR (Gaston, 1978, but the author has not mentioned the race); ODR & NDR (Kv, 1991a); Practically throughout Delhi's environment (present record).

Status : Resident; abundant; breeds.

199 Genus ***Petronia*** Kaup

414 (1949). ***Petronia xanthocollis xanthocollis*** (Burton)

Indian Yellowthroated Sparrow

1838. *Fringilla xanthocollis* Burton, *Cat. Bds. Mus. Fort. Pitt.* Chatham : 23, new name for *Fringilla flavicollis* Franklin, 1831, *nec F. flavicollis* Gmelin, 1789 (Ganges between Calcutta and Benares).

1926. Baker, *FBI* No. 1094, **3** : 166.

Local Name : Jangli-chiria.

Distribution : Delhi : Thin woodland of *babuls* (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a).

Status : Resident ; less common ; breeds (Kv, 1991).

Subfamily : PLOCEINAE (Weaver Birds, Bayas)

200 Genus ***Ploceus*** Cuvier

*415 (1957) ***Ploceus philippinus philippinus*** (Linnaeus)

Indian Baya

1766. *Loxia Philippina* Linnaeus, *Syst. Nat.*, ed. **12**, 1 : 305 (Philippines, *errore* = Ceylon).

1926. Baker, *FBI* No. 1008 (part), **3** : 67.

Local Name : Baya, Son-chiri.

Distribution : Delhi : Indigenous woodland, scrub and cultivation (Ganguli, 1975); NDR (Gaston, 1978); ODR & NDR (Kv, 1991a); Piggery farm, Humayun's tomb and roadsides (nest only-present record).

Status : Resident; common ; breeds (Kv, 1991).

416 (1961) ***P. benghalensis*** (Linnaeus)
Blackthroated Weaver Bird

1758. *Loxia benghalensis* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 175 (Benghala).

1926. Baker, *FBI* No. 1012, **3** : 72.

Local name : Sarbo baya.

Distribution : Delhi : Reed-beds near Okhla (Alexander, 1949) ; near the new bridge opposite Indraprastha Estate (Ganguli, 1975).

Status : Resident; uncommon; breeds (Kv, 1991).

417 (1962) ***P. manyar flaviceps*** Lesson
Indian Streaked Weaver Bird

1831. *Ploceus flaviceps* Lesson, *Traite d'Orn.*:435 (Pondichery).

1926. Baker, *FBI* Nos. 1013, 1014, **3**: 73, 74.

Local name : Telia baya.

Distribution : Delhi: Thick reed-beds in north and south Delhi and the enclosure for water-birds in the Delhi zoo (Ganguli, 1975).

Status : Resident; less common; breeds (Kv, 1991).

Sub family : ESTRILDINAE (Avadavat, Munias)
201 Genus ***Estrilda*** Swainson
* 418 (1964) ***Estrilda amandava amandava*** (Linnaeus)
Red Munia or Avadavat

1758. *Fringilla Amandava* Linnaeus, *Syst. Nat.*, ed. **10**, 1 : 180 (eastern India, restricted to Calcutta, West Bengal, by Baker, 1921, *JBNHS*, **27** : 725. Whistler & Kinnear, 1933, *JBNHS*, **36** : 837, designate northern Gujarat, apparently unaware of the earlier restriction).

1926. Baker, *FBI* No.1036, **3** : 96.

Local name : Lal or Lal Munia.

Distribution : Delhi: Long grass along the canal banks at Kingsway (Basil-Edwardes, 1926) ; across the marsh on the Mathura road (Alexander, 1949) ; reeds near the railway bridge over the canal at Muradnagar and corase grass south of Okhla (Ganguli,1975); Okhla (present record).

Status : Resident; less common; breeds? (Kv, 1991).

419 (1965) ***E. formosa*** (Latham)
Green Munia

1790. *Fringilla formosa* Latham, *Index Orn.* **1** : 441 (India).
1926. Baker, *FBI* No. 1035, **3** : 94.
Local Name : Hari munia, Hari lal.
Distribution : Delhi: Near Yamuna river (Kv, 1991).
Status : Vagrant, uncommon? (Kv, 1991).

202 Genus ***Lonchura*** Sykes
420 (1966) ***Lonchura malabarica malabarica*** (Linnaeus)
Whitethroated Munia

1758. *Loxia malabarica* Linnaeus, *Syst. Nat.*, ed. **10**, 1:175 (India).
1926.Baker, *FBI* No. 1030, **3** : 89.
Local name : Charakka.
Distribution : Delhi: Indigenous vegetation and open waste country (Ganguli, 1975); NDR (Gaston, 1978) ; ODR & NDR (Kv, 1991a).
Status : Resident; common; breeds (Kv, 1991).

*421(1967, 8?) *L. striata* (Linnaeus)
Whitebacked Munia

1926. Baker, *FBI* Nos. 1021, 1024, **3** : 83, 84.
Distribution : Delhi (Kv, 1991); Jahapanah, BJ park and IARI campus (present record).
Status : Resident; uncommon.

422 (1974) ***L. punctulata punctulata*** (Linnaeus)
Indian Spotted Munia

1758. *Loxia punctulata* Linnaeus, *Syst. Nat.*, ed. **10**, 1: 173 (Asia = Calcutta).
1926. Baker, *FBI* No. 1031, **3** : 91.
Local name : Telia munia.
Distribution : Delhi: Country districts (Frome, 1947) ; Okhla (Alexander, 1949); garden north Delhi (Ganguli,1975); NDR (Gaston,1978); ODR & NDR (Kv, 1991a).
Status : Resident; uncommon; breeds (Kv, 1991).

423 (1977) ***L. malacca atricapilla*** (Vieillot)
Eastern Blackheaded Munia

1807. *Loxia atricapilla* Vieillot, *Hist. nat. ois. chanteurs* : 84, pl.53 ('Les Grandes-Indes', restricted to Lower Bengal by Robinson & Kloss, 1924, *Jour. Nat. Hist. Soc.* Siam **5** : 362).

1926. Baker, *FBI* No. 1020 (Part), **3** : 81.

Local name : Nakalnur.

Distribution : Delhi : New Delhi garden (Benthall, 1949) ; Delhi (Kv, 1991).

Status : Vagrant; uncommon (Kv,1991).

424 (1978) ***L. m. malacca*** (Linnaeus)
Southern Blackheaded Munia

1766. *Loxia malacca* Linnaeus, *Syst. Nat*, ed. **12**, 1 : 302 (`China, Java and Malacca' *errore* = Belgaum, restricted by Baker, 1926, *Fauna Brit. India* **3** ; 78).

1926.Baker, *FBI* Nos. 1017 and 1018, **3** : 78, 79.

Local name : Nakal nur.

Distribution : Delhi: Madanpur (Ganguli, 1975); NDR (Gaston, 1978); Delhi (Kv, 1991).

Status : Resident?; uncommon; breeds? (Kv,1991).

58 Family : FRINGILLIDAE (Finches)
Sub-family : CARDUELINAE (Goldfinches & Allies)
203 Genus ***Carpodacus*** Kaup
425 (2011) ***Carpodacus erythrinus roseatus*** (Blyth)
Indian Rosefinch

1842. *Pyrrhula roseata* 'Tickell'= Blyth, *Jour. Asiat. Soc.* Bengal **11** : 461 (`sold..... in Calcutta').

1926. Baker, *FBI* No. 1069, **3** :137.

Local name : Lal tuti.

Distribution : Delhi : Thin babul jungle near Jantar Mantar (Basil-Edwardes, 1926); light woodland at Okhla, Ridge,garden etc. (Ganguli,1975); NDR (Gaston, 1978 ; Kv, 1991a).

Status : Winter visitor (Ganguli 1975); less common (Kv, 1991).

59 Family : EMBERIZIDAE (Buntings)
204 Genus ***Emberiza*** Linnaeus
426 (2043) ***Emberiza melanocephala*** Scopoli
Blackheaded Bunting

1769. *Emberiza melanocephala* Scopoli, *Annus.I, Hist. Nat.* : 142 (Carniola).

1926. Baker, *FBI* No. 1133, **3** : 213.

Local name : Gandam.

Distribution : Delhi: A tree in the riverain belt (Hutson, 1954); in a field on the road to Najafgarh (Ganguli, 1975).

Status : Vagrant. Only two records, before 1962 (Kv, 1991).

427 (2044) *E. bruniceps* Brandt
Redheaded Bunting

1841. *Emberiza bruniceps* Brandt, *Bull. Sci. Acad. Imp. St. Petersb.* **9**, col.12 (Turkmenia).

1926. Baker, *FBI* No. 1134, **3**: 215.

Local name : Lalsir gandam.

Distribution : Delhi : *Keekar* trees near riverain area, ripening corn fields and cultivation (Ganguli, 1975).

Status : Passage migrant ; uncommon (Kv, 1991).

428 (2048) *E. stewarti* (Blyth)
Whitecapped Bunting

1854. *Euspiza Stewarti* Blyth, *Jour.Asiat. Soc.* Bengal **23** : 215 (Landour and Dehra Dun).

1926. Baker ,*FBI* No. 1124 , **3** : 203.

Local name : Safedsir gandam.

Distribution : Delhi: Open scrubland (Frome, 1947); Ridge and other stony country (Alexander, 1949); indegenous woodland (Hutson, 1954); NDR (Gaston, 1978; Kv, 1991a).

Status : Passage migrant; uncommon (Kv, 1991).

429 (2049) *E. hortulana* Linnaeus
Ortolan Bunting

1758. *Emberiza Hortulana* Linnaeus, *Syst. Nat.*, ed. **10**, 1: 177 (Europa = Sweden).

1926. Baker,*FBI* No. 1130, **3** : 209.

Distribution : Delhi: Mehrauli -rocky wastelands (Ganguli,1975).

Status : Passage migrant; uncommon. Seen in 1970, one of few records for India (Kv, 1991).

430 (2050) *E. buchanani buchanani* Blyth
Greynecked Bunting

1845(1844). *E.(mberiza) Buchanani* Blyth, *Jour. Asiat. Soc.* Bengal **13** : 957 (Indian

Peninsula).

1926. Baker, *FBI* No. 1129, **3** : 208.

Local name : Jamjohara.

Distribution : Delhi: North Delhi Ridge (Alexander, 1949); Lodi golf links surroundings and bare story area close to Qutab (Ganguli, 1975).

Status : Passage migrant ; uncommon (Kv, 1991).

431 (2051) ***E. cia par*** Hartert
Transcaspian Rock Bunting

1904. *Emberiza cia par* Hartert, *Vog.pal. Fauna* **1** : 184 (Gudan, Transcaspia).

1926. Baker, *FBI* No. 1126, **3** : 206.

Distribution : Delhi : The ridge (Frome, 1947); Tughlaqabad (Hutson, 1954); Ridge at Kingsway, north Delhi (Ganguli, 1975).

Status : Winter visitor; rare. Only three records, before 1946 (Kv, 1991).

432 (2057) ***E. striolata striolata*** (Lichtenstein)
Striolated Bunting

1823. *E.(ringilla) striolata* Lichtenstein, *Verz. Doubl. Mus.* Berlin : 24 (Ambukol, Nubia).

1926. Baker, *FBI* No. 1136, **3** : 217.

Distribution : Delhi ; Near Qutab (Ganguli, 1975); Tughlaqabad (Alexander, 1949).

Status : Passage migrant ? ; rare. Seen only twice (Kv, 1991).

433 (2058) ***E. schoeniclus pallidior*** Hartert
Central Asian Reed Bunting

1904. *Emberiza schoeniclus pallidior* Hartert. *Vog. pal. Fauna* **1** : 197 (Aiderli, Turkestan).

1926. Baker, *FBI* No. 1119, **3**: 197.

Distribution : Delhi (Kv, 1991).

Status : Winter visitor; rare (Kv,1991).

205 Genus ***Melophus*** Swainson
434 (2060) ***Melophus lathami*** (Gray)
Crested Bunting

1831. *Emberiza lathami* Gray, *Zool. Misc.* **1** : 2 (Canton, Kwangtung).

1926. Baker, *FBI* No. 1132, **3** : 221.

Local name : Patthar- chiria.

Distribution : Delhi: Open country (Frome , 1947); riverain belt (Hutson, 1954); NDR

(Gaston, 1978).

Status : Passage migrant ; rare. Three records only (Kv, 1991).

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REFERENCES

Abdulali, H. and Panday, J.D. 1978. Checklist of the Birds of Delhi, Agra, and Bharatpur.

Alexander, H.G..1949. The birds of Delhi and district. *J.Bombay nat. Hist. Soc.*, **48** : 370 -372.

Ali, S and Ripley, S.D. 1969-1978. *Handbook of the Birds of India and Pakistan*, Vols 1-10. Oxford University Press, Bombay.

Anon. 1967. Birds of Delhi and District, Field Checklist. Delhi Bird Watching Society.

Baker, E.C.S. 1922-30. *Fauna of British India : Birds.* Vols. 1-8. Taylor Francis, Landon.

Basil-Edwardes, S. 1926. A contribution to the ornithology of Delhi. *J.Bombay nat. Hist. Soc.*, **31** : 261-273, 567-578.

Benthall, E.C. 1949. The birds of Delhi and district. *ibid* **48** : 368-370, 811-812.

Donahue, J.P. 1967. Notes on a collection of Indian birds, mostly from Delhi. *ibid.* **64** : 410-429.

Frome, N.F. 1947. The birds of Delhi and district *ibid.* **47** : 277-300, 751-753.

Ganguli, Usha. 1975 *A guide to the birds of the Delhi area.* Publ. by Jagan Nath, Under Secretary, for the Indian Council of Agricultural Research, New Delhi, pp. i-ix+1-301, xx colour pls.

Gaston, A.J.1973. Black Bulbuls *Hypsipetes madagascariensis* (P.L.S. Muller) in Delhi. *J.Bombay nat. His. Soc.*, **69** (3) : 651-652.

Gaston, A.J. 1976. The moult of Blyth's Reed Warbler *Acrocephalus dumetorum* in India, with notes on the moult of other Palaearctic Warblers in India. *ibis* **118** : 247 - 251.

Gaston, A.J. 1978. The seasonal occurrence of Birds on the New Delhi Ridge *J.Bombay nat. Hist. Soc.*, **75** (1) : 115-128.

Gaur, S. 1995. Bird Haven (in a drain !). *Srishti* **2** (1) : 34-38.

Hutson, H.P.W. 1954. *The birds about Delhi.* Delhi Bird Watching Society.

Kalpavriksh, 1991. *What's that bird ? A guide to birdwatching, with special reference to Delhi.* pp. 1-93. Publ. by Kalpavriksh, C 17/A Munirka, New Delhi.

Kalpavriksh, 1991a. *The Delhi Ridge Forest-Decline and Conservation.* Publ. *ibid.* pp. i-vi + 1-49.

Menon, V. and Gandhi, T. 1992. Sighting of Skimmer at Najafgarh, Delhi. *Newsletter for Birdwatcher,* **32** : 17.

Satya,Sri, C. 1993. Effect of Urbanization on Avifaunal Diversity in Delhi. (M.Sc. Thesis). Dept. of Environmental Biology, Univ. of Delhi. pp. 1-85 (unpublished).

Singh, K. and Basu, S. 1990. *Nature Watch.* Tien Wah Press, Singapore.

Srishti. 1991. Saving The Delhi Ridge- One year of conservation : A Report. pp. 1-81 (Birds : 39).

Tikader, B.K. undated. *Meet Your Feathered Friends at Teen Murti House, New Delhi*. Zool. Surv. India, Calcutta. : 1-16.

Urfi, A.J. 1993. The birdlife of Okhla. *Sanctuary,* **13** (5) : 50-53.

Urfi, A.J. 1995. Wetlands of ornithological significance in the Delhi region. *OBC Bulletin* No. **22** : 38-41.

Varma, Priti, 1994. Najafgarh Drain- A Prospective Reserve for wetland Avifauna of Delhi- An Insight (M.Sc. Thesis). Dept. of Environmental Biology, Univ. of Delhi. pp. 1-67 (unpublished).

Addendum

After the present manuscript went to the press in October, 1996, the authors have come across the paper of Vyas (1996), on 19th Nov., 1996 on the update of birds of Dehi region. This checklist adds the following two species to the avifauna of Delhi,

1. *Surniculus lugubris*, Drongo-Cuckoo

2. *Saxicola leucura*, Whitetailed Bush Chat.

Vyas, S. 1996. Checklist of the birds of the Delhi region : An update. *J.Bombay nat. Hist. Soc.*, **93** (2) : 219 - 237.

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State Fauna Series 6: Fauna of Delhi, 823-839, 1997

MAMMALIA

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INTRODUCTION

The mammals are important constituents of faunal wealth of a particular region. Their abundance or scarcity has got a direct bearing on the ecological conditions prevailing in a particular area. The knowledge of mammalian fauna is also important for sound wildlife conservation measures and promotion of tourism.

Long before Moghul's invasion of India and particularly Delhi, this area was full of shrub forests, mainly of kikar trees (*Prosopis* spp), stretching from the Aravalli hills in Rajasthan to the banks of river Yamuna. This forest was once abode for a large variety of wild animals. Big cats like the tiger, the leopard and smaller cat *viz.* the hyaena, the wolf, the jackal and the fox, etc. were in abundance. Large herds of antelopes and the wild boar also roamed about freely around Delhi (John and Krishnan, 1995).

The Moghul Kings had special fascination for the wildlife and nature. They have recorded their abundance and observation in the annals of that era. Ali (1927, 1927-28) and Rao (1957) have summerised the important works of those days viz. the *Humayunama*, the *Ain-e-Akbari*, the *Jehangirnama* and the *Shajahanama*. Those Moghul historians have given a general account of large mammals of India and no mammal was particularly mentioned from Delhi. Although, no collaborative evidence is available yet this was perhaps true that since wildlife fauna was in abundance throughout the country and more particularly in the surrounding areas of Delhi, these may also be plenty in Delhi. This view got strengthened by the evidence of fencing off large portion of forests as the royal hunting reserve by the Emperor Feroz Shah Tughlak (1351-1388) and his constructing of a hunting reserve called "*Khushak-i-shikar*", ruins of which are still present near the Hindu Rao Hospital (John and Krishnan, 1955).

With the advent of British rule and shifting of colonial activities from Calcutta to Delhi in early part of this century, more and more forests were cleared to accommodate the increasing human population. The lust for hunting and trophies have resulted in the decline of wildlife population which was already under stress because of shrinking habitat. John and Krishnan (1995) have given an account of wildlife scenario during the early part of this century. According

to them "the forest cover has shrunken, leaving many of the wild creatures either to die out or wander away to more greener areas. Tiger by then had left the shrub jungle on the city's periphery. Leopards were dying out and took shelter in the ruins of Tughlaqabad. But herds of black buck, nilgai and chinkara roamed along the wooded areas. People, it is told, avoided passing by the ridge for fear of wolves and striped hyaenas"

Till about 60 years ago, the wildlife population was fairly large. During second world war and afterwards, large chunks of Delhi forests began to be cleared for human habitation and large animals began disappearing one by one. Only some pockets of wilderness remained. Nilgai rampaged crops in the airport area in Palam and herds of wild boar seen digging root rhizomes in Shahadara areas.Occasional hauling of jackals and foxes were not uncommon at dusk and night.After independence, the destruction of wildlife has assumed an alarming proportion because of indiscriminate killing, fast urbanisation, greater industrial development, improvement in tracking and fast transport system

The Gazetteer of Delhi (1883-84) has given a list 13 species of mammals belonging to five orders. The orders insectivora, primates and lagomorpha are represented by single species. The order carnivora is represented by four species and order artiodactyla is represented by five species. The Gazetteer of Delhi (1912) reports 13 species of mammals. Two species, the hyaena and the jackal were added and the mongoose was deleted from the order carnivora. A single species of order rodentia i.e., the porcupine was also added in this edition of Gazetteer of Delhi (1912).

Singh and Bhatia (1959) have given an account of seven species of order rodentia from Delhi. The Gazetteer of Delhi (1976) has given an enlarged list of 30 species of mammals belonging to eight orders namely, insectivora, chiroptera, primates, pholidota, carnivora, artiodactyla, lagomorpha and rodentia. The details of species of each order has been given in table 1. The record of *Macaca radiata* from Delhi is probably a misidentification of *Macaca mulatta*, which has a known distribution in the area. Generally *M. radiata* is found below latitude 21° N approximately (Fooden *et al.*, 1981). Singh and Basu (1990) have mentioned some mammals from different localities of Delhi. Kalpavriksh (1991) has published a list of 29 species of mammals recorded from Delhi between 1981-89. The detailed list of species with remarks on their existence in earlier years are given in table 1. Srishti report (1994) has given list of 25 species of mammals inhabiting Delhi (Table, 1). In the above report, however, it has also been mentioned that only 10 species belonging to six orders are presently found in Delhi.

The present paper lists 32 species of mammals belonging to 27 genera, 17 families, and eight orders from Delhi, which are recorded either by direct observation or cited from recent publications. However, the table of annotated species gives a list of 40 species out of which now eight species are not found in Delhi. The classification followed is after Simpson (1945). The distribution and other characters are after Blanford (1880-1891), Pocock (1939), Ellerman and Morrisson-Scott (1951), Walker (1968), Prater (1971), Anderson (1981) and Sclater (1981).

SYSTEMATIC ACCOUNT

Class : MAMMALIA

Order : INSECTIVORA

Family : ERINACEIDAE

1. ***Hemiechinus auritus*** (Gmelin)

Long-eared Hedgehog

1770. *Erinaceus auritus* Gmelin, *Nov. Comment. Acad. Sci. Petrop.* **14** : 519. (Type locality : Astrakhan, south-eastern Russia).

Material observed : Reported from literature.

Distribution : India : Gujarat, Delhi, H.P., Punjab. *Elsewhere* : neighbouring tracts in Pakistan.

Status in Delhi : Being nocturnal exact status is not known. However, the hedgehog has been reported from Delhi in the Gazetteer (1883-84, 1976), Kalpavriksh (1991) and Srishti (1994).

Family : SORICIDAE

2. ***Suncus murinus*** (Linnaeus)

House Shrew or Grey Musk Shrew

1776. *Sorex murinus* Linnaeus, *Syst. Nat.* 12th Ed. **1** : 74. (Type locality : Java).

Material observed : The species was obsereved in Pitampura; October, 1993; and Boat Club, May, 1995

Distribution : India. *Elsewhere* : Throughout temperate and tropical regions of Europe, Africa, North America and Asia.

Status in Delhi: Common. The species has been recorded in Gazetteer of Delhi (1976), Kalpavriksh (1991) and Srishti (1994).

Order : CHIROPTERA

Family : PTEROPIDAE

3. ***Pteropus giganteus*** (Brunnich)

Indian Flying Fox

1782. *Vespertilio gigantea* Brunnich, *Dyrenes Historie*, **1** : 45 (Type locality: Bengal, India).

Material observed : Colony of this flying fox was recorded in Najafgarh in October, 1993, Kamala Nehru Ridge, and Humayun's Tomb in February, 1995.

Distribution : India : Widely distributed in peninsula, northward to Gujarat, Rajasthan, Punjab, and Indian Himalaya. *Elsewhere* : Sri Lanka; Nepal; Bhutan and Myanmar.

Status in Delhi : Common. The species has earlier been reported in Delhi Gazetteer of Delhi (1976), Kalpavriksh (1991) and Singh and Basu (1990).

Family : MEGADERMATIDAE

4. ***Megaderma lyra*** Geoffroy

Indian False Vampire

1810. *Megaderma lyra* Geoffroy, *Ann. Mus. H.N.Paris,* **15** : 190 (Type locality : Madras, India).

Material observed : The species was observed at Kamala Nehru Ridge in February, 1995, Humayun's tomb and IARI in July, 1995.

Distribution : India : Widely distributed from Kashmir to Kanya Kumari and from Gujarat to Bhutan duars. *Elsewhere* : Southern China; Malay States; Myanmar and Sri Lanka.

Status in Delhi : Common. The species has been reported in Gazetteer of Delhi (1976), Kalpavriksh (1991) and Srishti (1994).

Family : RHINOPOMATIDAE

5. ***Rhinopoma hardwickei*** Gray

Lesser Rat-tailed Bat

1831. *Rhinopoma hardwickei* Gray, *Zool Misc.*, **37** : (Type locality : India)

Material observed : Reported from literature.

Distribution : India : Peninsula upto Sindh in west, Palampur in the north and Bengal in the east. *Elsewhere* : Myanmar; Lower Thailand and Arabian countires.

Status in Delhi : Not known. Dr.I.Prakash in a personal communication has pointed out that this species should be present in Delhi.

Family : VESPERTILIONIDAE

6. ***Pipistrellus coromandra*** (Gray)

Indian Pipistrelle

1838. *Scotophilus coromandra* Gray,*Mag. Zool. Bot.* **2** : 498 (Type locality : Pondicherry, Coromandel coast, India).

Material observed : At Kamala Nehru Ridge, a single specimen of this species was seen in February, 1995.

Distribution : India : Peninsula. *Elsewhere* : Southern China; Hainan; Indo-China; and Sri Lanka.

Status in Delhi : Kalpavriksh (1991) has reported this species from Delhi.

Order : PRIMATES

Family : CERCOPITHECIDAE

7. ***Macaca mulatta*** (Zimmermann)

Rhesus Monkey

1780. *Cercopithecus mulatta* Zimmermann, *Geogr. Gesch. Mensch* **2** : 195 (Type locality : India).

Material observed : During recent surveys various troups of rhesus monkey were observed from Tuglaqabad, Kamala Nehru Ridge, Asola WLS, Old Fort, Chanakyapuri, Jahanpanah Park, Naraina, IARI campus and north campus of Delhi University between 1993 to 1995. The species is very common around the ruins of Tughlaqabad.

Distribution : India : Widely distributed from river Tapti and Godavari in south to whole of central and northern parts including Himalaya where the species is found upto 2340 m altitude. *Elsewhere* : Afghanistan; Nepal; Myanmar; Vietnam; south China and Tibet.

Status in Delhi : Common. The species has been frequently recorded from Delhi [Gazetteer of Delhi (1883-84, 1912, 1976); Singh and Basu (1990); Kalpavriksh (1991), Malik (1993) and Srishti (1994)]. Most of the troups are found in the semi urban localities of Delhi.

8. ***Presbytis entellus*** (Dufresne)

Hanuman Langur

1797. *Simia entellus* Dufresne, *Bull. Soc. Philom.* Paris. **7** (1) : 49 (Type locality : Bengal, India).

Material observed : At Kamala Nehru Ridge, a floating male was seen during the present survey (February, 1995).

Distribution : India : Throughout except western deserts. *Elsewhere* : Sri Lanka and southern Tibet.

Status in Delhi : Not common. The migratory troups and solitary individuals from the neighbouring states of U.P. and Haryana have been recorded by the forest and wildlife officials (personal comm. 1995).

Order : PHOLIDOTA

Family : MANIDAE

9. ***Manis crassicaudata*** Gray

Indian Pangolin

1827. *Manis crassicaudata* Gray, in *Griffith's Cuvier Anim. Kingd.* **5** : 282 (Type locality : India).

Material observed : Reported from literature.

Distribution : India : Throughout peninsula upto Kutch and West Bengal; foot hills of Himalaya (Dehradun Valley). *Elsewhere* : Sri Lanka.

Status in Delhi : Because of its nocturnal habits, the species is seldom noticed. The Indian pangolin has been recorded from Delhi [Gazetteer of Delhi (1976) and Kalpavriksh (1991)]. Though Kalpavriksh (1991) apprehends the survival of the species in Delhi, Shrishti (1994) records that till last two-three decades the species could be sighted in the Ridge forest of Delhi.

Conservation status : Vu (Vulnerable).

Order : CARNIVORA

Family : CANIDAE

10. ***Canis aureus*** Linnaeus

Asiatic Jackal

1758. *Canis aureus* Linnaeus, *Syst. Nat.* 10th ed., **1** : 40 (Type locality : Province of Lar Iran).

Material observed : At Asola WLS a few individuals were recorded recently by the state wildlife officials and students of Wildlife Institute of India (1996).

Distribution : India : Throughout. *Elsewhere* : South-eastern Europe; south-west Asia; Nepal; Sri Lanka; extending a little into Myanmar and south-eastern Thailand.

Status in Delhi : Occur in forest tracts of the Ridge [Gazetteer of Delhi (1883-84, 1912, 1976); Kalpavriksh (1991); Srishti (1994) and Sawarkar *et al.* (1996)].

11. ***Vulpes bengalensis*** (Shaw)

Bengal Fox

1800. *Canis bengalensis* Shaw, *Gen.Zool.* **2** (1) : 330 (Type locality : Bengal, India).

Material observed : Reported from literature.

Distribution : India : Thoughout. *Elsewhere* : Nepal.

Status in Delhi : Occasionally seen in the Ridge forest [Gazetteer of Delhi (1883-84, 1912, 1976); Kalpavriksh (1991) and Srishti (1994)]. However, Kalpavriksh (1991) doubted the survival of this species in Delhi.

Family : VIVERRIDAE

12. ***Viverricula indica*** (Desmarest)

Rasse or Small Indian Civet

1817. *Viverra indica* Desmarest, *Nouv. Dict. N.H.* **7** : 170 (Type locality : India).

Material observed : Reported from literature.

Distribution : India : Throughout except high Himalaya. *Elsewhere* : Southern China; further to south-eastern Asia; Bhutan and Myanmar.

Status in Delhi : The survival of the species in Delhi is uncertain (Kalpavriksh,1991). However, Sawarkar *et al.* (1996) recorded it from Asola WLS.

13. ***Herpestes auropunctatus*** (Hodgson)

Small Indian Mongoose

1836. *Mangusta auropunctata* Hodgson, *J.Asiat. Soc.* Bengal, **5** : 235 (Type locality : Nepal).

Material observed : The small Indian mongoose were sighted in Chhawla, Najafgarh, IARI, Bijvasan, Ranibag, Wazirabad, Majnu-ka-tila, Okhla, National Zoological Park, Piggery farm, Qutub Minar, Asola WLS, Humayun's Tomb, Jahanpanah Park, Kamla Nehru Ridge, Lodhi Garden, Tuglaqabad and Budha Jayanti Park during the present survrys (June 1993, October 1993, May 1994; September, 1994; December 1994; February 1995; May 1995; July 1995).

Distribution : India : Found from Kashmir to Bengal, Orissa and Assam. *Elsewhere* : Western Asia; Myanmar and Malay countries.

Status in Delhi : Very common. The species has been recorded in Delhi [Gazetteer of Delhi (1883-84, 1976); Singh and Basu (1990); Kalpavriksh (1991) and Srishti (1994)].

14. *Herpestes edwardsii* (Geoffroy)
Indian Grey Mongoose

1818. *Ichneumon edwardsii* Geoffroy, *Deser. Egypt*, **2** : 139 (Type locality ; Madras, India).

Material observed : IARI campus, Okhla and National Zoological Park (October, 1993, Septemebr, 1994, February, 1995).

Distribution : India : Throughgout except Himalaya. *Elsewhere* : West Asia; Pakistan, Nepal and Sri Lanka.

Status in Delhi : It has been recorded from Delhi [Gazetteer of Delhi, (1883-84, 1976); Singh and Basu (1990); Kalpavriksh (1991) and Srishti (1994)].

15. *Herpestes smithi* Gray
Ruddy Mongoose

1837. *Herpestes smithi* Gray, *Charlesw. Mag. N.H.* I : 578 (Type locality : Bombay, India).

Material observed : Reported from literature.

Distribution : India : Kashmir, Rajasthan, West Bengal, southward to Maharashtra, Karnataka, Andhra Pradesh and throughout eastern and western ghats. *Elsewhere* : Sri Lanka.

Status in Delhi : At Asola WLS two sightings were reported by Sawarkar *et al.* (1996).

Family : FELIDAE

16. *Felis chaus* Guldenstaedt
Jungle Cat

1776. *Felis chaus* Guldenstaedt, *Nov. Com. Acad. Petrop.* **20** : 483 (Type locality : Terek river, north of the Caucasus).

Material observed : Reported from literature.

Distribution : India : Kashmir to Sikkim in Himalaya , Gujarat, West Bengal, Peninsular India. *Elsewhere* : West coast of Caspian sea to Turkistan; Palestine; Egypt, Afghanistan; Baluchistan; Nepal; Sri Lanka; Myanmar; Indo-China; Thailand.

Status in Delhi : The species has been identified by the scats recorded by Sawarkar *et al.* (1996). The identification needs further confirmation.

17. *Felis bengalensis* Kerr
Leopard Cat

1792. *Felis bengalensis* Kerr, *Anim. Kingd.*: 151 (Type locality; Bengal, India).

Material observed : Reported form literature.

Distribution : India : In forested regions from Kashmir to Kanya Kumari. *Elsewhere* : Siberia; South-eastern Asia to north Korea.

Status in Delhi : The species has been reported from Delhi, based on the sighting of two pairs from ridge in 1987 by the Ridgewoodpeckers , members of nature's club, APS, New Delhi (Kalpavriksh, 1991 and Srishti, 1994).

Conservation status : Vu (Vulnerable).

Order : ARTIODACTYLA

Family : SUIDAE

18. ***Sus scrofa*** Linnaeus

Wild Boar

1758. *Sus scrofa* Linnaeus, *Syst. Nat.*, 10th ed. **1** : 49 (Type locality : Germany).

Material observed : Reported from literature.

Distribution : Widely distributed throughout the world.

Status in Delhi : Not recorded in Delhi since, 1940. Presently absent (Kalpavriksh, 1991). However, in the last century and early part of the present century it was recorded from the Shahdara across Yamuna river, south Delhi and Khader tracts [Gazetteer of Delhi (1883-84, 1912, 1976); Srishti (1994)].

Family : BOVIDAE

19. ***Boselaphus tragocamelus*** (Pallas)

Nilgai ; Blue Bull

1766. *Antilope tragocamelus* Pallas, *Misc. Zool.* **5** (Type locality: Plains of Peninsular India)

Material observed : Herd of about 20 individuals was sighted in Asola WLS in July and December 1995.

Distribution : India : Whole of peninsular and its adjoining areas in north and north-west.

Status in Delhi : The species has been regularly reported from ridge forest [Gazetteer of Delhi (1883-84, 1912, 1976), Kalpavriksh (1991) and Srishti (1994)]. Sawarkar *et al.* (1996) records the occurrence of this species from Sanjay Van and Asola WLS. This has been further confirmed by the sighting by the ZSI survey parties in July and December 1995.

Order : LAGOMORPHA

Family : LEPORIDAE

20. ***Lepus nigricolis*** Cuvier
Indian Black-naped Hare

1823. *Lepus nigricollis* Cuvier, *Dict. Sci. Nat.* **26** : 307 (Type locality : Madras, India).

Mateial observed : During present surveys the species has been recorded from the Punjabi bag, Hauzkhas, Okhla, Asola WLS and Bhalsawa lake in February 1995 and July 1995.

Distribution : India : Throughout. *Elsewhere* : Pakistan; Nepal; Bhutan; Myanmar; Java and Sri Lanka.

Status in Delhi: Common. The species has been regularly recorded from Delhi [Gazetteer of Delhi (1883-84, 1912, 1976); Kalpavriksh (1991); Srishti (1994) and Sawarkar *et al.* (1996)].

Order : RODENTIA
Family : SCIURIDAE
21. ***Funambulus pennanti*** Wroughton
Northern Palm Squirrel

1905. *Funambulus pennantii* Wroughton, *J. Bombay nat. Hist. Soc.*, **16** (3) : 411 (Type locality : Surat, India).

Material observed : The species has been recorded from Qutab Minar, Humayun's Tomb, Pragati Maidan, Mehrauli, Wazirabad, Dhaulakuan, National Zoological Park, IARI campus, Tughlaqabad, Kamala Nehru Ridge, Lodhi Garden, Bhalswa Lake, Ramghat, Piggery farm, Asola WLS, Boat Club, Budha Jayanti Park, Jahanpanah Park and Punjabi Bag by the survey parties in June, 1993; October 1993; September 1994; December 1994; February 1995; May 1995 and July 1995.

Distribution : India : Throughout except southern states. *Elsewhere* : Pakistan; Nepal.

Status in Delhi : Very common. It has been widely reported form Delhi both in forested areas as well as in cultivated gardens, parks and monuments [Gazetteer of Delhi (1976); Singh and Basu (1990); Kalpavriksh (1991) and Srishti (1994)].

Family : HYSTRICIDAE
22. ***Hystrix indica*** (Kerr)
Indian Crested Porcupine

1722. *Hystrix cristata* var. *indica* Kerr, *Anim. Kingd.* : 213 (Type locality : India).

Material observed : Reported from literature.

Distribution : India : Widely distributed in north, north-western states and Peninsula.

Elsewhere : Western Asia; Southern Arabia; Parts of Turkistan; Transcaucasia; Sri Lanka and Nepal.

Status in Delhi : The Gazetteer of Delhi (1912) records the species to be common near city area, where they infest the vegetable and horticultural gardens. Kalpavriksh (1991) and Srishti (1994) reports its presence in Delhi till about two decades back. However, Sawarkar *et al.* (1996) has reported the presence of this speceis from Asola WLS on the basis of shed quills and scrape marks.

Family : MURIDAE

23. ***Apodemus sylvaticus*** (Linnaeus)

Common Field Mouse

1758. *Mus sylvaticus* Linnasus, *Syst. Nat.*, 10th ed. **1** : 62 (Type locality : Upsala, Sweden).

Material observed : Sighted from IARI campus and Wazirabad area in June, 1993 and July 1995.

Distribution : India : Throughout. *Elsewhere* : Throughout the world.

Status in Delhi : Common in the cultivated areas.

24. ***Rattus rattus*** (Linnaeus)

House Rat ; Black Rat

1758. *Mus rattus* Linnaeus, *Syst. Nat.* 10th ed. **1** : 61 (Type locality : Sweden).

Material observed : Recorded from IARI campus, Okhla and Punjabi Bag area in June 1993 and February, 1995.

Distribution : India : Widely distributed. *Elsewhere* : Throughout the world.

Status in Delhi : Common. The species has been reported from Delhi [Gazetteer of Delhi (1976); Singh and Bhatia (1959); Kalpavriksh (1991) and Srishti (1994)].

25. ***Rattus norvegicus*** (Berkenhout)

Brown Rat

1769. *Mus norvegicus* Berkenhout, *Outlines N.H.Gt. Britain and Ireland*, **1** : 5 (Type locality : Great Britain).

Material observed: Reported from literature.

Distribution: World wide, common in cooler countries.

Status in Delhi : Singh and Bhatia (1959) reported the species from Delhi.

Remarks : Occurence in Delhi is doubtful because it is a temperate species.

26. *Mus musculus* Linnaeus
House Mouse

1758. *Mus musculus* Linneaus, *Syst. nat.* 10th ed. **1** : 62 (Type locality : Upsala, Sweden).

Material observed : During recent surveys the species was seen at IARI campus and Patparganj area in September, 1994 and July, 1995.

Distribution : India : Throughout. *Elsewhere* : Throughout the World.

Status in Delhi : Not common. It has been reported from Delhi [Singh and Bhatia (1959); Gazetteer of Delhi (1976) and Prakash personal comm. (1995)].

27. *Mus booduga* (Gray)
Little Indian Field Mouse

1837. *Leggada booduga* Gray, *Charlesworths Mag. N.H.* **1** : 586 (Type locality : southern Maharashtra, India).

Material observed : From Tughlaqabad and Punjabi Bag area in June, 1993 and February 1995.

Distribution : India : Northern and Peninsular region, Western and Eastern Ghats, Kumaon and Punjab. *Elsewhere* : Myanmar.

Status in Delhi : The species has been reported from Delhi with the remark that its survival in Delhi area may be uncertain (Kalpavriksh, 1991).

28. *Bandicota bengalensis* (Gray and Hardwicke)
Lesser Bandicoot Rat ; Indian Mole Rat

1833. *Arvicola bengalensis* Gray and Hardwicke, *Illustr. Ind. Zool.* **2** : pl. 21 (Type locality : Bengal, India).

Material observed : Reported from literature.

Distribution : India : Throughout. *Elsewhere* : South-east Asia.

Status in Delhi : Though listed in Gazetteer of Delhi (1976), the present day existence of the species in Delhi is doubtful (Kalpavriksh, 1991).

29. *Bandicota indica* (Bechstein)
Large Bandicoot Rat

1800. *Mus indicus* Bechstein, *Ueber Vierb. Thiere*, **2** : 497 (Type locality : Pondicherry, India).

Material observed : A few rats were sighted at IARI campus in February, 1995.

Distribution : India : Widely distributed. *Elsewhere* : Sri Lanka; Nepal; Myanmar; Taiwan, Indo-China; Thailand; Java; Sumatra and Hong Kong.

Status in Delhi : The species has been recorded from store houses in Delhi [Singh and Bhatia (1959); Gazetteer of Delhi (1976) and Srishti (1994)].

30. *Nesokia indica* (Gray and Hardwicke)
Short-tailed Bandicoot Rat ; Short-tailed "Mole-Rat"

1832. *Arvicola indica* Gray and Hardwicke, *Illustr. Ind. Zool.* **1** : Pl.xi (Type locality : India).

Material observed : This bandicoot rat was recorded from IARI campus in June, 1993 and July, 1995.

Distribution : India : Punjab, Rajasthan, Kumaon and Garhwal region. *Elsewhere* : Turkistan; southern Russia; Chinese Turkistan and western Asia.

Status in Delhi : Singh and Bhatia (1959) have reported the species from Delhi. Observations on the behaviour of these rats from Delhi have been made by Ramesh (1992). Gazetteer of Delhi (1976) reported that it is a serious pest of the gardens and lawns in Delhi.

31. *Tatera indica* (Hardwicke)
Indian Gerbille ; Antelope Rat

1807. *Dipus indicus* Hardwicke, *Trans. Linn. Soc.* London, **8** : 279 (Type locality : Between Varanasi and Haridwar, India).

Material observed : Reported from Literature.

Distribution : India : Widely distributed, recorded from Punjab, Rajasthan and Gujarat, *Elsewhere* : Pakistan; just over the borders into Afghanistan and Iran.

Status in Delhi : Common. Reported from Delhi by Singh and Bhatia (1959) ; Gazetteer of Delhi (1976); Kalpavriksh (1991); Srishti (1994).

32. *Mariones hurrianae* (Jerdon)
Indian Desert Gerbille

1867. *Gerbillus hurrianae* Jerdon, *Mamm. India,* **186** (Type locality : Hissar, Haryana, India).

Material observed : Reported from literature.

Distribution : India : Widely distributed, recorded from Punjab, Rajasthan and Gujarat. *Elsewhere* : Pakistan; just over the borders into Afghanistan and Iran.

Status in Delhi : It has been reported from Delhi by Singh and Bhatia (1959); Gazetteer of Delhi (1976). Kalpavriksh (1991) remarked that the presence of this in Delhi is uncertain.

REFERENCES

Ali, S.A. 1927. The Mughal Emperors of India as Naturalists and Sportsmen. *J. Bombay nat. Hist Soc.*, Part-I, **31** (4) : 833-861.

Ali, S.A. 1927-28. The Mughal Emperors of India as Naturlists and Sportsmen. *J. Bombay nat. Hist. Soc.*, Part-II, **32** : 34-64.

Anderson, J. 1981. *Catalogue of mammals in the Indian Museum,* Part-I, Calcutta : Government Printing Press.

Anonymous, 1883-84. *Gazetteer of Delhi District*, compiled and published, Punjab Govt.

Anonymous, 1912. *Gazetteer of Delhi District*, Part A. compiled and published, Delhi Administration.

Blanford, W.T. 1880-1891. *The fauna of British India including Burma and Ceylon : Mammalia.* London : Taylor and Francis.

Chopra, P. 1976. *Gazetteer of Delhi.* compiled and published, Delhi Administration.

Ellerman, J.R. and Morrison Scott, T.C.S. 1951. *Checklist of Palaearetic and Indian Mammals,* 1758 to 1946. British Museum, London.

Fooden, J. Mahabal, A. Saha, S.S. 1981. Redefinition of rhesus macaque-bonnet macaque boundary in Peninsular India (Primates : *Macaca mulatta, M. radiata*). *J.Bombay nat. Hist. Soc.* **78** (3) : 463-474.

John, W. and Krishnan, D. 1995. Cry, the wilderness. *The Hindustan Times*, New Delhi (Sept. 20th).

Kalpavriksh, 1991. *The Delhi Ridge Forest*, Decline and Conservation. pp. 1-19.

Malik, I. 1993. Troops at the fort. *Srishti* **1** (3) : 38-44.

Pocock, R.I. 1939. *The Fauna of British India, including Ceylon and Burma*: *Mammalia* **I**. London, Taylor and Francis.

Prater, S.H. 1971. The *Book of Indian animals*. 3rd ed. Bombay nat. Hist. Soc.,Bombay.

Ramesh, P. 1992. Observations on the behaviour of the short-tailed mole-rat, *Nesokia indica* Gray. *Rodent Newsletter*,**16** (3) : 5-7.

Rao, H.S. 1957. History of our knowledge of the Indian fauna through the ages. *J.Bombay nat. Hist. Soc.* **54** (2) : 251-280.

Sawarkar, V.B., Uniyal, V.K., Misra, C., Srivastava, P., Kumar, S., Sinha, B.C., Hussain, S.A., Mohanty, T. 1996. *Management Planning of Asola-Bhatti Wildlife Sanctuary*. Wildlife Institute of India, pp. 1-131.

Sclater, W.T. 1981. *Catalogue of Mammalia*, **2** : XXX + 1-375. Cosmo Publication, New Delhi.

Simpson, C. 1945. Principles of classification and classification of mammalia. *Bull. Amer. Mus. nat. Hist.* No. 85. New York.

Singh, K. and Basu, S. 1990. *Nature Watch*. Tien Wah Press, Singapore.

Singh, S. and Bhatia, M.L. 1959. On the rat fauna of Delhi. *Proc. 46th Ind. Sci. Cong. III* : 416.

Srishti, 1994. *Saving the Delhi Ridge : One year of Conservation Action :* A Srishti Report, pp. 1-81.

Walker, A.E. 1968. *Mammals of the world*. 2nd Ed. John Hopkins Press, Baltimore.

Table. 1 : Annotated list of mammals of Delhi :

S.No.	Scientific Name	Common Name	Gaz.Del. 1883-84	Gaz.Del. 1912	Singh & Bhatia 1959	Gaz.Del. 1976	Singh & Basu 1990	Kalp. 1991	Srishti 1994	WII 1996	Present Study 1993-95
1.	*Hemiechinus auritus*	Long-eared Hedgehog	+			+		+	+		
2.	*Suncus murinus*	House Shrew				+		+	+		+
3.	*Pteropus giganteus*	Indian Flying Fox				+	+	+			+
4.	*Rhinopoma hardwickei*	Lesser Rat-tailed Bat									
5.	*Megaderma lyra*	Indian False Vampire				+		+	+		+
6.	*Rhinolophus luctus*	Great Eastern Horseshoe Bat				+					
7.	*Pipistrellus coromandra*	Indian Pipistrelle						+			+
8.	*Macaca mulatta*	Rhesus Monkey	+	+		+	+	+	+		+
9.	*Presbytis entellus*	Hanuman Langur									+
10.	*Manis crassicaudata*	Indian Pangolin				+		+	+		
11.	*Canis aureus*	Asiatic Jackal	+	+		+		+	+	+	+
12.	*Vulpes bengalensis*	Bengal Fox	+	+		+		+	+		
13.	*Viverricula indica*	Rasse or Small Indian Civet						+		+	
14.	*Herpestes auropunctatus*	Small Indian Mongoose	+			+	+	+	+		+
15.	*H. edwardsi*	Indian Grey Mongoose				+	+	+	+		+
16.	*H. smithi*	Ruddy Mongoose								+	
17.	*Hyaena hyaena*	Striped Hyaena		+		+		*	+		
18.	*Canis lupus*	Wolf	+	+		+		*	+		
19.	*Felis chaus*	Jungle Cat								+	
20.	*F.bengalensis*	Leopard Cat						+	+		
21.	*Panthera pardus*	Leopard	+	+		+		*			
22.	*Lutra lutra*	Common Otter				+					
23.	*Sus scrofa*	Wild Boar	+	+		+		*	+		

S.No.	Scientific Name	Common Name	Gaz.Del. 1883-84	Gaz.Del. 1912	Singh & Bhatia 1959	Gaz.Del. 1976	Singh & Basu 1990	Kalp. 1991	Srishti 1994	WII 1996	Present Study 1993-95
24.	*Cervus porcinus*	Hog Deer (Para)	+	+				*	+		
25.	*Antilope cervicapra*	Blackbuck	+	+		+		*	+		
26.	*Gazella bennettii*	Chinkara	+	+		+		*	+		
27.	*Boselaphus tragocamelus*	Nilgai or Blue Bull	+	+		+		+	+	+	+
28.	*Lepus nigricolis*	Indian Black-naped Hare	+	+		+		+	+	+	+
29.	*Funambulus pennanti*	Northern Palm Squirrel				+	+	+	+		+
30.	*Hystrix indica*	Indian Crested Porcupine		+		+		+	+		
31.	*Apodemus sylvaticus*	Common Field Mouse									+
32.	*Rattus rattus*	House Rat or Black Rat			+	+		+	+		+
33.	*R.norvegicus*	Brwon Rat			+	+					
34.	*Mus musculus*	House Mouse			+	+			+		+
35.	*M.booduga*	Indian Field Mouse						+	+		+
36.	*Bandicota indica*	Large Bandicoot Rat			+	+			+		+
37.	*B.bengalensis*	Lesser Bandicoot Rat				+		+			
38.	*Nesokia indica*	Short-tailed Bandicoot Rat			+	+					+
39.	*Tatera indica*	Indian Gerbil			+	+		+	+		
40.	*Meriones hurrianae*	Indian Desert Gerbil			+	+		+			

Note : * Presently absent, recorded till 1940.

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REMOTE SENSING AND GIS DATA BASE FOR ASOLA-BHATTI WILDLIFE SANCTUARY

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INTRODUCTION

Remote Sensing and Geographic Information System (GIS) have emerged as excellent tool to create natural resource data base which can be utilized for effective management and monitoring. An attempt has been made to create such data base in Asola-Bhatti Wildlife sanctuary.

Asola and Bhatti Wildlife sanctuaries with an area of 1883 and 866.8 hectares respectively were notified under section 18 of the Wildlife (Protection) Act, 1972, during 1986 and 1991 respectively. A 41 km large wall has been constructed along the boundary of Asola Wildlife Sanctuary. The study area also known as southern Ridge , is the terminating branch of Aravalli and has been used for extensive mining of Quartzite sand (popularly known as `Badarpur'). This being the superior quality of construction material and hence in high demand, has been extensively mined leading to severe degradation of the southern ridge.

Inspite of its status as Wildlife sanctuary, the area experiences severe onthopogenic pressure due to extraction of fuelwood and fodder. Often one can also notice stray cattle grazing in the sanctuary area. This has resulted in serious degradation jeopardising the conservation effort.

The effort initiated to conserve the area in the form of natural habitat has met with limited success due to serious human interventions. The construction of boundary wall has partially reduced the pressure and one can notice the improvement in the form of increased vegetation cover, depletion of soil erosion and improvement in soil water regime. Due to its proximity from the capital city and villages (within and around) maintenance of boundary wall is challenge for the sanctuary authority. There is an acute shortage of water in the sanctuary habitat area. The present study attempts to prepare reliable data base using remote sensing and GIS on vegetation/land cover, topography, drainage and cultural features. The data base can be used for future management and monitoring.

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The Sanctuary and its Environment : Asola-Bhatti Wildlife sanctuary with an area of 27.498 km^2 falls between the geo-coordinates 28°24'00" to 28°30'00" N and 77°12'00" to 77°17'00" E. It forms a part of Delhi southern ridge, an extension of the Mewat branch of Aravalli hills. The Aravalli range is one of the oldest mountain systems in India, supposed to have originated in the pre-Cambrian period. The ridge on its way through the capital is broken. The undulating landscape with highest and lowest altitudes as 310 m and 240 m respectively is having numerous storm water drains but no permanent natural water bodies. The composition and structure of Delhi system of rock types, the quartzite and the excellent building material of red sand stone, exercise a powerful influence on the growth of vegetation. The effect of rocks on surface vegetation is two fold; i) lithological and ii) structural. In the first case, the growth of vegetation at the surface is governed by the presence or absence of mineral elements in the rock. The second factor concerns the availability of mineral salts and water supply in a particular rock bed, depending on its position. The climate of Delhi is characterised by cold winter months and hot, dry summer months. The south-west monsoon has a major impact as almost 80% of the precipitation is received during this period. The soil is shallow, skeletal and sandy of red colour and comprises sand stone rocks of Delhi ridge and the texture varies from sandy loam to clay loam. Due to uneven topography, the soil erosion and formation of gullies is common.

Biotic Pressure : Three villages comprising about 4000 families are situated within the Bhatti sanctuary. Water scarcity is acute and villagers have to purchase drinking water from tankers. The rain water collected in the abandoned mining pits in Bhatti is used for washing and other purposes. The villagers also depend on the resources of the sanctuary area for grazing and fuel wood collection. In addition to that sanctuary area is surrounded by five villages comprising about one lakh human population and 5000 livestock population. The boundaries of wildlife sanctuary, in some places are under dispute with the residents of adjoining areas and it regimes settlement.

Sand Mining : According to an estimate the 8.57 km^2 area of Bhatti mines has 300 million cubic metre of quartzite sand, besides unlimited reserves of stone and inferior grade sand. Mining operations continued till the mines are notified as Wildlife sanctuary. Mining operations were carried out mostly by tunneling. But after 1970 open cast mining started and huge pits are created (Fig.3).

Water Holes/Abandoned Mining Pits : After the Wildlife sanctuary came in to existence, twenty seven water holes have been developed for providing water to the wildlife. But most of them do not retain water during the summer. Natural water bodies, streams and springs do not exist in the wildlife sanctuary. The open cast mining have bottoms of almost pure silica without vegetation. At some places the pits are exposed to water table level. Rain water percolation is high in the pits due to moderate to high porosity of substrate and water escapes through the fissures left in the quartzite stones. It is most likely that at most places the pit bottom correspond to water table level. Only two

water holes along with an abandoned mining pit are considered to be capable of holding water (Fig.4).

Vegetation : The native plants exhibit xerophytic adaptations such as thorny appendages, wax coated, succulent and tomentose leaves. Maheshwari (1963) describes the vegetation as semi-arid thorny shrub. As per Champion & Seth (1968), the vegetation would fall under Northern Tropical Thorn Forest type (Fig. 1).

MATERIAL AND METHOD

Vegetation cover mapping was done using remote sensing data. Both digital and analogue data were used for digital analysis and visual interpretation respectively. Other supplementary data include the Survey of India toposheets and the information obtained from the Office of Deputy Conservator of Forests, Delhi Administration.

Data Types :

1. **Satellite Data**

Satellite	Sensor	Path	Row	Date of pass	
				Geo- coded paper print	Digital data
IRS 1B	LISS II	29	48	16.12.1993	-
IRS 1A	LISS II	29	48	-	7.4.1988

2. **Conventional Data**

Toposheets used — No. 53 H/3, 53 H/7
Scale - 1:50,000
Contour interval - 20 metres

3. **Computer Systems**

- IBM RS 6000 with EASI/PACE Software
- PC 386 with PAMAP GIS Software

Visual Interpretation : Visual interpretation technique was used for the vegetation cover type mapping of the study area. The map of the sanctuary area obtained from the office of Delhi Administration, was on 1:10000 scale. It was reduced optically to the scale of 1:50,000. This map was used to delineate sanctuary boundary over the toposheets. The interstate boundary between Delhi and Haryana and the drainage pattern were taken from Survey of India toposheets. The base map of 1:50,000 was laid over the geocoded imagery matching the prominent feature like drainage and was visually interpreted on the basis of image elements. The ground truth information was collected from each of the varied image elements delineated on the imagery. An interpretation key (Table-1) has been developed based on the satellite image characteristics and ground truth.

Identification and delineation of all the forest vegetation types and other landuse/land cover features was done by following the standard visual interpretation technique (Bowden & Prutt, 1983). Extensive ground checks were undertaken to confirm the interpretation key. The final map was prepared on 1:50,000 scale after transferring the interpreted details from satellite image (Fig.1).

Digital Image Processing : The digital image processing of the present study area was done in IBM RS 6000 system with EASI-PACE Image Analysis software. The data was rectified geometrically. Geometric rectification from image to map was performed by selecting four ground control points easily identifiable on both the image and the map (Survey of India toposheet). After rectification, boundary of the study area was digitized on the image and the study area was extracted by masking the area outside the boundary. False colour composite of bands 4,3 and 2 was generated and enhancement technique of linear stretching (Fig.6) was applied before going for further analysis. The supervised classification with Maximum Likelihood algorithm was applied for detailed classification of digital data (Fig.7). The training sets collected during field visit were used to train the digital data and to generate training signature. The statistical information obtained from the training sets is used to calculate the probabilities assigning the unknown pixels to its specific class with the Maximum Likelihood Classifier and Neural Network Classifier.

Geographic Information System - Database : Drainage and contour maps prepared from the Survey of India toposheets, and vegetation cover map prepared using visual interpretation technique of remote sensing data were digitized. For preparing a vegetation cover map, the steps involved in sequence are (a) digitization, (b) vector cleaning, (c) assignment of attributes, (d) polygonisation, (e) area calculation through dBASE. A drainage map (Fig.8) has been prepared to find the sites for water harvesting. The elevation information of the digitized contour map was used to make Digital Elevation Model (Fig.9). The topographer Software Package of PAMAP was used for preparing such model. A slope map has been generated from digital elevation model by feeding the values of existing slope categories which could be discernible after assigning their different colours (Fig.10). The cultural features along with water bodies have been demarcated/depicted on the topographical map sheet of the area during field visit. A GIS layer of the same has been generated to show their spatial distribution in the area (Fig.11).

RESULTS AND DISCUSSION

The areal estimates with respect to forest cover and landuse/land cover classes which were discernible and delineated on the image after ground truthing are shown in Table-2 and their spectral characteristics have been shown in Table-1.

Description of the Classes:

Prosopis juliflora closed forest : The density is more than 40%. *Prosopis juliflora* commonly known as Vilayati Kikar, is an exotic to place but has become naturalized. After providing protection by building a wall along the boundary of the Sanctuary it has prospered well. Gap planting done as late as 1991-92 has established well. Natural regeneration of this species is quite good wherever the moisture retentivity of soil is considerably better.

Prosopis juliflora open forest : The density is 5% to 40%. This type is occurring amidst the rockout crop and scrub \ shrubby vegetation.

Anogeissus pendula dominated open forest : It is seen amidst the loose boulders and the patches of rock out crops, especially along the eastern boundary. The growth is quite poor/stunted.

Scrub/Shrub : The scrub/shrubby vegetation comprises *Capparis sapiaria, C. decidua, Croton sparaiflorus, Tephrosia purpurea, Zizyphus* spp. The deciduous trees such as *Balanites aegyptica, Acacia leucophloea*, etc. are also occurring sporadically within such type of vegetation. Rockout crop/loose boulders are quite prominent. These scrub/shrubs also have come up well on the mining dumps.

Habitation : There are patches of habitation within the Bhatti sanctuary area. The extension of habitation has also been detected along the northern boundary of Asola.

Blanks : These are blanks/barren patches. Soil is sandy, devoid of moisture. Plantation have been attempted without much success to talk about.

Rockout crop : These are out crops and loose boulders of quartzite and other rock types (Fig 2). Very sparse, stunted scrub is found in between.

Abandoned mining areas : These are the results of open cast mining of quartzite sand. The bottom of most of the bigger pits correspond with the water table. These pits do not have water holding capacity. The bottom have silica and the water percolates down through the fissures.

The study presents vegetation /land cover map (Fig.7) of the area using digital and false colour image (Fig. 6). The GIS data base, comprising of maps showing slope classes, terrain height classes, drainage pattern and the map showing the spatial distribution of human activities within the sanctuary area, has been created (Figs. 8-11).

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REFERENCES

Bowden, L.W. and Pruitt, E.L. 1983. *Manual of Remote Sensing*. American Society of Photogrammetry, Falls Church, Virginia, Z. : 882-891.

Champion, H.G. and Seth, S.K. 1968. *Forest types of India*. Manager Publications, Government of India, Delhi.

Maheshwari, J.K. 1963. *The flora of Delhi*. CSIR, New Delhi.

The Delhi Ridge Forest-Decline & Conservation, Kalpavriksh, 1991.

Table-1.Interpretation Key used for Visual Interpretation of False Colour Composite (IRS-1B LISS II) :

	Type	Tone	Texture	Pattern
1.	*Prosopis* closed forest	Reddish	Medium	Irregular
2.	*Prosopis* open forest	Light red	Coarse	Irregular
3.	*Anogeissus* dominated open forest	Light brown	Rough to coarse	Irregular
4.	Scrub/Shrub	Bluish brown	Fine	Irregular
5.	Mines	Black	Smooth	Irregular
6.	Rock out crop	Bluish black	Medium	Irregular
7.	Habitation	Greenish blue	Medium	Regular
8.	Blanks white	Yellowish	Smooth	Regular/ Irregular

Table- 2. Area under each mapping unit based on Visual Interpretation of IRS-1B LISS II Image :

Class	Name	Area (km^2)	Percentage of total geographical area
1.	*Prosopis* closed forest (density >40%)	1.989	7.23
2.	*Prosopis* open forest (density 5-40%)	6.155	22.38
3.	*Anogeissus* dominated open forest (density 5-40%)	1.023	3.72
4.	Scrub/Shrub	11.629	42.29
5.	Abandoned mining areas	0.662	2.41
6.	Habitation	0.512	1.86
7.	Blanks	2.704	9.84
8.	Rock outcrop	2.824	10.27
	Total	27.498	100.00

Table-3. Area statement of forest cover and other land cover categories based on Digital Image Processing of IRS-1A LISS-II data :

Class	Name	Area ($km^{2)}$	Percentage of total geographical area
1.	*Prosopis* closed forest (density >40%)	1.966	7.15
2.	*Prosopis* open forest (density 5-40%)	6.348	23.08
3.	Scrub/shrub	12.238	44.51
4.	Blank	2.774	10.09

5.	Rock outcrop	2.838	10.32
6.	Gullied land	1.334	4.85
	Total	27.498	100

Table-4. Terrain Height Class (in metres) Area Analysis :

Height (from msl)	Area (Km^2)	Percentage
240-250	1.866	6.78
250-260	3.638	13.23
260-270	2.996	10.90
270-280	6.942	25.24
280-290	6.139	22.33
290-300	5.592	20.34
300-310	0.325	1.18
Total 27.498		100.00

Table-5. Area Under Different Slope Classes (%) :

Slope classes	Area (km^2)	Percentage
1-2	8.086	29.41
2-5	8.986	32.69
5-10	5.744	20.90
10-15	2.403	8.75
15-22	1.342	4.88
22-30	0.927	3.37
Total	27.498	100.00

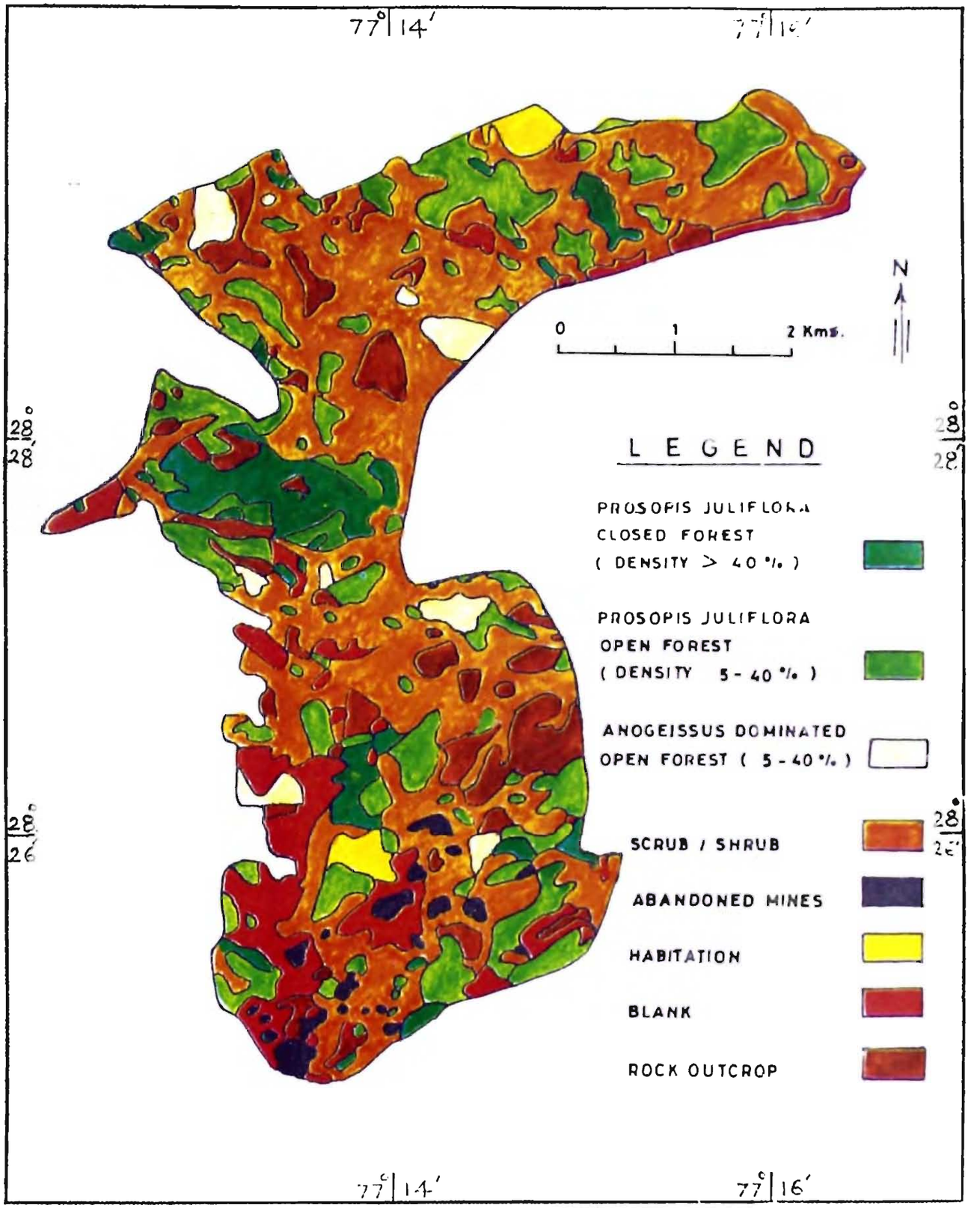

Fig. 1 Vegetation cover map : Asola-Bhatti WLS : Based on visual Interpretation of IRS-IB, LISS-II Data

Fig. 2, A typical thorny scrub vegetation; Fig. 3, Prevalence of rocky outcrop; Fig. 4, Ruthless mining ; Fig. 5, Abandoned mine with perennial water

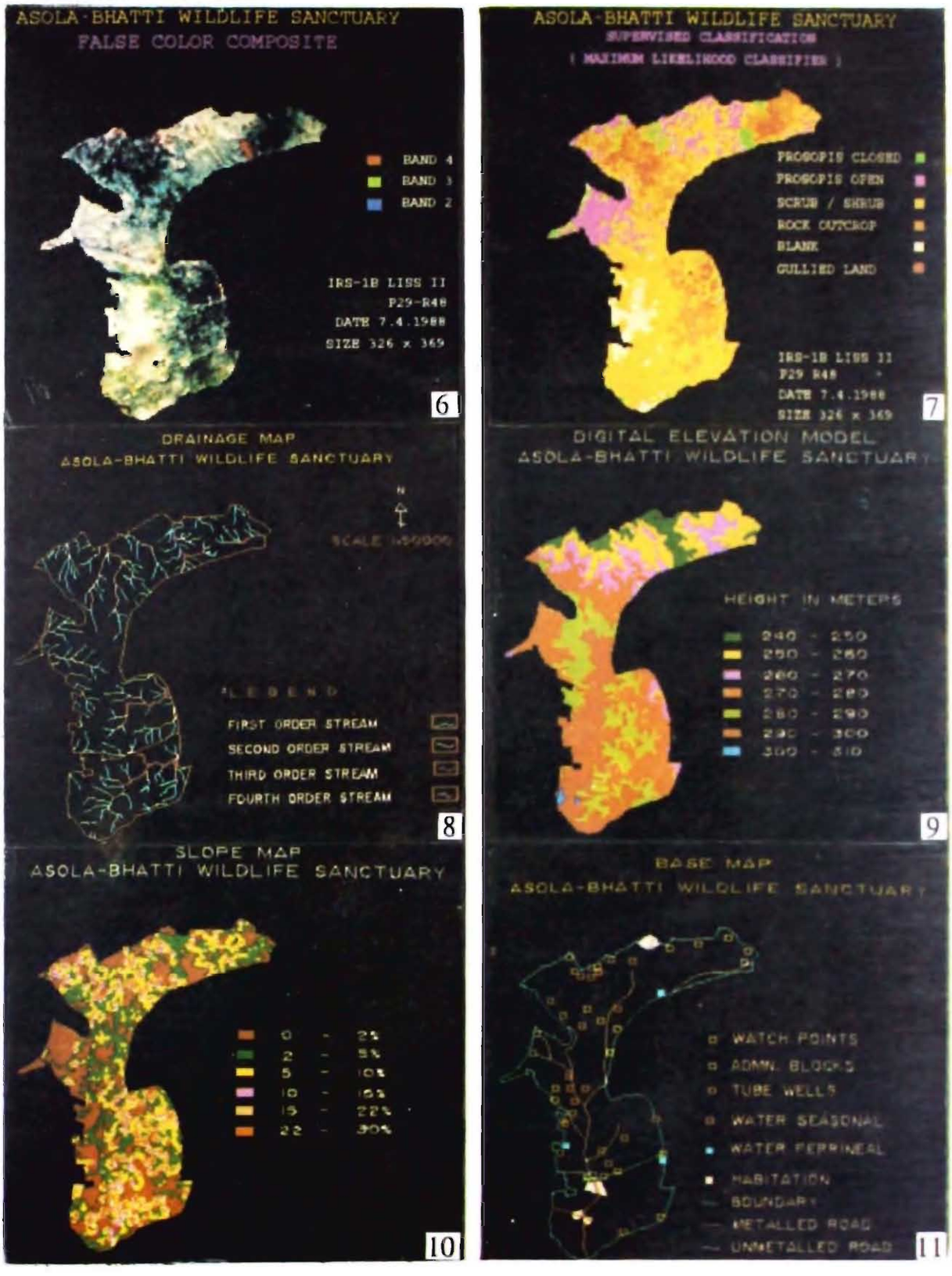

Fig. 6, False colour composite(bands 4,3,2); Fig. 7, Supervised classification (Digitally classified map); Fig 8, Drainage map; Fig.9, Digital elevation model; Fig.10, Slope map; Fig.11, Base map showing cultural features.

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PROBLEMS AND PROSPECTS IN CONSERVING ASOLA-BHATTI WILDLIFE SANCTUARY : SOME MANAGMENT STRATEGIES

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INTRODUCTION

The city of Delhi straddles across a disjointed table land known as the Ridge which is the northern terminal of Aravalli hills, one of the oldest mountain systems of the world. The conservation significance of the terminal Aravalli ridge lies in its merger with the Indo-gangetic plains on the east. It enters Delhi from Gurgaon (Haryana)in the south and breaks into four disjunctive spurs, now known as the Northern, Central, South Central and South Ridge. In the past, the Ridge supported a low density, dry deciduous scrub forest and savanna vegetation which was subsequently complemented by extensive plantations by the Britishers. The North and Central Ridges were notified as Reserved forests in 1942 but the status of the Central and South Ridge remained uncertain until 1986, when Asola Wildlife sanctuary (4707 acres) was carved from the community land of three villages. Subsequently in 1991 another notification was issued to declare Bhatti (2107 acres) as Wildlife sanctuary (WLS). Both the Asola and Bhatti WLS fall within the Southern Ridge.

Biogeographically the Aravalli hill ranges represent one of the ancient landforms of India. Approximately 800 kms. long, these ranges originate in Rajasthan and extend northeastward across Haryana. The Mewat branch of Aravalli enters Gurgaon from the south and terminates in Delhi in the form of a tableland, creating a transitionary zone between the Aravallis and the Indo-gangetic plain. Sixteen Kms. south of the city of Delhi, the range splits, with one branch turning backwards to re-enter Gurgaon thus forming a crescent and the other continuing northeastward bisecting Delhi. These disjointed narrow hillocks are collectively referred to as the Delhi Ridge which has been officially divided into four zones. The Northern or the old Delhi Ridge, 87 ha. in extent, lies on the west bank of Yamuna between civil lines and the University of Delhi. It is the smallest section of the Ridge. The Central or New Delhi Ridge, comprising 864 ha. lies north of Dhaulakuan. These two sections have received administrative attention since 1878 and have been collectively developed as the `green lung' of Delhi by raising plantations of native and exotic trees.

The South-Central Ridge, 4266 ha. in extent, lies in Mehrauli while outside the city limits to the south lies the Southern Ridge, 6200 ha. in extent. The Southern Ridge appears like a crescent which starts from the east from Badarpur along the Haryana state limits and joins the Mehrauli-Mahipalpur road near Sultangarh tomb.

The Asola Bhatti Wildlife sanctuaries (Map 1) are located in the south eastern part of the

southern Ridge. The 230 m. contour line of the Ridge is the western boundary of the Gangetic plain, east of which are the vast alluvium flats of Indo-Gangetic plains. The wildlife sanctuary falls in the Kohi or Pahari (hill side) physiographic division (Kalpavriksh, 1991) which represents highly rocky and undulating landform. The land is characterised by a weathered low plateau, the highest point being 320 m. above MSL at Bhatti. The area is broken into spurs and is dominated by exposed, irregularly distributed boulders of precambrian, quartzite rock base. The rock outcrops are the northern most section of the Alwar formation and are found with several interbanded schist and phyllite. The quartzite is vitreous and coarsely crystalline in texture. Extensive weathering of these quartzite rocks yields high quality silica sand which is locally known as `Badarpur' or `Bajri'. The soil is thin, dry and sandy with high porosity and low humus status supporting sparse vegetation of scrubby nature.

Due to the predominantly sandy nature of the soil, the surface run off is low and rain water quickly seeps down and gets trapped in the underlying rocks. The water table depth varies from 35-50 m. in Bhatti. The ground water is used for irrigation and drinking purposes in the plains and flat areas lying in the vicinity of the wildlife sanctuary. The District Gazetteer of Delhi (1883-84) records that in the latter part of the last century the best drinking water was obtained from springs on the Ridge. There is little evidence that these springs still exist. This reflects the grave status of degradation.

Vegetation : The vegetation in the WLS is predominantly an open canopied thorny scrub. The native plants exhibit xerophytic adaptations such as thorny appendages, wax coated, succulent and tomentose leaves. Maheswari (1963) describes the vegetation as semi arid thorny scrub. As per Champion & Seth (1968), the vegetation falls under Northern Tropical Thorn Forests type. Despite all the mining impact and pressures, samples of native floral and faunal communities still exist. Thereby reinforcing the conservation significance of this area.

The native vegetation includes many species of *Acacia* such as *A. nilotica, A. leucophloea, A. catechu* and *A. modesta,* along with few scattered *Butea monosperma, Cassia fistula, Salvadora persica.* In the small bouldery hillocks a few scattered trees of Anogeissus pendula can also be seen. The shrubs mainly include *Capparis sepiaria, C. decidua, Tribulus terrestris, Zizyphus aenoplia, Croton sparaiflorus, Tephrosia purpurea. Prosopis juliflora,* which is native of Mexico was planted on the Ridge some years ago. It appears to have established on barren, devegetated areas and areas near human settlements. Large thickets of *Prosopis juliflora* form the chief vegetal cover in the wildlife sanctuary. *Calotropis procera, Withania somnifera, Achyranthes aspera, Aerva scandens, Tridax procumbens, Alysicarpus vaginalis, Euphorbia hirta, Pupalia lappacea, Peristrophe bicalyculata* constitute the common herbaceous flora. The soil supports good grass in protected areas and species like *Cenchrus ciliaris, Aristida spp., Eragrostis poaeoides, Saccharum spontaneum* and *Vitiveria zizanioides* are commonly seen (Mukherjee, 1953).

Fauna : A detailed checklist of mammals, reptiles, amphibians, insects and birds for the Delhi ridge, has been prepared by Kalpavriksh (1991). The faunal elements in the WLS need to be investigated and it is assumed that it will not be much different than the list prepared by Kalpavriksh. The records suggest that before 1900 AD abundant population of blackbuck, nilgai and chinkara was found in these areas (Anonymous, 1883). By 1908 blackbuck had become rare and wolf, hyena, leopard and chinkara were not seen after 1940. The WLS now harbours few nilgai, common mongoose, small Indian mongoose, rhesus macaque, flying fox, porcupine and palm squirrel. Amongst the carnivores, jackal and hyena have been reported. About 200 bird species have been identified along the entire Delhi Ridge.

The human interface : Three villages namely Sanjay colony, Indira nagar and Balbir nagar comprising of about 4000 families are situated within the Bhatti sanctuary. These villages have existed for the last 40 years. Balbir nagar and Indira nagar are inhabited mainly by the mine workers. Residents of Sanjay colony are the people who came to India as refugees from Pakistan. These villagers face paucity of drinking water which is purchased from tankers. Water that collects in the now abandoned mine pits in Bhatti sanctuary is used for washing and other purposes. Other dependence of the PA side people on the resources of the sanctuary is mainly the requirement for cattle grazing and fuelwood collection. These pressures are very heavy.

The Asola WLS and the adjoining area of Bhatti WLS are surrounded by seven villages, five in Delhi and two in Haryana, with approximately one lakh human and around 5000 livestock population. To the west are the villages of Satbari, Sahurpur and Maidangari. Deoli village, inhabited by the resettled mine worker of Asola WLS, lies to the north-west, while Tuglaqabad abuts the north-eastern boundary. Anagpur and Surajkund villages in Haryana state lie to the south of the Bhatti WLS area. Within 1 km. periphery of the north eastern boundary is situated the shooting range of the Sports Authority of India, while farms owned by ex-army personnel and well off individuals form a chain along the northern boundary of the sanctuary. An unauthorised colony, Sangam Vihar, has come up along the north-western boundary.

Administrative control : In the document prepared by Kalpavriksh in 1991, it is stated that the Ridge forests have been notified as Reserved Forests under the Indian Forest Act 1878, perhaps in 1878 itself. The Delhi Ridge from north to south is either controlled directly or through various developmental activities by several organisations. The First Master Plan of Delhi (1962) identified the importance of the Ridge and recommended that the entire Ridge should be preserved as close to an undisturbed forest as possible. In the late 1970s the control of the Delhi Ridge was handed over to various local administrative bodies. Today the Delhi Development Authority (DDA), the New Delhi Municipal Corporation (NDMC), the Delhi Administration (DA), Central Public Works Department (CPWD), and Land and Development Office (LDO) control different parts or functions of the Ridge. Interestingly, except the DA, none of the other agencies have a forest department in their planning or implementation programmes. The Forest Department of Delhi Administration has

repeatedly requested control over the entire Ridge, which has been endorsed by the Union Ministry of Environment and Forests. On the other hand the Horticulture Department of DDA and NDMC have suggested clearing the Ridge at some places of its natural vegetation to create parks, which is contrary to the recommendations of the First Master Plan. Parks can easily by created but once destroyed, the original vegetation and site potential requires a long time to recover.
It was the Flood Wing of the DA that proposed creation of the Asola WLS in 1986. It is only since 1990 that a Deputy Conservator of Forests (DCF) has been made incharge of the Wildlife sanctuary. The District Magistrate, DA discharges the functions of the Chief Wildlife Warden (CWLW). No Forest Act or Wildlife Rules exist for Delhi.

The DCF has inadequate and mostly untrained staff consisting of one ACF, one Range Officer, two Dy. Range Officers and 12 forest guards to assist him in the management. In the absence of rules delegating powers to the DCF, and the junior field personnel, the management team finds the implementation of the provisions of the WL(P) Act, 1972 for the management of the WLS next to impossible.

THE ISSUES

Mining for Badarpur sand : Active mining of mineralised quartzite sand, or Badarpur had been going on in the WLS till very recently. As the city of Delhi expanded over the last half century, the demand for Badarpur rose steadily for construction purposes. According to an estimate, the 8.57 sq.km. area of Bhatti mines has 300 million cubic meter of quartzite sand besides unlimited reserves of stone and inferior grade sand. Short term permits for mining to private entrepreneurs were issued since 1969 and long term leases were granted since 1984. The Delhi State Mineral Development Corporation (DSMDC) became the controller of Bhatti mines in 1985 and continued operations till the mines were notified as WLS. On the other side of Delhi, in the state of Haryana, many government mines exist and heavy mining continues at the boundary of the WLS. In Bhatti, until 1970, mining operations were carried out mostly by tunnelling. It did not create that many open scars on the ground. However, after 1970 this approach was given up in favour of open cast mining resulting in creation of huge pits which dot the Bhatti landscape now. The DSMDC also switched to mechanised mining, increasing the yield of Badarpur substantially. During 1985-86, 91981 truck loads of Badarpur were extracted by DSMDC which more than doubled to 191081 truck loads by 1989-90.

Of the 857 ha. land leased to DSMDC on the southern Ridge, 250 ha. got included in the active mining zone at Bhatti. When mining was closed in 1991 about 200 pits of various sizes, honey combing the area, were left open by various operators including DSMDC. The vertical sides of these pits consist of weathered quartzite, sandstone, friable Badarpur and clay veins. No post mining restorative operations were carried out by the operators, only DSMDC attempted small scale reclamation by planting 20000 sapling on 100 acres of boulder strewn area.

The pits are irregularly distributed soil excavation sites which vary in size, the smallest being about 20-30 m. deep with a surface cut of about 25 to 50 m across. Some pits like pit no.2 and 12 have much larger dimensions. About three such pits are considered to be capable of holding some water perennially. The pit bottoms consist of almost pure silica without vegetation. At some places the pits are exposed down to the water table level. Rain water percolation is high in the pits due to moderate to high porosity of substrate and water escape routes through the fissures left in the quartzite stones. It is likely that at most places the pit bottoms correspond to the water table level. While mining was on, the excavated earth (overburdens) used to be dumped near the mines. These overburdens are scattered near the major pits and can be seen as huge mounds of earth with the potential for revegetation.

Use of biomass by people : The mining and associated activities provided employment to the resident villagers and also to people from nearby areas. After the closure of mining, a large number of labourers were settled in Deoli thus reducing the direct demands on forest biomass, mostly for fuelwood. The villagers settled around the Asola and Bhatti WLS have largely depended upon forest biomass for fuel and cattle grazing. The Asola WLS, after notification, was fortified by a rubble and concrete wall of about 41 km. in length, protecting the sanctuary against grazing and illicit cutting of wood. However, the wall has been breached at many places indicating that the dependence on the WLS continues and the villagers would continue to use the resources if not provided with alternatives. It is stated that the maximum pressure for grazing comes from Mehrauli and Anangpur villages, although it is denied by the villagers themselves. It is however emphasized that the socio-economic profile of the villagers living in the vicinity of the WLS is not land based to the extent seen in other rural areas. Most of the villagers, colony dwellers are working in Delhi or Haryana and live a semi-urban life. People are not solely dependent upon forest biomass except for fuelwood and grazing. But these two demands are very impactive. A large socio-economic study will be required to assess the relationship between people and resources of the WLS.

Water : The green cover as a rule improves water retention capability of the soil, allowing water to slowly percolate down to the underlying rocks and reaching water table. Vegetation also has a major role in improving soil structure and nutritional status. Water run off is checked and hence vegetal cover is important for soil conservation. Through the process of evapotranspiration the water is maintained in circulation between the soil and the air. It is in turn taken out for agriculture and drinking purposes elsewhere through aquifers and tubewells. It is noteworthy that severe shortage of drinking water is experienced in these areas and the villagers depend upon tankers who bring water from the city of Delhi and sell it to the people. It is a manifestation of improvident use of the land for short term gains.

Twenty seven water holes have been developed in the Asola WLS after it came into existence for providing water to wildlife. But most of them do not retain water and few others

barely make it through the summer. The accessible water is mostly used by the wandering herds of cattle, goat and sheep. Natural water bodies, streams and springs do not exist in the WLS and ground water utilisation remains the most important possibility for providing water to the wild animals as well as to the villagers. However, if the degraded sites of the Ridge are not restored, it is unlikely to bode well for the future of the ground water status.

Trespass and thoroughfare : When mining was at its peak, hundreds of trucks loaded with Badarpur and stones used to crisscross through the WLS. The trucks would go to the excavation sites and transport material from the pits to the markets, creating a haphazard road network. Now that the mining is closed within the WLS, the vehicular traffic has reduced. However, mining continues on the Haryana side and trucks loaded with quartzite sand and stone, come to Delhi using a part of the Bhatti WLS as a thoroughfare. Mining operations continue on the other side while the location market, and developmental activities are mostly on Delhi side. The situation in which work site is in Haryana but the work force and disposal dumps from where sales are made persist in Delhi is a problem. Although the Forest Department has put up a barrier on the Delhi side entry point, its effectiveness is questionable due to inadequate administrative infrastructure and absence of acceptable alternative road linkage. The department has unsuccessfully tried to stop vehicles from plying by either digging trenches on the main road linking Delhi to mine sites in Haryana or if the trucks are caught within the WLS, they are merely asked to return as the forest officials are not adequately empowered to take punitive action. As the Bhatti landscape represents low plateau, the truck operators cut across makeshift routes causing immense harm to the already impoverished WLS. It will be desirable to have no traffic whether man, donkey or vehicle, through the WLS. Alternative routes, even if longer need to be used.

The land : The population of Delhi has increased from 1.75 million in 1951 to 9.25 million in 1991, indicating a decadal growth of 53%, perhaps the highest in the country. Land is in high demand and sold at a premium. Sangam Vihar colony along the north western boundary is already in the records as an unauthorised settlement. Genuine fear exists regarding encroachment on the WLS. Within 1 km. of the north-eastern and northern periphery of the WLS lie privately owned farmlands from where although the land encroachment may not be an imminent threat, but use of forest biomass, water and unauthorised trespass cannot be discounted. The Asola area is fortified with a boundary wall which is breached at several places. This is indicative of the rising pressures. There is no such clearcut demarcation in the Bhatti area making it vulnerable to encroachment. It needs urgent delineation on a firm basis with demarcation on ground and mechanism in place for effective protection. The entire PA is used by the human population in the adjacent villages as an outdoor toilet facility. This is an extremely unhygienic practice, especially in context of the future plans.

Stray Cattle : The WLS is looked upon by the villagers as a place where they can dump their unproductive cattle. It is evident from the fact that more than 500 stray cattle stay within the WLS

utilising its biomass, thus undermining the chances of recovery of the site. Chances of continued addition to this already high number of cattle cannot be ignored. The competitive superiority of stray cattle against that of few existing nilgai in the short run would lead the local population of nilgai to either migrate to better habitats on the farmlands to the detriment of both, or to their extinction. The contiguity of Asola with the dry deciduous forest of Aravalis is tenuous and possibility of establishing a viable corridor is negligible, unless long term planning addressing sustainable landuse is ensured.

The biological potential : Although the Bhatti mine area looks barren, dry and honeycombed with pits and roads, a look into the long abandoned pits indicates the biological capability of these sites. There is evidence of grasses coming up in these areas, interspersed by xerophytic shrubs. Asola is showing signs of some vegetation recovery, not solely natural. The Acacias have returned and the spreading *Prosopis* is contributing leaf litter, adding nutrient content and nitrogen to the soil. Pit No.3 in Bhatti, which has been under `rest' for a period of more than 10 years showed water pools, and establishment of grasses and shrubs in the crevices of the vertical slopes. A preliminary observation therefore suggests that the soil is biologically active and the site has capability of recovering, provided it is accorded protection and some habitat restoration strategies are undertaken. It is to be highlighted here that the area falls in the dry tropical thorn forest zone, therefore the natural regeneration would lead to a xerophytic open canopy scrub-forest situation and an expectation of emerging patches of mesophytic higher density forest over moister sites in a decade or so might not be unrealistic.

In terms of biodiversity the area might be considered as a low ranging zone. But `low' and `high' are relative terms and must be seen in context of a system's characteristics. If the natural potential of dry Aravallis can be attained it will be a creditable achievement. Nevertheless a variety of small mammals, reptiles, amphibians, insects and birds are likely to occupy the recovering habitats during the successional process. Some nilgai inhabit Asola and would flourish if competition from stray and domestic cattle is reduced. Thus the system promises to be biologically active and calls for action to facilitate its rejuvenation.

MANAGEMENT IN COMING YEARS

The Asola-Bhatti WLS has a unique place in India's network of protected areas. Among the 421 wildlife sanctuaries and 75 national parks in the country, it is the only area representing the northeastern, rolling outliers as a landform of the country's oldest hill ranges, the Aravallis. Thus it biogeographically represents a landform not earlier represented in the national P.A. network. This therefore is a value of national significance. As a `wildlife' sanctuary it is very different from the popular perception of a sanctuary. Years of abuse has made it biologically depauperate and in the foreseeable future it is most unlikely to attain the status of a show place for wildlife. It need not have to for it has a very different role to play. Unfortunately, judgemental as public perception is,

has time and again dictated that unless a natural area serves public use' it has no value. `Public use' has a very restrictive connotation. There often is a thin line that separates `use' and `abuse'. The degradation of forests and pastures in India is just one story. Now wilderness recreation, the so called non consumptive use, is threatening the ecological integrity, at least of the best known and therefore most visited PAs. For all practical purposes, recreation has become the main `use'. All other values are relegated to platitudes. Recreation is taken as entertainment that is often completely divorced from education. Though the ecological security and functions are the bottomline in managing PAs, they continue to be the most invisible values and therefore the least supported, if not on paper, then most certainly in practice. The Asola-Bhatti is therefore a stern test for conservation commitment, because wildlife wise it is not spectacular and might not be in future. Currently it is in a state of high degradation and continues to bear a very high pressure of cattle grazing, operating threats of encroachment, removal of biomass, of the unhygienic use as an outdoor toilet for a vast number of people residing in its surrounds, of a convenient rubbish dump, of travel shortcuts between settlements and use of draught animals, trucks and heavy machinery moving towards Badarpur mining sites located along the boundary of the WLS and beyond. The latent threat of land speculators also can never be underestimated.

Even if the threats are brought to heel, the question most certainly to be raised would be, `what is in it for the public?' A great challenge lies in its answer, because the answer does not entirely fall in the `popular' category. Wildlife based entertainment is not going to be its strong point. It is designed to serve a higher purpose but not without `public utility'. The managers, however, must necessarily expect the pressures of popular opinion, not to mention the resistance of the pressure groups of local residents whose freedom of action is going to be curbed to a considerable extent.

The P.A. is small and represents a portion of a highly fragmented landscape. Even at its best, it is going to be an habitat island with low diversity of plants and animal species and relatively low wildlife populations (MacArthur and Wilson 1967, Harris 1984, Soule 1986, Hunter 1990). The most abundant group will be constituted by birds, followed by reptiles, mammals, fishes and amphibians, in that order. The larger vertebrates are going to be very few, as species and will be represented by small populations. Structurally, as it is currently, the habitat has all the appearance of potentially supporting blackbuck, wolf, and other fauna of the typical dry open scrub. However, this is misleading. Nilgai are few and on virtue of its habitat adaptation, this is likely to be the only large vertebrate which might occur in the sanctuary. The immigration possibilities of other dry habitat species are remote since there are no corridors left that might connect the PA to large patches of scrub forests under reasonable status of management. In fact, judging by the trends, this might be the only area left in this landscape with evidence of original habitat attributes. It is likely to be a completely isolated habitat island.

The Bhatti portion of the sanctuary has several large pits. They have struck water, and probably there are a few springs or aquifers which keep charging the water bodies. The water quality is excellent. A typical wetland vegetation community has now developed, with floating and emergent species. Waterfowl, mainly ducks and teals can now be seen, as already recorded earlier. There undoubtedly is a developing community of amphibians. The sloping sides of the pits have at places, natural ledges which support grasses and herbs. The ledges are being used as nesting sites by birds. There also are several cavities along the slopes which are used as nesting and roosting sites. Normally, what might be considered as precarious slopes are now supporting communities of plants and animals which is an indication of stabilising forces at work, as the soil is attaining its natural angles of repose. Certain amount of erosion undoubtedly might be seen over several further rainy seasons. The harmful rill formation can be easily checked along the rim of the pits where such symptoms first develop. The pits are now an inherited attribute and there should not be any attempt at modifying the slopes or filling the pits. Whatever impacts which already have been sustained will be further compounded if any attempts are made towards filling the pits or easing the slopes. New habitats are developing and the process needs to be supported by complete protection of pits. These are not dangerous to the native animals.

Currently, all kinds of non biodegradable and biodegradable rubbish is being dumped in and outside the rim of the pits. This needs to be stopped forthwith. All rubbish already dumped needs to be cleared and an alternate site, well away from the sanctuary needs to be identified for dumping rubbish and an efficient system of garbage disposal needs to be established. It is not just the sanctuary but also the surrounds need to be protected from the evils of such activities. Nature interpretation and conservation education are the two main values associated with the sanctuary. It is expected that once the facilities are developed the sanctuary will have a flow of visitors. If the surrounds are littered with rubbish dumps, then, however good the programmes might be, the visitors are bound to get severely discouraged. Even more serious than this is the use of the area as an outdoor toilet by a great number of people. An efficient public convenience facility is necessary.

While the sanctuary boundaries are mostly well defined by a wall, the demarcation over a section along the south eastern portion (interface of Bhatti and the active mining areas in Haryana) is not clear. Presumably this is because of a dispute. However some directional markers as per the claims of the sanctuary management need to be established if only for the knowledge of the local staff. As a result of an old encroachment, a settlement is now well entrenched within and inside the sanctuary boundary wall and we found evidence of odd persons coming to this area in search of work from distant locations in India and settling down as squatters. The previous attempts of eviction have not succeeded. The `village' is now developing with a few masonry structures. Handpumps and wells are evidence. It might prove very difficult now to attempt a relocation without complete government backing. An alternative could be to redraw the boundaries slightly to exclude this portion from the sanctuary and provide extra protection investment at this point and along other points where threats of a settlement are in evidence.

Some portions of the sanctuary are being used by army/para military units for the purpose of exercises. It is acknowledged that such exercises are important. However, the management is already dealing with a very small protected area and by ecological implications it is inappropriate to allow such exercises to continue. Legally also, these activities cannot be allowed. We estimate that there still are sufficiently large areas with similar attributes for the purpose of the exercises outside the P.A. These opportunities might not have been considered earlier by these units since they already had a convenient area inside the sanctuary. This matter needs to be resolved through a dialogue with the concerned formations at the appropriate level.

Once the management support is established, two points of entry would be available to visitors. One near Surajkund where an office complex is being developed and the second, off Sanjay Colony (new approach). In case of the former, not very far from the entry gate, there is an excellent patch of old forest with a stream channel passing through. Such patches are rare and hence visitors are likely to be attracted to this area. On account of its size, the forest patch must be considered as highly vulnerable to change and hence no visitor facilities should be developed in this area such as sit outs or shelters which might gather people and in turn exert pressure of their activities on this patch. Visitors undoubtedly must be enabled to see this area. It can be achieved through a track that skirts along its periphery. More about this in a later section.

Since it is proposed to develop the main visitor centre and interpretive facilities at different locations, visitors gaining entry near Surajkund might like to travel to those locations. This can be achieved by providing a route that exposes the visitors to a cross section of the P.A. features. A road be developed all along the wall to prevent vehicular traffic from cutting across the sanctuary and along some sensitive sites. Such a road will have a dual purpose, the other being an excellent patrolling facility along the boundary of the P.A. which would be to a significant advantage of the field staff on protection duty.

The protection and management responsibility of each beat, if necessary can be shared jointly by two or more guards assisted by labour which is already employed. Patrolling schedules must be developed. Thus, as a system, across the sanctuary an efficient mechanism of protection is required to be established. At strategic locations, patrolling sheds of economic construction and design which merge into the landscape should be established. The purpose is for these to serve as shelters during the day in rains and hot summers and as an overnight camping place for the patrolling staff. This will also encourage the field staff to remain in the field and will enable establishment of a tradition. Each beat guard must maintain a daily diary of his activities on duty, the area patrolled, management activities implemented, events of management significance detected and action taken. Supervising staff should scrutinize these, at least once a week. All field staff, irrespective of rank must maintain such documents, which will be a permanent record and should be available for scrutiny any time by authorised officials.

The field staff will need to be oriented to this system, especially in the matter of what is expected of each level of responsibility and how to record and what to record. This is best developed in the field as an `on the job' orientation. All protection related events must find a place on record eg. detection of a breach in wall; illegal cattle grazing; illegal collection of fuelwood, fodder, cutting of trees; outbreak of fire extent, location and control measures; trespass; poaching etc. The record should also reveal the progress of implementation of management activity assigned.

To strengthen protection capability and management coordination, a wireless system should be established with `control' station on site being located at the management headquarters (Surajkund entry point) and another station in Asola, within the current Ranger station facility. Each patrolling party, depending on the jurisdiction location, can either be given hand held sets or manpack. Two 4 wheel drive vehicles need to be permanently stationed in the sanctuary. One should be detailed exclusively for protection support and patrolling and the other for supervising the management activities. Each should be fitted with a mobile wireless set.

Currently, the field staff is not trained and hence the existing force is weak in meeting the challenges. Staff at the level of forest/wildlife guard, forester (section officer) and Range Officer must be fully trained in their field tasks and such training can be had in the training institutions for the appropriate levels established by the Forest Department. One Range Officer is already trained at the Ranger's College, Haldwani. This was an excellent step. There is a Forest Guard's training school at Pinjore, Haryana where the guards could be trained. Madhya Pradesh has the only training school in India for training wildlife guards at Tala, on the border of the Bandhavgarh National Park. The W.I.I., has recommended new syllabi of training for all institutions which conduct training for guards and foresters, and offers a 3 month certificate course in wildlife management at the WII for trained Range officers. Some of the forestry aspects being taught at the training schools might not be of immediate relevance for the Asola-Bhatti guards or foresters, however, the tradition, discipline, skills and knowledge imparted are critically important and unless the field staff is trained, we cannot foresee an adequate performance. Mere number and ad-hoc watch and ward are of little help.

All land comprising the sanctuary needs to attain the substantive status of a Reserved Forest, and this action has already been initiated. The settlement needs to be completed on priority. While any existing rights as a corollary to such status will stand acquired or commuted, the concessions that might be admitted need careful consideration, especially with reference to the Wildlife (Protection) Act. Regulated livestock grazing might need to be admitted initially with the ultimate aim of reducing it so that cattle belonging to only a few villages inside and immediately outside might be the only beneficiaries. Securing the cooperation of such owners of cattle in maintaining the integrity of the P.A. is vital. In consideration to the fragility of the area a rotational system is recommended with annually rotating closures of selected compartments followed by only cutting of fodder on recovered areas and phasing out all livestock grazing over the next 5 years.

Removal of fuel material under regulations could be another concession. Goat grazing and sheep grazing needs to be shifted outside the P.A. immediately.

For dispersing and reducing the grazing pressure, a water based strategy is most likely to work effectively. The available ponds inside the sanctuary are heavily used by cattle. Water availability is a problem, both for cattle and human settlements. It is recommended to create water points in the neighbourhood of the settlements immediately outside the WLS. The only approach likely to work is sinking deep to very deep borewells. Water table in this region is low and the borewells are definitely going to be expensive. In fact, managing Asola-Bhatti, at least in the initial years is going to be expensive. If there is sufficient drinking water for cattle and people, people will definitely begin to listen, which would be a good beginning. It would also be possible to reduce the magnitude of presence of cattle on the water sources within the P.A. considerably. The situation of water sources within the sanctuary has already been discussed. It is recommended to have a ground water survey conducted within the P.A. and based on this a decision on the technique for creating new waterholes and their location could be taken. Again, the borewell seems to be the best option since bunds are not likely to hold water through the critical part of the summer. Asola-Bhatti represents a dry ecosystem with natural `scarcity' of water, therefore creating too many water points will not necessarily be to any advantage. Some locations have been indicated on a map which may be considered for location of new waterhole.

Any effort to protect and enhance the quality of the renewable natural resources of Asola-Bhatti sanctuary will largely depend on the support of local people who inhabit the villages all around the sanctuary and are directly dependent on the resources of this sanctuary. Their support can be solicited by initiating trust building activities and helping them to augment their economic status through eco-friendly small scale income generating activities. Once the people of neighbourhood are convinced that their long term welfare is directly linked to the protection of Asola and Bhatti, their cooperation will be ensured.

Roads or sections of roads, other than the ones recommended for visitor use should be closed to public, and used only for the purpose of management. A road be closed by simple arrangement of posts on either side and a chain locked across. If the sides allow a vehicle an opportunity to skirt the barrier, then trenches be dug on either side where they meet a bouldery area or such topographical difficulties. A site for a barrier be chosen with this factor in mind so that digging is avoided. Roads of either category should be annually maintained. Some rocky substrates might be unavoidable. However, where it is possible to provide a good earthen surface, the road should accordingly be maintained. It is one thing to allow a road to look natural with all the obstructions, but a bad road is hard on vehicles. No off road driving be permitted.

It is essential to have adequate staff presence on the sanctuary at all times. There would be little problem relating to staff residing locally, but those that must travel from distances will not be

available when needed. It is ideal to provide housing facility near the sanctuary. Within the sanctuary, camping facilities, i.e., structures economically constructed and aesthetically merging with the surrounds need to be located at strategic points to enable patrolling staff and others on duty to stay overnight.

To assist in the recovery of habitat, a plantation programme is normally considered an important activity. However, currently the grazing pressure is extremely heavy, both of attended and unattended cattle, and unless it is possible to completely protect some areas, no plantation is likely to survive. Therefore accent has to be on reduction of grazing pressure and at least maintaining some patches free of grazing. There is a need to conduct `intervention management' experiments to find ways for encouraging the growth of existing native species within the rank growth of *Prosopis*. Cutting, or uprooting *Prosopis* over patches of different sizes, or pruning regimes need to be tried. It will not be possible to drastically reduce the *Prosopis* cover and it is also not desirable at this stage. The objective should be to create better regeneration and growth opportunities for native species of grass, herbs, shrubs and trees. Only an objectively laid out scheme of such treatment and monitoring over at least a period of 5 years is likely to provide an insight on the trends.

REFERENCES

Anonymous, 1883-84. *Gazetteer of Delhi District*. Compiled and Pub. Punjab Govt.

Harris,L.D., 1984. *The Fragmented Forest : Island Biogeography Theory and the Preservation of Biotic Diversity.* Chicago and London.

Hunter,M.L.Jr. 1990. *Wildlife, Forests and Forestry - Principles of managing forests for biological diversity.* Prentice Hall N.J.

Kalpavriksh, 1991. *The Delhi ridge forest* : Decline and conservation.

MacArthur, R.H. and Wilson, E.O.1967. *The Theory of island biogeography.* Princeton, N.J.

Maheshwari, J.K. 1988. *The flora of Delhi*. CSIR, New Delhi.

Mukherjee, S.K. 1953. Vegetation of the Delhi ridge. *Jour. Bombay nat. Hist. Soc.*, 51: 439-465.

Soule, M.E. 1986. *Viable populations*. Cambridge.

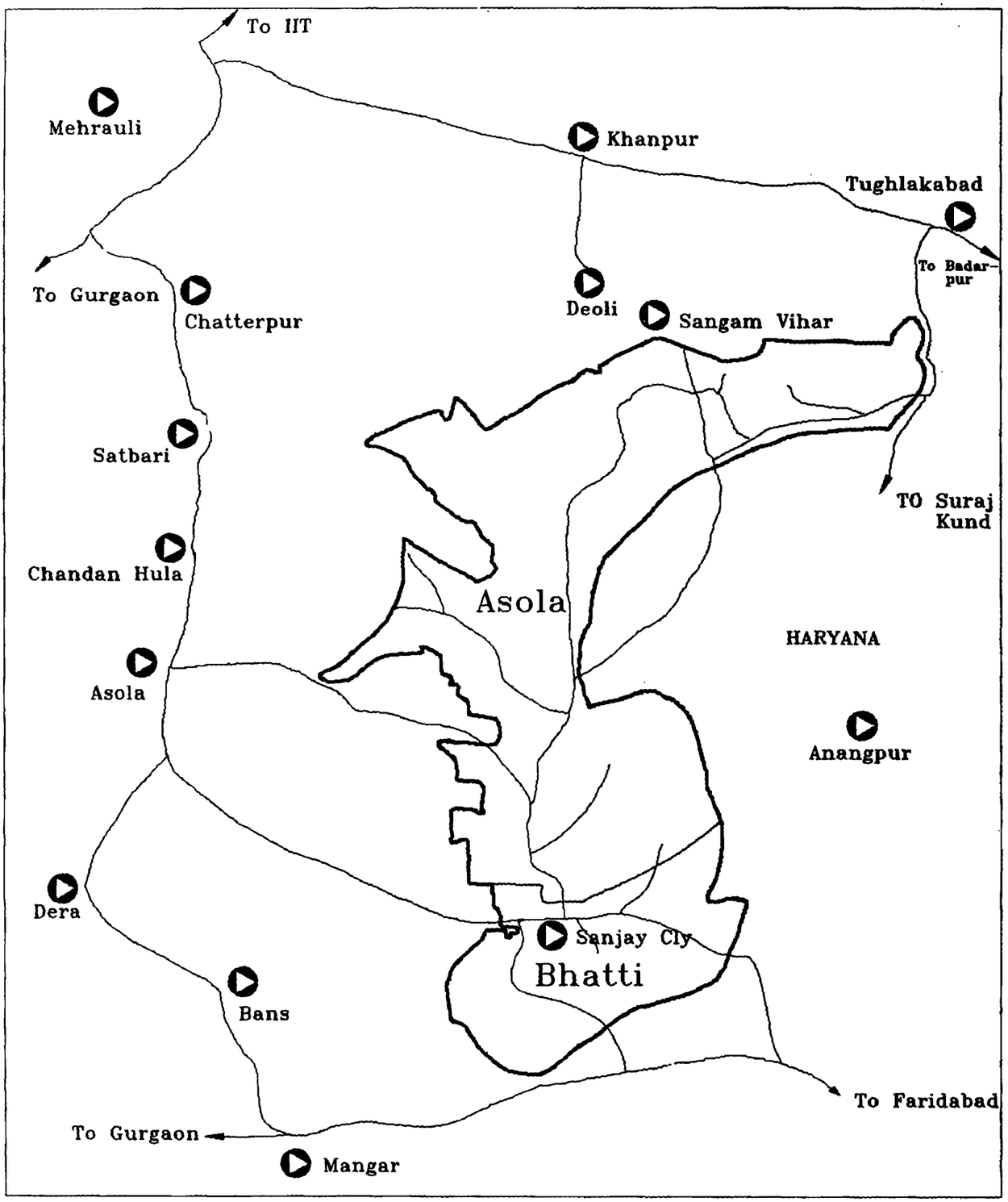

Fig. 1. Map of Asola-Bhatti WLS.

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NATIONAL ZOOLOGICAL PARK : PIONEER IN EX-SITU CONSERVATION

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The recommendation of the Indian Board of Wildlife and the keen interest of the then Prime Minister Pandit Jawahar Lal Nehru saw the setting up of a Zoological Park at the capital in 1952, with an area of 214 acres of thickly wooded land. It was created for education and recreation of the people of Delhi. Finally this Zoological Park was inaugurated on 1st November, 1959. The area between the 16th century Old fort and the Humayun's Tomb was selected as the site for this Zoological Park due to the following factors - there was sufficient area, deep soil, undulating topography, possibility of ample water supply, easy communication, open landscape with the beautiful Purana Quila in the background and scattered historical ruins to give it a aura of the past. The historical sites in and around the National Zoological Park have been the seat of power during various periods of civilization. It is believed that it was part of the old Indarprastha and structures like the Azimganj Sarai, Kosh minar and smaller burial site give testimony to its being a nerve centre of Mughals and Sher Shah Suri.

With the announcement of the establishment of the Zoological Park gifts started coming in. Two leopard cubs, aged 3 months, came from the state of Madhya Pradesh. A Japanese Sikka deer stag and a pair of Japanese Brown bear were presented by the crown Prince of Japan. a pair of lions came from Ethiopia as a gift of their King. A few other animals like tiger, leopard, bear and foxes came from state Govts. All these animals were housed in temporary enclosures which formed the nucleus of what, was then known as the Delhi Zoological Park but finally permanent enclosures were made and animals were shifted to these.

The display was designed by geographical regions - Asian, Australian, American and African. Swamp land were also created where water birds inhabited. These swamp lands especially the Indian swamp became home to a large number of migratory birds both local and from across the country. The land had high salinity and the enclosures have thick growth of *Prosopis juliflora*. Efforts were made to plant species native to different geographical regions. With the passage of time and non-availability of the animals these could not be strictly housed according to the geographical regions. At present mammals and reptiles are accommodated in suitable enclosures.

In addition there are separate reptile and nocturnal animal houses. Among the mammals there is a good collection of carnivores, herbivores and primates along with a marsupial and a pair of the western grey Kangaroo. Some of the primates like the chimpanzee, lion tailed macaque and Hamadryas baboon are displayed in moated enclosures where especially Rhesus and Assamese macaque are housed in enclosures where most have done well.

Asiatic lion and hybrid lion are in moated enclosures which have been displayed in groups of at least two each. The famous white tiger, which is a mutant, is a captivating sight for visitors and has bred well here. The normal coloured tigers are in two other moated enclosures and are very popular with visitors. These also have leopard (India) and Jaguar (from America) among other cats. The small carnivores displayed include the common Palm civet, large Indian civet and leopard cat which have finally started breeding by raising up a litter of two kittens. There are also wolf, jackal, hyeana, American raccoon and the great acrobatic otter.

Among the herbivores there is a group of four Indian elephants who have a private swimming pool and are a great attraction to visitors. They also provide rides which are enjoyed by visitors both young and old. The Great Indian rhino, four in all, are now breeding well and have a huge moated enclosure. These draw a large number of visitors thanks to the myths attached to their skin and horn. Closely on the heels drawing the public are the hippo which are gentle giants and now number seven. This family which is of different ages wallow in pools which they soil badly. The Mithun, a docile version of the gaur, do well in a big enclosure which is also thickly wooded. A herd of African buffalo including some bad tempered ones move around a sprawling enclosure.

The Indian antelope present in this Zoological Park are the black buck, nilgai and chinkara. They all have open enclosures and breed very well. The African antelopes are represented by the water buck and eland (the biggest antelope in the world).

The Indian deer mostly in big herds are the spotted deer, highly rare and threatened Sangai (Manipur Brow antlered deer). Swamp deer, Japanese Sikka deer; hog and Barking deer can be seen in sylvan moated enclosures at the Zoological Park. Apart from these antelopes and deer, the national Zoological Park has a growing population of Goral which though come from pretty high up in the mountains breed well in its craggy enclosure.

The rodents of display value are the porcupine, hedge hog and Malayan giant squirrel.

The breeding of all deer and antelopes is very good. The Zoological Park is proud to breed more than 170 Sangai and sending five specimen back to their native range state at Imphal Zoological Park and also to other Zoological Parks in the country. This year 12 young ones were born in the National Zoological Park. The current population is 46 which is the largest in the world after the one hundred and fifty odd in wild at Keibul Lamjao National Park, Manipur.

One of the pride possession of the Zoological Park are the birds and we have here one of the biggest collection of parrot and parakeet, macaw, cockatoo and conure of varying colour and sizes. There are Grey parrot, yellow headed parrot, Eclectus parrot, lesser and greater Sulphur crested cockatoo, Bared eyed cockatoo, Moluccan cockatoo, Rose breasted cockatoo, Blue and yellow macaw, Scarlet macaw, military macaw, Illiger's macaw, etc. Even the ordinary green

parakeets are represented by the yellow and blue phases. The pheasants are represented by the Golden, Silver, Lady Amherst and Kalij pheasants. Also displayed are the grey Jungle fowl besides white and normal coloured peafowl.

The aviary houses scarlet and white Ibis, Brahmini duck and purple heron. White Ibis deserves special mention because they have bred so well, that around 70 odd birds were released in the park. These have inhabited the Indian swamp and are now breeding well in wild conditions and have added to the regular breeding birds of this park. The cranes of the park include the Sarus crane, Common crane, Demoiselle crane and also the crowned crane of Africa. Other important birds on display are the great Indian hornbill, flamingo, Hill mynah, Grey and black partridge, shikra, Red billed blue magpie and Indian roller. The flightless birds from the Australian region are represented by the emu and cassowaries which are displayed in open enclosures. Black swan of the region also breed here from time to time. Painted stork and white stork who visit the ponds embellish the display. Owls find themselves in the nocturnal house.

Gharial and crocodile inhabit enclosures which draw a number of visitors who think these are all dead as they move very seldom. A number of species of turtles inhabit the ponds. The Indian python, Reticulated python, two species of sand boa, the ordinary cobra and even the king cobra in all its glory inhabit the reptile house enthralling visitors.

The four large water ponds spread in the body of this park are not only the homes of pinioned stork and crane but also to pelican which though pinioned, breed well (thank to the visiting pelicans) on one of the islands in a pond.

The tree canopies in the islands are hardly vacant as there are a large number of nesting birds such as baya nesting in their complicated woven nests in summer, to the heron, white Ibis, cattle and little egrets during June-July. Come August and flights of painted stork descend on these trees and after some initial squabbling serious nesting activities take place. Since these birds are in large numbers, a spill over population inhabit the tree tops of some of the nearby enclosures of the black buck and nilgai.

The little and large cormorants who are on specified trees of one of these islands throughout, breed very well here and can be seen in series of colonies. Night heron and pond heron though make themselves a nuisance in many Zoological Parks live in peace along with other birds and nest on their own trees.

Grand spectacles of flight and colour are provided by the painted stork and also the pelican whose young ones are chocolate brown as compared with the light pink of adult. The raising of chicks by these species provide a sanctuary like atmosphere for visitors right in the heart of the meteropolis which is hardly duplicated by any other Zoological Park of the world.

A large number of non-captive avian species migrating to the Zoological Park inhabit the ponds. Besides the said painted stork, pond heron, Ibis, cormorant, egret and many species of ducks like pintail, shoveller. common teal, pochard, gadwall and the resident spot billed duck inhabit these water bodies.

A large population of peafowl inhabit the length and breadth of the Zoological Park and it is not unusual to see the old grey partridge taking cover with her covey of chicks. Different species of birds live in wild like the green pigeons, emerald dove, grey hornbill, cuckoo, barbet, crow pheasant, robin, babbler, wagtail, mynah, parakeet and other species due to the fact that there are semi wild conditions and plenty of fruit trees available here. Other than birds there are plenty of species of reptiles like cobra, kraits, rat snake, water snake, python and mammals like porcupine, Palm civet and mongoose. All this makes the Zoological Park a veritable sanctuary and attracts nature lovers and cameramen of all hues.

Stud books are maintained on the Sangai deer and the white tiger, which form an important tool in Zoological Park management. Stud books are very important for the scientific management of endangered animals in captivity. It is essential that genetic diversity is maintained so that the present stock in a modern Zoological Park act as gene pool (to act as insurance) for future. With this idea and to have all the information readily available regarding blood lines, parentage, causes of death and other details stud books are being maintained at National Zoological Park for all the animals. Special emphasis is added to the endangered animals and primarily the species for which the Zoological Park is participating in the CBSG captivity breeding programme like Lion tailed macaque, Sangai deer, Asiatic lion, Swamp deer, tiger and chinkara.

With the passage of time the Zoological Park management has become specialised job and required technical input for the animal behaviour, health care breeding biology, neonatal care, population management and latest techniques of bio-technology with high degree of sensitivity and commitment. With this idea and under the comprehensive captive breeding programme covering all the participating nations of the world, it has become necessary to maintain stud books in respect to endangered fauna and to maintain proper record. One should not be surprised to find the record of endangered animals housed at national Zoological park in any other Zoological Park in the world and similarly the details of the animals in any big Zoological Parks in the world in Delhi Zoological Park. This shows that the management of endangered animals in captivity has now become a global phenomena.

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ENVIRONMENTAL LAND MARKS OF DELHI AND THEIR IMPACT ON BIODIVERSITY

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The earliest reference to a settlement where modern day Delhi is located, is found in the ancient epic Mahabharata. The habitation was then known as Indraprastha. If the land marks of Indraprastha were 53 km long uninterupted forest cover (known as The Ridge today), a clean gushing river Yamuna, and 1161 sq.km of unpolluted fertile land, the land marks of Delhi of 1996 are :

i) Vanishing greens and black smog,
ii) Dry taps and dirty water,
iii) PVC fires, melting tyres and smelting lead,
iv) Noise all around,
v) Garbage dumps and Toxic soil,

Life of 10 million Delhites is at stake in this most polluted, oxygen and water starved 1500 sq.km area of the country. And so is Delhi's biodiversity.

i) **Vanishing greens and black smog** : DDA claims that they have developed 16000 acres of 1384 sq.km of Delhi's land mass into recreational area by planting 168 lacs of trees and shrubs.

Delhi also has over a hundred public parks, tree lined avenues and thousands of mericured lawns. But, Delhi's forest cover has been reducing at the rate of 1% per year since 1940.

Result : The oxygen release is decreasing. One Sq.km of dense tree area emanates approximately three tonnes of O_2 while the same area of a park release just one ton of O_2. One sq. km of dense tree cover can absorb 2.5 tons carbon dioxide while to do the same job a golf course or a manicured lawn would have to be 10 times more in size. There is almost an inverse ratio at which the number of polluting vehicles is increasing and the `real green is going down.

In 1960 the forest cover (Ridge) in Delhi was 48%. The number of vehicles were about 3 lakhs. Today 25 lakhs vehicles ply the roads of Delhi and only 6% of the Delhi Ridge is unencroached. Thus during the last 30 years number of vehicles increased eight times and the Ridge decreased eight times.

Emissions from automobiles in Delhi, are contributing to about 65 percent of the total air pollution. Presently 168000 metric tonnes of pollutants are being emitted. This is about 50 percent more than 87000 metric tonnes emitted in 1987. In the last eight years emission of carbon monoxide has gone up 120 times, hydrocarbons by 204 times, sulphur dioxide 5.8%, oxides of nitrogen by 45 times and lead particles by 100 times.

Every day 1220 metric tons of carbon dioxide, 570 metric tons of hydrocarbons, 330 metric tons of nitrogen oxide and 253 metric tons of sulphur dioxide are released in Delhi's air.

Carbon monoxide, which accounts for more than 11 percent of the auto exhaust, reduces the oxygen carrying capacity of the haemoglobin, affecting the central nervous system.

Sulphur dioxide and nitrogen oxide also affect the lungs directly and reduce body's defences. Both these oxides are very irritant gases and cause watering of the eyes and spasms of the mucus membrane of the throat and lungs leading to tuberculosis or even cancer of the lungs. Oxides of nitrogen can cause blood cancer and neurological problems. Lead affects our kidneys, blood and brain. As if this is not enough, there are 3 thermal power stations (Indra Prastha, Badarpur and Okhla), which inspite of upgrading their anti polluting equipment, emit 302 metric tonnes of pollutants and 50 metric tonnes of fly ash. Particles of flyash suspended in the atmosphere carry toxic elements like lead, arsenic and mercury.

Though every Delhite breaths nearly 16.5 kg of air loaded with vehicular emissions, the Auto, Bus and Truck drivers get maximum exposure to the vehicular pollution due to their long hours (14-18hrs) of driving. *Vatavaran* conducted a survey of 82 truck drivers, 100 bus drivers and 118 auto drivers and found (according to the drivers) their critical problems were irritating watering eyes, diminishing eye sight, nausea, headache, cough, digestive or respiratory problems and low pays for the long hours they put in (Details in `*Status of Vehicular Pollution in Delhi by Vatavaran*).

ii.) **Dry taps and dirty water :** In 1970 the ground water level in Delhi was 30ft below surface. In 1996 it is 70 meters below surface. Over 50% Delhites do not get regular supply of potable water. And what ever water we do get is not safe to drink.

Ground water levels have been falling by up to 3 meters every year. In Najafgarh and Mehrauli blocks the exploitation of water is the highest in Delhi. Vatavarn's survey of Krishna Nagar (A 50 year old, low middle income colony with 4000 residents in south Delhi) revealed that of all the problems faced by the residents of this colony the problems related to water are most critical. There is not only acute shortage of drinking water supplied by municipal authorities but the water invariably is muddy or yellow and smelly. 90 percent of the 400 house holds visited were found to be worried about their health due to the quality of water they receive.

Three fourth of Delhi's surface water is polluted due to sewage alone as only 50 percent of Delhites have some sanitary facilities. Also 70 to 75% of the domestic water comes out as domestic sewage. About 300 million litres of sewage is generated in Delhi every day and the total treatment capacity of the three plants is only 100 million litres. 20 percent water pollution of Yamuna in Delhi is due to the dumpings of industrial waste and 74 percent due to domestic sewage, thus 94% of the water entering the Yamuna is untreated and consists of dissolved and suspended solids.

In the rural Delhi (Tughlaqabad for example) though the input sewage pipes were laid by DDA the receiving tanks were never made. Result is sewage flowing on roads and has collected in some low lying areas. Tanneries beyond Greater Noida are releasing waste water with bio oxygen demand (BOD) as high as 16 mg/lt. of water, high pH and 50% lime content, due to the tanning of thousands of raw skins these tannries receive from the legal and illegal slaughter houses of the city. The air in that area has perceptible hydrogen sulphide in it.

iii. **PVC Fires, melting tyres and smelting lead :** The 50% of 283 sq. km. rural area of Delhi is cluttered with over 5000 recycling units. All either in one room living quarters or in the agricultural fields. Each primitive, hazardous and polluting, but sustaining lakhs of families till they succumb to a premature death. The colonies all around are suffering almost equally. 30% of agricultural land has been converted into toxic soil polluted with nickle, chromium, zinc (electroplating units in Motia Khan and Okhla) 10 percent soil is toxic due to frequent burning of tyres.

In Onkar Nagar and Inder Puri the old tyres are first shred and then melted. The emitting smoke is high in sulphur, carbon, zinc, iron, tars and phenol. The soil has high deposits of these chemicals. From soil they reach the underground water and affect us all. Lead smelting goes on in the agricultural fields at Siraspur, Karam Pura and Delhi Haryana border. This started after supreme court's ruling to close all polluting Industries. From Industrial area smelting has shifted to the fields. Lead smelting is hazardous business. With acetylene torch the battery is cut open. Casing is split and the lead plates are pulled out. Sulphuric acid from these batteries is dumped into the fields and the lead plates are smelted.

There are over 260 lead smelting units around Delhi only. A village at Delhi-Haryana border has 23 secondary lead smelting units. Most of these units have been operating without any licence. According to one smelter he only has to pay to Delhi Pollution control Board and local police to carry on his smelting in middle of the night. Each smelting unit is small enclosure, of about 4'x4'x8' size and it houses the crucible. The emissions are let out through a stack fitted on top of the enclosure. Wood charcoal and old lead plates are put in equal proportions in the crucible and the *'bhatti'* is fired. Air is supplied using a manual blower. The molten metal is tapped from the side and moulded into ingots. The slag tapped is reprocessed for 3 or 4 times in the same crucibles,

and then this slag and other obnoxious discards are dumped. Every few weeks the `bhatti' is shifted to a new area. But by then the fields have been poisoned. Adults who have been working in these smelting units invariable suffer from lead poisoning. They have anemia, headaches, irritability, abdominal pain, vomiting and constipation group of symptoms called lead colic.

PVC recycling units at Tri Nagar, Shazeda Bagh and Wishvas Nagar give out chlorine, carbon monoxide, Vinyle chloride, benzene, formaldehyde, sulphur dioxide and hydrogen cyanide. The soil around these units have 90 mg of cyanide in every gram of soil. Burning of plastics also release Phosgene (used in first World War as chemical weapon) and toulene diisocynate - similar to the methyl isocynete that killed and crippled thousands in Bhopal (For details see `*Plastics In Our Lives'* Report).

Our survey before Jwalapuri fire revealed that 80% residents of Paschim Vihar had breathlessness and choking feeling when recycling of PVC was taking place in Jwalapuri. Paschim Vihar is adjacent to Jwalapuri and before this PVC market cought fire in 1995 the area had a black smog all the time. The furniture in the houses was invariably covered by bits and dust of plastic which were constantly in air. PVC recycling goes on, only the location has changed.

iv) **Noise all around** : We Delhites are basically noisy people. Whether we are at home, bazar, hospital, station or in cars.

Unregulated traffic in the parking lots of Connaught Place leads to 65 to 80 dB of sound. In Karol Bagh it is the intense, noisy human activities like bargaining by the customers and attempts by the traders to attract customers by yelling discounts better than their competetors. The noise levels vary between 67dB to 80dB. Palika Bazar has noise levels between 75 - 90 dB making this market one of the noisiest in Delhi. Most shops here play their music system at a very high volume. The echo of the noise created in this close dome shaped market increases the noise pollution to an unbearable threshold.

Our railway stations are noisy due to poorly maintained tracks, sirens given by trains and excessive number of wrongly placed shrieking loud speakers. The irritating, shrill and harsh voices of the announcers is adding to the 80-100dB of noise pollution at the stations.

Industrial areas any way have a higher prescribed noise levels (60-65 dB). But as 50% industrial units are located in residential areas it is affecting the sleep patterns and levels of concentration of the residents. Anand Parvat has 72 to 85 dB of noise levels through out the night, while Wazirpur has 74 to 100 dB.

Even our hospitals - which are suppose to be silent zones have noise levels between 66 - 90 dB within their premises. 4 to 15 horns per minute in the emergency wards of most hospitals are

converting these silent zones to high pitched zones.

v): **Garbage dumps and toxic soil :** 60% of Delhi's ten million people live in 500 authorised residential colonies and an equal number of unauthorised colonies. About 40% of Delhi's population lives in slums. Every year a city as big as Chandigarh is being added to Delhi. And on an average each citizen is producing about half a kg of garbage daily, making a collosal 5000 metric tones. Every week and estimated 28-35000 metric tones of garbage is generated.

In most localities the legal garbage dumps are over flowing and the number of open garbage dumps in the by lanes, parks and road side are on the increase. Besides being eye sores these garbage dumps are health and environment hazard for the ten million people who live in Delhi. Unorganized sector of ragpickers, pigs, cows, dogs, cats and monkeys are seen wallowing in the garbage. This rotting biodegrable matter is a healthy breeding ground for flies and mosquitoes. Germs responsible for plague, tuberculosis, cholera, dysentry, diahhorea, leprosy, eye infections, skin allergies and breathing problems multiply here. This is also where people often slip and fall and where even a perfumed hanky on the nose cannot keep the stench away.

At present there are 5000 garbage dumps in Delhi. Five percent of Delhi's land mass is being choked by the garbage. This five percent has become a wasteland, its utility is steadily declining and soil quality is deteriorating. Reasons for that are (i) Mixing of kitchen waste with toxic and chemical waste at the household level, (ii) Presence of shops responsible for creating bio or chemical pollution in the neighbourhood bazars, (iii) mixing of infectitious hospital waste with the house hold garbage due to the mushrooming of small nursing homes in all residential localities, (iv) disposal of the waste by small recyling units in residential areas in the community bins of the locality is also making the garbage rich in lead, cadmium or other dangerous pollutants, (v) the non scientific way of managing the land fill sites of Delhi is leading to leaching of all pollutants to underground water. This is contributing in the increase of the waste lands.

IMPACT ON BIODIVERSITY

Denuding Ridge, increased vehicular pollution, excessive recyling, increased toxicity of the soil and water and dangerously high noise levels have not only affected the quality of human life in Delhi but also its biodiversity. During the last 50 years there has been a very rapid alteration in the critical balance of Delhi's ecosystem most of it has been man made.

Alterated land use pattern of the Delhi Ridge has led to disappearance, displacement or dispersal of many species.

In 1940 there were 300 species of birds in Delhi but by 1990's the number had gone down

to 200. Of the 40 species of birds of prey in 1940 only 11 are present now. Among mammals, fox, hare, pig, blackbuck, chinkara, jackal, nilgai, hogdeer, leopard cat, wolf, hyena, Crested porcupine, cheetal and wild boar were present in the Ridge about a century back, but today higher mammals have almost vanished.

At present the insects have a patchy distribution on the Ridge, and this is not conducive for species survival. During a study of the distribution of insects on Delhi Ridge it is found that there was not a single species of butterfly, moth, wasp, beetle or bug in those parts of the Ridge where black smog, due to vehicular pollution was most prevalent. Relationship among all animals in an environment helps to maintain stable population size of various species. When ever species substitution is observed it indicates that a change has come in that environment.

The unisightly fuzz formed by the under growth on Ridge sheleters most reptiles and amphibians. It allows mammals such as porcupine, jackal, fox and hare to lead undisturbed lives and in addition provides food for most other forms of life. The capparise bush with its scraggly appearance and the `ber' with its nasty interlocking thorns, are both providers for fruit eating birds and mammals and nectar seeking insects. More than 30% of birds nests are 2-3 ft. or so above the ground in the undergrowth. Clearing of the under has decreased the number of ground nesting birds and bird nesting in the under growth. It is feared that this has also led to reduced insect population which form a principal food source for many of the birds. Tampering with the biological and physical factors of the Delhi Ridge has affected the biodiversity of the area.

Scarcity of water in Delhi has affected the monkeys most conspicously. In the last 10 years about 60 percent of Delhi's residential areas have had monkeys in them if not permanently then at least for short periods. In addition the Rashtrapati Bhawan, numerous institutions, hospitals, government offices, etc., have been infilterated by monkey groups. Though there are many reasons for this monkey behaviour, an important one is monkey's search for water, in this water scarce city.

Also my study shows that those feral monkeys who visit the garbage dumps for food are in worst of health. Many are clearly suffering from tuberculosis, influenza, bronchitis, skin and eye allergies. Bio-degradable garbage, if not cleared for even 12 hrs. in Delhi's weather conditions, can breed enough germs to affect not only the monkeys of the area but the humans too. Though I have not studied if there is an inverse relationship in increase of `*negative biodiversity* (pests, disease causing germs, etc.) and decrease of `*positive biodiversity*', I presume it exists.

Water polluted with chemicals and toxins has adversely affected the water bodies of Delhi. The number of migratory birds visiting Delhi has gone down by over 50 percent from 1980's to 1995.

Recyling or/and smelting of lead acid batteries in agricultural land has made that soil toxic. This has affected the microbes of the area and the once fertile soil has now become waste land.

To find out how noise affects animals a study was conducted by Vatavaran. In National Zoological Park, five elanders are kept in an enclosure which is situated right next to the railway track, located at a higher level than the enclosure. The track is above the tree line and the boundary wall of the zoo. The passing trains are clearly visible from this site. The siren and the rumbling of trains can be heard the most here.

Approximately 40 trains pass this track everyday. The frequency varies between 15 minutes to one hour. The cacophony by the trains can be heard for 30-45 seconds. The noise pollution ranges between 50-60 decibles for goods trains, 60-80 decibles for passenger trains and the sirens of both type cause 90 decibles of sound; of the 7 percent of their waking hours spend on foraging activity, 3.1 percent times the elanders stop this activity due to the passing of the trains. Though the total time animals are exposed to this noise every day is only between one-and-a-half hour, it is affecting the animals because of repeated bombastic noise level. 35 percent of Elanders daily activity pattern is disrupted due to the passing trains. Behaviours which get most affected are aggression, feeding, foraging, playing and resting.

Among the male elanders clubbing their long hollow spiraled horns into one another is a show of power and strength and 25 percent of their daily time is spent on it. Delhi Zoo elanders on the other hand spent only 11 percent of their daily time on this activity and 8.4 percent of this is disrupted by the passing trains. This probably is going to affect the dominance hierarchy among these animals which is a natural phenomenon in the wild.

Passing of the trains affects the resting animals the most. 68 percent of the total rest time is disrupted. This is affecting the animals adversely. They have become dull, fatigued and tense. Elanders spent 37.8 percent time of this disrupted rest time rubbing their heads against the meshwire of their enclosure. The shrill noise shocks the animals. They either keep standing stunned or go berserk and run to the extreme corner of their enclosure. I am sure that high noise levels on the Delhi Ridge also has contributed towards reduced biodiversity.

As yet, no long term and detailed study has ever been undertaken to find out the collective effects of the 5 environmental land marks on Delhi's biodiversity, however Zoological Survey of India's project on the faunal diversity of Delhi being the most recent and detailed long term study is definitely a step in this direction.

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SAVING DELHI'S BIODIVERSITY: THE ROLE OF NGOs

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INTRODUCTION

It is surprising to many that in the midst of one of the world's most polluted and congested cities, Delhi, there exists an amazing amount of biological diversity. The location of the city, with ecological features such as the river Yamuna, the Aravallis, low-lying water-logged areas, and dry scrub, is itself a major reason for this. While built-up areas have steadily increased at the expense of these natural habitats, there nevertheless remain a number of wild and semi-natural ecosystems which harbour wildlife, to which some predominantly human-made ecosystems have added their own characteristic life-forms.

The survival of significant wildlife habitats is no accident. Partly because of the foresight of some sensitive individuals within Delhi's decision-makers, some of these habitats have been protected. However, equally if not more significant have been the efforts of ordinary citizens and voluntary groups, who have fought hard to keep destructive factors at bay. Given below are the various ways in which NGOs have acted to save Delhi's wildlife.

THE STRUGGLE TO SAVE THE RIDGE

While many examples come to mind of the role of NGOs and citizens in saving Delhi's biodiversity, perhaps the most important is that of the Ridge. It is worthwhile recounting the story of the campaign to save the Ridge, in some detail.

The Delhi Ridge forest is the last outcrop of the Aravalli hills of western India. The tall and often steep hills mellow into low, rounded slopes as they enter the city of Delhi, and run through it from South-west to north-east, almost bifurcating it into two. The hills taper off near river Yamuna, and provide an interesting third dimension to the flatness of Delhi. Spreading over an area of 7,770 hectares, the Ridge vegetation is classified as a Tropical Thorn Forest type. Additionally, the Mughals and British have also done tree planting here. Coincidentally, the central or New Delhi Ridge Forest (one of the four main pockets of the Ridge) looks like a single lung on a map.

With Delhi's rapid growth and development, land sharks began eating into this green lung, shortening the city's lifeline. Encroachments into the Ridge by government and private agencies increased. Valuable scrub and undergrowth were cut and "developed" into manicured parks. And there were more people, buildings, automobile exhaust, noise, and dust.....Delhi was starting to

choke and gently called out it's inability to cope.

Some people, a few school and college students, heard this cry for help. Concerned that very soon there would be precious little to live for, they organised a march through the streets of Delhi in October 1979, urging the government to take measures to protect the Ridge as a natural heritage site. A movement was born, more people joined up. The original bunch of students stuck together and formed a group called Kalpavriksh, after the mythical wish-granting tree of Hindu folklore. The word began to spread - through slide shows, lectures, and walks through the Ridge. Nature clubs began springing up in schools and colleges, and birdwatching became a favourite activity. These young ornithologists started keeping a list of their feathered friends, and soon had over 200 species for the Ridge alone quite something for a teeming urban metropolis!

If we are to live at all in this city, then we need to coexist with the Ridge and its inhabitants, was the rallying call of these young environmentalists. Self-appointed Ridge patrollers would sniff around for any suspicious activity in the area. Anything that seemed threatening was investigated: felling of trees, further expansion of existing encroachments, dumping of garbage. Local government officials were approached relentlessly and action sought. The press was kept abreast of all happenings, and it responded well.

The movement never really went "mainstream" - a symptom that seems to dog many people's movements in India today. To get even one percent of Delhi's nine millions odd people "involved" was impossible. There were frustrating times too, when just not enough volunteers were available or interested in keeping up the pressure. The multiplicity of administration over the Ridge did not help matters either, as one had to spend a lot of effort to find out under whose jurisdiction a problem area came - the Delhi Development Authority (DDA), or the Municipal Corporation of Delhi (MCD), or the New Delhi Municipal Committee (NDMC).

The irritation of having to deal with an insensitive and confusing bureaucracy, and the fact that more people were getting interested in saving Delhi's green areas, led to the publication of a small booklet on the Ridge (Kalpavriksh 1991a). This was widely distributed in schools, colleges, and at various workshops.

All this while, the Ridge quietly went on working alongside - air conditioning in summer, oxygenating, absorbing exhaust, buffering noise, harbouring hundreds of species of flora and fauna, and of course providing a haven to thousands of city worn visitors. Anthony Gaston, a Canadian scientist who had worked on the Ridge nearly two decades ago, reported on a recent visit, that **dhok** (*Anogeissus pendula*) was regenerating well --- a good sign for the health of that part of the Ridge, since **dhok** is an indigenous tree and was earlier being subdued by the introduced **vilayati babul** (*Prosopis juliflora*).

The movement became more systematic with the formation of a Joint NGO Forum to Save the Delhi Ridge --- a coalition of citizens' groups including the World Wide Fund for Nature-India, Srishti, DRAG, the Conservation Society of Delhi, Development Alternatives, Kalpavriksh, and others. Through the efforts of the Forum, things moved a lot faster. Increasing pressure forced the Lt. Governor of Delhi to appoint a committee to a suggest a management strategy for the Ridge. This committee, which included many NGO representatives as its members, recommended several measures for the conservation of the Ridge, starting with clear marking of it's boundary on the ground.

With the government of Delhi moving rather slowly on many of the recommendations of the committee, it was time for citizens to take to the streets once more. In February 1994, the NGO Forum organised a march similar to the one in 1979. Memorandums were presented to the Lt. Governor, the Chief Minister, and the Development Minister of Delhi, urging that all further encroachments into the Ridge be stopped, and a Ridge Management Committee consisting of officials and citizens be appointed.

The rally, and sustained pressure before and after it, had their intended effect. In mid-1994, the government officially accorded Reserve Forest status to the Ridge, giving it greater legal protection. A Forest Settlement Officer was appointed to go into the various encroachments and allotments on the Ridge. Subsequently, a Ridge Management Committee was appointed, with an equal number of official and non-governmental members (though unfortunately it has held only one meeting in two years!). Simultaneously, the NGO Forum found new ways to highlight the issue, including commissioning film clips and persuading Doordarshan to air them. Srishti and DRAG brought out reports and booklets which updated the information provided in the Kalpavriksh one (e.g. Agarwal and Menon 1993).

Then in 1995 the Supreme Court took up a case filed by advocate M.C. Mehta, and ordered that the Ridge be cleared of all encroachments. The NGO Forum had to point out that unfortunately the authorities were following this directive by evicting poor shanty-dwellers, while letting the big encroachers go scot-free! To show that it meant business, the forum sent a notice to the President of India to remove the Delhi Polo Club (under his jurisdiction) from within the Ridge; to his credit, the President immediately responded by ordering its demolition! The Supreme Court also asked that the stick be wielded against all; even while this article is being written (early 1996), the demolition of structures on the Ridge is on. The new NGO Vatavaran has shown that many structures still remain. Hopefully, sustained citizens' alertness will ensure that once free of encroachments, this forest will remain free forever.

OTHER CAMPAIGNS

A major positive spin-off of the Ridge campaign was the inspiration it provided to protect

other green areas. One of the successful cases involved saving a stretch of park and 300 trees in Lajpat Nagar, a residential area in south Delhi, from being destroyed for road widening. Kalpavriksh volunteers mapped the area, studied traffic magnitude, organised a signature campaign amongst the park users and residents, and approached all levels of the local administration. They showed that traffic was not heavy enough to justify the widening, and if it was allowed to increase substantially, there was a bottleneck along the road which could not take heavier traffic loads anyway. The lobbying went on for months, till the park and trees were saved.

Another ongoing crusade is the one against indiscriminate tiling of pavements and road dividers without leaving any breathing space for trees and other vegetation. Indeed, tiling in Delhi has consistently violated the administration's own stipulation that 3 feet by 4 feet of open earth be left around trees. Every square foot meant hard money and the contractors were not going to give that up. Kalpavriksh members took pictures of huge avenue trees along Delhi's prominent roads that were choking to death, of healthy trees with grassy dividers and pavements, and of areas where perfectly good concrete paving was being dug up and tiles put instead. Reporters were contacted and the issue made it to front page headlines. Some quick calculations revealed that the cost of unnecessary tiling was running intó crores of tax-payers' rupees. Kalpavriksh organised some protests in which schoolchildren joined in digging up tiles, freeing the trees they were choking! All this had some effect, as the authorities passed orders restricting the tiling, and began removing tiles on some roads themselves. The campaign carries on, as a lot of past damage has to be undone, and the administration has a tendency to slip into inaction once the pressure is off.

Aware that NGOs alone cannot possibly monitor and save all of Delhi's green areas and trees, Kalpavriksh brought out a citizens' action guide (Singhal 1994). This guide, perhaps the first of its kind for an Indian city, provides a complete who's who, what's what, and how's how of Delhi's administration dealing with green areas, it's urban planning, the law, and action against environmental crimes. It was interesting that even some of the government officers were not aware of many relevant rules and regulations, and were rather grateful that they had been dug out and and put together in this booklet!

Several other NGOs, including those involved in the Joint NGO Forum, have also successfully campaigned to save pockets of greenery in Delhi. Even individual citizens, and residents' associations, have been active; for example, in 1989 residents of West End colony hugged the trees in the legendary "Chipko" fashion, to save them from being cut.

At another level, members of TRAFFIC, WWF-I, and other groups have helped the authorities to detect wildlife trade offences in many parts of Delhi. Often this has been done at personal risk, since the trade involves powerful vested interests who would not hesitate to retaliate with violence.

DOCUMENTING BIODIVERSITY, SPREADING AWARENESS

While public campaigns are the most visible part of NGO work on Delhi's environment, quieter work to document biodiversity and spread awareness about it has been as important. A number of groups and individuals have contributed. Kalpavriksh, for instance, carried on systematic bird counts in some locations for almost a decade in the 1980s. In the process of these counts and innumerable birding trips, its members updated the knowledge regarding Delhi's avifauna which had earlier been built up by ornithologists such as Humayun Abdulali, Usha Ganguli, N.F. Frome, and A.J. Gaston. Concerned that there was no simple publication which could be used by lay persons in this field, it brought out a cheap guide with illustrations of common birds and a complete checklist (Kalpavriksh 1991b). The group has also been conducting monthly bird counts at Sultanpur National Park, just adjacent to Delhi, for nearly a decade; in 1994-5 it also carried out an ecological study. One result is a simple guide to Sultanpur, meant for the thousands of visitors who visit the lake (Kalpavriksh 1996). Earlier it had carried out a similar study at Bhindawas Bird Sanctuary in Haryana, for use in determining proper management of this wetland (Sharma and Rao 1991).

Birds have also been the subject of studies being carried out by groups like Srishti, WWF-I, and others. Srishti has helped to coordinate the annual winter waterfowl census in north India. More recently, these and other NGOs and individuals have joined together to form a Delhi Bird Club (reviving, in a somewhat different way, the former Delhi Birdwatching Association). Individuals like Bikram Grewal and Jamal Urfi are doing consistent bird observations, and currently preparing a checklist of the birds found at Okhla barrage (part of the sanctuary).

Unfortunately, 'lesser' creatures like invertebrates and plants have not been given the same attention by NGOs. Kalpavriksh hopes to partly redress this by bringing out a booklet, for the lay person, on butterflies of Delhi (Smetacek, in press). It also did some research on plants and insects in its work on Sultanpur. Srishti carried detailed lists of some invertebrates and other small fauna in its report on the Ridge, and its members have been involved in some systematic research on such fauna. The vegetation of the Ridge has been documented in some of the NGO publications, and by the Botany Department of Delhi University; significant work has been done by professors like C.R. Babu and H.Y. Mohan Ram. However, much more effort at studying and creating awareness of smaller animals and of plants needs to be done by NGOs.

Spreading awareness through means other than publications has also been a major activity for many NGOs. The Nature Clubs of India network of WWF-I, Srishti, Kalpavriksh, KARE, and other groups have regularly interacted with students and other sectors of the society; one of the most effective activities has been to take kids out on nature hikes through the Ridge or along the Yamuna, to observe and enjoy wildlife.

To help more and more people, especially students, to get involved, Kalpavriksh published a detailed directory of NGOs, government agencies, libraries, and nature clubs active in Delhi, providing information on what they do, and how citizens could be involved with them (Rahul and Rao 1995).

CONCLUSION

By all visible standards, Delhi is dying. But the fight for the Ridge and other green areas, has shown that a handful of committed citizens can even reverse what seems an inexorable process of destruction. It has now become much more difficult for the administration or private parties to destroy green areas and wetlands.

Even if it is a tiny microcosm of India, the campaigns in Delhi symbolise a growing and increasingly successful struggle to retain environmental sanity in the face of forces which are otherwise bent on pushing our country towards collective suicide. At the 1994 rally to save the Delhi Ridge, one of the schoolkids sported a badge with a statement made by Margaret Mead: "Never doubt that a small group of thoughtful committed citizens can change the world: indeed it's the only thing that ever has." That is the inspiration with which citizens of Delhi continue to act and hope.

REFERENCES

Agarwal, Ravi and Menon, Vivek, 1993. *The Delhi Ridge: Issues and Perspectives*. A Srishti Discussion Paper. Srishti, New Delhi.

Kalpavriksh, 1991a. *The Delhi Ridge Forest: Decline and Conservation*. New Delhi.

Kalpavriksh, 1991b. *What's That Bird: A Guide to Birdwatching, with Special Reference to Delhi*. New Delhi.

Kalpavriksh, 1996. *Small and Beautiful: The Sultanpur National Park*. New Delhi.

Rahul, Rajesh and Rao, Sunita, 1995. *The Little Green Book: A Directory of Environmental Opportunities, with Special Reference to Delhi*. 2nd Edition. New Delhi.

Sharma, Suresh and Rao, Sunita, 1991. *Baseline Survey of Bhindawas Bird Sanctuary, Haryana, India*. Kalpavriksh, New Delhi. Unpublished report prepared for World Wide Fund for Nature - India.

Singhal, G. 1994. *Saving Delhi's Green Areas: A Citizens' Action Guide.* Kalpavriksh, New Delhi.

Smetacek, Peter (In press) *Butterflies of Delhi.* Kalpavriksh, New Delhi.

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ANNEX: SOME NGOS ACTIVE ON DELHI'S ENVIRONMENT

Conservation Society of Delhi (CSD), N-7/C, Saket, New Delhi 110017. Contact: Madhu Bajpai.

Delhi Bird Club, 101/4 Kaushalya Park, Hauz Khas, New Delhi 110016. Contact: Bikram Grewal.

Development Alternatives (DA), B 32 Institutional Area, N Mehrauli Road, Hauz Khas, New Delhi 110016. Contact: George Varghese.

Development Reaserch Action Group (DRAG), 75 Paschimi Marg, Vasant Vihar, New Delhi 110057. Contact: Gautam Vohra, Anu Gupta.

Friendecos-SECA, 27/273 under Defence Colony Flyover, New Delhi 110024. Contact: Gita Seshamani.

Indian National Trust for Art and Cultural Heritage (INTACH), Delhi branch, Bharatiyam Complex, Nizamuddin, New Delhi 110013. Contact: O.P. Jain.

Kalpavriksh (KV), C17/A Munirka, New Delhi 110067 (This is a mailing address only, and no office exists at this place). Contact: Hemanshu Kumar.

Kindness to Animals and Respect for the Environment (KARE), M-39 Main Market, Greater Kailash I, New Delhi 110048. Contact: Camellia Satija, Anuradha Modi.

Srishti MB 11 Antriksh Bhawan, Kasturba Gandhi Marg, New Delhi 110001. Contact: Ravi Agarwal, Bharati Chaturvedi.

Vatavaran, 540 Hawa Singh Marg, Asiad Games Village, New Delhi 110049. Contact: Iqbal Malik.

World Wide Fund for Nature-India (WWF-I), Headquarters, 172 B Lodi Estate, New Delhi 110003. Contact: Avenash Dutta.

World Wide Fund for Nature-India (WWF-I), Delhi-Haryana office, Deepak Building, 3rd Floor, Flat No. 32, Nehru Place, New Delhi. Contact: Akhil Chandra.

Note: There are upwards of 50 environmental NGOs located in Delhi; however, many of them do not work on issues related to Delhi. For a full list and details of their activities, pl. see *The Little Green Book: A Directory of Environmental Opportunities, with Special Reference to Delhi*, by Rajesh Rahul and Sunita Rao, Kalpavriksh, 1995 (2nd edition). .op

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THREATENED FAUNA OF DELHI

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Zoological Survey of India, Dehra Dun 248 195

Conservation Status :

Species	Listed in : Red Data Book ZSI (1994)	IUCN (1993)	W(P) Act (1972)	CITES	Current status
A. Mammalia					
1. *Manis crassicaudata* Gray **Indian Pangolin**	Vu		Sch. I	App. II	uncertain
2. *Canis lupus* Linnaeus **Indian Wolf**	Vu		Sch. I	App. I	not sighted since 1940
3. *Felis bengalensis* Kerr **Leopard Cat**	Vu		Sch. I	App. I	+
4. *Panthera pardus* (Linnaeus) **Panther or Leopard**	Vu		Sch. I	App. I	not sighted since 1940
5. *Antilope cervicapra* (Linnaeus) **Blackbuck**	Vu		Sch. I	App. III	not sighted since 1940
6. *Gazella bennettii* (Pallas) **Chinkara**	Vu		Sch. I		not sighted since 1940
B. Aves					
7. *Pelecanus philippensis philippensis* (Gmelin) **Spottedbilled or Grey Pelican**		I			+
8. *Pelecanus philippensis crispus* Bruch **Dalmatian Pelican**	Vu				+
9. *Ardea insignis* Hume **Great Whitebellied Heron**	Ra		Sch. IV	App. I	+
10 *Leptoptilos dubius* (Gmelin) **Adjutant Stork**	En	En			+

Species	Listed in : Red Data Book ZSI (1994)	IUCN (1993)	W(P) Act (1972)	CITES	Current status
11. *L. javanicus* (Horsfield) **Lesser or Haircrested Adjutant**	En	Vu			+
12. *Platalea leucorodia major* Temminck & Schlegel **Spoonbill**	En		Sch.I		+
13. *Pandion haliaetus haliaetus* Linnaeus **Osprey**	Vu		Sch.I	App. II	+
14. *Falco biarmicus cherrug* J.E. Gray **Saker or Cherrug Falcon**	En		Sch.I	App.II	not sighted since 1948
15. *F. biarmicus jugger* J.E. Gray **Laggar Falcon**	En		Sch. I	App. II	+
16. *F. peregrinus* Tunstall **Peregrine Falcon**	En		Sch.I	App. I	+
17. *Pavo cristatus* Linnaeus **Indian Peafowl (National Bird)**	Vu		Sch.I	App. I	+
18. *Grus leucogeranus* Pallas **Siberian or Great White Crane**	En	Ra	Sch.I	App. I	not sighted since 1910
19. *Choriotis nigriceps* (Vigors) **Great Indian Bustard**	En		Sch.I	App.I	not sighted since last century
20. *Chlamydotis undulata macqueenii* (J.E. Gray) **Houbara Bustard**	En	Vu	Sch.I	App.I	
21. *Rynchops albicollis* Swainson **Indian Skimmer or Scissorbill**	En		Sch.I		possibly disappeared
22. *Anthracoceros malabaricus malabaricus* (Gmelin) **Indian Pied Horbill**	Vu		Sch.I		+

Species	Listed in : Red Data Book ZSI (1994)	IUCN (1993)	W(P) Act (1972)	CITES	Current status
C. Reptilia					
23. *Crocodylus palustris* (Lesson) **Snubnosed or Marsh Crocodile**	En	Vu	Sch.I	App.I	+
24. *Gavialis gangeticus* (Gmelin) **Long snouted Crocodile**	En	En	Sch. I	App.I	+
25. *Aspideretes gangeticus* (Cuvier) **Softshell or Box Turtle**	Vu		Sch.I	App.I	+
26. *Lissemys punctatus punctatus* (Bonnaterre) **Pond Turtle**	Vu		Sch.I	App.I	+
27. *Uromastix hardwickii* Gray **Spiny Tailed Lizard**				App. II	+
28. *Varanus monitor* (Linnaeus) **Common Monitor**	En		Sch. I	App. I	+
29. *Eryx johnii* (Russell) **John's Sand Boa**				App.II	+
30. *Python molurus molurus* (Linnaeus) **Indian Python**	En	Vu	Sch.I	App. I	+
31. *Ptyas mucosus* (Linnaeus) **Rat Snake**				App.II	+
32. *Xenochrophis piscator* (Schnneider) **Cheekered Keelback**				App. III	+
33. *Naja naja* (Linnaeus) **Common Cobra**				App. II	+
34. *Vipera russelli* (Shaw) **Russell's Viper**				App. III	+

Species	Listed in : Red Data Book				
	ZSI (1994)	IUCN (1993)	W(P) Act (1972)	CITES	Current status
D. Ambhibia					
35. *Rana tigerina* Daudin				App.II	+
E. Insecta					
Lepidoptera					
36. *Chilasa clytia* Linn.			Sch. I (Pt.iv)		+
37. *Cepora nerissa* Fabr.			Sch. II (Pt. ii)		+
38. *Euchrysops cnejus* Fabricius			Sch.II (Pt.ii)		+

Abbreviations used :

Ra	=	Rare
I	=	Indeterminate
En	=	Endangered
Vu	=	Vulnerable
Sch.	=	Schedule
App.	=	Appendix
W(P) Act	=	Wildlife (Protection) Act 1972
CITES	=	Convention on International Trade in Endangered Species
+	=	Reported in last 50 years.

REFERENCES

1990. *The Indian Wildlife (Protection) Act, 1972 (revised ed.)*. Natraj Publishers, Dehradun.

1993. *IUCN Red List of Threatened Animals*. IUCN, Gland, Switzerland, and Cambridge, U.K.

1994. *The Red Data Book on Indian Animals. Pt. I : Vertebrata (Mammalia, Aves, Reptilia and Amphibia)*. Zool. Surv. India, Calcutta.

Published in Commemoration of the 50th Anniversary of India's Independence
Zool. Surv. India
State Fauna Series 6: Fauna of Delhi, 891-903, 1997

FAUNAL ANALYSIS (BASED ON AVAILABLE DATA)

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INTRODUCTION

It is seen from the following tables that Delhi is well represented by most groups of fauna from the unicellular Protozoa to the highest group of Mammalia.

On a general analysis it is observed that all the groups are not equally represented. The largest group is Aves with a maximum of 434 species. However, if all the orders of insects represented are grouped together under Insecta then the total number of insect species amounts to 872. Interestingly some groups like Porifera, Coelenterata, Crustacea and Diplopoda recorded only 1 to 3 species each. Even known insects, orders like Thysanura, Mantodea and Dermaptera have 1 to 3 species. Three insect order only recorded more than 400 species namely Hymenoptera (178 spp), Hemiptera (152 spp) and Lepidoptera (101 spp). Acari, comprising of Plant Mites, Soil Mites and House Dust Mites formed a considerable number with 145 spp.

Among the vertebrates, as mentioned earlier, birds formed the largest group, followed by the fish, mammalia and reptilia. The amphibians accounted for only 7 species. Among the fishes, of a total of 87 species spread over 24 families it has been seen that except for Cyprinidae, which has 33 species, all other families recorded only 1 to 5 species. Amphibia has only 3 family and Ranidae is the only family with 4 species while the other two have only 1 to 2 species. Similarly, Reptilia which is represented by eleven families all have just 1 or 2 species except the family Colubridae which recorded 7 species. Of the 434 species under Aves, the group Passeriformes has more than 50% of the total recorded species, itself recording 287 species. Mammalia is represented by 17 families and as seen in other except family Muridae which recorded 10 species, the other are represented by only one species and three families by 2-3 species each.

As was expected of the faunal biodiversity of any region, Delhi fauna also revealed values in that the vertebrates were nearly half of that of the invertebrate fauna.

Interestingly enough, it is observed that of the recorded Delhi fauna there are 24 species belonging to Schedule I of the Wild Life (Protection) Act, 1972 and 15 species of these also feature under Appendix I of CITES. All these belong to vertebrates except one which is an invertebrate (Lepidoptera).

A further analysis revealed that among the vertebrates 6 species were Mammals, 11 species of birds and 6 species of reptiles belonging to Schedule-II. This in itself is sufficient to be more conscious of Delhi environment and conserve the bio-diversity wealth of Delhi.

* Zoological Survey of India, Dehra Dun -248 195

Invertebrata

Table - 1

Group	Genera	Species
Protozoa	**32**	**44**
Phytomastigophora	2	2
Rhizopoda	4	4
Heliozoa	1	1
Kinetofragminophorea	6	6
Oligohymenophora	4	6
Polyhymenophora	4	4
Zoomastigophora	4	7
Lobosea	1	2
Sporozoea	5	11
Polyhymenophorea	1	1

Table - 2

Group	Genera	Species
Porifera	**1**	**1**

Table - 3

Group	Genera	Species
Coelenterata	**1**	**2**

Table - 4

Group	Genera	Species
Helminthes	**17**	**20**

Table - 5

Group	Genera	Species
Nematoda	**32**	**57**
Tylenchida	20	39
Aphelenchida	02	05
Dorylaimida	09	12
Triplonchida	01	01

Table - 6

Group	Genera	Species
Mollusca	**17**	**23**
Mesogastropoda	04	06
Basommatophora	05	07
Uninoida	02	03
Veneroidea	01	01
Stylommatophora	04	05
Soleolifera	01	01

Table -7

Group	Genera	Species
Annelida	**08**	**09**
Lumberiidae	01	01
Megascolecidae	04	05
Octochaetidae	01	01
Glossiphonidae	01	01
Hirudidae	01	01

Table - 8

Group	Genera	Species
Crustacea	**02**	**03**
Palaemonidae	01	02
Potamonidae	01	01

Table - 9

Group	Genera	Species
Thysanura	**01**	**01**

Table - 10

Group	Genera	Species
Odonata	**31**	**47**
Coenagriidae	09	15
Gomphidae	03	03
Aeshnidae	02	03
Libellulidae	17	26

Table - 11

Group	Genera	Species
Orthoptera	**63**	**99**
Pyrgomorphidae	04	04
Acrididae	41	70
Tetrigidae	02	03
Tettigonidae	01	02
Gryllidae	12	16
Trigonidae	01	02
Eniopteridae	01	01
Grylotalpidae	01	01

Table - 12

Group	Genera	Species
Blattariae	**05**	**06**
Blattidae	01	01
Blattellidae	02	03
Pycnoscelidae	01	01
Ectobiidae	01	01
Mantodea	**03**	**03**
Mantidae	03	03

Table - 13

Group	Genera	Species
Dermaptera	**04**	**04**
Pygidicranidae	01	01
Anisolabididae	01	01
Labiduridae	02	02

Table - 14

Group	Genera	Species
Isoptera	**08**	**14**
Kalotermitidae	01	01
Rhinotermitidae	01	01
Termitidae	06	12

Table - 15

Group	Genera	Species
Hemiptera	**62**	**100**
Aphididae	13	24
Cicadellidae	22	44
Dictyophoridae	02	03
Membracidae	03	03
Psyllidae	05	06
Coreidae	05	05
Lygaeidae	04	04
Pyrrhocoridae	01	01
Pentatomidae	02	02
Dinidoridae	02	02
Reduviidae	03	06
Hemiptera : Water Bugs	**12**	**21**
Corixidae	03	04
Nepidae	03	06
Belostomatidae	02	04
Pleidae	01	01
Notonectidae	01	03
Veliidae	01	01
Gerridae	01	02

Hemiptera : Coccoidea	**15**	**18**
Monophlebidae	02	02
Tachardiidae	01	01
Dactylopiidae	01	01
Pseudococcidae	05	05
Coccidae	01	02
Diaspididae	05	07
Homoptera	**06**	**13**

Table - 16

Group	Genera	Species
Thysanoptera	**67**	**91**
Acolothripidae	02	02
Thripidae	47	69
Urothripidae	01	01
Allothripidae	01	01
Phlaeothripidae	16	18

Table - 17

Group	Genera	Species
Coleoptera	**63**	**97**
Carabidae	04	06
Paussidae	01	01
Dytiscidae	09	12
Gyrinidae	02	02
Hydrophillidae	05	07
Histeridae	02	02
Staphylinidae	07	08
Scarabaeidae	10	12
Buprestidae	01	01
Elateridae	03	03
Coccinellidae	06	07
Meloidae	06	10
Crysomelidae	05	06
Curculionidae	01	19
Leptoceridae	01	01

Table - 18

Group	Genera	Species
Diptera	**39**	**79**
Tipulidae	01	01
Culicidae	04	22
Stratiomyidae	02	02
Asilidae	03	04
Syrphidae	08	16
Tephritidae	01	01
Otitidae	01	01
Sciomyzidae	01	02
Sepsidae	01	01
Chamaemyiidae	01	01
Agromyzidae	04	10
Muscidae	03	03
Calliphoridae	01	01
Sarcophagidae	03	09
Tachinidae	01	01
Gasterophilidae	01	01
Tendipedidae	01	01
Heleidae	01	01
Tabanidae	01	01

Table - 19

Group	Genera	Species
Lepidoptera	**71**	**101**
Papilionidae	04	05
Pieridae	11	21
Danaidae	03	04
Nymphalidae	09	15
Hesperiidae	12	16
Riodinidae	01	01
Acraeidae	01	01
Lycaenidae	15	23
Satyridae	04	04
Sphingidae	01	01
Zygaenidae	01	01
Lymentriidae	01	01
Arctiidae	01	01
Noctuidae	04	04
Geometridae	02	02
Pyralidae	01	01

Table - 20

Group	Genera	Species
Hymenoptera : Aculeata	**35**	**62**
Dryinidae	01	01
Bethylidae	04	06
Chrysididae	02	05
Tiphidae	03	04
Scoliidae	03	08
Mutillidae	01	01
Formicidae	01	01
Pompilidae	02	02
Eumenidae	02	04
Vespidae	05	13
Sphecidae	11	17
Apidae	01	01
Hymenoptera : Formicidae	**08**	**19**
Hymenoptera : Icneumonidae	**14**	**24**
Hymenoptera : Chalcidoidea	**42**	**73**
Chalcididae	21	43
Pteromelidae	18	24
Encyrtidae	03	06

Table - 21

Group	Genera	Species
Diplopoda	**03**	**04**
Sphaerotheriidae	01	01
Spirobolidae	01	01
Harpagphoridae	02	02

Table - 22

Group	Genera	Species
Chilopoda	**06**	**11**
Cryptopidae	01	01
Scolopendridae	05	10

Table - 23

Group	Genera	Species
Arachnida : Araneae	**08**	**11**
Pholcidae	01	01
Salticidae	01	01
Gnaphosidae	01	01
Lycosidae	01	03
Tetragnathidae	01	01
Araneidae	03	04
Acari : Plant mites	**46**	**113**
Tetramychidae	07	33
Tenuipalpidae	04	17
Eriophyidae	10	23
Rhyncaphytoptidae	01	01
Cheyletidae	02	03
Stigmaeidae	01	01
Tydeidae	01	02
Raphignathidae	01	01
Bdellidae	01	01
Cunaxiade	01	01
Erythraeidae	06	09
Ascidae	03	03
Phytoseidae	03	13
Acaridae	03	03
Otopheidomenidae	01	01
Tuckerallidae	01	01
Acari : Soil Mites	**01**	**02**
Macrochalidae	01	02
Acari : House dust mites	**13**	**16**
Pyroglyphidae	01	02
Glycyphagidae	02	03
Acaridae	02	02
Chartoglyptidae	01	01
Hypochthoniidae	01	01
Cheyletidae	01	02
Tetranychidae	01	01
Cunaxidae	01	01
Ameroseiidae	01	01
Dermanyssidae	01	01
Ascidae	01	01
Acari : Ixodidae	**06**	**14**
Ixididae	06	14

Vertebrata

Table - 24

Group	Genera	Species
Pisces	**56**	**87**
Notopteridae	01	02
Clupeidae	02	01
Engraulidae	01	01
Cyprinidae	17	33
Psilorhynchidae	01	01
Balitoridae	01	03
Cobitidae	02	02
Bagridae	03	06
Siluridae	02	02
Schilbeidae	04	05
Sisoridae	05	07
Clariidae	01	01
Heteropneustidae	01	01
Belonidae	01	01
Poeciliidae	01	01
Synbranchidae	01	01
Centropomidae	02	03
Nandidae	02	02
Cichlidae	01	01
Mugilidae	02	02
gobiidae	01	01
Belontiidae	01	02
Channidae	01	04
Mastacembelidae	02	03

Table - 25

Group	Genera	Species
Amphibia	**04**	**07**
Bufonidae	01	02
Microhylidae	01	01
Ranidae	02	04

Table - 26

Group	Genera	Species
Reptilia	**24**	**25**
Crocodylidae	02	02
Trionychidae	02	02
Agamidae	03	03
Gekkonidae	01	02
Scincidae	02	02
Varanidae	01	01
Boidae	02	02
Colubridae	07	07
Elapidae	02	02
Typhlopidae	01	01
Viperidae	01	01

Table - 27

Group	Genera	Species
Aves	**205**	**434**
Pedicipediformes	01	002
Pelecaniformes	03	007
Ciconiiformes	17	027
Anseriformes	13	028
Falconiformes	21	041
Galliformes	04	008
Gruiformes	12	018
Charadriiformes	28	060
Columbiformes	04	010
Psittaciformes	01	003
Cuculiformes	06	009
Strigiformes	06	009
Caprimulgiformes	01	005
Apodiformes	02	003
Coraciiformes	08	014
Piciformes	04	005
Passeriformes	74	287

Table - 28

Group	Genera	Species
Mammalia	**26**	**32**
Erinaceidae	01	01
Soricidae	01	01
Pteropidae	01	01
Megadermatidae	01	01
Rhinopomatidae	01	01
Vespertilonidae	01	01
Cercopithecidae	02	02
Manidae	01	01
Canidae	02	02
Viverridae	02	03
Felidae	01	01
Suidae	01	01
Bovidae	01	01
Leporidae	01	01
Sciuridae	01	01
Hystricidae	01	01
Muridae	07	10

Table-29. Consolidated summary of the fauna of Delhi (Computed on the basis of table 1-28).

GROUP	SPECIES
I. **INVERTEBRATA**	
PROTOZOA	44
PORIFERA	01
COELENTERATA	02
HELMINTHES	20
NEMATODA	57
MOLLUSCA	23
ANNELIDA	09
CRUSTACEA	03
INSECTA	
Thysanura	01
Odonata	47
Orthoptera	99
Blattariae & Mantodea	09
Dermaptera	04
Isoptera	14
Hemiptera	152
Thysanoptera	91
Coleoptera	97
Diptera	79
Lepidoptera	101
Hymenoptera	178
DIPLOPODA	04
CHILOPODA	11
ARANEA	11
ACARI	145
Total	**1202**
II. **VERTEBRATA**	
PISCES	87
AMPHIBIA	7
REPTILIA	25
AVES	434
MAMMALIA	32
Total	**585**
III. **Grand Total (I + II)**	**1787**

ERRATA

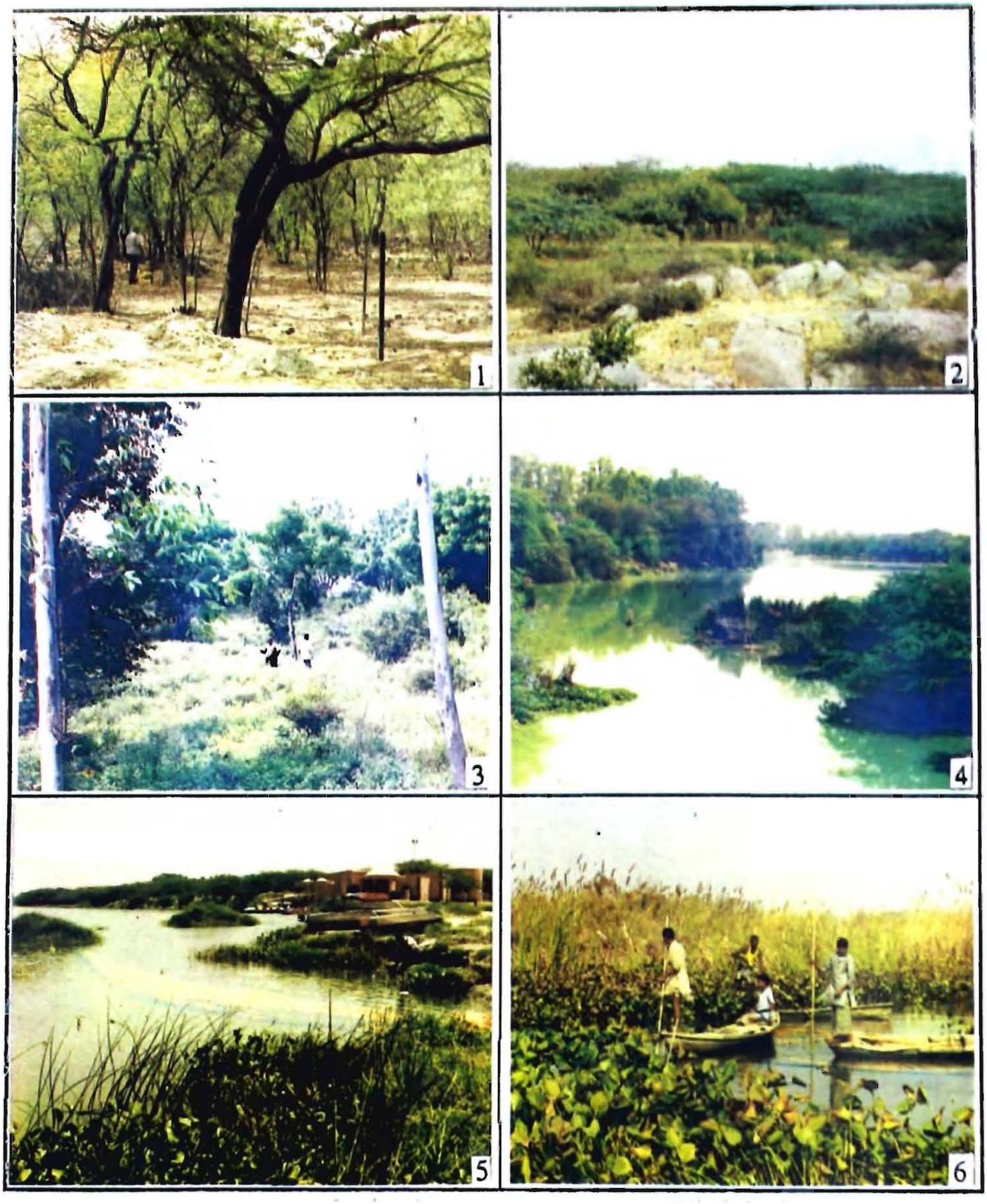
Page	Line from top	to read
110	3	6. *tuberculata*
110	5	LYMNAEIDAE
110	6	Lamarck
110	8	7. *acuminata*
110	9	*chlamys*
110	29	UNIONOIDA
111	2	s.str.
111	9	*striatella*
112	7	shell
112	12	whorls
112	16	Lymnaeidae
112	18	striated
112	19	interior nacreous
112	22	striations
113	3	without
113	8 & 34	Handbook:
113	15	v
113	17 & 18	ix
115	6	party
115	15	4. *Digoniostoma*
115	23	Throughout
115	28	Handbook:... *Molluscs*
117	3	*acuminata*
117	22	*L. acuminata*
117	24	*chlamys*
117	25 & 34	1989... Handbook:
118	5	*Distribution*: India: common throughout. *Elsewhere*: Myanmar.
118	10	Delhi; total no. of examples 53:
122	28	oblong
122	32	Bangladesh
123	1	nacreous
123	8	not
123	17	inequilateral
124	4	Bangladesh
124	21	muscle
124	30	spire
127	1	thin
128	23	amphibious
129	4	including
129	27	Subba Rao, N.V. and Dey, A.
135	18	1. *Eisenia foetida*

Page	Line from top	to read
135	20	*Allolobophöra*
135	22	*Allolobophora (Eisenia) foetida*
135	25	*Distribution*
135	27	widely
136	24	*Fauna*
137	4	*Fauna*
137	15	*Fauna British India, Oligochaeta:356.*
137	20	This pregrine species
138	3	RHYNCHOBDELLAE
138	13	ARHYNCHOBDELLAE
138	14	HIRUDIDAE
138	31	80: 265-290.
150	19	September.
150	31	species is multivoltine
151	27	*Remarks*
153	20	25.x.93
154	24	coll. J.P. Sati & party.
154	30	Myanmar
156	21	sitting
159	18	Ltd.
174	13	*Atractomorpha*
179	21 & 22	Stal
179	31	Arunachal Pradesh
180	20	TROPIDOPOLINAE
180	21	without asterisk
180	23	*Revue*
181	8	whitish
181	14 & 16	*Eyprepocnemis*
181	26 & 28	*Choroedocus*
182	27	without asterisk
185	8 & 9	(Stal)
189	13	big... globular
190	1	*Trigonidium*
191	29	crickets
195	15	(Stal)
196	1	EYPREPOCNEMIDINAE
196	2	*Eyprepocnemis*
196	3	*Choroedocus*
198	2 & 15	cockroach
198	15	prefers
201	5	Tamil Nadu
261	14	Belostomatidae
262	6	*Cercotmetus*
263	7	no distinct
263	26,29 & 32	hemelytra

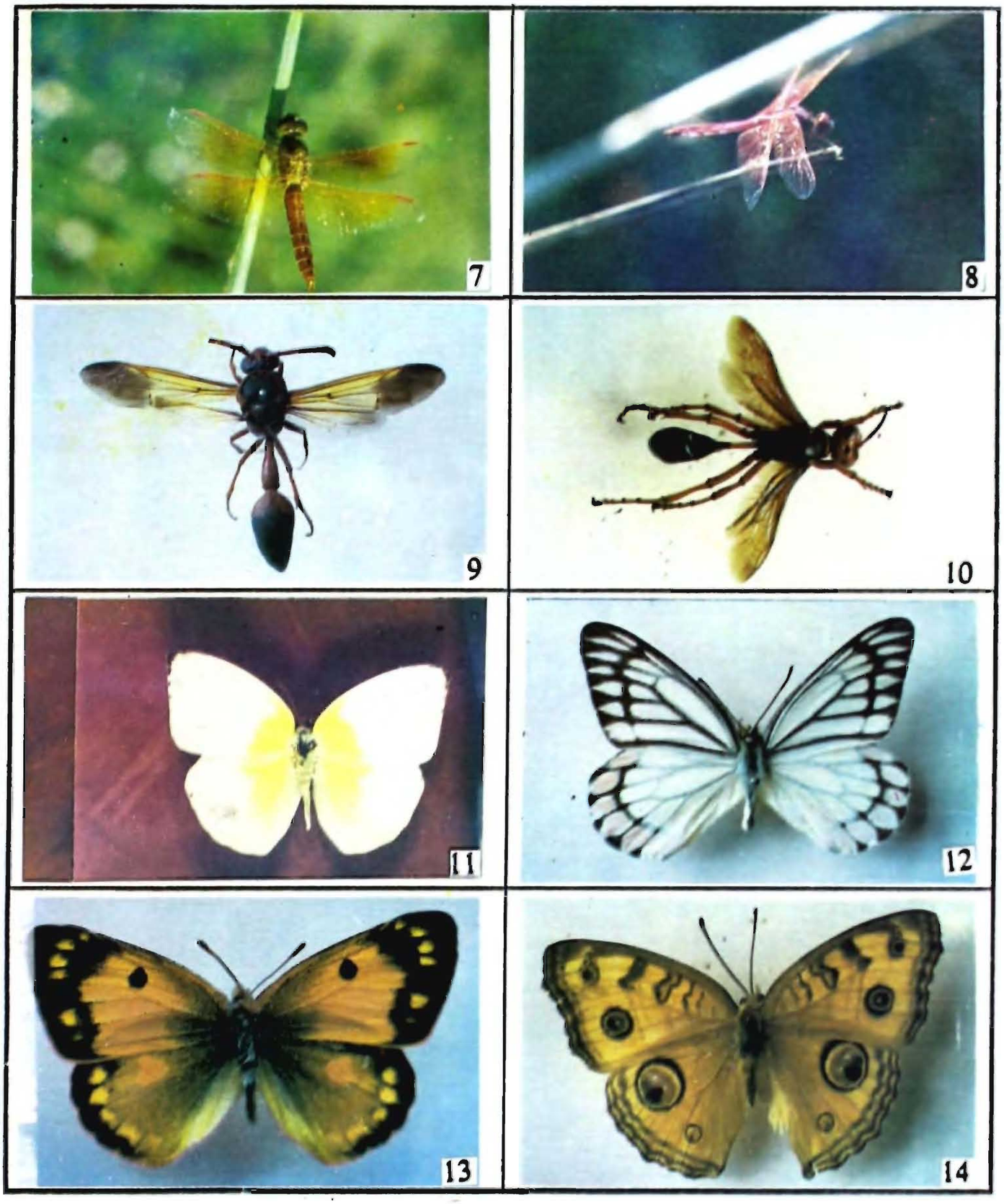
Page	Line from top	to read
264	3	opening
267	7	1992. *Proc. zool. Soc.*, Calcutta, **45** (suppl.): 325.
271	23	*metiadusa*
410	3	*Precis lintingensis lintingensis*,
410	20	Sri Lanka; Pakistan.
410	21	3. *Junonia almana almana* (Linnaeus)
410	35	December... displays
411	2	starts
411	9	excluding Car Nicobar Islands.
411	29	Sri Lanka; Pakistan.
412	14	India: throughout.
413	1	7. *Hypolimnas misippus* (Linnaeus)
413	21	8. *Ariadne merione* (Cramer)
413	20	Myanmar; Pakistan.
414	1	like *Byblia* spp.
552	3	*Parluciosoma*
552	4	*bleekeri*
553	11	capsule... rigid
553	18	long (85-141
553	29	*notopterus*
555	5	lentic
557	26	tremendous
560	23	length
561	17	length
561	20	washed down
561	24	*cirrhosus*
562	6	*Gazetteer*
567	19	length
567	28	Gazetteer
567	30	Anonymous
572	31	length
578	1	Common Razor-belly Minnow
581	14	344,
587	30	slightly... insertion
588	17	Anterior
589	8	*Nemacheilus*
589	21	Lateral
593	35	*Mystus*
596	8	painful
603	21	damage
605	23	*Gagata*
606	3	upper
608	35	occipital

Page	Line from top	to read
611	23	length
611	33	*fossilis*
612	15	South
614	28	isthmus
617	36	edentate
618	26	edentate
621	12	apparent
623	7	extending
623	19	eyes
623	21	entirely or nearly.... their
624	24	pseudobranchiae
627	1	upper
629	1	fin
629	20	(1,70...juveniles, River
634	23	commercial
635	4	Mackerel
654	20	Diagnostic
656	29	dilated
657	10	rudimentary
659	16	submerges
665	35	Asola-Bhatti Wildlife Sanctuary
667	3	juxtaposed
667	24	extending
670	2	plastron
670	26	entoplastron
675	10 & 11	past.
675	12/13	(insert) i Schedule II, Wildlife (Protection) Act, 1972, ii
676	26	under stones
677	10	length from snout to vent.
683	13	night. Feeds
683	15	Female
683	25	quadrate
683	32	distinct
690	8	*Gazetteer*
690	34	respiratory
691	18	Anonymous Zoological Park...
691	36	food
693	14	Mexico
693	22	developed
827	27	8. *Semnopithecus entellus* (Dufresne)
838	12	9. *Semnopithecus entellus*

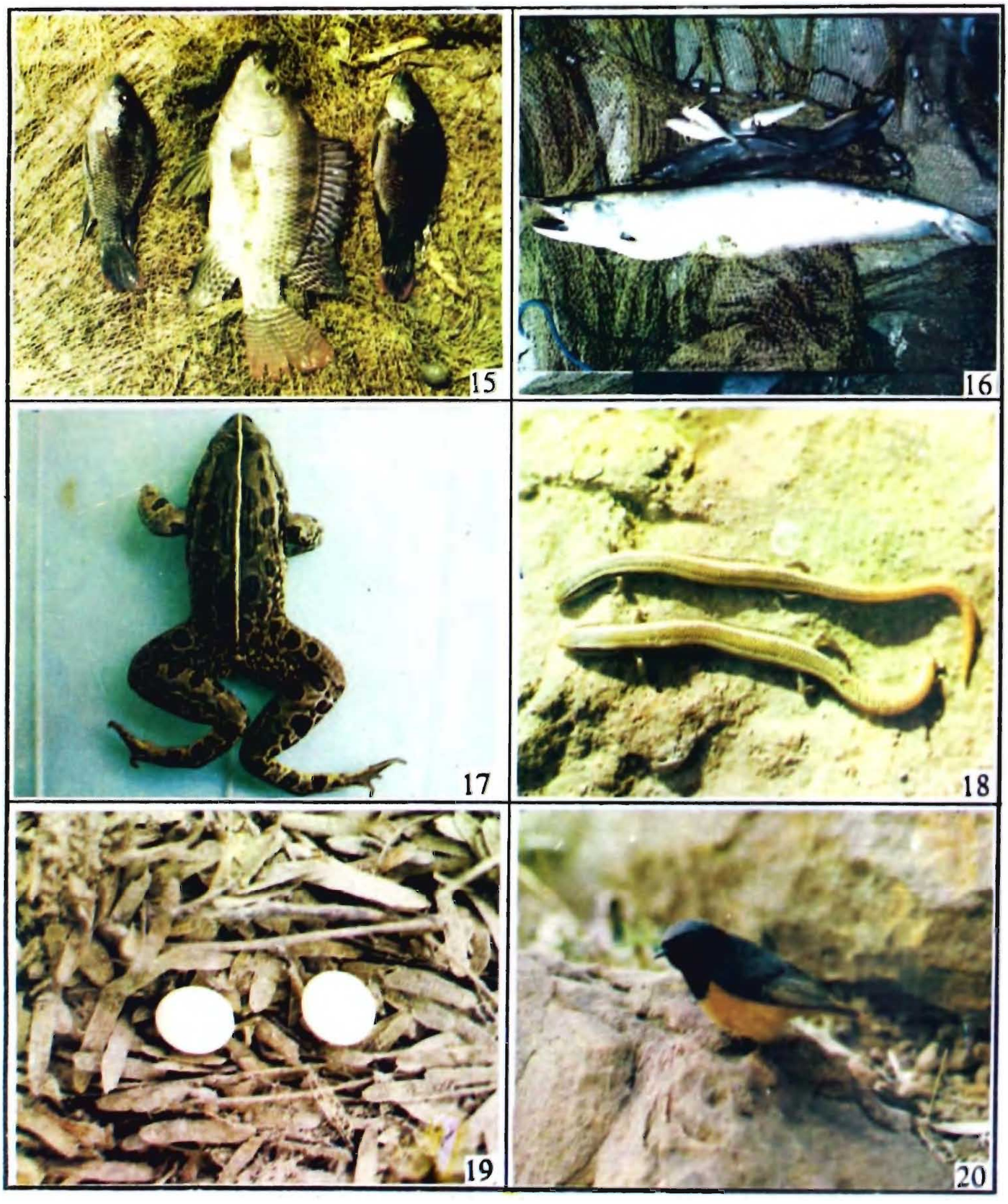
MGIPRRND—2552 ZSI/96—425 copies.



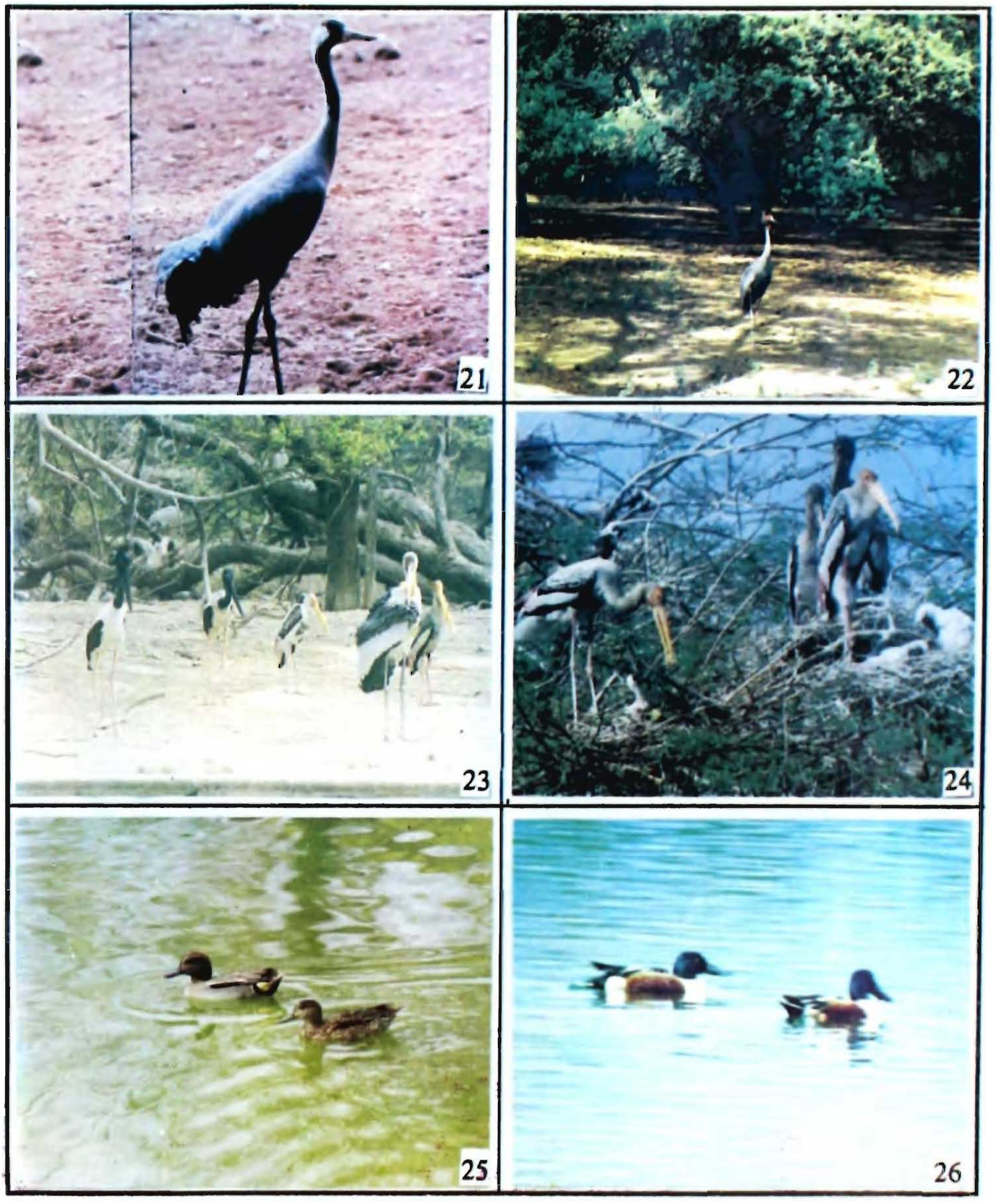
1 Lake-park, Dhaulakuan. 2 *Prosopis juliflora* forest in Asola-Bhatti WLS. 3 Tuglaqabad Garden. 4 Najafgarh drain near Chhawala bridge. 5 Horse-shoe Lake, Bhalswa. 6 Water hycinth and reedy bank, Ramghat.



7 *Brachythemis contaminata* (Fab.). 8 *Trithemis aurora aurora* (Burm.). 9 Eumenid Wasp, *Eumenes dimidiatipennis* Saussure. 10 Sphecid Wasp, *Parapsammophila erythrocephalus* (Fabricius). 11 *Catopsilia pomona* (Fab.). 12 *Delias eucharis* (Drury). 13 *Colias fieldi* Menestries. 14 *Precis almana* (Linn.).



15 Tilapia, *Oreochromis mossambica* (Peters). 16 "Freshwater Shark", *Wallago attu* (Schneider); Stinging Catfish, *Heteropneustes fossilis* (Bloch); Day's Mystus, *Mystus bleekeri* (Day). 17 Bull Frog, *Rana tigerina* Daudin. 18 Striped Skink, *Riopa punctata* Gray. 19 Eggs of *Hemidactylus brooki* Gray, Spotted Brook's Gecko. 20 Black Redstart, *Phoenicurus ochruros phoenicuroides* (Moore).



21 Common Crane *Grus grus lilfordi* Sharpe. 22 Indian Sarus Crane, *Grus antigone antigone* (Linnaeus). 23 Blacknecked Stork, *Ephippiorhynchus asiaticus asiaticus* (Latham); and Adjutant Stork, *Leptoptilos dubius* (Gmelin). 24 Painted stork, *Mycteria leucocephala* (Pennant). 25 Common Teal, *Anas crecca crecca* Linnaeus. 26 Shoveller, *A. clypeata* Linnaeus.

27 Coot, *Fulica atra atra* Linnaeus. 28 Indian Blue Rock Pigeon, *Columba livia intermedia* Strickland. 29 Bengal Green Pigeon, *Treron phoenicoptera phoenicoptera* (Latham). 30 Nilgai or Blue Bull, *Boselaphus tragocamelus* (Pallas). 31 Fivestriped Palm Squirrel, *Funambulus pennanti* Wroughton. 32 Rhesus Macaque, *Macaca mulatta* (Zimmermann).