Conservation Area Series 19

FAUNA OF DESERT NATIONAL PARK RAJASTHAN

(Proposed Biosphere Reserve)

ZOOLOGICAL SURVEY OF INDIA

Conservation Area Series No. **19**

FAUNA OF DESERT NATIONAL PARK RAJASTHAN

(Proposed Biosphere Reserve)

Edited by the Director, Zoological Survey of India, Kolkata

Zoological Survey of India
Kolkata

CITATION

Editor—Director. 2004. *Conservation Area Series, No.* **19** : 1-135 (5 Plates) (Published by the Director, *Zool. Surv. India*, Kolkata)

Published – August, 2004

ISBN 81-8171-049-5

Project Coordinator

DR. N. S. RATHORE

Scientist-E

Desert Regional Station,

Zoological Survey of India, Jodhpur

PRICE

India : Rs. 350.00

Foreign : $ 20.00; £ 15.00

Published at the Publication Division by the Director, Zoological Survey of India, 234/4, A J C Bose Road, 2nd MSO Building, (13th Floor), Nizam Palace, Kolkata-700 020 and printed at East India Photo Composing Centre, Kolkata-700 006.

Fauna of Desert National Park
Conservation Area Series

No. 19 **2004** **Pages 1–135**

CONTENTS

Zool. Surv. India
Conservations Area Series **19**, *Fauna of Desert National Park*, : 1-32, 2004

DESERT NATIONAL PARK — AN OVERVIEW

N. S. RATHORE
Desert Regional Station, Zoological Survey of India, Jodhpur, India

INTRODUCTION

Biosphere Reserve Programme is an extended activity of conservation of representative ecosystem in the form of National Park or nature reserve. It emphasises the need for conservation of the whole environment including man and his traditional activities.

The concept of establishing Biosphere Reserve is the major aim of the UNESCO'S Man and the Biosphere (MAB) programme. By now a network of about 250 Biosphere Reserves has developed in more than 70 countries. Indian Biosphere reserve's Programme, initiated in 1979 intends to preserve representative biotic communities in 13 potential biogeographical regions of country. The Thar Desert has been included as one of the 13 biomes.

The hot desert in northwestern region is a unique and the only habitat of its type over the Indian subcontinent. It was, therefore, appreciable that the Ministry of Environment and Forests constituted a working group in 1988 to draw a project document on the Thar Desert Biosphere Reserve (Anon. 1988). The major objective of Biosphere Reserve system is to provide *in situ* conservation of plants, animals and micro-organisms, not in isolation but in their totality as components, of the ecosystem. The concept emphasis's the need for conserving ecosystem of a size large enough to ensure self-perpetuating and unhindered evolution of the web of living organisms. Being the most populated desert of the planet, large enough, undisturbed areas are not available presently in the Thar Desert. Resultantly the working group recommended to upgrade the status of the Desert National Park as a Thar Desert Biosphere reserve (Anon. 1988).

Inspite of the fact that climatic conditions are very harsh, the extreme xeric region of the country exhibits a vivid and spectacular biodiversity. Moreover, the abundance of certain insects, mites, arachnids, reptiles and rodents is simply astonishing and speaks of the highly specialized desertícolous adaptations.

Some studies were undertaken on the fauna occurring in districts of Jaisalmer and Barmer and good work on the subject has been published by several scientists (Sinha, Prakash *et al.* Prakash and Gupta, Kapoor, Rahmani, Roonwal *et al.* and others).

However, an intensive faunal composition of proposed DNP/DBR was yet to be ascertained. Realising the importance of the bio-geography of the area, a research project entitled "Studies on Vertebrate and Invertebrate Fauna of Desert National Park/Desert Biosphere Reserve" was undertaken during 1994-98. The faunistic surveys and material collections were taken up by the parties of the Desert Regional Station, Jodhpur.

In the present publication, the results of these surveys, together with information available from earlier surveys done by this department and other scientists have been collaborated, compiled and presented in the form of papers. Brief overview of relevent aspects as location, area, topography, climate, geology, soil, vegetation, fauna, etc, have been given to act as a general introduction to all the contributions that follows.

The Desert National Park—Desert Biosphere Reserve

The Desert National Park (DNP), the proposed Desert Biosphere Reserve (DBR) is situated between 25°47' N and 26°46' N and 70°15' and 70°45' E, (Figs. 1 and 2). This covers an area of 3162 Km. of which 1900 Km. is in Jaisalmer district and remaining 1262 Km. in Barmer district of Rajasthan state. It is the western most geographic region of India. The area falls in the extreme hot, arid region of very low rainfall zone of the country. The human population is low, 4-5 persons per Km.

TOPOGRAPHY

The entire area is essentially plain grassland with a few hills in the north-western side of the D N P. The entire zone is dominated by sand hills and sand dunes. Most of the dunes are of Barchan type but tall; fixed and parallel dunes are also present. These dunes at places rise up to 100 m. elevation. The blown sands (mostly due to aerodynamic processes and partly due to biotic interference from shifting sand dunes) add to the inhospitability of the area At places topography is gravelly and stoney with few isolated ridges. Interdunal and sandy plains are other topographic units occurring in the region. There are interdunal depression and valleys originated mostly by wind action. There are no perennial river but seasonal streams are mostly nallahs. The water table is very deep.

CLIMATE

The climate of this region is characterised by extremes of temperature. In summer, the day temperature rises up to 49°C with surface temperature sometimes touching 50°C. The nights are generally very cool. The temperature in winter may fall up to 2°C. Several droughts

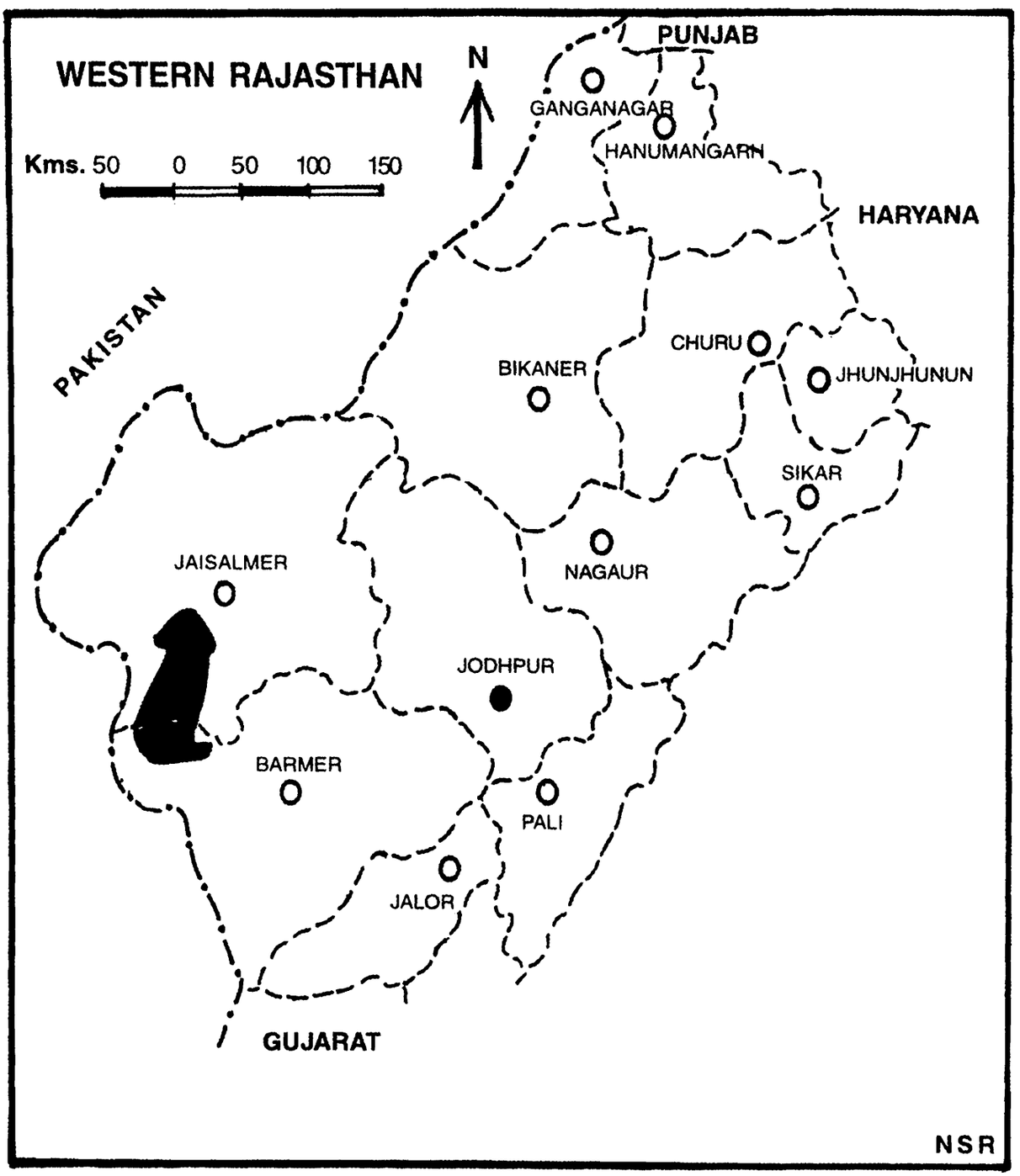

Fig. 1. : Map of western Rajasthan.
Showing proposed area of the Thar Desert Biosphere Reserve.

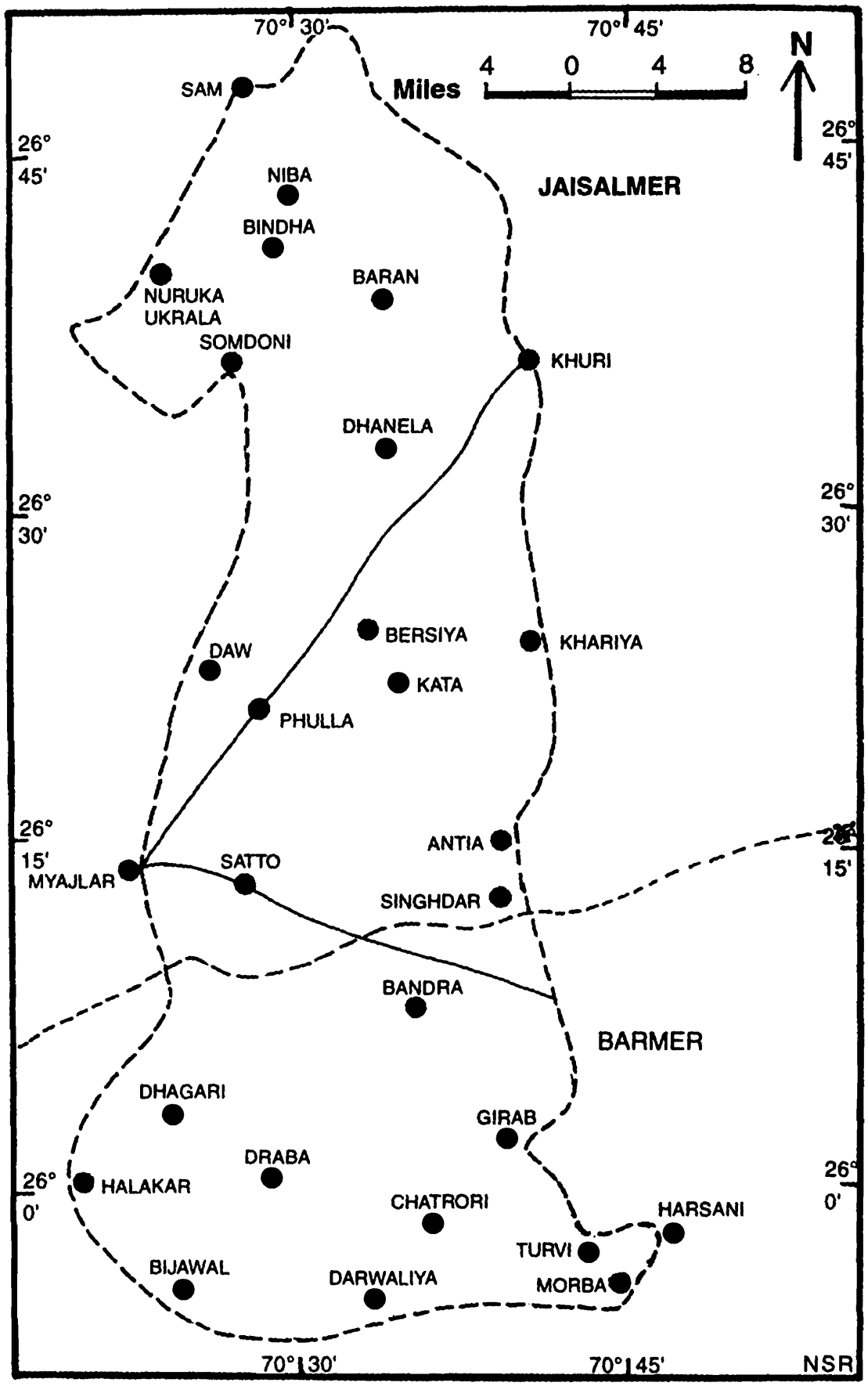

Fig. 2. : Desert National Park.
Area covering proposed Thar Desert Biosphere Reserve.
(After Anonymous 1988)

accompanied by very strong high wind velocity, low relative humidity, evaporation far exceeding precipitation, aridity index being 80 percent, are the characteristic features. The rainfall pattern is extremely erratic, and annual rainfall is about 100-150 mm. but it falls only in about 3-7 days in a year, mostly during the months July-September. The winter is quite cold while the heat during summer is intense and scorching.

GEOLOGY

Jaisalmer district was submerged under sea during the Jurassic, Cretaceous and Eocene ages. It probably uplifted in the upper tertiary times. Resultantly the rivers, Saraswati and Dhrishtavati changed their course and aridity spread in the region. The region is characterised by an entire range of formations from the lower pre-Cambrian to the Quaternary. Among the oldest are the Banded Genissic complexes. The sedimentary rocks and Tertiary formations are sediment deposited in shallow neritic environment. The Quaternary was characterised by a massive alluvial activity which formed by far a major part of the arid zone, followed by the latest pleistocene and recent sand spread of acolian origin.

SOIL

The desert is not necessarily "all Sand", at many places it consists of gravel, bare rock, sun-baked mud, and the loam. The later one form the bulk of the soil of this region. The major area, however, consists of sandy plains.

VEGETATION

The vegetation of this tract is quite sparse with limited number of species. Its vegetation can be described into following types based on landforms or habitats.

Rocky and hilly habitats are confined to the northern most part of the Desert National Park. The plant communities growing on these rocky habitats are "mixed xerophytic thorn forest", in which the principal plants are *Euphorbia caducifolia, Acacia senegal, Caparris decidua, Grewia tenax* etc. The associated trees and shrubs of the above climax are *Salvadora persica, Maytenus emarginata,* etc. A large number of climbers such as *Coculus pendulus, Asparagus racemosus, Ephedra foliata, Rhynchosia minima* and *Coccinia grandis,* are supported by the trees and shrubs. The plants of the ground floor are *Oropetium thomeum, Tephrosia uniflora, Enneapogon brackystachya, Lepidagathis bhandaraensis* and *Barleria acanthoides.* On flat terrain, made up of rock fragments and little amount of sand, the vegetation consists of *Acacia senegal, Zizyphus nummularia, Lycium barbarum* and other common trees. On the gravelly plain, semi–shrub type of vegetation is observed, *Capparis decidua* and *Zizyphus nummularia* are two common shrubs and their common associates are *Leptadenia pyrotechnica, Boerhavia diffusa, Heliotropium strigosum, Salvia aegyptica, Indigofera trigonelloides.*

Alluvial plains form the major part of the habitat. The vegetation has been grouped here as mixed xeromorphic wooded desert. The dominant tree species of this habitat are *Prosopis cineraria, Salvadora oleoides* and *Tecomella undulata.* The common associates of these trees are *Calotropis procera, Mimosa hamata, Acacia jacquemonti, Haloxylon salicornicum, Crotalaria burhia, Lasiurus sindicus, Cenchrus biflorus, Cyperus rotundus, Indigofera cordifolia, Aerva persica* etc. On the dunes the vegetation mostly consists of *Calligonum polygonoides, Panicum turgidum, Lasiurus sindicus, Cenchrus biflorus,* etc.

So far, 168 species of vascular plants belonging to 111 genera under 45 families were reported by Pandey, Shethy and Verma (1985) exclusive from DNP.

Not far from the DNP, on the Jaisalmer-Barmer Road, the Wood Fossil Park (Akal) is located. The fossilised wood logs (trees) are lying prostrate in random orientation on the hilly surface. The wood fossils are considered to represent Gymnosperms tree like Chir, Deodar and red wood of low Jurassic age.

FAUNA

Protozoa

The freshwater protozoa of Rajasthan, including the desert area have been studied by Mahajan (1969, 1971, 1977). He has listed 82 species belonging to class Mastigophora, Sarcodina and Ciliata. Misra (1960) has reported opalinid infection in the faeces of monitor lizard, while Mahajan and Mukherjee (1977) have recorded 7 species of rectal ciliates from frogs.

Porifera

Freshwater sponges were studied by Soota and Saxena (1983). Out of a total 31 species belonging to 11 genera of family Spongilidae hither to known from India, 7 species belongs to 5 genera occuring in the Thar desert.

Platyhelminthes

Among various platyhelminthes, only Trematodes and Cestodes have been studied in the desert. Gupta (1970) reported 15 species of Trematodes from Amphibians, *Reptilia, Aves* and Mammals. Later on Nama (1974 a, b; 1975, 1976 a, b; 1979, 1980, 1987), Nama and Khichi (1973 a, b : 1974), Nama and his other colleagues (1976 a, b; 1978 a, b; 1981, 1985) and Wason and Johnson (1977, 1978 a, b; 1979 a, b;) added few more species. Hafeezullah (in press) added 6 more species to already known species of Trematodes. Thus approxomately 35–38 species of Trematodes were recorded so far.

Adams (1899) recorded first time few species of Cestodes from Western Rajasthan. Mukherjee (1970), recorded 26 species. Later on Gupta (1976), Nama and his colleagues

(1972–90). Johnson and his colleagues (1977) reported some more Cestodes from Vertebrate hosts. Thus about 45–50 species of Cestodes have been recorded from Rajasthan.

Nematoda

Nematodes are both parasitic and free living are economically very important, the former causes diseases in man and domestic animals, while the later one seriously affect plants. The guinea worm (*Bala*) is common in rural areas due to water insamination. Its incidence and ecology in the desert area was published by Tewari (1968). Johnson (1966–68c, 69 and 75) described several new species of nematodes from reptilian and mammalian hosts.

Plant nematodes : Their incidence and ecology in the desert have been studied by several workers, Khera (1966), Nandkumar and Khera (1969, 1971), Khera and Bhatnagar (1977), Mathur (1969, 1977), Nama and Tikyani (1977), Prasad (1977), Swarup and Sethi (1977), etc. The review of nematology literature reveals that about 55 species of phytophagus nematodes (Baqri, 1996) have been reported from the Thar Desert.

Mollusca

A comprehensive account of molluscs of Rajasthan is provided by Ray and Mukherjee (1969). They have listed 28 species (21 Gastropods and 7 Bivalves), out of which 17 species were reported for the first time. There are reports of rich fossil deposits from the desert (Roonwal, 1982).

Annelida

The annelid fauna in Rajasthan is represented by aquatic leeches (Hirudinea) inhabiting tanks, ponds, nadis and lakes, etc. Mahajan and Chandra (1976) reported 5 species and Soota *et al.* (1982), Soota and Saxena (1984 a, b) recorded 6 more speices of leeches. Latter on Sawyer (1986) added a few more. Thus 14 species of leeches are so far known from Rajasthan. Julka (1996) reported 12 species of earthworms (Oligochaeta) from eastern and western region of Rajasthan.

Acarina

Acarina (ticks and mites) group is poorly known from Rajasthan. The little which is initiated and known through the work of Hoogstraal and Trapido (1963), Wattal and Srivastava (1967), Kaul *et al.* (1978), Advani and Vazirani (1981), and Gupta (1996). 12 species were recorded by Sanyal and De (1996) from different hosts. A total 23 species including 17 ixodids and 6 argasids are known from the state.

The soil mites have practically not been studied in Rajasthan, but Khot (1963) reported two new species from Bikaner district. Later Reddy *et al.* (1978) recorded one species, Roy (1988)

added one more species from western Rajasthan. Sanyal (1996) recorded 10 species of soil mites from the state.

The plant mites are known through the work of Prasad (1975), Gupta (1977, 1977a, 1985, 1986), Sharma and Kushwaha (1983, 1983a, and 1990).

Diplopoda

Only a single species has been recorded so far from Rajasthan (Roonwal, 1982).

Chilopoda

So far 12 species were recorded from Rajasthan by Attems (1930), Vazirani and Khanna (1976, 1977), Khanna (1977a).

Crustacea

Shrimps, isopods, prawns, crabs, daphnias, cyclops are know through the works of Baid (1958), Bhargava and Alam (1980), Jhakher *et al.* (1981), Tiwari (1951, 1958, 1962a, 1965a, 1966 and 1996), Mathur and Sidhu (1957), Biswas (1964, 1965, 1971), listed 45 species from Rajasthan. Deb (1973), Lindburg (1942) reported 5 species of copepods.

Insecta

The insects of Indian desert have largly remained unexplored for considerable period of time. The systematic surveys for the collection of insects were carried out from 1952 onwards mainly by the Zoological Survey of India, Insects are represented in the Thar Desert by almost all the major orders : Roonwal (1982) and Tandon (1996) provided details of following orders : Odonata, Orthoptera, Dermaptera, Dictyoptera, Isoptera, Mallophaga, Anoplura, Hemiptera, Thysanoptera, Neuroptera, Lepidoptera, Diptera, Siphonaptera, Hymenoptera and Coleoptera.

Odonata

Causal reference about the occurrence of Odonata have been made by Fraser in Volume on Odonata in the Fauna of British India series and in the work of Addam (1899). Agarwal (1957) reported 13 species from Pilani. On the basis of work by Bose and Mitra (1967), Prasad and Thakur (1981), Thakur (1985), Tyagi and Miller (1991); Prasad (1996) reported 31 species of Odonata belonging to 22 genera under 5 families from the Thar Desert.

Orthoptera

Considerable information is available on grasshopper, locust and crickets from Rajasthan. The invasions of locusts was recorded by Uvarov (1928). Thereafter the antilocust Warning

Organisation (Pruthi and Bhatia 1952) (Pruthi 1951) took this responsibility. Dr. Ramachandra Rao and Dr. M. L. Roonwal and his students carried out pioneering research work on Desert locust *Schistocerca gregaria.* Roonwal (1945a), Bhanotar (1975), Bhatia (1937, 1940), Bhargava (1996) reported 24 species of Gryllus from Rajasthan. Bhowmik (1969, 1971, 1977, 1985) described new species of Gryllus from Rajasthan. Kushwaha and Bhardwaj (1977), Parihar (1996), Tandon and Shishodia (1976), Venkatesh (1977) have so far reported 67 species from Rajasthan.

Dermaptera

7 species were reported by Srivastava (1988) from Rajasthan.

Dictyoptera

Roonwal (1982) reporeted 3 species of Cockroches from Thar Desert. Bohra and Rathore (1996), further added 6 species from Rajasthan. However according to Tandon (1996), so far 20 species of Cockroaches and Mantids have been recorded from desert region.

Isoptera (Termites)

Adams (1899) was the first to mention in his book about termites of Rajasthan. After him, over a half-century later Pruthi and Bhatia (1952) casually reported 3 species of termites. In the Year 1953 Roonwal and Pant added one more species. Similarly Srivastava (1959) added 2 species and Roonwal and Sen Sharma (1960) added 4 more species. Kushwaha (1960, 61) listed 5 species from Udaipur district. But first monographic work was published by Roonwal and Bose (1964) and reported 19 species with description of 3 new species. Later on Roonwal and Verma (1977) resurveyed the area and reported 32 species including earlier known species. Further Verma and Thakur (1977) added 1 species; Verma and Purohit (1999) added 2 more species. Rathore (1989, 1995, 1998) described 2 new species and added new records to raise the total number of species so far known from Rajasthan to 40. Roonwal (1976) published field ecology and eco-biogeography of Rajasthan termite. Parihar carried out exhaustive work on control and pest status of termites (1977, 1978 a, b, 1980b, 1981b, c). Roonwal and Rathore studied the biology of half a dozen species (1974, 1975 a, b) and Rathore reported observation on swarming, post swarming and breeding biology of 4 species (1978 a, 1984, 1994 a, 1998) of desert termites and also reported termites of Thar desert (1996).

Mallophaga

40 species of chewing lice from birds have been reported by Laxminarayana (1981) from Rajasthan.

Anoplura

The common louse (2 species *Pediculus humanus* and *P. h. corporis*) infest man and generally live among hair and the body. Besides this 7 species are found on rats and gerbils as reported by Mishra and Kaul (1973), and Kaul *et al.* (1978).

Hemiptera

Plants and aquatic bugs, aphids, coccids and scale insects were studied by Kushwaha and Sharma (1961), Joshi and Mathur (1967), Kushwaha (1977), Kurl and Mishra (1979), Bhargava (1985) reported 12 species belonging to 7 families of aquatic hemipterans of lentic habitats around Jodhpur, Ghosh, Biswas and Ghosh (1996) and Varshney (1996) so far recorded 53 species from desert area.

Thysanoptera

8 species of *thrips* are recorded by Kushwaha (1977). Some more species have been reported from Rajasthan by Bhatti (1990), Mathur and Verma (1973), Ananthakrishnan and Sen (1980). About 21 speices are known from desert region.

Neuroptera

Ghosh (1977) listed 13 species of neuropterans.

Coleoptera

The Coleopterans are known through the work of Vazirani (1964, 1970) who recorded 29 species of aquatic beetles. Kapur and Bhowmik listed 3 species of Coccinellidae, Saha (1972, 1979) described 4 new species and recorded 7 species of blister beetles, Sewak (1986) reported 36 species of family Scarabaeidae and Tak and Sewak (1987) listed 22 species of aquatic beetles. Parihar (1996) has described the habitat preference of 17 Tenebrionids in the desert, 24 species of Borers mainly on desert trees have also been recorded by him. Tak (1996) reported 28 species of aquatic beetles belonging to family Heliplidae, Gyrinidae, Dytiscidae and Hydrophilidae. Vyas (1996) exclusively reported 96 species of Coleopterans of IGNP area belonging to different families.

Diptera

This large insect order has been very poorly studied in the desert. Kaul *et al.* (1973) reported some species of sandflies. Vazirani and Advani (1976b, 1977b) reported 6 species of parasitic dipterans. The diptera fauna of Rajasthan was also known by the work of Joseph and Parui (1990), Nandi (1990), Parihar (1993), Kumar and Kumar (1996) provided list of 75 species of diptera exclusively from the Thar desert region of Rajasthan.

Siphonaptera

Detailed taxonomic studies have not been made so far; but Iyengar (1993) and Kaul *et al.* (1973), recored 5 species, which are ectoparasite on rodents.

Lepidoptera

Few systematic studies on the lepidoptera fauna of the desert are available Macpherson (1927) gave a list of some 78 species of butterflies. Vyas (1996) reported 161 species of lepidopterans from IGNP area, out of which 95 species are exclusively crop pests. Kushwaha *et al.* (1963, 1964) reported 37 species of butterflies and some moths. Similarly Arora (1974) reported 30 species, and also Gupta and Thakur (1986) reported butterflies and moth species from Rajasthan.

Hymenoptera

89 species have been recorded from Rajasthan by Chhotani and Roy (1976). Hayat (1975, 1977 a, b) recorded 19 species of Chalcids from the area. Vyas also reporded 27 species of Hymenopterans exclusively from IGNP area. Tak and Rathore (1996) gave a list of 28 species of ants (Formicidae) of Thar region of Rajasthan along with few new records.

Pisces

Hora and Mathur (1962) reported the existence of *Labeo nigripinnis* in the Aravalli range, indicating the former connection of Aravallis and Kirthar range in Sind hills, though both the hilly tracks are separated by a vast expence of the desert. Later fishes were studied by Mathur (1952), Dutta and Majumdar (1964), Krishna and Menon (1958), Mathur (1952, 1994), Sharma and Durve (1985), Yazdani (1992), Moona (1952) and Sharma *et al.* (1984) studied the fish fauna of ephemeral Ghaggar river during flooding period. Johal *et al.* (1993), have recently compiled the list of all the fish species reported from Rajasthan. The authors have reported new records of 9 Himalayan fish species in the Indira Gandhi Canal and in water logged areas in northwestern Thar Desert.

Amphibia

Mansukhani and Murthy (1964) reported the amphibians of Rajasthan. The Amphibian fauna of desert region is restricted to 2 species of toad, 5 species of frogs and 1 species of hyla. The illustrated key to field identification of Amphibians of Indian Desert was provided by Bohra *et al.* (1983).

Reptiles

Mc Cann (1938), gave a general description of reptiles of desert in Kutch state. Later Krishna and Dave (1960) and Krishna (1975) provided a fuller account of reptiles of Western

Rajasthan. Rathore (1969) studied the morphology and ecology of *Ophiomorus tridactylus*. Prakash (1973) described the little known lizards of the desert and reported the occurrence of the genus *Phrynocephalus* from India. Later it was described as new species of *P. laungwalensis* by Sharma 1978. The detailed taxonomy of testudines, lizards and snakes have been reviewed by Sharma (1996).

Aves

Studies on the avian fauna of the desert region were initiated late during the 19th century. Adam (1873) listed the birds of Sambar lake and its vicinity. Hume (1878) described birds, he had watched during a drought. Adams (1899) also furnished an exhaustive list of birds seen in Jaisalmer, Jodhpur and Sirohi districts. Whistler (1938) surveyed the earstwhile princely state of Marwar and described about 300 birds species. A check list of birds collected from Rajasthan was provided by Biswas (1947). Faruqui *et al.* (1960) studied the food of partridges and sandgrouse. Sharma (1969, 1969a) studied the ecology and breeding habits of peafowl and vulture at Jodhpur. Kapoor (1985) published a list of birds seen in Desert National Park region with detailed observation on the breeding biology of the Great Indian Bustard (*Ardeotis nigriceps*). Ali (1975) discussed various adaptations of the birds for surviving in the arid environment. Rahmani (1989, 1996ab, 1997) and Rahmani and Soni (1997) described the avifaunal changes in the Indian Thar Desert especially in the Indira Gandhi Canal region. Mukherjee (1995) published exhaustive description of birds of arid and semi-arid tracts in India. The author found that the avifauna of the desert is composed of 47 endemic, 118 resident and 157 migratory species. Out of the 322 species reported so far, Arctic region is represented by 11 species, Holartic (palaearctic) 140 species, Ethiopian 30 species and Oriental 96 species and the old world (Eurasia and Africa) 30 species and 14 species in miscellaneous category.

Mammals

The mammalian fauna was studied by a number of scientists Alfred and Agarwal (1996), Prakash (1956 a, b). Hedgehogs and shrew were studied by Krishna and Prakash (1955, 1956), Rana and Prakash (1979), Chiroptera by Prakash (1963) and Sinha (1975–1983). Reproduction biology of the Indian desert hare studied by Prakash and Taneja 1969. Primates by Mohnot (1996) and Roonwal, Mohnot and Rathore (1984), Carnivora by Kankane (1996), Artiodactyla by Rahmani (1997) and Rodentia by Prakash, Ghosh and their colleagues (1956 a, b, 1974, 1975, 1988, 1992, 1994), Ghosh (1975), Agrawal (1967 and 1977).

WILDLIFE

Unfortunately excellent behavioral observations made by Princes and Shikaris remained only in their diaries. Published good old records are, however, available in Adams (1899) and Erksine (1908). Lately Prakash and Ghosh (1964) reported the breeding of Great Indian Bustard *Ardeotis nigriceps,* for the first time in the Rajasthan Desert. Sen and Sankhla (1962) studies the wild life ecology in Rajasthan state. Sankhla (1963, 1964) provided wildlife conservation and an overview of various wildlife Sanctuaries in Rajasthan. The past and present decline in wildlife have been provided by Prakash (1975 a, b, 1998). Kankane (1995, 1997, 1999) has outlined the current status of desert cat, *Felis silvestris* and the Indian gazelle *Gazella bennetti*, Rahmani (1997) and Rahmani and Soni (1997) have studied the avifaunal changes in the Thar desert. Rahmani (1986, 1989) has studied Great Indian Bustard, Blackbuck and Chinkara (1991) and general wildlife aspects (1997), and also avifaunal changes in the Indian Thar Desert (1997) and status of vultures in the Thar desert of India (1996). In recent years a few reviews have been compiled in which good account of wildlife and faunal elements are available. Prakash and Agrawal (1994), Gupta and Prakash (1975), Prakash and Ghosh (1975), Prakash *et al.* (1992) and Roonwal (1982) published fauna of the Great Indian Desert, and Ghosh, Baqri and Prakash (1996) Faunal Diveristy in the Thar Desert.

The Indira Gandhi Canal has totally altered the scenario of the desert, from a typical grassland to an irrigated cropland. The Gadra tributary when completed will bisect the Desert National Park in the North-South direction. The year-long availability of soil moisture and large accumulation of water due to water logging and seepage will attract a large number of water loving species which are gradually replacing the deserticolous elements. Large scale monitoring will be required to assess as to which species will perish from I. G. Canal command region, which species will adapt to man-made environmental changes and what will be the extent of species richness by mesic elements.

FOSSILS

Abundant fossil evidence of Eocene transgression of the sea has been provided by Gupta (1972), who listed Foraminifera, Ostracoda, Decopoda, Crustacea, Echinodermata, Molluscs and a few fishes from the Desert. Tiwari (1962 a, b, 1963, 1965, 66, 68) had described an ocean fish and several crustaceans from Kapurdi.

Late Dr. M. L. Roonwal, when he was the Director of Zoological Survey of India, Calcutta, started a publication series "Fauna of Rajasthan" under which following groups were dealt with :

Group	Author	Year
General Introduction	M. L. Roonwal	1963
Protozoa Part I	K. K. Mahajan	1963
Protozoa Part II	K. K. Mahajan	1965
Mollusca	H. C. Ray & A. Mukherjee	1963
Crustacea	S. Biswas	1965
Insecta Isoptera	M. L. Roonwal & G. Bose	1963
Coleoptera (Dytiscidae)	T. G. Vazirani	1964
Trematoda	P. D. Gupta	1964
Cestoda	R. P. Mukherjee	1964
Amphibia	M. R. Mansukhani	1964
Pisces	A. K. Dutta & N. Majumdar	1964

AKNOWLEDGEMENTS

We are thankful to Director, Zoological Survey of India, Kolkata and Officer-in-Charge, Desert Regional Station, Jodhpur for providing facilities, constant encouragement and for taking keen interest in completion of this work. Thanks are also due to Scientists of the Zoological Survey of India, Kolkata and Regional Station's who have identified the material sent to them and contributed papers in this final Report. We are also thankful to Deputy Director-in-Charge, Desert National Park, Jaisalmer for cooperation and help in carrying out field surveys in DNP area.

REFERENCES

Adam, R. M. 1873. Notes on the birds of the Sambhar lake and its vicinity. *Str. Feath.*, **1** : 361-404.

Adams, A. 1899. *The Western Rajputana States* A medico-Topographical and General Account of Marwar, Sirohi and Jaisalmer, 464 PP. 63 pls. Junior Army and Navy stores Ltd. London.

Advani, R. and Vazirani, T. G. 1981. Studies on ectoparasites of bats of Rajasthan and Gujarat (India). *Rec. zool. Surv. India.*, Occ. Paper No. 22 : 1-55.

Agrawal, J. P. 1957. Contribution towards the Odonate fauna of Pilani. Proc. 45th Indian Sci. Cong., Calcutta part III. Abstract : 309.

Agrawal, V. C. 1967. New mammal records from Rajasthan. – *Labdev J. Sci & Tech.*, **5** : 342-344.

Agrawal, V. C. 1977. Adaptation in Indian Mammals to desert life. -*Bull. Indian Mus.*, **9** : 7-16.

Alfred, J. R. B. and Agrawal, V. C. 1996. The Mammal diversity of the Indian Desert. *In Faunal Diversity in the Thar desert : Gaps in Research.* (Eds. A. K. Ghosh : Q. H. Baqri and I. Prakash) : 335-348. Scienitific Publisher, Jodhpur.

Ali, S. 1975. On some birds of Indian desert. *In Environmental Analysis of the Thar Desert.* pp. 423-431. English Book Depot. Dehra Dun. (R. K. Gupta and I. Prakash Eds.).

Ananthakrishnan, T. N. and Sen, S. 1980. Taxonomy of Indian Thysanoptera. Handbook, Sr. 1., *Zool. Surv. India*, 234 pp.

Anonymous. 1971. Proceedings of the symposium on the "Problems of Indian Arid Zone" 1964. Jodhpur, Government of India, New Delhi pp. 1-495.

Anonymous. 1977. *Desertification and its Control.* ICAR, New Delhi, pp. 1-385.

Anonymous. 1983. Progress in Arid Zone Research : 1952-1982. CAZRI, Jodhpur, pp. 1-5.

Anonymous. 1984. Action plan for Biosphere Resources. In : Nature Resources, Vol. XX (4), October-December 1984, pp. 11-22, UNESCO, Paris.

Anonymous. 1988. Project document-7 for, *Thar Desert Biosphere Reserve.* Ministry of Environment and Forests, Government of India. Vii+ 100pp., 11 Figs.

Arora, G. S. 1974. Fauna of Rajasthan. Lepidoptera. *Proc. 61 Indian Sci. Cong.*, (3) : 148 (abst.).

Attems. G. 1930. *Scolopendromorpha.* Das Tierreich. Berlin, **54**(2) : 1-308.

Baid, I. 1958. Occurrence of *Artemia salina* in Sambhar Lake, Rajasthan. *Curr. Sci.*, **27** : 58-59.

Baqri, Q. H. 1996. Faunal diversity of nematada in the Thar Desert : Assessment and futuristic approach. In : *Faunal Diversity in the Thar Desert : Gaps in Research.* Ed. by A. K. Ghosh, Q. H. Baqri and I. Prakash. pp. 51-70. Scientific Publisher, Jodhpur.

Bhandari, M. M. 1978. *Flora of the Indian Desert.* Scientific Publisher, Jodhpur, pp. 1-71.

Bhanotar, R. K. 1975. Locust ecology. *In Environmental Analysis of the Thar Desert* (Ed. R. K. Gupta and I. Prakash) pp. 361-392. English Book Depot; Dehra Dun.

Bhargava, R. N. 1985. Studies on aquatic Hemiptera of lentic habitats around Jodhpur. *Proc. Nat. Sympos. Evalu. Environ.* (Spl. Vol. *Geobios*). Eds. S. D. Misra, D. N. Sen, and I. Ahmad, : 318-320.

Bhargava, R. N. 1996. Grylloid fauna of Thar Desert. In : *Faunal Diversity in the Thar Desert : Gaps in Research.* Ed. by A. K. Ghosh, Q. H. Baqri; and I. Prakash, 151-154 (16), Scientific Publishers, Jodhpur.

Bhargava, S. C. and Alam, M. 1980. Some limnological features of two saline lakes of Rajasthan. Abst. of paper. 5th *All India Cong. Zoology,* Bhopal, p. 151.

Bhatia, D. R. 1937. Food preferences of the Desert locust *Schistocerca gregaria* (Forskal) in the Indian Desert areas. In Y. R. Rao's Report. *Indian Council of Agri. Research,* during 1936.

Bhatia, D. R. 1940. Observations on the biology of the Desert locust *Schistocerca gregaria* (Forskal) in the Sind-Rajputana desert area I. The preferred food plants of the locust. *Indian J. Ent.,* **2**(2) : 187-192.

Bhatti, J. S. 1980. Species of the genus *Thrips* from India. *Systematic Entomology,* **5** : 106-166. London.

Bhowmik, H. K. 1969. Studies on Indian Crickets (Insecta : Orthoptera). *Zool. Anz.* Bd. 182. Helf **1/2** : 143-152.

Bhowmik, H. K. 1971. Two new species of Grylloidea (Orthoptera) from India. *Oriental Ins.* **5**(4) : 503-506.

Bhowmik H. K. 1977. Studies on some Indian Crickets with new distributional records of the subfamily Gryllinae (Gryllidae : Orthoptera). *Rec. zool. Surv. India.,* **73** : 229-238.

Bowmik H. K. 1985. Contributions to the gryllid fauna of the Western Himalays (Orthoptera : Gryllidae). *Rec. zool Surv. India.,* Occ. Paper. **73** : 1-85.

Biswas, B. 1947. On a collection of birds from Rajputana.–*Rec. Indian Mus.,* **45**(2 & 3) : 245-265.

Biswas, S. 1964. A new species of the Cladoceran genus *Latona* Straus, 1820 (Crustacea : Cladocera : Sididae) from Rajasthan, India. *Proc. zool. Soc.,* **17** : 149-152.

Biswas, S. 1971. Fauna of Rajasthan, India, Part II, Crustacea : Cladocera. -*Rec. zool. Surv. India, 63* (1-2) : 95-141 [1965].

Bohra, P. and Rathore, N. S. 1996. Dictyoptera of the Thar Desert. In : *Faunal Diversity in the Thar Desert : Gaps in Research.* Ed. by A. K. Ghosh., Q. H. Baqri and I. Prakash, 167-170 (18), Scientific Publishers, Jodhpur.

Bohra, P., Tak, N., Bhargava, R. N. and Rathore, N. S. 1983. Frogs of the Indian Desert with illustrated key to their field identification. – *Trans. Isdt. & Ucds*; **8**(2) : 113-118.

Bose, G. and Mitra, T. R. 1976. The Odonate Fauna of Rajasthan. *Rec. zool. Surv. India,* **71**(1973) : 1-11.

Chhotani, O. B. and Ray, K. K. 1976. Fauna of Rajasthan, India. Hymenoptera. *Rec. zool. Surv. India*, **71**(1973) : 13-49.

Datta, A. K. and Majumdar, N. 1964. Fauna of Rajasthan, India, Part 7 Fishes. *Rec. zool. Surv. India*, **62**(1 & 2) : 36-100, (Pub. 1970).

Datta Gupta, A. K., Menon, P. K. B, Nair, C. K. G. and Das, C. R. 1961. An annotated list of fishes of Rajasthan. *Proc. Rajasthan Acad. Sci.* Pilani, **8**(1 & 2) : 120-134.

Dave, K. C. 1960. Contribution to the systematics, distribution and ecology of the reptiles of the desert of Rajasthan, with special reference to the ecology of certain lizards. – *Proc 47th Indian Sci. Congr.*, Calcutta pt. **3** (abst.) 482-483.

Deb, M. 1973. Fauna of Rajasthan, India. Crustacea : Ostracoda. *Rec. zool. Surv. India,* **67**(1969) : 233-259.

Dhawan, P. 1969. Fish fauna of Udaipur lakes. *J. Bombay nat. Hist. Soc.*, **66**(1) : 190-194.

Erskine, K. D. 1908. Rajputana Gazetteers : The Western Rajputana States Residency and Bikaner Agency. Pioneer Press, Go I, Allahabad.

Faruqui, S. A., Bump, G., Nanda, P. C. and Christensen, G. C. 1960. A study of the Seasonal food of the Black Francolin (*Francolinus francolinus Linnaeus*), the Grey Francolin (*F. pondicerianus*) and the common Sandgrouse (*Pterocles exustus*) in India and Pakistan. *J. Bombay nat. Hist. Soc.*, **57** : 354-361.

Ghosh, A. K., Baqri, Q. H. and Prakash, I. (Eds.) 1996. *Faunal Diversity in the Thar Desert*: Gaps in Research, Xi + 410 pp (Scientific publisher, Jodhpur).

Ghosh, L. K., Biswas, B. and Ghosh, M. 1996. Faunal diverciy in Hemiptera of the Thar Desert. In : *Faunal Diversity in the Thar Desert* : *Gaps in Research.* Ed. by A. K. Ghosh, Q. H. Baqri and I. Prakash., 191-202, (21) Scientific Publishers. Jodhpur.

Ghosh, P. K. 1975. Adaptability of rodents to various environments. *Proc. Summer Inst. Rodentol.*, Jodhpur, pp. 35-37.

Ghosh, S. K. 1977. Fauna of Rajasthan, India. Neuroptera. *Rec. zool. Surv. India,* **72**(1974): 308-313.

Gupta, I. J. and Thakur, R. K. 1986. On a collection of the Lepidoptera from Rajasthan. *Rec. zool Surv. India*, 83, (3 & 4) : 109-120.

Gupta, P. D. 1964. Fauna of Rajasthan, India part 8-Trematoda.–*Rec. zool. Surv. India,* **62**(1 &2) : 171-190. (Publ. 1970).

Gupta, P. D. 1972. Fossil fauna of Rajasthan India.–*Rec. zool. Surv. India,* **66**(1968), : 153-190.

Gupta, P. D. 1973 Fauna of Rajasthan, India. Part 3-Mollusca (No. 2). Distribution of some Pelecypoda. *Rec. zool. Surv. India,* **67**(1969) : 159-163.

Gupta, P. D. 1975. Fifty years (1920–1968) of Faunistic survey of Rajasthan (India). *Rec. zool. Surv. India.,* **68**(1970) : 383-413.

Gupta, P. D. 1976. A new species of cestode of the genus *Schistometra* (Cestoda : Davaineidae : Idoigeninae) from the Great Indian Bustard *Choriotis nigriceps* (Vigors). *J. Bombay nat. Hist. Soc.* **73**(1) : 183-186.

Gupta, R. K. and Prakash, I. 1975. An *Environmental Analysis of the Thar Desert.* English Book Depot. Dehra Dun, pp. 1-484.

Gupta, S. K. 1977a. Some new and known species of *Typhlodromus* and *Phytoseius* (Acarina : Phytoseiidae) from western and northern India. *Indian J. Acar.,* **1** : 11-18.

Gupta, S. K. 1977b. Some undescribed and little known species of *Amblyseius* (Acarina : Phytoseiidae) from western and northern India. *Indian J. Acar.,* **1** : 28-37.

Gupta, S. K. 1985. *Handbook of plant mites of India.* Z. S. I., Calcutta. 1-520.

Gupta, S. K. 1986. Fauna of India. (Acari : Mesostigmata) family : Phytoseiidae. Z. S. I., Calcutta, 1-350.

Gupta, S. K. 1996. The Acarine fauna in Thar Desert. In : *Faunal Diversity in the Thar Desert : Gaps in Research.* Ed. by A. K. Ghosh, Q. H. Baqri and I. Prakash., 93-105, (11) Scientific Publishers. Jodhpur.

Hayat, M. 1977a. Second report on the Chalcids (Insecta : Hymenoptera) from Rajasthan, India. *Newslett. zool. Surv. India,* **3**(4) : 166-167.

Hayat, M. 1977b. Some Indian species of Anastatus (Hymenoptera : Chalcidoidea : Eupelmidae). *Oriental Ins.,* **9** : 261-271.

Hoogstraal, H. and Trapido, H. 1963. *Haemaphysalis Kutchensis* sp. n. a common larval and nymphal parasite of birds in northwestern India (Ixodoidea : Ixodidae). *J. Parasit.,* **46**(3) : 489-497.

Hora, S. L. and Mathur, B. B. L. 1952. On certain paleogeographical features of Rajasthan as evidenced by the distribution of fishes. *Bull. Nat. Instt. Sci., India,* **1** : 32-36.

Hume, A. O. 1878. The birds of a drought. *Str. Feather,* **7** : 52-68.

Iyengar, R. 1973. The Siphonoptera of the Indian subregion. *Oriental Ins.,* Supplement No. **3** : 1-102.

Jakher, G. R., Dey. T., Misra, S. D. and Bhargava, S. C. 1981. Diaurnal Variations in Physico–Chemical factors and zooplankton population in Balsamand Lake, Jodhpur. *Geobios,* **8**(3) : 119-122.

Jain, A. P. 1978. Eco-physiology of the Indian gerbil *Tatera indica indica* Hardwicke, 1807 in the Rajasthan desert. Ph. D. Dissertation, University of Jodhpur, Jodhpur.

Johal, M. S., Chahal, I. S. and Tandon, K. K. 1993. Ichthyofauna of Rajasthan state. *J. Bombay nat. Hist. Soc.*, **90** : 404-411.

Johnson, S. 1966. A new Oxyurid nematode of the genus *Thelandros* from *Calotes versicolor* (Daud.) from India, with a key to the Indian species of the genus from *Calotes. Indian Journal of Helminthology*, **18** : 123-127.

Johnson, S. 1967. A new nematode of the genus *Syphacia* (Oxyuroidae) from the squirrel *Funambulus pennanti* from Rajasthan, India. *Proceedings of Zoological Society*, Calcutta, **2** : 83-85.

Johnson, S. 1968a. A new Spiurid genus from the soft-furred field rat *Rattus meltada* (Nematoda : Spiriutinae). *Review of Brazilian Biology*, Rio de Janeiro, **28** : 111-114.

Johnson, S. 1968b. A new nematode of the genus *Dermatoxys* (Oxyuroidea) from the Desert Hare, *Lepus nigricollis dayanus*, from India. *Folia Parasitologica*, Prague, **15** : 78-82.

Johnson, S. 1968c. On *Castronodus* larva from the definitive host *Suncus murinus sindensis* (Nematoda : Spiruroidea). *Folia Parasitologica*, Prague, **15** : 271-274.

Johnson, S. 1969. On some nematodes belonging to the genus *Rictularia* (Nematoda : Spiruroidea).–*Rev. Biol. Trop.*, **15**(2) : 289-287.

Johnson, S. 1975. Nematode parasites of the Indian Desert Rodents. In *Rodents in Desert Environemnts* (Eds. I. Prakash and P. K. Ghosh). Dr. W. Junk b. v. Publishers. The Hague : 445-464.

Joseph, A. N. T. and Parui, P. 1990. A review of the Asilidae (Diptera) from India. *Rec. zool. Surv. India*. Occ. Paper No. **113** : 1-122.

Joshi, H. C. and Mathur, Y. K. 1967. Aphids of Rajasthan. *Madras Agric. J.*, **54**(5) : 239-243.

Julka, J. M. 1996. Annelid diversity in the Thar Desert. In : *Faunal Diversity in the Thar Desert : Gaps in Research.* Ed. by A. K. Ghosh, Q. H. Baqri and I. Prakash, 71-76. (7) Scientific Publishers, Jodhpur.

Kankane, P. L. 1995. Status Survey of Chinkara and Desert Cat in Rajasthan. *ZSI Envis Newsletter,* **3**(223) : 6-9.

Kankane, P. L. 1996. Carnivores in the Thar desert. In : *Faunal Diversity in the Thar Desert : Gaps in Research.* Ed. by A. K. Ghosh, Q. H. Baqri, I. Prakash, 379-388. Scientific Publishers, Jodhpur.

Kankane, P. L. 1997. The Desert Cat in Rajasthan. *Sanctuary Asia*, **XVII**(1) : 42-49.

Kankane, P. L. and Baqri, Q. H. 1993. Faunal diversity of the Greart Indian Desert. *Indo-British Reg. Workshop Biol. Divers. Arid. Des. Ecosyst., CAZRI*, Jodhpur, 13 & 14 Feb., Abstract No. 8.

Kapoor, J. P. 1985. Wildlife management in Desert National Park. *Proc. Nat. Sympos. Evalu. Environ.* (Spl. Vol. *Geobios.)* Eds. S. D. Misra, D. N. Sen and I. Ahmad : 273-278 (1981).

Kaul, H. N., Dhanda, V. and Modi, G. B. 1973. The Phlebotomine Sand-flies (Diptera : Psychodidae) from Rajasthan, India. *Indian J. Med. Res.*, **61** : 528-539.

Kaul, H. N., Mishra, A. C., Dhanda, V., Kulkarni, S. M. and Guttikar. S. N. 1978. Ectoparasitic arthropods of bats and mammals from Rajasthan state, India. *Indian J. Parasitol.*, **2** : 19-35.

Khanna, V. 1977. Studies on the centipede genus *Trachycormocephalus* (Myriapoda : Scolopendridae) from Rajasthan, India. *Orient. Ins.*, **11**(1) : 151-156.

Khera, S. 1966. Nematodes from the banks of still running water. III *Rogerus rajasthanensis* n. sp. sub family Cyllindrolaiminae and *Monhystrella gracilis* n. sp. Monhysterinae from India. *Nematologica*, **12** : 403-408.

Khera, S. and Bhatnagar, G. C. 1977. Plant nematology in Rajasthan : *A review. In the Natural Resources of Rajasthan* (Ed. M. L. Roonwal), Vol. 1, pp. 437-449, Jodhpur university Press, Jodhpur.

Khot, N. S. 1963. Studies on India Erythraeidae (Acarina). *Acarologia*, **5** : 232-234.

Krishna, D. 1975. Ecology of Reptiles of Thar desrt. *In Environmental Analysis of the Thar Desert.* Eds. R. K. Gupta and I. Prakash. English Book Depot. Dehra Dun. 423-431.

Krishna, D. and Dave, K. C. 1960. A note on the reptiles of the desert of Rajasthan. (in Hindi), *Vijnana Parishad Anusandhan Patrika*, Allahabad, **3** : 215-231.

Krishna, D. and Prakash, I. 1955. Hedgehog of the desert of Rajasthan. Pt. I. *J. Bombay nat. Hist. Soc.*, **53** : 38-43.

Krishna, D. and Prakash, I. 1956. Hedgehog of the desert of Rajasthan. Pt. II. *J. Bombay nat. Hist. Soc.*, **53** : 362-366.

Krishna, D. and Menon, C. B. 1958. A note on the fishes of Jodhpur (Rajasthan) (in Hindi) *Vijnana Parishad Anusandhan Patrika* **1**(4) : 207-209.

Kumar, S. and Kumar, S. 1996. Diptera fauna of the Thar Desert. In : *Faunal Diversity in the Thar Desert : Gaps in Research*, Ed. by A. K. Ghosh., Q. H. Baqri and I. Prakash, 241-251 (26), Scientific Publishers, Jodhpur.

Kurl, S. P. and Misra, S. D. 1979. A preliminary report on aphid fauna of Jodhpur. *Geobios*, **6** : 286-287.

Kushwaha, K. S. 1960. A note on infestation of termites (Insecta : Isoptera) around Udaipur (Rajasthan). Sci. & Cul., **26**(1) : 29-40.

Kushwaha, K. S. 1961. A note on termites (Insecta : Isoptera) infesting sugarcane crop in Rajasthan. *Sci. & cul.*, **6** : 229-230.

Kushwaha, K. S 1977. A review of progress in studies on forage and pasture insect pests of Rajasthan. *In the Natural resources of Rajasthan* (Ed. M. L. Roonwal), Vol. 1. pp. 367-411, Jodhpur University press, Jodhpur.

Kushwaha, K. S. and Bharadwaj, S. C. 1977. Forage and pasture Insect pests of Rajasthan. *Indian Cong. Agri. Res.* 1-86.

Kushwaha, K. S., Sharma, J. C. and Sharma, L. S. 1963. Common Lepidopteran fauna of Udaipur, Rajasthan. Part I Butterflies. *Indian J. Ent.*, **25**(2) : 141-146.

Kushwaha, K. S. and Sharma, L. S. 1961. Some common insect pests of vegetable crops in the state of Rajasthan, with brief notes on their infestation. *Proc. 48th Indian Sci. Congr.* Calcutta. P. **3** : 1-428.

Kushwaha, K. S., Sharma, L. S. and Bharadwaj, S. C. 1964. Common Lepidopteran fauna of Udaipur, Rajasthan. Part II-Moths. *Univ. Udaipur Res. Stud.*, **2** : 109-127.

Laxminarayana, K. V. 1981. The chewing-lice (Insecta : Phthiraptera) from birds of Rajasthan (India). *Jantu*, **1** : 14-41.

Lindberg, K. 1942. Crustaces de l'etal Jodhpur (*Rajpootana*). *Rec. Indian Mus.*, **44** : 341-345.

Macpherson, A. D. 1927. Notes on a collection of Butterflies made in Jodhpur and Mount Abu during the year 1924 to 1926. *J. Bombay nat. Hist. Soc.*, **32** : 228-230.

Mahajan, K. K. 1969. Fauna of Rajasthan, India. Part 2-Protozoa (No. 1). *Rec. zool. Surv. India*, **61**(3 & 4) [1963] : 291-376.

Mahajan, K. K. 1971. Fauna of Rajasthan, India. Part 10-Protozoa (No. 2). *Rec. zool. Surv. India*, **63**(1-4) [1965] : 45-76.

Mahajan, K. K. 1977. Fauna of Rajasthan, India. Part 10-Protozoa (No. 3). *Rec. zool. Surv. India*, **71** [1973] : 143-148.

Mahajan, K. K. and Mukherjee, R. 1977. On some rectal Protozoa from frogs and toads of Rajasthan. *Newsletter zool. Surv. of India.*, **3**(6) : 365-367.

Mansukhani, M. R. and Murthy, T. S. N. 1964. Fauna of Rajasthan, India, Part. 6. Amphibia. *Rec. zool. Surv. India*, **62**(1 & 2) : 51-60 (Pub. 1970).

Mathur, B. B. L. 1952. Notes on fishes from Rajasthan, India. *Rec. Indian Mus.*, **50**(1) : 105-110.

Mathur, B. N. 1969. Studies on cereal root eelworm (*Heterodera avenae* Woll) with special reference to molya disease of wheat and barley in Rajasthan; Ph. D. thesis. University of Rajasthan, Jaipur : 233pp.

Mathur, B. N. 1977. Some investigations on the "Molya" disease of wheat and barley in Rajasthan. *In : Natural Resources of Rajasthan* (Ed. M. L. Roonwal), Vol. I. pp. 451-464, Jodhpur University press, Jodhpur.

Mathur, D. S. 1977. On a collection of fishes from Jodhpur district (Rajasthan). *Newslett. zool. Surv. India*, **3**(4) : 158-159.

Mathur, S. N. and Sidhu, N. S. 1957. Occurrence of *Apus* (Crustacea : Notostraca) in Pilani, Rajasthan. J. *Bombay nat. Hist. Soc.*, **54** : 961-962.

Mathur, Y K. and Verma J. P. 1973. Predators of *Thrips* infesting *Sesamum* in Rajasthan. *Entomologists Newslett.*, **3**(7) : 45.

Mathur, D. S. and Yazdani, G. M. 1970. *Naemacheilus rajasthanicus*, a new species of loach, from Rajasthan. *J. zool. Soc. India*, **22**(1 & 2) : 97-100.

Mathur, D. S. and Yazdani, G. M. 1973. Additional records of fish from Jodhpur with a list of species occurring in this district. *Sci. & Cult.*, **39**(2) : 87-89.

Mc Cann, C. 1938. The reptiles and amphibians of Cutch State. –. *J. Bombay nat. Hist. Soc.*, **40** : 425-247.

Mc Cann, C. 1943. A "Bushman's holi day" in the Abu hills. *J. Bombay nat. Hist. Soc.*, **43**(2) : 206-217, figs & Pls.

Misra, A. C and Kaul, H. N. 1973. *Hoplopleura cutchicus* n. sp. (Anoplura : Hoplopleuridae) parasitising *Rattus* (*Cremonomys*) *cutchicus* (Wroughton) in India. *J. Med. Ent.*, **10** : 43-46.

Misra, P. L. 1960. Incidence of opalinid infections in certain monitor lizards. *J. zool. Soc. of India*, **12** : 201-208.

Misra, S. D., Sen, D. N. and Ahmad, I. Eds. (1985). *Evolution and Conservation of Environment* (Proceeding of National Symposium 1981), Jodhpur (University of Jodhpur) vii +362 (Geobios International).

Mohnot, S. M. and Srivastava, A. 1996. Jodhpur Langurs : Eco-behavioural diversity and survival strategies. In : *Faunal Diversity in Thar Desert : Gaps in Research*. Ed. by A. K. Ghosh., Q. H. Baqri and I. Prakash, 365-377 (38). Scientific Publisher, Jodhpur.

Moona, J. C. 1963. Notes on fishes from Bharatpur district, Rajasthan. *Rec. Indian Mus.*, **58**(2) : 59-66.

Mukharjee, A. K. 1963. The Analysis of the food of Grey quail in Western Rajasthan (India). Pavo, *Indian J. Ornithol.* **1** : 31-34.

Mukharjee, A. K. 1995. Birds of arid and semi-arid tracts, *Rec. zool. Surv. India*, Occ. Paper No. **142** : 1-303.

Mukharjee, R. P. 1964. Fauna of Rajasthan, India part. 9-Cestoda. -*Rec. zool. Surv. India*, **62**(1 & 2) : 191-215.

Nama, H. S. 1972. A note on some Cestodes of goat. *India J. Helminth.* **24**(1) : 52-55.

Nama, H. S. 1974. On certain Cestodes of Rajasthan. *Ind. J. Zool.* **2**(1) : 33-36.

Nama, H. S. 1984. On genus *Raillietina* Fuhrmann, 1920 from Indian birds. *Indian Rev. Life Sci.*, **4** : 219-223.

Nama, H. S. 1984. Faunistic Survey of Helminth parasites of vertebrates of Rajasthan with special reference to Arid zone. *Sci. Rev. Arid Zone Res.*, **2** : 187-195.

Nama, H. S. 1987. Helminth parasites from freshwater fishes in Rajasthan. *2nd Int. Symp. Ichthyoparasitology*. Sept. 27 Oct. 3, 1987, Tihany. Hungary P. 69 Abt.

Nama, H. S. 1990. An overview of the Tapeworm genus *Hymenolepis* Weinlend. 1858 *sensu* lato from arid and non-arid regions. *Sci. Rev. Arid Zone Res.* **7** : 1-80.

Nama, H. S. 1990. Cestode parasites of Indian Mammals. Scientific Publishers, Jodhpur, 342.

Nama, H. S. and Khichi, P. S. 1974. Studies on some Trematodes from Rajasthan. *Annals of Arid Zone*, **13**(4) : 353-360.

Nama, H. S and Tikyani, M. G. 1977. Nematode pests of certain vegetables of Jodhpur. *In the Natural Resources of Rajasthan* (Ed. M. L. Roonwal), Vol. I, pp. 465-467, Jodhpur University press, Jodhpur.

Nand Kumar, C. and Khera, S. 1969. *Paurodontus aberrans* n. sp. (Nematoda : Tylenchida) with a note on a special branch of the oviduct. *Indian J. Helminth.*, **21** : 1-15.

Nand Kumar, C and Khera,S. 1971. Plant parasitic nematodes from the rhizoshpere of pearl millet (*Pennisetum typhoides*) in Rajasthan. *Indian J. Helminth.*, **22** : 136-138.

Nandi, B. C. 1990. Sarcophagid flies (Diptera : Sarcophagidae) from Rajasthan, India. *J. Beng. nat. Hist. Soc.*, (N. S.) **9** : 49-55.

Pandey, R. P., Shetty, B. V. and Verma, M. P. 1985. A check-list to the flora of the Desert National Park in Western Rajasthan. *J. Econ. Tax. Bot.*, **6**(1) : 45-65.

Parihar, D. R. 1977. Note on some termites of Rajasthan Desert. *Geobios*, **4**(4) : 173.

Parihar, D. R. 1978. Field observations on the nature and extended damage by Indian desert termites and their control. *Annals of Arid Zone*, **17**(2) : 192-199.

Parihar, D. R. 1980. Termite problems in desert plantations. *Annals of Arid Zone*, **19**(3) : 329-334.

Parihar, D. R. 1981. Some observations on distribution and pest status of termites attacking forestry plantation in the Rajasthan Desert. *Indian J. Forestry*, **4**(1) : 22-25.

Parihar, D. R. 1981. Termite pests of vegetation in Rajasthan and their management. *CAZRI*, Monograph No. **16** : 1-31, Jodhpur.

Parihar, D. R. 1993. Insect fauna of Khejri (*Prosopis cineraria*) of arid zone of India. *Indian J. Forestry.*, **16**(2) : 132-137.

Parihar, D. R. 1996. Species richness of Orthoptera and Coleoptera in the Thar Desert. In : *Faunal Diversity in the Thar Desert : Gaps in Research.* Ed. by A. K. Ghosh., Q. H. Baqri and I. Prakash, 155-166 (17), Scientific Publishers, Jodhpur.

Prakash, I. 1956a. A list of the mammals of Rajasthan Desert. *J. Beng. nat. Hist. Soc.*, **28** : 1-7.

Prakash, I. 1956b. Addition to the list of mammals of Rajasthan Desert. *J. Beng. nat. Hist. Soc.*, **28** : 169-170.

Prakash, I. 1962. Group organization, sexual behaviour and breeding season of certain Indian monkeys. *Jap. J. Ecol.*, **12**(3) : 83-86.

Prakash, I. 1963. Taxonomic and biological observations on the bats of Rajasthan deserts. *Rec. Indian. Mus.*, **59**(1961) : 149-170.

Prakash, I. 1973. Notes on little known lizards from the Rajasthan desert. *J. Bombay nat. Hist. Soc.*, **69** : 643-645.

Prakash, I. 1974. The ecology of Vertebrates of the Indian desert. In *Biogeography and Ecology of India.* (Ed. M. S. Mani, Junk Publishers. The Hague. 369-420.

Prakash, I. 1975. The ecology and zoogeography of Mammals. In : *Environmental Analysis of the Thar Desert.* (Ed. R. K. Gupta and I. Prakash). English Book Depot. Dehra Dun. 448-467.

Prakash, I. 1975a. The amazing life in the Indian desert. *Illustrated Weekly Annual*, 64-121.

Prakash, I. 1975b. Wildlife ecology and conservation. Chapter XX in "*Environmental Analysis of the Thar Desert*" Ed. by R. K. Gupta and I. Prakash. English Book Depot. Dehradun : 468-480.

Prakaskh, I. (Edited) 1988. Desert Ecology xii + 313 pp. Scientific Publishers, Jodhpur.

Prakash, I. 1992. Future line of Research in Rodents in Indian Agriculture Ed. I. Prakash and P. K. Ghosh. Scientific Publisher, Jodhpur. **1** : 585-692.

Prakash, I. 1994. Mammals of Thar Desert, 1-114. Scientific Publishers, Jodhpur.

Prakash, I. and Ghosh, P. K. 1964. The Great Indian Bustard breeding in Rajasthan desert. *Newsletter for Birdwatchers*, **3** : 15-16.

Prakash, I. and Ghosh, P. K. (Eds.) 1975. Rodents in Desert Environments. Junk Publishers. The Hague.

Prakash, I., Saxena, S. K., Ghosh, P. K. and Bohra, H. C. 1992. Vegetation and Wildlife in the Thar. In perspectives of the Thar and Karakum. Eds. Kar, A., Abhichandani., Anantharaman, K. and Joshi, D. C. Department of Sci. & Tech. Govt. of India, New Delhi : 98-109.

Prakash, I. and Taneja, G. C. 1969. Reproduction biology of the Indian desert hare, *Lepus nigricollis dayanus* Blanford. *Mammalia*, **33**(1) : 102-117.

Prasad, M. 1996. Odonata in the Thar Desert. In : *Faunal Diversity in the Thar Deset : Gaps in Research.* Ed. by A. K. Ghosh, Q. H. Baqri and I. Prakash, 145-149 (15), Scientific Publishers, Jodhpur.

Prasad, M and Thakur, R. K. 1981. Further additions to the Odonate (Insecta) fauna of Rajasthan. *Jantu,* **1** : 26-28.

Prasad, N. 1977. Nematodes in relation to plant diseases in Rajasthan. In the : *Natural Resources of Rajasthan* (Ed. M. L. Roomwal), Vol. I, pp. 423-430. Jodhpur University Press, Jodhpur.

Prasad, V. 1975. Plant feeding mites of India (Acarina : Tetranychidae); II. Genera *Bakerina, Mesobryobia, Panonychus* and *Porcupinychus. Internat. J. Acarol.*, **1**(2) : 18-25.

Pruthi, H. S. 1951. The Desert locust cycle in 1940-46 in India–Its progress and control. *Mem. Ent. Soc. India*, **2**(2) : 1-113.

Pruthi, H. S. and Bhatia, D. R. 1952. Peculiarities of the insect fauna of Rajasthan desert and the share of insects in the maintenance of the desert.–*Bull. natnl. Inst. Sci. India*, **1** : 241-245.

Rahmani, A. R. 1986. Status of the Great Indian Bustard in Rajasthan. Technical Report No. 11, p. 34, B. N. H. S.

Rahmani, A. R. 1989a. The Great Indian Bustard; final report. B. N. H. S. 234 pp.

Rahmani, A. R. 1989b. The uncertain future of the Desert National Park in Rajasthan, India. *Environmental Conservation*, **16**(3) : 237-244.

Rahmani, A. R. 1996a. Status of vultures in the Thar desert of India. *Vulture News*, **35** : 23-30.

Rahmani, A. R. 1996b. Changing avifauna of the Thar Desert. In : *Faunal Diversity in Thar Desert : Gaps in Research*, Ed. by A. K. Ghosh; Q. H. Baqri and I. Prakash, 307-323. Scientific Publishers, Jodhpur.

Rahmani, A. R. 1997a. *Wildlife in the Thar.* Worldwide Fund for Nature, India WWF, New Delhi, 1-100.

Rahmani, A. R. 1997b. The effect of Indira Gandhi Nahar Project on the Avifauna of the Thar Desert. *J. Bombay nat. Hist. Soc.*, **92**(2) : 233-266.

Rahmani, A. R. and Sankran, R. 1991. Blackbuck and Chinkara in the Thar desert : a changing scenario. *J. Arid. Env.*, **20** : 379-391.

Rahmani, A. R. and Soni, R. G. 1997. Avifaunal changes in the Indian Thar Desert. *J. Arid. Env.*, **36** : 687-703.

Rajasthan District Gazetters-Barmer. 1962. Directorate District Gazetters Govt. of Rajasthan, Jaipur, pp. 1-227.

Rajasthan District Gazetters-Jaisalmer. 1973. Directorate, District Gazetters, Govt. of Rajasthan, Jaipur, pp. 1-381.

Rama Rao, K. V. 1979. Fauna of Rajasthan. In Second All India Conference on Desert Technology (Bikaner, October 1979) Souvenir volume, pp 13-14. *Indian Society of Desert Technology*, Jodhpur.

Rama Rao, K. V. 1980. Fauna of arid zones with special reference to Rajasthan. Lecture Notes ICAR Summer Institute on management of Arid Zones in India. Vol. 2, pp. 74-78. *CAZRI*, Jodhpur. (Cyclo styled).

Rana, B. D. 1981. Ecological studies on soft-furred field rat, *Rattus meltada pallidior* (Ryley) with special reference to its feeding and breeding habits, population structure and interspecific relationship in mixed population of small mammals. Ph. D. Thesis, Agra University, Agra.

Rana, B. D. 1994. Bio-diversity among bird fauna in Rajasthan desert. In *Advances in Forestry Research in India* (Ed. Ram Prakash), 199-207. Dehra Dun.

Rana, B. D. and Prakash, I. 1979. Reproduction biology and population structure of House shrew, *Suncus murinus sindensis* in Western Rajasthan. *Z. Saugetierh*, **44** : 333-343.

Rao, K. S. 1960. *The Desert Locust in India.* XXI + 721 pp. 25 text-figs, 59 pls. *Monograph of Indian Council of Agricultural Research*, New Delhi.

Rathore, G. S. and Nama, H. S. 1985. Helminth parasites of birds of the arid zone. *Sci. Rev. Arid Zone Res.*, **3** : 128-143.

Rathore, M. S. 1969. The morphology of the Indian Sand Lizard. *Ophiomorus tridactylus* (Blyth) Boulenger. *Morphologische Jahrbuch.*, **114** : 161-168.

Rathore, N. S. 1978. Some observations on the biology of *Eremotermes paradoxalis* (Isoptera : Termitidae : Amitermitinae). *J. Indian Acad. Wood. Sci.*, **8**(2), pp. 111-119.

Rathore, N. S. 1984. Biological observations on Indian desert termite *Microtermes mycophagus* (Termitidae). *Oikoassay*, **1**(1& 2), pp. 5-10.

Rathore, N. S. 1989. A new termite of genus *Microtermes* (Isoptera : Macrotermitinae) from Rajasthan, India. *Entomon*, **14**(1) : 53-57.

Rathore, N. S. 1994. Breeding Biology of Indian Desert termite, *Microcerotermes raja* (Isoptera : Termitidae). *Annals Arid Zone*, **33**(1) : 61-66.

Rathore, N. S. 1995. A new species of *Eurytermes* Wasmann (Insecta : Isoptera : Termitidae), from India. *Entomon*, **20**(3 & 4) : 203-207.

Rathore, N. S. 1996. Termites (Isoptera) of the Thar Desert. In : *Faunal Diversity in the Thar Desert : Gaps in Research.* Ed. By A. K. Ghosh., Q. H. Baqri and I Prakash, 171-183. Scientific Publisher, Jodhpur.

Rathore, N. S. 1998. (Abst). Taxonomy and Ecology of termites of Rajasthan. National Seminar on Entomology in 21st century, (The Entomological Society of India) R.C.A., Udaipur.

Ray, H. C. and Mukharjee, A. 1969. Fauna of Rajasthan, India, Part 3. Mollusca. *Rec. zool. Surv. India*, **61**[1963] (3 & 4) : 377-402.

Reddy, A. S., Kumar, R. and Mathur, S. N. 1978. Studies on the biology of *Galumna flabellifera* Hammer. 1958 and its role as fungal spore carrier. In : *Soil Biology and Ecology in India* Ed. C. A. Edward & G. K. Veeresh. UAS Tech. Ser. No. **22** : 134-143.

Roonwal, M. L. 1945. Two colour-types in solitaria-phase adults and hoppers of the Desert Locust. *Nature*, **155**. p. 792.

Roonwal, M. L. 1963. Fauna of Rajasthan, India, Part. I. General introduction with a list of collecting localities and a Bibliography of Rajasthan Zoology. *Rec. zool. Surv. India.*, **61**(3 & 4) : 1-290.

Roonwal, M. L. 1976. Field ecology and eco-biogeography of Rajasthan termites : A study in desert environment. *Zool. Jahrb.* (Syst.), **103** : 455-504.

Roonwal, M. L. 1982. Fauna of the Great Indian Desert. (Past and present composition, zoogeography, ecology, biology, physiology and conservation). *In : Desert Resources and Technology*, (Ed. Alam Singh) Scientific Publishers & Geo-Tech Academy, Jodhpur. Vol. **1** : 1-86.

Roonnwal, M. L. 1987. Recent advances in rodentology in India. *Rec. zool. Surv. India*, Occasional paper No. **105** : 1-126.

Roonwal, M. L. and Bose, G. 1963. Fauna of Rajasthan, India, part. 4. A check list of Rajasthan Termites (Insecta : Isoptera). *Rec. zool. Surv. India*, **61**(3 & 4) : 403-437.

Roonwal, M. L. and Bose, G. 1964. Termite fauna of Rajasthan, India, *Zoologica*, **113** : 1-58.

Roonwal, M. L., Mohnot, S. M. and Rathore, N. S. (Edited by) 1984. *Current Primate Researches*. Xiii + 627 pp. 31. Pls. Jodhpur (Dept. of Zoology, Jodhpur University), S. K. Enterprises, Jodhpur.

Roonwal, M. L. and Rathore, N. S. 1974. Biological observations on three Indian Desert termites, *Eremotermes paradoxalis, Microcerotermes raja and Angulitermes jodhpurensis* (Termitidae). *Ann. Arid Zone*, **13**(3) : 237-258.

Roonwal, M. L. and Rathore, N. S. 1975. Swarming of primary reproductive, egg laying and hatching in the Indian desert harvester termite, *Anacanthotermes macrocephalus* (Hodotermitidae). *Ann. Arid Zone*, **14**(4), pp. 329-338.

Roonwal, M. L. and Rathore, N. S. 1975. Swarming, egg-laying and brood-care in termite of genus *Microtermes* (Termitidae) in the India Desert. *J. Ind. Acad. Wood Sci.*, **6**(1) : 37-55.

Roonwal, M. L. and Sen-Sarma, P. K. 1960. Contributions to the Systematics of Oriental Termites. Xiv + 407 pp., 65 pls. *Indian Council of Agricultural Research, Entomological Monograph* No. **1**, New Delhi.

Roonwal, M. L. and Verma, S. C. 1977. Re-survey of the termite fauna of Rajasthan, India, and its Zoo-geography. *Rec. zool. Surv. India*, **72** : 425-480.

Roy, R. K. 1988. The Genus *Macrocheles latreille* 1829 in India : Two new species and three new records. *Geobios new Reports*, **1** : 150-154.

Saha, G. N. 1972. Studies on Indian blister beetles (Coleoptera : Meloidae). II. Four new species of *Mylabris* Fab. From Rajasthan. *Oriental Ins.*, **6**(3) : 273-280.

Saha, G. N. 1979. Revision of Indian blister beetles (Coleoptera : Meloidae : Meloinae). *Rec. zool. Surv. India*, **74**(1) : 1-146.

Sanyal, A. K. 1996. Soil mite (Acarina) Fauan in the Thar Desert. In : *Faunal Diversity in the Thar Desert. : Gaps in Research*. Ed. by A. K. Ghosh, Q. H. Baqri and I. Prakash, 89-92 (10). Scientific Publishers, Jodhpur.

Sanyal, A. K. and De. S. K. 1996. Tick (Acarina : Metastigmata) fauna in the Thar Desert. In : *Faunal Diversity in the Thar Desert. : Gaps in Research*. Ed. by A. K. Ghosh, Q. H. Baqri and I. Prakash, 81-87, (9). Scientific Publishers, Jodhpur.

Sawyer, R. T. 1986. Leech *Biology and Behaviour*. Vol. 2, *Oxford Science Publications*. Claredon Press, Oxford. pp. 410-793.

Sen, N. N. and Shankhala, K. S. 1962. Wild life of Rajasthan : A study in ecology. *Proceedings of first All-India Congress of Zoology* (Jabalpur, 1959) Calcutta, pt. 2 (*Scientific Papers*), pp. 258-268, 5pls.

Sewak, R. 1986. On a collection of dung beetles (Coleoptera : Scarabaeidae : Coprinae) from Rajasthan, India. *Oikoassay*, **3**(1&2) : 11-16.

Shankhala, K. S. 1963. Wildlife conservation in Rajasthan. *Indian Forester*, **89**(2) : 117-124.

Shankhala, K. S. 1964. Wildlife sancturies of Rajasthan. *J. Bombay nat. Hist. Soc.*, **61**(1) : 27-34.

Sharma, A. and Kushwaha, K. S. 1983. Distribution of *Larvacarus transitans* (Ewing) in Rajasthan. *Abst. II All India Symp. Acarology*, Pune, 17-18.

Sharma, A. and Kushwaha, K. S. 1983a. Some plant mites of agricultural importance in Rajasthan. *II All India Symp. Acarology*, Pune. 19.

Sharma, A. and Kushwaha, K. S. 1990. Distribution of *Larvacarus transitans* in Rajasthan. *Acar. Newsl.*, **17** : 18-b.

Sharma. I. K. 1969. Breeding of Indian white-backed vulture at Jodhpur. *Ostrich*, 10.

Sharma I. K. 1969a. Habitat et comportement du Paon (*Pavo cristatus*). *Alauda*, **37** : 219-223.

Sharma, I. K. 1981a. Conservation of vanishing fauna and control of pests and Vermins in Indian Desert ecosystem. Abstract natnl. symposium. *Evolution of our environment* (Jodhpur April, 1981), 63.

Sharma, K. P., Tyagi, A. P. and Ranjana Saxena. 1984. Fishries potential of Thar Desert, India. *Proc. Sem. Eff. Pest. Aq. Fau. The Academy of Environmental Biology, India.* 91-97.

Sharma, M. S. and Durve, V. S. 1985. Tropic status and fishery potential of Rajasthan waters. *Proc. Nat. sympos. Evolu. Environ. (Spl. Vol. Geobios)* Ed. S. D. Misra; D. N. Sen and I. Ahmad, 1985 (1981), pp. 180-186.

Shrama, R. C. 1974. A report on the snakes of Rajasthan. *Indian Journal of Zoology*, **2**(2) : 19-28.

Sharma, R. C. 1978. A new species of *Phrynocephalus* Kaup (Reptilia : Agamidae) India. from the Rajasthan Desert, India, with notes on its ecology. *Bull. zool. Surv. India*, **1**(3) : 291-294.

Sharma, R. C. 1996. Herpetology of the Thar Desert. In : *Faunl Diversity in Thar Desert : Gaps in Research.* Ed. by A. K. Ghosh, Q. H. Baqri, and I. Prakash, 297-306. Scientific publisher, Jodhpur.

Sinha, Y P. 1975. New records of bats (Chiroptera) from Rajasthan. *Sci. & Cult.*, **42**(12) : 608-610.

Sinha, Y P. 1976. New records of the Indian sheath-tailed bat, *Taphozous longimanus*, from Rajasthan with remarks on winter fat deposition in *T. Kachhensis. Sci. & Cult.*, **42**(3) : 169-170.

Sinha, Y P 1976. Records of the Bat *Scotophilus temmincki* Horsfield. (Vespertilionidae) from Rajasthan. *J. Bombay nat. Hist. Soc.*, **72**(3) : 837.

Sinha, Y P. 1977. The oriental bats of genus *Megaderma* (Megadermatidae). *Geobios*, **4**(1) : 9-12.

Sinha, Y P. 1977. A new and rare record of fruit bat (Pteropidae) from Rajasthan (Mammalia : Chiroptera). *Sci. & Cult.*, **43**(7) : 264-265.

Sinha, Y P. 1977. *Studies on Taxonomy, Distribution, Zoo-geography, Osteology and Field Ecology of Bats of Rajasthan especially the Indian Desert.* 204 pp. Many fig. Ph. D. Thesis, Jodhpur University. Jodhpur.

Sinha, Y P. 1980. The bats of Rajasthan : Taxonomy and zoogeography. *Rec. zool. Surv. India,* **76** : 7-63.

Sinha, Y P. 1980. Further observations on the field ecology of Rajasthan bats. *J. Bombay nat. Hist. Soc.*, **77**(3) : 465-470.

Sinha, Y P. 1981. New record of black-bearded tomb bat, *Taphozous melonopogon melanopogon* Temminck from Rajasthan. *Geobios*, **8** : 225-226.

Sinha, Y P. 1983. The bats of Rajasthan. *Sci. Reptr.*, **20**(7) : 423-424.

Soni, R. G. 1994. Checklist of birds of Indira Gandhi Nahar Project Stage II (Rajasthan). *Indian Forester*, **120**(10) : 929-935.

Soota, T. D., Saxena, M. M. and Baskaran, S. 1981. Leeches of arid region of Rajasthan around Jodhpur, and their ecology, *Abstract natnl. Sympos. Evolution of our Environment* (Jodhpur April, 1981) Jodhpur.

Soota, T. D., Baskaran, S. and Saxena, M. M. 1981. Sponges of lake kailana (Jodhpur) their ecology with a note on role of sponges as indicators of water quality. *Abstract natnl. Sympos. Evolution of our Environment* (Jodhpur April 1981), Jodhpur : 28.

Soota, T. D., Saxena, M. M. and Baskaran, S. 1982. Leeches of arid region around Jodhpur and their ecology. *Geobios new Reports*, **1** : 136-138.

Soota, T. D. and Saxena, M. M. 1983. Sponge fauna of some waters of Rajasthan and its ecology. *Trans. Isdt. Ucds.*, **8**(2) : 131-133.

Soota, T. D. and Saxena, M. M. 1984a. Leeches of some waters of Rajasthan and their ecology. *Geobios new Reports*, **3** : 125-127.

Soota, T. D. and Saxena, M. M. 1984b. Leeches of some waters of the Indian desert and their ecology. *Oikoassay*, **1**(1 & 2) : 29-31.

Srivastava, B. K. 1959. Insect pests of maiz in Rajasthan. *J. Bombay nat. Hist. Soc.*, **56**(3) : 665-668.

Srivastava, G. K. 1988. Fauna of India and Adjacent countries. Dermaptera, 1 : xii+268. Zoological Survey of India, Calcutta.

Swarup, G and Sethi, C. L. 1977. Plant parasitic nematodes of Rajasthan. In : *The Natural Resources of Rajasthan* (Ed. M. L. Roonwal), vol. 1, pp. 431-435, Jodhpur University Press, Jodhpur.

Tak, N. 1996. Aquatic beetles of Thar Desert. In : *Faunal Diversity in the Thar Desert. : Gaps in Research.* Ed. by A. K. Ghosh, Q. H. Baqri and I. Prakash, 221-226 (24), Scientific Publishers Jodhpur.

Tak, N. and Sewak, R. 1987. On the Collection of aquatic beetles (Coleoptera) from Lake Kailana, Jodhpur, India, *Oikoassay*, **4**(2) : 33-38.

Tak, N. and Rathore, N. S. 1996. Ant (Formicidae) fauna of the Thar Desert. In : *Faunal Diversity in the Thar Desert. : Gaps in Research.* Ed. by A. K. Ghosh, Q. H. Baqri and I. Prakash, 271-276 (28), Scientific Publishers, Jodhpur.

Tandon, S. K. 1996. Insect diversity in the Thar Desert. In : *Faunal Diversity in the Thar Desert. : Gaps in Research.* Ed. by A. K. Ghosh, Q. H. Baqri and I Prakash, 131-143 (14), Scientific Publishers, Jodhpur.

Tandon, S. K. and Shishodia, M. S. 1976. On a collection of Acridoidea (Orthoptera) from Rajasthan. *Newl. zool. Surv. India*, **2**(1) : 7-11.

Tewari, A. K. 1968. Encidence and ecology of guineaworm disease in Rajasthan. *Rajasthan Medical Journal*, **8**(4) : 229-242.

Tiwari, K. K. 1951. Indian species of the genus *Apus* (Crustacea : Branchiopada) with description of two new species. *Rec. Indian Mus.*, **49**(2) : 197-205.

Tiwari, K. K. 1958. Diagnosis of a new species of the genus *Branchinella* Sayce (Crustacea : Branchiopoda : Anostraca) from Sambhar Lake, Rajasthan, *J. Bombay nat. Hist. Soc.*, **55** : 585-588.

Tiwari, K. K. 1962. New species of conchostraca (Crustacea : Phyllopoda) from Rajasthan. *Proc. of 1st All India Congr. Zool.* (Jodhpur, 1959). Pt. 2, pp. 180-190.

Tiwari, K. K. 1962a. Occurrence of Fossil penaeid prawn in the Fuller's earth deposits of Kapurdi (Barmer District, Rajasthan). *Sci. and Cult.*, **28** : 244-245.

Tiwari, K. K. 1963. Lower tertiary penaeid shrimps from Kapurdi (Barmer district, Rajasthan, India). *Crustaceana*, **5** : 205-212.

Tiwari, K. K. 1965. *Brachinela kugenumaensis* (Ishikawa, 1894) (Phyllopoda : Anostraca) in Rajasthan, western India. *Crustaceana*, **9** : 220-222.

Tiwari, K. K. 1966. A new species of *Nuculana* Link (Mollusca : Bivalvia) from lower Eocene Fuller's earth deposit of Kapurdi, Rajasthan (Western India). *Annals and Magazine of Natural History* (ser. 13). **9** : 161-163.

Tiwari, K. K. 1968. A new Fossil period fish from lower tertiary Fuller's earth deposti of Kapurdi, Barmer district, Rajasthan. *J. Zool. Soc. India*, **20** : 95-103.

Tiwari, K. K. 1996. Branchiopod, crustacea of Rajasthan Desert. In : *Faunal Diversity in the Thar Desert : Gaps in Research.* Ed. by A. K. Ghosh, Q. H. Baqri and I. Prakash, 113-129 (13), Scientific Publishers, Jodhpur.

Thakur, R. K. 1984. An addition to the termite fauna of Thar Desert. *J. Bombay nat. Hist. Soc.*, **81**(2) : 496-497.

Thakur, R. K. 1985. Field notes on the Odonata around Lake Kailana, Jodhpur (Rajasthan). *Bull. zool Surv. India*, **7**(1) : 143-147.

Tyagi, B. K. and Miller, P. L. 1991. A note on the Odonata collected in South-Western Rajasthan, India. *Notul. Odonatol.*, **3**(8) : 134-135.

Uvarov. B. P. 1928. Locusts and Grasshoppers. London. 352 pp.

Varshney, R. K. 1996. Scale insects and Mealybuges in the Thar Desert. In : *Faunal Diversity in the Thar Desert : Gaps in Research.* Ed. by A. K. Ghosh, Q. H. Baqri and I. Prakash, 185-189 (20), Scientific Publishers, Jodhpur.

Vazirani, T. G. 1964. Fauna of Rajasthan India. Part. 5. Aquatic beetles (Insecta : Coleoptera : Dytiscidae). *Rec. zool. Surv. India.*, **62**(1 & 2) : 29-49.

Vazirani, T. G. and Advani, R. 1976b. Some ectoparasites of bats from Rajasthan (Diptera : Streblidae) with description of a new species. *Oriental Insects*, **10** : 453-457.

Vazirani, T. G. and Advani, R. 1977b. Preliminary report on the Nycteribidae (Diptera : Pupipara) ectoparasites on bats of Rajasthan. *Abst. Sec. Ori. Ent. Sym.*, (Madras), pp. 72-73.

Vazirani, T. G. and Khanna, V. 1976. First record of the centipede *Cormocephalus* (S. str.) *pygmaeus* Pocock (Scolopendridae) from Rajasthan India. *Newsl. zool. Surv. India*, **2**(1) : 25-26.

Vazirani, T. G. and Khanna, V. 1977. First record of the centipede, *Trachycarmocephalus indae* Chamberlain (Scolopendridae), from Rajasthan, *India. Newsl. zool. Surv. India*, **3**(4) : 141-142.

Venkatesh, M. V. 1977. Some grasshoppers and locusts of Rajasthan. In : *The National Resources of Rajasthan*. (Ed. M. L. Roonwal). Vol. 1. pp. 353-362. Jodhbpur University Press, Jodhpur.

Verma, S. C. and Purohit. G. L. (in press). Additions to the termite (Insects : Isoptera) fauna of Rajasthan, India. *Indian Journal of Forestry*, Dehra Dun.

Verma, S. C. and Thakur R. K. 1977. New distributional records of termites (Isoptera) from Jodhpur, Rajasthan, India. *Newsl. zool. Surv. India*, **3**(1) : 14-16.

Vyas, H. K. 1996. Insect pests in Indira Gandhi Canal region of the Thar Desert. In : *Faunal Diversity in the Thar Desert* : *Gaps in Research*. Ed. by A. K. Ghosh, Q. H. Baqri and I. Prakash, 203-213 (22), Scientific Publishers, Jodhpur.

Wason, A. and Johnson, S. 1977. A new genus of Hymenolepid cestodes from the Indian gerbil *Tatera Indica. J. Heliminth.*, **51** : 309-312.

Wason, A. and Johnson, S. 1978. Trematode parasites of the microchiropteran bats of Jodhpur, India. *Asian Congress of Parasitology*, Bombay. February 23-26. 1978. Abst. No. IV-66, P. 235.

Wattal, B. L. and Srivastava, S. P. 1967. Ectoparasitic forms of small mammals and domestic animals in the neighbourhood of Alwar city, Rajasthan. *Bull. India Soc. Malaria and Comn. Diseases*, **4** : 191-202.

Whistler, H. 1938. The ornithological Survey of Jodhpur State. *J. Bombay nat. Hist. Soc.*, **40** : 213-235.

Yazdani, G. M. 1996. Fish diversity in the Thar Desert. In : *Faunal Diversity in Thar Desert : Gaps in Research*. Ed. by A. K. Ghosh., Q. H. Baqri and I. Prakash, 285-295, Scientific Publisher, Jodhpur.

Zool. Surv. India
Conservations Area Series **19**, *Fauna of Desert National Park*, : 33-38, 2004

PLANT AND SOIL NEMATODES

P. BOHRA AND Q. H. BAQRI
Desert Regional Station, Zoological Survey of India, Jodhpur, India

INTRODUCTION

The members of the phylum Nematoda (nematodes) are characterised by having appendageless, non-segmented and mostly cylindrical body. Since most of them have cylindrical body they are generally called "round worms" or "thread worms" They are found in astonishingly unimaginable number habitats, different shapes and sizes. Nematodes found in soil are phytophagous, predaceous or saprophagous. Hence, they together form a separate group i.e., "Plant and Soil nematodes" The identification of these nematodes is important because each group plays important role in the ecosystem in which they are found either as parasites of plants or in maintaining the balance.

Our knowledge on fauna of plant and soil nematodes from Desert of Rajasthan is based only on a few papers (Khera and his co-workers, 1962–1970; Swarup and Sethi, 1968; Lal and Mathur, 1986–1990; Nama and Soni, 1979; Baqri, 1996).

The present paper reports the species of nematodes from the soil samples collected by the survey parties of Desert Regional Station, Jodhpur during 1995–1996 from Desert National Park, Rajasthan. These samples yielded 8 species belonging to 8 genera under 5 families of the following three orders; Tylenchida, Aphelenchida and Dorylaimida. Out of these, one species has been found as new to science and two have been recorded for the first time from Rajasthan. Besides *Labronema virgo* is also being reported for the first time from India. The brief descriptions and information on hosts and localities of known species are being provided below. The detailed description and illustration of *Kochinema* sp. n. have been published in a separate paper (Baqri and Bohra, 2001).

SYSTEMATIC ACCOUNT

Order TYLENCHIDA Thorne, 1949

Suborder TYLENCHINA Chitwood in Chitwood & Chitwood, 1950

Superfamily HOPLOLAIMOIDEA Filipjev, 1934 (Paramonov, 1967)

Family HOPLOLAIMIDAE Filipjev, 1934 (Wieser, 1953)

Hoplolaimus indicus Sher, 1963

Measurements :

Females (5) : L = 1.56 mm.; a = 28–34; b = 7.1–8.6; c = 70–80; V = $^{9-11}55–60^{10-11}$.

Males (5) : L = 0.92–1.20 mm.; a = 24–33; b = 7.8–8.5; c = 31–38.

Description : FEMALE : Body almost straight or slightly ventrally curved upon fixation. Cuticle coarsely striated, striae 2 µm apart at mid-body. Lateral fields marked by 2–4 irregularly broken incisures at different level of the body. Lip region set off, conical, marked by 3–4 annules. Labial framework strongly sclerotized. Stylet 38–44 µm. long; its basal knobs tulip-shaped, conus 20–24 µm. long or 52–54% of stylet length. Orifice of dorsal oesophageal gland 4–5 µm posterior to stylet base. Median oesophageal bulb 57–72% of oesophageal length from anterior end. Oesophageal glands overlapping intestine dorsally; with six nuclei. Anterior and posterior phasmids at 27–30% and 75–77% of body length, respectively, from anterior end. Female reproductive system amphidelphic. Vulva a transverse slit Epiptygma single. Spermatheca distinct, set off, generally filled with sperms. Ovaries outstretched; oocytes arranged generally in single row except in growth region. Intestine is slightly overlapping rectum. Rectum 10–12 µm long or 0.5–0.6 anal body width long. Tail 12–20 µm long or 0.6–1.1 anal body-width long, with bluntly rounded terminus, marked by 5–9 striae.

MALE : Testis single, outstretched. Spicules 37–42 µm long, arcuate and cephalated. Gubernaculum 16–20 µm long, conoid enveloped by bursa.

Habitat and locality : Collected from soil around roots of unidentified grass at Harsoni village, Barmer and Sam area, Jaisalmer.

Remark : It is widely distributed species in the state.

Order APHELENCHIDA, Siddiqi, 1980

Suborder APHELENCHINA, Geraert, 1966

Superfamily APHELENCHOIDEA Fuchs, 1937 (Thorne, 1949)

Family APHELENCHIDAE Fuchs, 1937 (Steiner, 1949)

Aphelenchus avenae Bastian, 1865

Measurements :

Females (5) : L = 0.55 mm.; a = 25–39; b = 4.9–6.9; b' = 7.2–9-2; c = 26–34; V = $^{26-36}74–78^{6-8}$.

Description : FEMALE : Body slightly ventrally arcuate upon fixation, narrowing just posterior to vulva. Lip region rounded to flattened, not set off from body, with three to four faint labial striae. Lateral fields widest in mid-body, marked 10–12 incisures. Stylet 10–12 µm long, without basal swellings. Procorpus of esophagus cylindrical. Median bulb widening abruptly from procorpus, well developed, rectangular to oval in shape. Dorsal lobe of oesophageal gland overlaps intestine on subdorsal side. Vulva a short transverse oval slit. Vulval lips slightly protruded. Female reproductive system mono-prodelphic, ovary outstretched. Posterior uterine sac reaching about half way from to vulva to the anus. Tail usually bluntly rounded 16–33 µm long or 0.7 to 1.0 anal body-width long.

MALE : Not found.

Habitat and locality : Collected from soil around roots of unidentified grasses at Sam area, Jaisalmer.

Order DORYLAIMIDA Pearse, 1942

Suborder DORYLAIMINA Pearse, 1936

Superfamily DORYLAIMOIDEA De Man, 1876

Family QUDSIANEMATIDAE Jairajpuri, 1965

Labronema virgo Monteiro, 1970

Measurements :

Female (1) : L = 1.98 mm.; a = 36; b = 7.35; c = 56.71; V = 51.

Description : FEMALE : Body more or less straight upon fixation. Cuticle thick. Lip region offset by constriction. Odontostyle 15 µm long slightly ventrally bent. Guiding ring double. Odontophore rod-like. Basal expanded part of oesophagus occupies about more than half of oesophageal length. Female reproductive system amphidelphic. Vulva longitudinal. Ovaries reflexed Prerectum 4–5 times anal body-width long. Rectum 2–3 times anal body-width long. Tail 30 µm long, rounded conoid.

MALE : Not found.

Habitat and locality : Collected from soil around roots of unidentified grasses at D. N. P. Jaisalmer.

Remarks : This species is being reported for the first time from India.

Discolaimus major Thorne, 1939

Measurements :

Females (15) : L = 1.4–2.63 mm.; a = 32–36; b = 3.9–4.5; c = 46–58; V = $^{11-12}47-48^{11-12}$.

Description : FEMALE : Body almost straight upon fixation. Inner cuticle finely striated, 2–5 µm thick (thickest at tail). Lateral hypodermal chords with well developed 120–140 glandular bodies. Lip region discoid. Odontostyle 22–25 µm long; aperture occupying 50–52% of odontostyle length. Guiding ring single. Odontophore rod-like, 30–35 µm long. Basal expanded part of oesophagus occupies 50–55% of total oesophageal length and surrounded by a conspicuous muscular sheath. Vulva a transverse slit. Vagina 15–17 µm., extending inwards about one-third of corresponding body-width. Female reproductive system amphidelphic. Ovaries reflexed. Prerectum 100–120 µm or 4.0 to 4.5 anal body-width long. Rectum 40–45 µm or 1.8 to 2.0 anal body-width long. Tail 30–35 µm. or 1.2 to 1.5 anal body-width long, conoid.

MALE : Not found.

Habitat and locality : Collected from soil around roots of unidentified grasses at Sam area, Jaisalmer.

Discolaimium mukhtarpuriense Baqri and Jairajpuri, 1969

Measurements :

Females (4) : L = 0.80–0.87 mm.; a = 25–32; b = 3.8–4.2; c = 28–29;
V = $^{10-11}53-55^{10-11}$

Description : FEMALE : Body slender, slightly tapering in posterior third of its length upon fixation. Cuticle smooth. Lateral chords $1/5^{th}$–$1/4^{th}$ of body-width, with well developed 60–70 glandular bodies. Lip region set off. Odontostyle 14–16 um long; its aperture 5–6 µm. Guiding ring single. Odontophore 15–17 µm long. Basal expanded part of oesophagus occupies 33–36% of total neck region. Vulva transverse. Vagina 9–10 µm or about one third of corresponding body-width. Female reproductive system amphidelphic. Ovaries reflexed. Prerectum 72–102 µm or about 3–5 anal body-width long. Rectum 30–32 µm or 1.2 anal body-width long, Tail 28–30 µm or 1.2 anal body-width long convex-conoid, with a rounded terminus.

MALE : Not found.

Habitat and locality : Collected from soil around roots of unidentified grasses at Sam area, Jaisalmer.

Remark : This species is reported for the first time from Rajasthan.

Dioscolaimoides bulbiferus (Cobb, 1906) Heyns, 1963

Syn : *Dorylaimus bulbiferus* Cobb, 1906

Discolaimus bulbiferus (Cobb, 1906) Thorne & Swanger, 1936

Discolaimium bulbiferus (Cobb, 1906) Timm & Bhuiyan, 1963

Measurements :

Females (6) : L = 1.40–1.65 mm.; a = 46–55; b = 4.0–5.2; c = 35–36; V = $^{8-10}45–53^{8-10}$.

Description : FEMALE : Body c-shape upon fixation, tapering in its posterior half. Cuticle smooth. Lateral glandular bodies 150–165 present in entire length of body. Lip region expanded but not set off by constriction. Odontostyle 15–17 µm long; aperture about one-half of odontostyle length. Basal expanded part of oesophagus occupies 52–56% of total neck region. Vulva a transverse slit. Vagina 9–10 µm or about one-third of corresponding body-width. Female reproductive system amphidelphic. Ovaries reflexed. Prerectum 100–120 µm or 4.5–4.8 anal body-width long. Rectum 28–30 µm or 1.2 anal body-width long. Tail 40–45 µm or 1.8 anal body width long, conoid with narrowly rounded terminus.

MALE : Not found.

Habitat and locality : Collected from soil around roots of unidentified grasses at Sam area, Jaisalmer.

Family NORDIIDAE Jairajpuri and A. H. Siddiqi, 1964

Kochinema Heyns, 1963

Remarks : Described and illustrated in separate paper (Baqri & Bohra, 2001).

Superfamily TYLENCHOLAIMOIDEA Filipjev, 1934.

Family TYLENCHOLAIMIDAE Filipjev, 1934.

Tylencholaimus suryawanshii Ali and Chisty, 1972

Measurements :

Females (5) : L = 0.71–0.75 mm.; a = 21–29; b = 3.8–4.7; c = 31–33; V = $^{10-11}52–55^{10-11}$.

Description : FEMALE : Body slightly ventrally arcuate upon fixation, tapering gradually towards both ends. Inner cuticle striated. Lip region set off from body by constriction. Odontostyle 8–9 µm long; aperture 3–4 µm or onefourth of odontostyle length. Odontophore 10–11 µm with small basal thickenings. Basal expanded part of oesophagus occupies 40–43% of neck region. Vulva a transverse slit. Vagina 10–12 µm, extending inward about $1/4^{th}$–$1/3^{rd}$ of corresponding body-width. Female reproductive system amphidelphic; ovaries reflexed. Prerectum 42–45 µm or 2.2–2.3 anal body-with long. Rectum 17–19 µm or 0.8–1.0 analbody-width long. Tail 21–24 µm or 1.1–1.2 anal body-width long with hemispheroid terminus.

MALE : Not found.

Habitat and locality : Collected from soil around roots of unidentified grasses at Harsoni Village, Barmer.

Remarks : *Tylencholaimus suryawanshi* is being reported for the first time from Rajasthan.

SUMMARY

The soil samples brought from Desert National Park yielded the following. 8 species of plant and soil nematodes : *Hoplolaimus indicus* Sher, 1963; *Aphelenchus avenae.* Bastian, 1865, *Labronema virgo* Monteiro, 1970; *Discolaimus major* Thorne, 1939; *Discolaimium mukhtarpuriense* Baqri & Jairajpuri 1969; *Discolaimoides bulbiferus* (Cobb, 1906) Heyns 1963; *Tylencholaimus suryawanshii* Ali & Chisty, 1972 and *Kochinema* sp. n. *Discolaimium mukhtarpuriense* Baqri & Jairajpuri, 1969 and *Tylencholaimus suryawanshii* Ali & Chisty, 1972 are being recorded for the first time from Rajasthan while *Labronema virgo* Monteiro, 1970 as new record from India.

REFERENCES

Baqri, Q. H. 1996. Faunal diversity of Nematoda in Thar Desert : Assessment and Futuristic Approach. In *Faunal Diversity in the Thar Desert : Gaps in Research.* (Eds. A. K. Ghosh, Q. H. Baqri and I. Prakash) Scientific Publishers, Jodhpur : 51-70.

Baqri, Q. H. and Bohra, P. 2001. Nematodes from Rajsthan, India. I. Six new species of Dorylaimida. *Nematology,* **3**(2) : 113-127.

Jairajpuri M. S. and Ahmad, W. 1992. *Dorylaimida : free living., predacious and plant-parasitic nematodes.* G. J. Brill Leiden. The Netherlands and Oxford and IBH, New Delhi, India, 458 pp.

Khera, S. 1967. *Acrobelinema cornis* n.g.n. sp. subfamily Acrobelinae Thorne from rhizosphere of millets from India. *Indian J. Helminthology* **21**(2) : 159-163.

Lal, A. and Mathur, V. K. 1986. Nematodes in the rhizosphere of date palm with description of *Longidoroides bikanerensis* sp. n. (Nematoda : Dorylaimoidea). *Date Palm. J.* **5** : 208-214.

Nama, H. S. and Soni, G. R. 1979. A New species of *Acrobeloides* associated with *Allium sativum* L. *Indian J. of Nematology,* **9** : 33-39.

Siddiqi, M. R. 1986. *Tylenchida : Parasites of plants and Insects.* Published by Commonwealth Institute of Parasitology by the Commonwealth Agricultural Bureax, Farnhan Royal Slongh SL 23 BN. U. K.

Swarup, G. and Sethi, C. L. 1968. Plant parasitic nematodes of North-Western India. II.

Zool. Surv. India
Conservations Area Series **19**, *Fauna of Desert National Park,* : 39-44, 2004

MOLLUSCA

K. V. SURYA RAO, S. C. MITRA AND R. N. MANNA
Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053

INTRODUCTION

Our knowledge on the malacofauna of Thar Desert is known from the early works of Ray and Mukherjee (1969), Roonwal (1982) and more recently by Subba Rao (1996). Ray and Mukherjee reported a total of 28 species from Rajasthan which included 6 species of land forms, 4 marine molluscs collected from the excavations of a mound near Sambhar Lake and the 18 species of freshwater molluscs.

Roonwal (1982) reported a number of species under 52 genera and 36 families. After critical analysis of the collection data, Subba Rao (1996) recorded a total of 23 species under 15 genera and 9 families of both freshwater and land molluscs from the actual desert areas. The list included 7 species under 6 genera and 5 families of freshwater and 16 species under 9 genera and 4 families of land molluscs.

The present studies were made based on the material collected from the Desert National Park by staff of Desert Regional Station, Zoological Survey of India, Jodhpur in 1996 and earlier collections present in the National Zoological collections.

LIST OF SPECIES RECORDED FROM THE DNP AREA

(Jaisalmer and Barmer)

Class GASTROPODA

Order MESOGASTROPODA

Family VIVIPARIDAE

Bellamya dissimilis (Mueller)

Family BITHYNIIDAE

Digoniostoma pulchella (Benson)

Family THIARIDAE

Thiara (Melanoides) tuberculata (Mueller)

Order BASOMMATOPHORA

Family PLANORBIDAE

Indoplanorbis exustus (Deshayes)

Order STYLOMMATOPHORA

Family SUBULINIDAE

Zootecus estellus (Benson)

Z. insularis (Ehrenberg)

SYSTEMATIC ACCOUNT

Class GASTROPODA

Order MESOGASTROPODA

Family VIVIPARIDAE

Genus ***Bellamya*** Jousseaume, 1886

Bellamya dissimilis (Mueller)

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

1969. *Viviparus variatus* : Ray & Mukherjee, *Rec. zool. Surv.* India, **61**(3 & 4) : 417, pl. 18, fig. 11.

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

Material examined : Barmer district : 2 exs., Dried up bed of balu River, 7.1.59, S. Biswas coll.

Measurements :	Length	Diameter	H. of aperture
	14.5	10.0	7.15

Distribution : INDIA : Rajasthan, (Barmer, Tonk, Udaipur), common throughout rest of the country. *Elsewhere* : Bangladesh, Malaysia, Myanmar, Pakistan and Sri Lanka.

Diagnostic characters : Shell ovately conical, greenish, without spiral bands, whorls 5, sutures deep, bodywhorl subangulate and often with a faint whitish narrow bands around the periphery, peristome blackish.

Family BITHYNIIDAE

Genus ***Digoniostoma*** Annandale, 1920

Digoniostoma pulchella (Benson)

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

1969. *Digoniostoma pulchella* : Ray and Mukherjje, *Rec. zool. Surv. India*, **61**(3 & 4) : pl. 18, figs. 8, 8a.

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

Material examined : Barmer District : 5 exs., N.E. of Circuit House, Pachpadra, 12.2.58, K. K. Tiwari & S. Biswas coll. 3 exs., Ramsar tank, W. of Rest House, Pokran, 20.12.57, K. K. Tiwari & S. Biswas coll.

Measurements :	Length	Diameter	H. of aperture
	5.85	4.15	2.10

Distribution : INDIA : Rajasthan (Ajmer, Barmer, Jaipur, Jaisalmer, Jhunjhunu, Jodhpur, Nagaur, Pali, Sikar, Sirohi, Udaipur).

Diagnostic characters : Shell small, elongate, imperforate or very narrowly perforate, whorls 5, notmuch rounded, aperture oval.

Family THIARIDAE

Genus ***Thiara*** Roeding, 1798

Subgenus ***Melanoides*** Olivier, 1807

Thiara (Melanoides) tuberculata (Mueller)

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

1969. *Melanoides (Melanoides) tuberculatus* : Ray & Mukherjee, *Rec. zool. Surv. India*, **61**(3 & 4) : 420, pl. 19, figs. 22a.

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

Material examined : Barmer district : 51 exs., Luni River, at Syndhri, 10.ii.58, K. K. Tiwari & S. Biswas coll.

Measurements :	Length	Diameter	H. of aperture
	9.5–18	2.40–7.15	2.8–5.8

Distribution : INDIA : Rajasthan (Barmer, Chittorgarh, Jaipur, Pali, Sirohi, Udaipur); Throughout rest of the country except Jammu & Kashmir. *Elsewhere* : N. & S. Africa, Eastern Mediterranean countries, S. E. Asia, S. China, Malaysia, Malaya Archipelago, N. Australia, Pacific Islands, Ryu Kyu Islands of Japan, New Hebrides.

Diagnostic Characters : Shell elongate, turretted, sculptured with vertical ribs and spiral striae and also with dark red spots and flames, whorls 10–12, rounded.

Order BASOMMATOPHORA

Family PLANORBIDAE

Genus ***Indoplanorbis*** Annandale & Prashad, 1921

Indoplanorbis exustus (Deshayes)

1834. *Planorbis exustus* Deshayes, in Balanger, *Voy. Indes. Orientales* : 417, pl. 1, figs. 11-13.

1969. *Indoplanorbis exustus* : Ray and Mukherjee, *Rec. zool. Surv. India,* **61**(3 & 4) : 422, pl. 19 fig. 5.

1989. *Indoplanorbis exustus* : Subba Rao, in *Handbook Freshwater Molluscs of India* : 142, figs. 326, 327.

Material examined : Barmer district : 12 exs., E. of circuit House, Pachpadra, 14.2.58, K. K. Tiwari & S. Biswas coll., 2 exs., Balu river bed, 7.1.59, S. Biswas coll. Jaisalmer district : 8 exs., Ranisar, A large tank at Pokran, 20.12.59; 7 exs., Golabsagar tank, Jaisalmer, 26.12.57; 18 exs., Jedbaiser, E. of Jaisalmer, 21.1.58, K. K. Tiwari & S. Biswas coll.

Measurements :	Height	Diameter	H. of aperture
	4.5–4.8	6.8–10.2	4–4.25

Distribution : INDIA : Rajasthan (Barmer, Bikaner, Churu, Dungarpur, Ganganagar, Jaipur, Jaisalmer, Jhunjhunu, Jodhpur, Nagaur, Pali, Sikar, Udaipur), common throughout rest of the country. *Elsewhere* : Celebes, Indonesia, Malaysia, Myanmar, Pakistan, Persia, Sri Lanka, Thailand, N. & S. Vietnam.

Diagnostic Characters : Shell large and thick, depressedly coiled, with an ear-shaped aperture.

Remarks : This species is an important intermediate host for trematode parasites. Largest number of cercariea are recorded from this snail.

Order STYLOMMATOPHORA

Family SUBILINIDAE

Genus ***Zootecus*** Westerlund, 1887

Zootecus insularis (Ehrenberg)

1831. *Pupa insularis* Ehrenberg, *Symb. Phys. Anim. Evert. Moll.* **1** : 3.

1914. *Zootecus insularis* : Gude, *Fauna Brit. India, Mollusca,* **2** : 367.

1969. *Zootecus insularis* : Ray and Mukherjee, *Rec. zool. Surv. India,* **61**(3 & 4) : 413, pl. 18, fig. 3.

Material examined : Jaisalmer district : 1 ex., Nokh, 25.viii.60, S. Biswas coll.

Measurements :	Length	Diameter	H. of aperture
	11.20	3.60	3.0

Distribution : *India* : Rajasthan (Bikaner, Ganganagar, Jaipur, Jaisalmer, Jhunjhunu, Nagaur), Gujarat, Jammu & Kashmir, Madhya Pradesh, Maharashtra, Punjab, Uttar Pradesh. *Elsewhere* : Africa to Arabia, Myanmar, Pakistan, Sri Lanka.

Diagnostic characters : Shell small and narrow, subcylindrical perforate, with close, vertical striae and a few faint spiral markings, whorls 7–8, convex, body whorl slightly ascending near the aperture, peristome slightly thickened inside.

Zootecus estellus (Benson)

1857. *Bulimus estellus* Benson, *Ann. & Mag. nat. Hist.*, (2)**19** : 327.

1914. *Zootecus estellus* : Gude, *Fauna Brit. India, Mollusca*, **2** : 369.

1969. *Zootecus estellus* : Ray and Mukherjee, *Rec. zool. Surv. India*, **61**(3 & 4) : 414, pl. 18. Fig. 4.

Material examined : Barmer District : 10 exs., Gadra Rd., W. of Afforestation Nursery, 31.1.58; 2 exs., Syndhri, 36 kms. From Balotra, 10.2.58, K. K. Tiwari & S. Biswas coll. 1 ex., Girab, 97 kms from Barmer, 2.10.96; 2 exs., Turvi, NW. of Barmer, 1.10.96, N. S. Rathore coll. Jaisalmer District : 2 exs., Jaisalmer; 24 exs., Badabagh, 25.12.57, K. K. Tiwari & S. Biswas coll.; 11 exs., Sam Area, 24.9.96; 16 exs., Magra village, 30.9.96; 1 ex., Kuri Phoolia, 51 kms. from DNP 25.4.96; 10 exs., Barna Sudasari Rd., 6 kms. W. of Barna, 28.9.96, N. S. Rathore coll.

Measurements :	Length	Diameter	H. of aperture
	10.35–14.65	3.85–5.35	3.50–4.20

Distribution : INDIA : Rajasthan (Barmer, Jaipur, Jaisalmer, Jodhpur Nagaur), Andhra Pradesh. *Elsewhere* : Pakistan.

Diagnostic characters : Shell cylindrical, perforate, whitish, finely and closely marked by vertical striae, intersected by a few distant spiral markings, whorls 8; body whorl ascending near aperture; aperture vertical.

SUMMARY

A total of 6 species under 5 genera and 5 families are recorded from the Desert National Park. It include 4 species of freshwater molluscs under four genera *viz.*, *Bellamya, Digoniostoma, Thiara* and *Indoplanorbis* and two species of land molluscs under a single genus, *Zootecus*. Though the actual desert fauna of molluscs includes a total of 23 species under 16 genera and 9 families. The present fauna of the Desert National Park represents only 25% of the total Thar Desert fauna of 23 species under 16 genera and 9 families.

All the four freshwater species recorded in the park have all India range of distribution, hence there is no zoogeographical significance in the occurrence of the freshwater molluscs. *Indoplanorbis exustus*, the pulmonate gastropod is most common being recorded from 13 districts of Rajasthan including Jaisalmer and Barmer. No fresh material was collected during the recent surveys under taken in the Desert National Park.

Among the land snails, though 5 species, *Boysia boysii,Pupoidus coenopictus, Allopeas gracile, Zootecus insularis* and *Zootecus estellus* are known from the Thar desert, only two species under the genus, *Zootecus* are recorded from the Desert National Park. This genus essentially inhabits the arid regions and is one of the best-adapted taxa of terrestrial molluscs for arid situations. Its shining white shell helps in reflecting light and absorbing heat. The two species of the genus *Zootecus* viz., *Z. insularis* and *Z. estellus* are very similar to each other, the later onbeing distinguished by its slightly longer and shorter shell. Populations of the desert gastropods show great variability in the shell characters resulting in occurrence of ill-defined species. This has been termed as 'reticulate interrelationships' by van Bruggen (1978).

The recent survey made in the Desert National Park in 1996 by Desert Regional Station, Zoological Survey of India, Jodhpur, yielded a single land snail, *Zootecus estellus.* It indicates that thorough surveys, conducted by a specialist in different seasons, are needed to have a complete picture of the malacofauna of the Desert National Park. At present it is difficult to estimate the faunal status of the National Park and it is left for future workers.

REFERENCES

Subba Rao, N. V. 1996. Molluscs in the Thar Desert. In *Faunal Diversity In the Thar Desert* : Gaps in Research. Ed. A. K. Ghosh, Q. H. Baqri & I. Prakash, : 277-283. Scientific Publisher, Jodhpur.

Van Bruggen, A. C. 1978. Land molluscs in : *Biogeography and Ecology of Southern Africa* (ed. M. J. A. Werger) : 877-923, figs. 1-18.

Zool. Surv. India
Conservations Area Series **19**, *Fauna of Desert National Park,* : 45-50, 2004

INSECTA : THYSANURA

A. K. HAZRA, M. BISWAS AND S. K. MITRA
Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053

INTRODUCTION

The study of Indian Thysanuran fauna has been neglected for a long time in contrast to world fauna for this group of insects. A good amount of work was carried out from various parts of the world. The first record of Thysanura from India is that of Escherich (1903) who described the species *Lepisma indica* and *L. gyriniformis*. Thereafter, Silvestri (1913, 1938, 1948) and Wygodzinsky (1954, 1972) contributed significantly to our knowledge of Indian fauna. Subsequently, Hazra (1980, 1993) described some species of Thysanura from West Bengal. Mendes (1990) published on zoogeographic affinities of Indian Thysanura and rightly pointed out that "The quite poorly known Indian fauna of Thysanurans" is for the reason that these insects are not found frequently due to their concealing habit and special efforts are needed for their collection'

The Indian Fauna of Thysanura is presently represented by 31 species belonging to 21 genera and 6 families and 2 suborders. Order Thysanura comprises insects popularly known as 'Silver fish and bristle tails' Two families, Machilidae and Meinertellidae, can be recognised under suborder Microcoryphia, while suborder Zygentoma has four families *viz.*, Lepidotrichidae, Nicoletiidae, Lepismatidae and Ateluridae. The free-living forms are found in the forest floor, under bark of trees, under rocks in the nests of ants and termite. The members of the family Machilidae occur mostly in the decomposing litter of the forest floor and are capable of jumping by means of the apical ventral stylets. A few species such as *Lipisma saccharina* and *Ctenolepisma longicaudata* cause damage to books, photographs and other household articles.

The present study is mostly based on two small lots of about 44 exs. made in 1995 and 1996 by Dr. N. S. Rathore of Desert Regional Station, Zoological Survey of India, Jodhpur during his survey at Desert National Park, Jaisalmer and Barmer districts of Rajasthan, a proposed Thar Desert Biosphere Reserve and its surroundings. Thus, this report does not reflect the total fauna of this order from the State of Rajasthan and extensive exploration might enrich our knowledge further from this area.

This paper deals with 3 species of Thysanura under 1 family and 2 genera. In view of the fact that no information is available till now on Thysanura of Rajasthan. The genera and species dealt with represent first records from Rajasthan.

Key to the genera of *Lepismatidae*

1. Last tergum not sharply pointed with 1 + 1 bristle combs ..... *Ctenolepisma*
– Last tergum sharply pointed with more than 1 + 1 bristle combs .....*Acrotelsa*

Genus ***Ctenolepisma*** Escherich, 1905

Key to the species

1. Maximum length about 10 mm; antennae and caudal filaments not longer than body; distinct violaceous hypodermal pigment on head, body and appendages ..... *C. ciliata*
– Maximum length 13–15 mm; antennae and caudal appendages longer than body; head, body and appendages without hypodermal pigment ..... *C. longicaudata*

SYSTEMATIC ACCOUNT

Order THYSANURA

Suborder ZYGENTOMA

Superfamily LEPISMATOIDEA

Family LEPISMATIDAE

Ctenolepisma longicaudata Escherich, 1905

1905. *Ctenolepisma longicaudata* Escherich, *Zoologica* (Stuttgart) **43** : 83.

1940. *Ctenolepisma urbana* Slabaugh, Ent. News, **51** : 95.

1993. *Ctenolepisma longicaudata*, Hazra, *Rec. zool. Surv. India*, (4) : 3.

Material examined : INDIA : Rajasthan, 1♂, Turvi village, 93 Kms. of Barmer (under stone), 1.x.1996, 1 ♀, Baran village and around, Jaisalmer (under stone), 27.ix.1996, 2 ♀♀, 1♂, (ZSI Reg. No. 6597/5), Jaisalmer, Sam area, Ca–34 kms. from Jaisalmer district, 7.ii.1995, 1 ♀ (ZSI Reg. No. 6889/5), Barmer district, Harsani, 85 kms. N.W. of Barmer district (under stone), 19.vii.1995, 1♂, (ZSI Reg. No. 6924/5), Lot no. 38/96, Rajasthan, Barmer district, Turvi, 93 kms. N.W. of Barmer district. (under stone), 20.vii.1995, 2 ♀♀, (ZSI Reg. No. 7001/5), Rajasthan, Jaisalmer, Sam area, 42 kms. west of Jaisalmer district (under stone), 23.vii.1995, 2♂♂, 3 ♀♀, (1♂, 1 ♀ dissected), (ZSI Reg. No. 7128/5), Rajasthan, Jaisalmer district, Baran village, 40 kms. away from Jaisalmer district (under stone) 26.vii.1995,

1 ♀, (ZSI Reg. No. 7140/5), Rajasthan, Jaisalmer district, Khuri, near DNP area, 49 kms. from Jaisalmer district (Under stone), 27.vii.1995. All N. S. Rathore coll.

Diagnostic character : Body elongate, thorax slightly broader than the abdomen, gradually tapering with relatively short segments; length 13 mm to 15 mm, with conspicuous silvery shine; antennae, cerci and median tail appendages very long, longer than the body length; maxillary palpi 5 segmented and slender; labial palpi 4 segmented, last segment broad and oval; abdominal terga II–VI with 3 + 3 bristle combs; tergite X twice as long as tergite IX being wide at base, usually trapezoid in shape; one to three pairs stylets, present on segment VII–IX; ovipositor long and slender; body length : 13 mm, width 4 mm.

Distribution : INDIA : West Bengal, Tripura, Uttar Pradesh, Manipur, Sikkim, Bihar, Rajasthan (Barmer district Turvi, Harsani), (Jaisalmer district Baran, Sam, Khuri). *Elsewhere* : U.S.A., South Africa, Australia.

Remarks : The species is recorded for the first time from Rajasthan. It is widely distributed in the tropics and subtropics of old and New World. This species is very common in houses and libraries and a very serious pest in India.

Ctenolepisma ciliata Dufour (1831)

1831. *Lepisma ciliata* Dufour, *Ann. Sci. nat. vov.* **22** : 420.

1838. *Lepisma ciliata*, Burmeister, *Handb. D. Entomol.*, Vol. **2** : 458.

1846. *Lepisma quadrilineata*, Lucas, *Rev. zool. Ix.*, 254.

1890. *Lepisma ciliata*, Grassiet Rovelli, *Nat. Sci.*, Vol. **9** : 80.

1905. *Ctenolepisma ciliata*, Escherich, *Zoologica* (Stuttgurt) **83** : 80.

Material examined : INDIA : Rajasthan, 1♂, 1 ♀ (ZSI Reg. No. 7519/5), 42/97, ZSI (D.R.S.) Jodhpur, mopping Survey, 1996, Barmer district, Girab, 110 kms. from Barmer (under dung), 3.x.1996, 1 ♀ (ZSI Reg. No. 7370/5), ZSI (D.R.S.), Jodhpur mopping Survey, Jaisalmer, Sudasari D.N.P. area, 62 Kms. from Jaisalmer (under stone), 26.ii.1996, 3♂♂ (1 Juvenile), 1 ♀ (ZSI Reg. No 7425/5), ZSI (D.R.S.) Jodhpur mopping survey, Jaisalmer, Baran to Sundasari Road, 6 kms. West of Baran (under dung).; 28.ix.1996, 3 ♀, 2♂♂, (ZSI Reg. No. 6597/5), Jaisalmer, Sam area, 34 kms. from Jaisalmer district, 7.ii.1995, 1 ♀, (ZSI Reg. No. 6703/5), Barmer, Turvi village, North west of Barmer district, 13.ii.1995, 1♂, (ZSI Reg. No. 6889/5), Barmer district, Harsani, 85 kms. North west of Barmer district (under stone), 19.vii.1995, (ZSI Reg. No. 6924/5) Barmer, Turvi 93 Kms. North West of Barmer district (under stone), 20.vii.1995, 2 ♀♀, 1♂, (ZSI Reg. No. 7001/5), Jaisalmer, Sam, 42 kms West of Jaisalmer district (under stone), 23.vii.1995, 1♂, 1 ♀, (ZSI Reg. No 7128/5), Jaisalmer, Baran Village, 40 kms. from Jaisalmer district (under stone), 26.vii.1995, 1 ♀, (ZSI Reg. No. 7149/5), Jaisalmer, Khuri, near DNP area, 49 kms. from Jaisalmer district (under stone), 27.vii.1995, N. S. Rathore coll.

Diagnostic character : Body elongated, head broad, eyes clearly elevated; thorax broader than abdomen; antennae and caudal filament shorter than body; distinct violaceous hypodermal pigment on head, body appendages, tergum ix small, half the length of tergum viii; tergite x is as long as those of ix and vii, trapezoidal shape with 1 + 1 bristle combs; sterna without bristle combs; abdominal terga ii-vi with 3 + 3 bristle combs; stylets 2 pairs on viii and ix; ovipositor long and slender and lacking fossorial spines; body length : 10 mm, width : 3 mm.

Distribution : INDIA : West Bengal, Delhi, Bihar, Sikkim, Manipur, Rajasthan, (Jaisalmer District, Sudasari, Baran, Sam, Khuri) (Barmer District, Girab, Turvi, Harsani). *Elsewhere* : U.S.A., Mexico, Africa, Spain.

Remarks : This species is free living and cosmopolitan in distribution. It is recorded for the first time from Rajasthan (Jaisalmer and Barmer districts). The detailed description of this species was given by Escherich (1905).

Genus *Acrotelsa* Escherich, 1905

Acrotelsa collaris (Fabricius) 1793

1793. *Lepisma collaris* (Fabr.) In : *Ent. Syst.*, **11** : 64.

1905. *Acrotelsa collaris* (Esch.), *Das System der. Lepismatiden Zoologica* (Stuttgart) **83** : 1-164.

1913. *Acrotelsa collaris*, Silvastri, *Rec. Ind. Mus. Calcutta*, **9** : 58.

1993. *Acrotelsa collaris*, Hazra, *Fauna West Bengal*, Series 3, part **4** : 1-17.

Material examined : INDIA : Rajasthan, 1♂, 2♀♀, (ZSI Reg. No. 7355/5), ZSI, D.R.S. (Jodhpur) mopping survey, 1996; Jaisalmer district, Khuri, Phoolia Road, DNP area, ca. 58 Kms. (Under stone), 25.ix.1996, 1♀ (ZSI Reg. No. 7317/5), Jaisalmer, Sam area, 42 kms. from Jaisalmer, (Under stone), 24.ix.1996, 1♂, 1♀, (ZSI Reg. No. 6597/5) Sam area, 34 Kms. from Jaisalmer district, 7.ii.1995, 1♂ (ZSI Reg. No. 7128/5), Baran village, 40 Kms. from Jaisalmer district (Under stone), 26.vii.1995, 1♂, (ZSI Reg. No. 7149/5), Khuri, near DNP area, 49 Kms. from Jaisalmer district, (Under stone), 27.vii.95, N. S. Rathore coll.

Diagnostic character : Body medium sized, robust, base of the body is light yellowish in colour and covered with dark brown scales; the macrochaetae in sub-median fields of the head capsule are arranged in a narrow elongated strip, not touching the anterior border of head capsule; bristles longer in the head those on thorax and abdomen feathered or serrated; the prosternum is covered by the fore coxae from underside; a bunch of solitary macrochaetae is present in the middle of the prosternum, the species can also be recognised by the arrangement of macrochaetae on legs and cerci in-indistinct whorls, not to be seen in other lepismatids.

Body length : 16 mm; width : 5 mm. Tergites of abdomen with one or two pairs of combs of setae; tergite x long, triangular sharply pointed and with more than 1 + 1 bristle combs. Ovipositor with fossorial spines apically on posterior gonapophyses and male with parameres.

Distribution : INDIA : West Bengal, Bihar, Orissa and Rajasthan, (Jaisalmer district, Khuri, Sam and Baran). *Elsewhere* : U.S.A., Caribbean Island.

Remarks : This is a tropicopolitan synanthropic species. It is recorded for the first time from the state of Rajasthan and is common in house hold and often of economic importance. The descriptions given by Escherich (1905) should be consulted for further taxonomic data.

SUMMARY

Three species of Thysanurans have been reported from DNP, these constitute their first record from Rajasthan.

ACKNOWLEDGEMENT

We express our sincere thanks to Dr. J.R.B. Alfred, Director, Zoological Survey of India, Calcutta for providing laboratory facilities.

REFERENCES

Escherich, K. 1903. Beiotrage Zur Kenntnis der Thysanura. 1. *Reihs. Zool. Anz.*, **26**(697) : 345-366.

Escherich, K. 1905. Das System der Lepismatiden. *Zoologica* (Stuttgart) 83; 164.

Hazra, A. K. 1980. On a new species of stylifera (Lepismatidae : Thysanura) from India. *Bull. zool. Surv. Ind.*, **2**(2 & 3) : 187–191.

Hazra, A. K. 1993. Thysanura fauna of West Bengal, *Rec. zool. Surv. India*, State Fauna Series-3, part **4** : 1-17.

Hazra, A. K. 1996. Thysanura fauna of Delhi, *Rec. zool. Surv. India*, State Fauna Series-6, 145-146.

Mendes, L. F. 1990. On the zoogeographic affinities of the thysanurans from India. In : Advances in management and conservation of soil fauna (Eds. G. K. Veeresh *et al.*) : 15-24.

Silvestri, F. 1913. On some Thysanura in the Indian Museum. *Rec. Indian. Mus.*, **9** : 51-62.

Silvestri, F. 1938. Description of a new *Myrmecophilous lepisma* (Thysnura) from India. *Rec. Indian Mus.*, **40** : 143-145.

Silvestri, F. 1948. Descrizione di una species note edi una nuova di Lepismatida (Insecta : Thysanura) *Boll. Lab. Ent. Agr. Portici.*, **1** : 100-106.

Wygodzinsky, P. 1954. Notes and description of Thysanura (Apterygota). *Proc. R. Entomol. Soc.*, London, (B), **23** : 41-46.

Wygodzinsky, P. 1972. A review of the Silver fish (Lepismatidae : Thysanura) of the United States and the Caribbean Area. *Amer. Mus. Novit.*, No. 2981 : 1-26.

Zool. Surv. India
Conservations Area Series **19**, *Fauna of Desert National Park,* : 51-58, 2004

INSECTA : ODONATA

M. PRASAD

Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053

INTRODUCTION

Our knowledge on Odonata fauna of Indian Thar Desert is based on the earlier works of Fraser (1933, 1934 and 1936), Agarwal (1957), Bose and Mitra (1976), Prasad and Thakur (1981), Thakur (1985), Tyagi and Miller (1991) Prasad and Varshney (1995) and Prasad (1996) have reported a total of 32 species from there. However, there is no record of any species of Odonata from Desert National Park of Rajasthan.

The present studies are based on the Odonata material collected by Dr. N. S. Rathore, Desert Regional Station, Zoological Survey of India, Jodhpur. The paper deals with a total of 11 species belonging to 10 genera under 3 families from the Desert National Park.

SYSTEMATIC ACCOUNT

Order ODONATA

Suborder ZYGOPTERA

Superfamily COENAGRIONOIDEA

Family COENAGRIONIDAE

Ischnura aurora aurora (Brauer)

1858. *Agrion delicatum* Hagen, *Verh. Zool.-bot. Ges. Wien.*, **8** : 479.

1865. *Agrion aurora*, Brauer, *Verh. Zool.-bot. Ges. Wien.*, **15** : 510.

1955. *Ischnura aurora*, Lieftink, *Trubia*, **22** : 74.

1991. *Ischnura aurora aurora*, Tsuda, A distributional list of world Odonata, 34.

Material examined : 1♂, Girab, 97 Kms. from Barmer, 3.10.96. DRS Reg. No. 7530/5.

Measurements :

	Abdomen	Forewing	Hindwing
Male :	20.00 mm.	13.50 mm.	13.00 mm.

Distribution : Through out India. *Elsewhere* : Australia, China, Malaysia, Nepal, New Guinea, New Zealand, Pacific Islands, Papua, Philippines and Sri Lanka.

Remarks : It is most common species and found in marshy areas flying through grasses and weeds. Sometimes also found away from the marshy land fluttering within the grassy fields in the neighborhood of temporary and permanent water bodies. It is the smallest species of the genus *Ischnura*.

Ischnura senegalensis (Rambur)

1842. *Agrion senegalensis* Rambur, *Ins. Neurop.*, : 276.

1933. *Ishnura senegalensis*, Fraser, *Fauna Brit. India Odon.*, 1 : 348-351.

Material examined : 2♂♂, Girab, 97 kms. from Barmer, 2.10.1996, DRS, Reg. No. 7482/5 and 4 ♀♀, Girab, 97 kms.from Barmer, 3.10.1996, DRS Reg. No. 7530/5.

Measurements :

	Abdomen	Forewing	Hindwing
Male :	20.00–21.00 mm.	14.50–15.50 mm.	14.00–15.00 mm.
Female :	24.00 mm.	17.00 mm.	16.00 mm.

Distribution : Through out India. Elsewhere : Africa, Indonesia, Japan, Malaysia, Myanmar, Philippines and Sri Lanka.

Agriocnemis pygmaea (Rambur)

1842. *Agrion pygmaea* Rambur, *Ins. Neurop.*, : 278.

1933. *Agriocnemis pygmaea*, Fraser, *Fauna Brt. India Odon.*, 1 : 398-401.

Material examined : 1♂, 1 ♀, Girab, 97 kms. from Barmer, 3.10.1996, DRS Reg. No. 7530/5.

Measurements :

	Abdomen	Forwing	Hindwing
Male :	16.00 mm.	10.50 mm.	10.00 mm.
Female :	16.00 mm.	10.00 mm.	10.00 mm.

Distribution : Throughout India. *Elsewhere* : Afghanistan, Australia, Bangladesh, China, Hongkong, Indonesia, Japan, Kampuchea, Malaysia, Myanmar, New Guinea, Pacific Islands, Pakistan, Philippines, Seychelles, Singapore, Sri Lanka, Taiwan and Thailand.

Remarks : It is almost common species of the genus and found throughout the Year in India.

Rhodischnura nursei (Morton)

1907. *Ischnura nursei* Morton, *Trans. Ent. Soc. Lond.*, : 306-307.

1933. *Rhodischnura nursei*, Fraser, *Fauna Brit. India Odon.*, **1** : 369-371.

Material examined : 1♂, Girab 97 Kms. from Barmer, 2.10.1996, DRS Reg. No. 7477/5.

Measurements :

	Abdomen	Forewing	Hindwing
Male :	16.00 mm.	10.00 mm.	9.00 mm.

Distribution : INDIA : Bihar, N. Uttar Pradesh, Gujarat, Madhya Pradesh, Maharashtra, and West Bengal. *Elsewhere* : Pakistan.

Remarks : There are 7 postnodal nervures in forewing and 5 in hindwing.

Suborder ANISOPTERA

Superfamily AESHNOIDEA

Family AESHNIDAE

Anax guttatus (Burmeister)

1839. *Aeschna guttata* Burmeister, *Handb. Ent.*, **2** : 840.

1936. *Anax guttatus*, Fraser, *Fauna Brit. India Odon.*, **3** : 140-142.

Material examined : 1♂, Girab, 97 kms. from Barmer, 2.10.1996, DRS Reg. No. 7486/5.

Measurements :

	Abdomen	Forewing	Hindwing
Female :	52.50 mm.	50.00 mm.	50.00 mm.

Distribution : INDIA : Andhra Pradesh, Bihar, Eastern Himalaya, Himachal Pradesh, Karnataka, Kerala, Punjab, Tamil Nadu and Uttar Pradesh. *Elsewhere* : Indonesia, Malaysia, Micronesia, Myanmar, Nepal, North Australia, Samoa Island, Seychelles, Taiwan and Sri Lanka.

Remarks : Discoidal cell traversed 4 times in forewing and 3 times in hindwing, there are 5 cubital nervures present in forewing. Pterostigma yellow in colour and covers more than 2 1/2 cells, membrane brown and its border white in colour. A pale yellow patch is present at the discoidal cells, it also extended upto cubital nervures, slightly distal to node and also upto the posterior border of wing. Nodal index

$$\frac{7-14}{10-10} \quad \frac{18-7}{11-10}$$

Superfamily LIBELLULOIDEA

Family LIBELLULIDAE

Orthetrum sabina sabina (Drury)

1770. *Libellula sabina* Drury, *Ill. Exot., Ins.*, **1** : 114.

1936. *Orthetrum sabina*, Fraser, *Fauna Brit. India, Odon.*, **3** : 300-302.

Material examined : 2♂♂, Girab, 97 Kms. from Barmer, 2.10.1996, DRS Reg. No. 7490/5 and 7491/5.

Measurements :

	Abdomen	Forewing	Hindwing
Male :	32.00–33.00 mm.	31.00–32.00 mm.	31.00–31.50 mm.

Distribution : Throughout India. *Elsewhere* : Afghanistan, Algeria, Angola, Australia, China, Cyprus, Egypt, Hong Kong, Indonesia, Iran, Iraq, Laos, Malaysia, Micronesia, Myanmar, Most of the African continent, Nepal, New Guinea, Papua, Philippines, Qatar, Samoa Island, Singapore, Sri Lanka, Sudan, Thailand, Tunisia, Turkey and Vietnam.

Remarks : It is a most common species of the genus *Orthetrum* and found almost throughout the year near temporary and permanent water bodies. Specimen of this species observed within the tall dry grasses present in the forest. Pterostigma dark yellow and covers $1^{1/2}$ cells. Membrane dark-brown, discoidal cell traversed once in forewing and entire in hindwing. Discoidal field in forewing begins with 3 rows of cells, but in hindwing it begins with 2 rows of cells, anal triangle 3 celled, 2 rows of cells in between IRiii & Rspl. Nodal index.

$$\frac{10-12}{10-9} \quad \frac{12-10}{10-12}$$

Acisoma panorpoides panorpoides Rambur

1842. *Acisoma panorpoides panorpoides* Rambur, *Ins. Neurop.*, : 28.

1936. *Acisoma panorpoides panorpoides*, Fraser, *Fauna Brit. India, Odon.*, **2** : 330-331.

Material examined : 1 ♀, Girab, 97 Kms. From Barmer, 2.10.1996, DRS Reg. No. 7480/5

Measurements :

	Abdomen	Forewing	Hindwing
Female :	18.00 mm.	21.00 mm.	20.00 mm.

Distribution : INDIA : Arunachal Pradesh, Asam, Bihar, Chandigarh, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalay, Mizoram, Orissa, Punjab, Rajasthan, South India, Uttar Pradesh and West Bengal. *Elsewhere* : China, Indonesia,

Japan, Malayan Archipelago, Myanmar, Nepal, Philippines, Sri Lanka, Taiwan and Thailand.

Remarks : Pterostigma yellow and covers more than a cell, membrane dark-brown with white border. Discoidal cell entire, discoidal field begins with two rows of cells, one row of cells in between IRiii and Rspl. Nodal index

$$\frac{7-6}{7-6} \quad \frac{7-6}{7-7}$$

Crocothemis servilia servilia (Drury)

1770. *Libellula servillia* Drury, I 11. *Ex. Ins.*, **1** : 6.

1936. *Crocothemis servilia servilia*, Fraser, *Fauna Brit. India Odon.*, **3** : 345-347.

Material examined : 1♂, Girab, 97 Kms. from Barmer 2.x.1996, DRS Reg. No. 7487/5 : 1♂, 1 ♀, Girab, 97 kms. from Barmer, 3.x.1996 DRS Reg. No. 7483/5 : 2 Exs., Sam area district Jaisalmer, 24.ix.1996, DRS Reg. No. 7324/5 and 3♂♂, 1 ♀, Sudasari, district Jaisalmer, 20.ix.1996, DRS Reg. No. 7369/5 and 7360/5.

Measurements :

	Abdomen	Forewing	Hindwing
Male :	24.00–27.00 mm.	29.00–31.00 mm.	28.00–30.50 mm.
Female :	22.00–26.00 mm.	27.00–29.50 mm.	26.00–29.00 mm.

Distribution : Throughout India. *Elsewhere* : Bangladesh, China, Indonesia, Iran, Iraq, Japan, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Taiwan and Thailand.

Remarks : It is most common species in India. Pterostigma dark-browish yellow and covers 1 1/2 cells, discoidal field bigning with 3 rows of cells, and triangle 3 celled. One row of cell inbetween IRiii and Rspl. Nodal index

$$\frac{8-11}{7-8} \quad \frac{11-7}{9-8} \text{ to } \frac{9-10}{9-8} \quad \frac{10-10}{8-9}$$

Bradinopyga geminata (Rambur)

1842. *Libellula geminata* Rambur, *Ins. Neurop.*, : 90.

1936. *Bradinopyga geminata*, Fraser, *Fauna Brit. India. Odon.*, **3** : 349-350.

Material examined : 1♂, on Barna-Sudasari Road, ca. 6 kms. west of Barna, district Jaisalmer, 28.ix.1996, DRS Reg. No. 7427/5.

Measurements :

	Abdomen	Forewing	Hindwing
Male :	28.00 mm.	34.00 mm.	33.00 mm.

Distribution : INDIA : Bihar, N. Uttar Pradesh, Eastern Himalayas, Delhi, Madhya Pradesh, West Bengal and Peninsular India.

Remarks : Pterostigma black in center and both ends (sides) white and covers more than 1 1/2 cells, membrane dark-brown.

Pantala flavescens (Fabricius)

1898. *Libellula flavescens* Fabricius, *Ent. Systn. Suppl.*, 285.

1836. *Pantala flavescens*, Fraser, *Fauna Brit. India, Odonata*, 3 : 414-416.

Material examined : 3♂♂, 3♀♀ Girab 97 kms. from Barmer, 2.x.1996 DRS Reg. No. 7479/5, 7484/5, 7485/5, 7488/5, 7489/5 and 7492/5.

Measurements :

	Abdomen	Forewing	Hindwing
Male :	30.00–31.50 mm.	38.00–39.00 mm.	38.00 mm.
Female :	30.00–32.00 mm.	39.00–40.00 mm.	38.50–40.0 mm.

Distribution : Cosmopolitan.

Remarks : It is one of the most common species. Two females Registration No. 7489/5 and 7492/5 have bright pale yellow markings at the base of hindwings.

Selysiothemis nigra (Van der Linden)

1825. *Libellula nigra* Van der Linden, *Monogr.*, 16.

1936. *Selysiothemis nigra*, Fraser, *Fauna Brit. India Odon.*, 3 : 451-452.

Material examined : 2♀♀, Sam area, district Jaisalmer, 24.ix.1996. DRS Reg. No. 7323/5.

Measurements :

	Abdomen	Forewing	Hindwing
Female :	18.00 mm.	22.00–25.00 mm.	21.50–24.00 mm.

Distribution : INDIA : Jammu & Kashmir and Rajasthan. Elsewhere : Iraq, Pakistan and Persian Gulf.

Remarks : It is a rare and small sized species, pterostigma white in between black nervures and covers more than a cell, membrane white.

Discoidal cell entire in forewing, discoidal field begins with two rows of cells, one row of cells in between IRiii and Rspl. Nodal index

$$\frac{5-5}{5-4}\ \frac{6-5}{4-5} \text{ and } \frac{5-6}{5-5}\ \frac{6-5}{5-5}$$

This species is recorded for the second time from Rajasthan and for the first time from the Desert National Park.

DISCUSSION

In this paper only 11 species of Odonata are reported from the Desert National Park. Out of these 10 species are common in Rajasthan and 9 species in Gujarat. Among these, 6 species are found almost throughout India. *Selysiothemis nigra* is a rare species and recorded for the second time from Rajasthan and for the first time from the Desert National Park. This species is earlier known from Jammu & Kashmir and Rajasthan (Jodhpur) in India. The present study provides poor knowledge in estimating the true position of Odonata fauna in the Desert National Park, Rajasthan. It is interesting to point out here that out of these 11 species, 8 species are collected from Barmer district and only 2 species are collected from Jaisalmer district. *Corocothemis servilia servilia* is the only species, which is collected from both the districts of Desert National Park.

SUMMARY

Altogether 11 species of Odonata belonging to 10 genera under 3 families are recorded from the Desert National Park, Rajasthan. Collection data, distributional range within India and outside, body measurements and notes on the taxonomic importance wherever applicable have been provided.

ACKNOWLEDGEMENTS

Author is thankful to Dr. J. R. B. Alfred, Director, Zoological Survey of India, Calcutta for providing opportunity to carry out this study. I am also thankful to Dr. Q. H. Baqri, Officer-in-Charge, Desert Regional Station, Zoological Survey of India, Jodhpur for providing unidentified collection of Odonata for study. I am grateful to Dr. R. K. Varshney, Scientist 'SG' and Dr. S. K. Mitra, Scientist-'SF' Zoological Survey of India, Calcutta for providing facilities for the work.

REFERENCES

Agarwal, J. P. 1957. Contribution towards the Odonata fauna of Pilani. *Proc. 44th Indian Sci. Congr.*, : 309.

Bose, B. and Mitra, T. R. 1976. The Odonata fauna of Rajasthan. *Rec. zool. Surv. India,* **71** : 1-11.

Fraser, F. C. 1933. *Fauna of British India*-Odonata. Taylor & Francis, London, **1** : 1-423.

Fraser, F. C. 1934. *Fauna of British India*-Odonata. Taylor & Francis, London, **2** : 1-398.

Fraser, F. C. 1936. *Fauna of British India*-Odonata. Taylor & Francis, London, **3** : 1-461.

Prasad, M. 1996. Odonata in the Thar desert. In : *Faunal diversity in the Thar desert : Gaps in research.* Ed. A. K. Ghosh, Q. H. Baqri & I. Prakash. 145-149. Scientific publishers, Jodhpur.

Prasad, M. and Thakur, R. K. 1981. Further additions to the Odonata (Insecta) Fauna of Rajasthan. *Jantu*, **1** : 26-28.

Prasad, M. and Varshney, R. K. 1995. A checklist of the odonata of India including data on larval studies. *Oriental Ins.*, **29** : 385-428.

Thakur, R. K. 1985. Field notes on the Odonata around lake Kailana, Jodhpur (Rajasthan). *Bull. zool. Surv. India.* **7**(1) : 143-147.

Tyagi, B. K. and Miller, P. L. 1991. A note on the Odonata Collected in South-Western Rajasthan, India. *Notul. Odonatol.*, **3** : 134-135.

Zool. Surv. India
Conservations Area Series **19**, *Fauna of Desert National Park,* : 59-65, 2004

INSECTA : ORTHOPTERA

M. S. SHISHODIA
Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053

INTRODUCTION

Desert National Park, covers two districts of Rajasthan state, *i.e.,* Jaisalmer and Barmer. Unfortunately, there is no record of any species of Orthoptera from this area. However, Bhargava (1990, 1996), Bhowmik (1967, 1969, 1971, 1977, 1985), Kushwaha and Bhardwaj (1977), Parihar (1996) Tandon and Shishodia (1976) and Venkatesh ((1977) have reported 67 species of Acridoidea and 38 species of Grylloidea from Rajasthan State. During the present study, the author has studied only 10 species of Acridoidea and one species of Grylloidea from the Desert National Park. This study is based on the collection brought by Dr. N. S. Rathore, Desert Regional Station, Zoological Survey of India, Jodhpur. All the species have already been recorded from Rajasthan.

SYSTEMATIC ACCOUNT

Order ORTHOPTERA

Superfamily ACRIDOIDEA

Family PYRGOMORPHIDAE

Chrotogonus (Chrotogonus) trachypterus (Blanchard)

1836. *Ommexycha trachypterus* Blanchard, *Annls. Soc. Ent. Fr.*, **5** : 618.

1959. *Chrotogonus (Ch.) tr. trachypterus* Keven, *Publcoes cult. Co. Diam. Angola,* no. **43** : 147.

Material examined : 1 ♀, Barna village and around Jaisalmer, 27.ix.1996; 2 numphs, Magra village and around Jaisalmer, 30.ix.1996; 2 ♀♀, Girab D.N.P. area 97 Kms. from Barmer, 2.x.1996.

Diagnostic characters : Body short and stout; anterior margin of prosternum strongly reflexed and dilated; pronotum heavily rugosed and much widened behind; posterior femora

stout, hind wings hyaline or occasionally faintly tinged yellowish-brown but never infumated or infuscated, and always at least two-third as long as tegmina.

Distribution : INDIA : Assam, Bihar, Delhi, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, West Bengal. It is also studied from : Haryana and Punjab States of India. *Elsewhere* : Baluchistan, Bangladesh, Nepal, Pakistan and Persia.

Family ACRIDIDAE

Subfamily TRUXALINAE

Truxalis eximia eximia Eichwald

1830. *Truxalis eximus* Eichwald, *Zool. Spec., II, Vilnae,* : 239.

1951. *Truxalis eximia eximia* : Dirsh, *Eos, Madrid, Tomo extrad* : 213-216.

Material examined : 1 ♂, Girab DNP area, 97 Kms. from Barmer 3.x.1996.

Diagnostic characters : Body more slender; antennae slightly shorter than head and pronotum together; fastigium with broadly rounded apex; lateral carinae of pronotum straight in prozona, excurved in metazona, posterior margin obtusangulate; tegmina straight and narrow, wings base very light pinkish; arolium smaller, about 1/4th the length of claw.

Distribution : INDIA : Punjab, Rajasthan. *Elsewhere* : Arabia, Iran, Iraq, Caucasus (USSR), Pakistan, Russia.

Measurements (in mm) : Body length 70.0 antenna 24.0, head 15.0, pronotum 10.0, tegmen 53.0, tegmen width 70.0, ratio 7.4, hind femur 41.0 hind tibia 41.0.

Subfamily GOMPHOCERINAE

Ochrilidia geniculata (Bolivar)

1913. *Platypteran geniculata* Bolivar, *Novit. Zool,* **20** : 607.

1977. *Ochrilidia geniculata* Jago, *Acrida,* **6** : 177.

Material examined : 1♂, Girab DNP are, 97 Kms. from Barmer.

Diagnostic characters : Lower edge of temporal faveolae clearly visible from above; lateral carinae of pronotum divergent posteriorly; mid dorsal line of body lacking white stripe; inner area of hind femur without spots.

Distribution : INDIA : Punjab, Rajasthan. *Elsewhere* : Aden, Africa, Iran, Israel, Kuwait, Oman, Pakistan, Saudi Arabia, Yemen.

Subfamily DEDIPODINAE

Acrotylus humbertianus Saussure

1884. *Acrotylus humbertianus* Saussure, *Mem. Soc. Phys. Hist. Nat.* Geneve, **28**(9) : 189.

Material examined: 1 ♀, Sam area, Jaisalmer, 24.ix.1996; 1 ♀, Sudasari DNP area, 62 kms. from Jaisalmer, 26.ix.1996; 1 ♂, 1 ♀, Barna village & around, Jaisalmer, 27.xi.1996; 1 ♂, on Barna to Sudasari Road 6 kms. west of Barna, 28.ix.1996; 2 ♂, 1 ♀, Girab DNP area, 97 kms. from Barmer, 2, 3.x.1996.

Diagnostic characters : Face nearly or quite vertical; median carina of pronotum cut by two grooves, without very distinct crest, short, broadly rounded behind, wings yellow at base, with a wide incomplete dark band, entirely or nearly reaching the anal veins.

Distribution : INDIA : Arunachal Pradesh, Bihar, Delhi, Goa, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu, West Bengal. *Elsewhere* : Afghanistan, Bangladesh, Nepal, Pakistan, Sri Lanka.

Oedaleus senegalensis (Krauss)

1877. *Pachytylus senegalensis* Krauss, *Sber. Akad. Wiss. Wien*, **76**(1) : 56.

1914. *Oedaleus senegalensis* Kirby, *Fauna British India, Orthopt.*, : 143.

Material examined : 1 ♂, Girab DNP area, 97 kms. from Barmer 2.x.1996.

Diagnostic characters : A little smaller than *O. nigrofasciatus* (Saussure) : pronotum with pale marks arranged so as to form an 'X', shorter than *O. nigrofasciatus*, cut by one transverse groove, round behind; wings with well-marked fascia.

Distribution : INDIA : Bihar, Delhi, Jammu & Kashmir, Rajasthan, Tamil Nadu, West Bengal. *Elsewhere* : Africa, S. W. Asia.

Sphingonotus longipennis Saussure

1884. *Sphingontus longipennis* Saussure, *Mem. Soc. Phys. Hist. Nat.* Geneva, **28**(9) : 197-203.

Material examined : 2 ♂, 1 ♀, Sudasari DNP area, 62 kms. from Jaisalmer, 26.ix.1996; 6 ♂, Girab DNP area, 87 Kms. from Barmer, 2.x.1996.

Diagnostic characters : Median carina of pronotum visible in anterior and posterior part dorsally, obscure in middle, lateral carinae absent, all the transverse sulci visible–Ist visible on dorsal part, 2nd reach upto the lower edge of lateral lobe and 3rd a little above the lower edge of lateral lobe; tegmina with three transverse bands–Ist wide, 2nd a little small, and 3rd much narrow; wings with complete, very narrow, dark-brown band, base scale very light bluish, apex clear, hind femur with two dark-coloured bands on external face and on internal face.

Measurements (*in mm.*) : Body length 16–21.5, pronotum 3–5, tegmen 18–24, hind femur 9–11, hind tibia 7–8.5.

Distribution : INDIA : Andhara Pradesh, Arunachal Pradesh, Assam Himachal Pradesh, Jammu & Kashmir, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal. *Elsewhere* : Bangladesh.

Scintharista notabilis pallipes Uvarov

1941. *Scintharista notabilis pallipes* Uvarov, *Proc. R. ent. Soc. Lond.* (B) **10** : 95.

Material examined : 1♂, Sam area 42 kms. from Jaisalmer, 24.ix.1996.

Diagnostic characters : Antennae filiform, apical segments depressed; fastigium concave and without median carinule; pronotum convex, anterior marign bent on head, posterior margin angulate; tegmen with narrow light bands–Ist from the base, and the 2nd (median) dark band are nearly or entirely fused jointly occupying the basal half of tegmen; wing base light pinkish, narrow light dark-brown band present from costa to anal angle, apex with dark spots; hind tibia yellow with dark-coloured ring at knee joint.

Measurements (*in mm.*) : Body length 21.0, pronotum 4.0, tegmen 23.0.

Distribution : INDIA : N. W. India (Rajasthan). *Elsewhere* : Afghanistan, Iran and Pakistan.

Subfamily CYRATACANTHACRIDINAE

Anacridium rubrispinum (Bei-Bienko)

1948. *Anacridium aegyptium rubrispinum* Bei-Bienko, *C.R. Acad. Sci. U.S.S.R.*, Moscow (N.S.), **60** : 499.
1953. *Anacridium rubrispinum* : Dirsh & Uvarov, *Eos, Madr.*, **29** : 50.

Material examined : 1♂, Girab DNP area, 97 kms. from Barmer, 2.x.1996.

Diagnostic characters : Posterior margin of pronotum rectangular, median carina, in profile, convex, deeply incised by transverse sulci, prozona constricted, metazona weakly widened; tegmina comparatively short, broad, and projecting beyond the apex of abdomen; wings broad, and little narrowed at apex, basal disc light violet or yellowish, fasciae light-brownish.

Measurements : (*in mm*) : Body length 50.0, pronotum 11.5; tegmen 48.0, hind femur 24.0, hind tibia 21.5.

Distribution : INDIA : Rajasthan, Uttar Pradesh. *Elsewhere* : Afghanistan, Iran, Pakistan, Persia (Baluchistan).

Schistocerca gregaria (Forskal)

1775. *Gryllus gregarius* Forskal, *Descript; Anim. Ins.* 81.

1907. *Schistocerca gregaria* Krauss, *Akad. Wiss, Wien, Vienna*, **71**(2) : 12.

Material examined : 1 ♀, Sudasari DNP area, 62 kms. from Jaisalmer, 26.ix.1996.

Diagnostic characters : Large in size; pronotum constricted, with obtuse median carian, sometimes indistinct in prozona, metazona slightly longer than prozona, with rounded posterior margin; prosternal process widened in middle narrowed at apex, which is obtuse, and moderately inclined backwards; tegmina with transparent membrane and sparse reticulation; hind femur short.

Distribution : Africa, S. Europe, and S. W. Asia. In India the 3 invasion is borne by Rajasthan, though parts of Punjab, Delhi, Uttar Pradesh, Gujarat, Maharashtra are also affected. However, in some peak years swarms have been known to reach all parts of India except the extreme south.

Subfamily EYPREPOCNEMIDINAE

Heteracris littoralis (Rambur)

1828. *Grullus litteralis* Rambur, *Faune Entomol. Andal., orth.*, **2** : 78.

1958. *Heteracris littoralis* : Dirsh, *Tijdschr. Ent.*, 54.

Material examined : 1 ♀, Barna village and around, Jaisalmer, 27.ix.1996.

Diagnostic characters : Antennae filiform; fastigium of vertex parabolic with obtuse apex and slightly depressed; pronotum flattened with sharp median and lateral carinae, all the carinae cut by transverse sulci; tegmina with numerous medium-sized dark, brown patches, transparent; wings base clear; hind femur with 2–3 black, linear line on the dorso-external carina, with white-yellowish ring before the apex; hind tibia with white-yellowish ring at base, followed by very narrow dark-brown ring, then red, with 15 on external end 14 on internal black tip spines.

Distribution : INDIA : Rajasthan. *Elsewhere* : Africa, S. Europe, S. W. Asia.

Superfamily GRYLLOIDEA

Family GRYLLIDAE

Acheta domesticus Linneoush

1758. *Gryllus acheta domesticus* Linneous *Syst. Nat.* (Ed. X), **1** : 428.

1967. *Acheta domesticus* : Chopard, *Orthopt. Cat., Pt.* **10** : 62.

Material examined : 1 ♀, Magra village and around, Jaisalmer 30.ix.1996; 1 ♀, Turvi, 93 kms. NW. of Barmer 1.x.1996.

Diagnostic characters : Body depressed, and pubescent; head with wide frontal rostrum, vertex with a yellow transverse band; tegmina well-developed; body size medium (16–20 mm).

Distribution : INDIA : Himachal Pradesh, Jammu & Kashmir, Kerala, Maharashtra, Rajasthan, Uttar Pradesh, West Bengal. *Elsewhere* : Pakistan.

SUMMARY

Eleven species of Orthoptera belonging to 11 genera under 3 families are studied here from the Desert National Park, Rajasthan. The distributional range in India, and abroad, body measurements and taxonomic characters, wherever desirable have been given.

ACKNOWLEDGEMENTS

I am thankful to the Director, Zoological Survey of India, Calcutta, for providing the opportunity to carry out this study. I am also thankful to the Officer-in-Charge, Desert Regional Station, Zoological Survey of India, Jodhpur, for handing over the collection at my disposal. My thanks are also due to Dr. R. K. Varshney, Scientist 'SG', and Dr. S. K. Mitra, Scientist 'SF', Zoological Survey of India, Calcutta, for suggestions.

REFERENCES

Bhargava, R. N. 1990. First record of the genus *Arachnocephalus costa* from India and description of the female *Loxoblemmus animae* Bhowmik (Insecta : Grylloidea). *Hexapoda*, **3**(1) : 75-78.

Bhargava, R. N. 1996. Grylloid fauna of the Thar Desert. In : *Faunal Diversity in the Thar Desert : Gaps in Research*. Ed. by A. K. Ghosh, Q. H. Baqri and I. Prakash. 151-154. Scientific Publishers, Jodhpur.

Bhowmik, H. K. 1967. *Gryllopsis rajasthanensis* Bhowmik, *Proc. India Assoc.*, Banaras, Part B : 191.

Bhowmik, H. K. 1969. Studies on Indian crickets (Orthoptera : Insecta). *Zool. Anz.*, Bd. 182, Heft : 1/2; 143-152.

Bhowmik, H. K. 1971. Two new species of Grylloidea (Orthoptera) from India. *Oriental Ins.*, **5**(4) : 503-506.

Bhowmik, H. K. 1977. Studies on some Indian crickets with new distributional records of the subfamily Grillinae (Gryllidae : Orthoptera). *Rec. zool Surv.* India, **73** : 229-238.

Bhowmik, H. K. 1985. Contributions to the gryllid fauna of the Western Himalayas (Orthoptera : Gryllidae). *Rec. zool. Surv. India*, Occ. Paper **73** : 1-85.

Kushwaha, K. S. and Bharadwaj, S. C. 1977. Forage and pasture Insect Pests of Rajasthan (Indian Council of Agriculture Research, New Delhi) : 1-86.

Parihar, D. R. 1996. Species richness of Orthoptera and Coleoptera in Thar Desert. In : *Faunal Diversity in the Thar Desert : Gaps in Research*. Ed. by A. K. Ghosh, Q. H. Baqri and I. Prakash. Scientific Publishers, Jodhpur.

Tandon, S. K. and Shishodia, M. S. 1976. On a collection of Acridoidea (Orthoptera) from Rajasthan, India. *Newsl. zool. Surv. India*, **2**(1) : 7-11.

Venkatesh, M. V. 1977. Some grasshoppers and locusts of Rajasthan (Ed. M. L. Roonwal) : 353-562.

Zool. Surv. India
Conservations Area Series **19**, *Fauna of Desert National Park,* : 67-68, 2004

INSECTA : DERMAPTERA

G. K. SRIVASTAVA
Desert Regional Station, Zoological Survey of India, Jodhpur, India

INTRODUCTION

The present report deals with one species of Dermaptera, namely, *Nala lividipes* (Dufour), represented by 1 male, 1 female from Barmer dist. and 1 female from Jaisalmer district. All the specimens have been collected under the moist clay soil. It occurs in a variety of habitats such as under stones, leaf axils, lead to light in large numbers during post monsoon period. It is dominantly a tropical species but is able to adapt at higher altitudes in Himalayas at 5000 ft. or above, where there is little moisture available.

Distribution : In India, it has been reported from NE States, West Bengal, Orissa, Bihar, Uttar Pradesh, Rajasthan, Tamil Nadu and Karnataka.

This species has worldwide distribution, occurring in the Palaerctic, Ethopian and Oriental Regions, Tropical Asia and Australia.

Nala lividipes (Dufour)

1820. *Forficula pallipes* Dufour, *Ann. gener. desn. Sc. Phys. de Brukelles*, **4** : 316, pl. 116, figs. 7, 7a & 7b (Male, Female; Lower Catalonai, Spain; Type repository not known).

1828. *Forficula lividipes* Dufour, *Ann. Sci. Nat.*, **13** : 430 (New name proposed).

1900. *Labidura lividipes* : Bormans and Krauss, *Das Tierreich*, **11** : 36.

1910. *Paralabidura lividipes*; Burr *Trans. ent. Soc. Lond.* : 184.

1911. *Nala lividipes*; Burr, *Genera Insect.*, **122** : 36.

1923. *Nala lividipes*; *Mem Dept. Agric. India, Ent. Ser.*, **7** : 210.

1976. *Nala lividipes*; Srivastava, *Rec. zool. Surv. India*, Occ. Pap., **2** : 41.

1997. *Nala lividipes*; Srivastava, *Zool. Surv. India* State Fauna Series, **6** : Fauna of Delhi : 204.

Material examined : INDIA : Rajasthan, Dist. Barmer, Turvi, ca 93 Kms. Northwest of Barmer, 1 Male, 2 Female, 01.x.1996, Ex. under moist clay. Magra village and around Jaisalmer, 1 Female, 30.ix.1996, Ex. under moist clay, N. S. Rathore coll.

Measurements : MALE : Length of body 6.1–8.7 mm.; Forceps 1.5–2.6 mm.; Female : Length of body 6.0–9.0 mm.; Forceps 1.5–1.6 mm.

Remarks : It is one of the most common species of Dermaptera, often attracted to light in large numbers. Body size and general colour vary and the inner apical tooth of male forceps is sometimes poorly marked.

Zool. Surv. India
Conservations Area Series **19**, *Fauna of Desert National Park*, : 69-70, 2004

INSECTA : MANTOIDEA

M. S. SHISHODIA
Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053

INTRODUCTION

There is no record of this group from Desert National Park except Roonwal (1982) who mentioned occurrence of some mantids from the Thar region. Later Bohra and Rathore (1996) reported 4 species from Jodhpur. The present paper deals with two species of mantids collected in DNP area.

Family MANTIDAE

Humbertiella sp.

Material examined : Baisala 34 Kms. Northwest of Barmer, 2 exs., 12.ii.1995., Pithla vill. ca. 28 Kms. Jaisalmer, 2 exs., 24.vii.1995., Barna vill. ca. 40 Kms. from Jaisalmer, 1 ex., 26.vii.1995. N. S. Rathore coll.

Family EREMIAPHILIDAE

Eremiaphila sacra (Thunb.)

Material examined : Nahar Singh ki Dhani 23 kms. from Jaisalmer, 1 ex., 7.ii.1995, Sam ca. 42 Kms. West of Jaisalmer, 2 exs., 23.vii.1995., Bhopa village. ca. 28 kms. from Jaisalmer, 1 ex., 25.vii.1995. N. S. Rahore coll.

REFERENCES

Bohra, P. and Rathore, N. S. 1996. Dictyoptera of the Thar desert. *In : Faunal Diversity in the Thar Desert : Gaps in Research*. Ed. by A. K. Ghosh, Q. H. Baqri and I. Prakash, 167-170, Scientific publisher, Jodhpur.

Roonwal, M. L. 1982. Fauna of the Great India Desert (Past and present composition, Zoogeography, ecology, biology, Physiology and conservation). In Desert Resources and Technology.(Ed. Alam Singh) Scientific publishers & Geo-Tech Academy, Jodhpur Vol. I : 1-80.

Zool. Surv. India
Conservations Area Series **19**, *Fauna of Desert National Park,* : 71-78, 2004

INSECTA : ISOPTERA

N. S. RATHORE AND N. TAK
Desert Regional Station, Zoological Survey of India, Jodhpur, India

INTRODUCTION

Termites are small, fragile, soft-bodied, social insects, which range in colour from dull white to pale yellow and light to dark brown. They are popularly called white ants, which is a misnomer. The author made an intensive collection of termites in the Desert National Park / Desert Biosphere Reserve area for three years (1994 to 1996). The present communication is based on the study of this collection. Altogether, 16 species belonging to 3 families are reported here.

Detailed information on the termites of Rajasthan is available in Roonwal and Bose (1964, 1969), Roonwal and Verma (1977) and Verma and Purohit (1997) and present studies of author himself where in 44 species out of about 348 known species from Indian region have been identified and reported.

SYSTEMATIC ACCOUNT

Family HODOTEMITIDAE

Anacanthotermes macrocephalus (Desneux) 1906

1906. *Hodotermes macrocephalus* Desneux, *Ann. Soc. Entoml. Belg.*, Brussels **49**(12) : 344-348.

Castes known : Imago (Im.), Soldier (S), Worker (W), from DNP.

Material examined : Pithla area on Jaisalmer-Khuri Road, 13W. Ex. Ground, 5.ii.1995, Sam dunal area ca. 43 Kms. West of Jaisalmer, 21 W. Ex. Ground, 7.ii.1995, Baisala ca. 34 Kms. North West of Barmer, 3 W. Ex. Small mound, 12.ii.1995, Pithla to Sudasari 45 Kms. from Jaisalmer, 4 S, 15 W and 10 alates, Ex. Under soil mound, 24.vii.1995, N. S. Rathore coll.

Distribution : From E. Afghanistan through Pakistan (Baluchistan, Sind, Punjab) to western Rajasthan and Kuchchh region of Gujarat, in India.

Remarks : This is a typically deserticolous species and is the only free foraging termite found in arid region. It damages and collects grass blades, seeds, thorns etc. and stored in small chambers made in between tunnels.

Family RHINOTERMITIDAE

Subfamily PSAMMOTERMITINAE

Psammotermes rajasthanicus Roonwal & Bose

1960. *Psammotermes rajasthanicus* Roonwal and Bose, *Sci. and Cult.*, **26**(1) : 38-39. Type-locality : India : Rajasthan : Balona, Jaisalmer district.

Caste known : Soldier (S) and Worker (W) from DNP.

Material : 8am ca. 40 Kms. from Jaisalmer, 2 S, 5 W, Ex. Under dry stick, 7.ii.1995, Turvi village south west of Barmer, 2 S, 6 W, Ex. Under dry dung, 13.ii.1995, Nahar Singh Ki Dhani ca. 23 Kms. from Jaisalmer 33 exs. (5 S Major, 3 S Medium, 25 W.), N. S. Rathore coll.

Distribution : This species occurs in the arid areas of Western Rajasthan, Kuchchh district of Gujarat in India and Pakistan (Punjab, Sind and Baluchistan).

Remarks : This is a very widely distributed species in Jaisalmer and Barmer districts and is found associated with dry dung, fallen twigs and dry logs, *etc.*

Subfamily HETEROTERMITINAE

Heterotermes indicola (Wasmann)

1902. *Leucotermes indicola* Wasmann, *Zool. Tahrb. Abst. Syst.*, Jena, **17**(1) : 118-119. Soldier and worker.

1979. *Heterotermes indicola*, M. L. Thakur and P. K. Sen Sarma, *Indian For. Rec*, **13**(2) : 10-15, Caste known : Imago, Soldier and Worker.

Caste known : Soldier (S), Worker (W) from DNP.

Material : Nahar Singh ki Dhani ca. 23 Kms. from Jaisalmer, 3 S, 30 W., Ex. Dry tree trunk, 6.ii.1995, N. S. Rathore coll.

Distribution : All over northern India upto an altitude of 1800 m and above 20 N lat., Gujarat (Kachchh region) and Rajasthan.

Remarks : Although it is a wood destroying termite but due to ecological changes in vegetation it is recorded from extreme desert region for the first time.

Subfamily COPTOTERMITINAE

Coptotermes heimi (Wasmann)

1902. *Arrhinotermes heimi* Wasmann, *Zool. Tahrb. Abst. Syst.*, Jena, **17**(1) : 104, Imago. Type locality : India : Maharashtra, Wallon (Ahmadnagar).

1949. *Coptotermes heimi* : T. E. Snyder, *Smith. Misc. Coll.* **112** : 79.

1962. *Coptotermes heimi* : M. L. Roonwal and O. B. Chhotani, Monogr. *Indian Species of Termite Genus Coptotermes*, Indian Counc. Agric. Res., New Delhi, *Entomol. Monogr.* No. **2** : IX+1-115.

Caste known : Soldier (S), Worker (W) from DNP.

Material : Pithla area ca. 28 kms. from Jaisalmer, 8 S and 20 W, Ex. Dry Trunk of tree, 24.vii.1995, N. S. Rathore coll.

Distribution : Very widely distributed almost all over India and Pakistan.

Remarks : It is a subterranean termite, which reaches dry wood above ground. It is a serious pest of woodwork. It is known to attack the dead wood of a large number of trees.

Family TERMITIDAE

Subfamily TERMITINAE

Amitermes belli (Desneux)

1906. *Termes belli* Desneux, *Ann. Soc. Entomol-Belg.*, Brussels, **49**(12) : 352-354. Imago, Soldier and worker. Type locality : Pakistan : Karachi (Sind).

1949. *Amitermes* : T. E. Snyder, Smiths, misc. coll., **112** : 113-114.

Caste known : Soldier (S), Worker (W) from DNP.

Material : Turvi ca. 93 Kms. North West of Barmer many exs. of S and W, Ex. Dry husk of pearl millet, 20.vii.1995, N. S. Rathore coll.

Distribution : Western India Rajasthan and Gujarat (Kuchchh district). Pakistan : Widely distributed all over NWF Provinces : Sind and Punjab.

Remarks : It is a first record from extreme arid region of Rajasthan.

Eremotermes paradoxalis Holmgren

1912. *Eremotermes paradoxalis* Holmgren, *K. Svenska Vetensk. Akad. Handl* : **48**(4) : 95, Soldier, Type locality : India : Karnataka : Banglore.

1949. *Eremotermes paradoxalis* : T. E. Snyder, Smiths. Misc. Coll., **112** : 132.

Caste known : Imago (Im), Soldier (S) and Worker (W) from DNP.

Material : Barna village ca. 40 kms. from Jaisalmer 30 exs. (alates), 26.vii.1995, Pithla area ca. 28 Kms. from Jaisalmer 50 exs. of S and W, 24.vii.1995, N. S. Rathore coll.

Distribution : It is a widely distributed species, occurring from Pakistan to almost whole of India, going south right up to Kerala.

Remarks : Swarming of this species was recorded for the first time from extreme desert area.

Eremotermes neoparadoxalis Ahmad

1955. *Eremotermes neoparadoxalis* Ahmad, Biologia, Lahore, 1(2) : pp. 252-253, Type-locality : West Pakistan : Shahadapur (Sind).

1960. *Eremotermes neoparadoxalis*, Roonwal and Sen Sarma, Contr. Syst. Orient. Termites (Indian Counc. Agric. Res., Entomol. Monogr. No. 1) New Delhi : pp. 79-83.

Caste known : Soldier (S), Worker (W) from DNP.

Material : Pithla area ca. 28 Kms. from Jaisalmer, 50 exs. of S and W, 24.vii.1995, Balewa ca. 73 Kms. from Barmer, 17 exs. of S and W 18.vii.1995, N. S. Rathore coll.

Distribution : Pakistan (Sind, Baluchistan, N.W.F.P.) and Western India (Rajasthan, Delhi and Gujarat).

Remarks : This is a soil-dwelling species, mostly found under dung, decaying wood, open as well as cultivated fields.

Microcerotermes raja Roonwal & Bose

1933. *Microcerotermes championi* Snyder, *Proc. U.S. Nation. Mus.*, Washington, 82 (art. 16), pp. 14-15, Type locality : India : Haldwani (Uttar Pradesh).

1964. *Microcerotermes championi raja* Roonwal and Bose, Termite fauna of Rajasthan, India, *Zoologica*, Stuttgart, 40(3) : (Heft 113) VI+58, 5 pls., 26-28. Type locality : India, Rajasthan, Jodhpur (Balsamand).

Caste known : Imago (Im.), Soldier (S) and Worker (W) from DNP.

Material : Turvi ca. 93 Kms. north west of Barmer, 100 exs. (76 alates, 4 S, 20 W) from Swarm (10AM), 20.vii.1995, N. S. Rathore coll.

Distribution : Rajasthan : Jodhpur, Nagaur, Jaisalmer, Barmer (DNP area).

Remarks : This is the first swarming record from extreme Thar desert area hundreds of alates swarming at 10 AM from number of swarming holes scattered all around water pond mud wall. Alates were devoured by Calotes, Red vented bulbul, House Sparrow, even *Rana cynophylectus* (frog), also capture when alates fall down on water surface.

Microcerotermes tenuignathus Holmgren

1913. *Microcerotermes tenuignathus* Holmgren. *J. Bombay Nat. Hist. Soc.*, Bombay, **22**(1) pp. 116-117 Soldier and Worker (major and minor) Type-locality : India : Vadtal (Gujarat).

Caste known : Soldier (S), Worker (W) from DNP.

Material : Girab area ca. 107 kms from north west of Barmer, 14 exs. 3S, 11W Ex. Dry stem of Til, 10.ii.1995, N. S. Rathore coll.

Distribution : INDIA : Rajasthan : Jaisalmer, Barmer, Jodhpur, Jaipur and Kota districts. Gujarat : Junagadh and Kuchchh. *Elsewhere* : Pakistan (Sind and Baluchistan).

Microcerotermes laxmi Roonwal and Bose

1964. *Microcerotermes tenuignathus laxmi* Roonwal and Bose, *Zoologica*, Stuttgart, **40**(113), pp. 29-31, Type-locality : India : Kolayat (Bikaner District : Rajasthan).

Caste known : Soldier (S), Worker (W) from DNP.

Material : Harsani ca. 85 Kms. north west of Barmer, 35 exs. 5 S, 30 W, Ex. Dry stems of Bajra, 19.vii.1995, N. S. Rathore coll.

Distribution : Rajasthan (Bikaner and Barmer District).

Microcerotermes sp.

Caste known : Soldier (S) and Worker (W) from DNP area.

Material : Sam area ca. 42 Kms. west of Jaisalmer, 27 exs. 7S, 20 W, Ex. dry twigs of *Calotropis* sp, 23.vii.1995, N. S. Rathore coll.

Subfamily MACROTERMITINAE

Odontotermes obesus Rambur

1942. *Termes obesus* Rambur, *Hist. Nat. Insectes, Neuropteres*, Paris, p. 304, (Im.) Type-locality : India : Bombay (Maharashtra).

1981. *Odontotermes obesus* : M. L. Thakur, *Indian For. Rec.* **14**(2) : 100-107.

Caste known : Soldier (S) and Worker (W) from DNP area.

Material : Bhopa village and around ca. 31 kms. from Jaisalmer 37 exs. 12S, 25W, Ex. from mud shelter tubes on ground, 25.vii.1995, N. S. Rathore coll.

Distribution : This is most widely distributed and common mound building termite species occurring all over India, Burma, Bangladesh and Pakistan.

Remarks : Although it is mound building species but in, dry and desertic conditions it makes under ground nest and spread over ground in earthen mud shelter tubes on grasses.

Odontotermes sp.

Caste known : Alates only from DNP area.

Material : Turvi ca. 93 Kms. north west of Barmer 40 exs. (alates), 20.vii.1995, N. S. Rathore coll.

Remarks : Large number of alates swarming in the open fields at 8 AM (Swarming time 8–9 AM). Alates when descend to ground predated by Calotes, and other lizard and by house sparrow, common Green bee eater, common Crow, common Babblers and Gray shrike, etc.

Microtermes mycophagus (Desneux)

1906. *Termes mycophagus* Desneux, *Ann. Soc, Ent. Belg.*, **49**(12) : 348-352. Imago, Soldier and Worker. Type-locality : Pakistan : Karachi (Sind).

1949. *Microtermes mycophagus*, T. E. Snyder, *Smith. Misc. coll.*, **112** : 252.

1964. *Microtermes mycophagus*, P. N. Chatterjee and M. L. Thakur, *India For. Rec.*, **10**(11) : 230-234.

Caste known : Imago (Im.) soldier (S) and Worker (W) from DNP.

Material : Sam ca. 42 Kms. west of Jaisalmer, exs. 1 S, 26 W, Ex. Dry grass 7.ii.1995., Nahar Singh Ki Dhani ca. 23 Kms. from Jaisalmer, exs. 2 S, 10 W, Ex. Dry stem of Calotropis, 6.ii.1995., Harsani ca. 85 Kms. north west of Barmer, exs. 4 S, 8 W, Ex. Under dung, 11.ii.1995., Girab ca. 107 Kms. north west of Barmer, exs. 6 S, 11 W. Ex. Dry Stem, 10.ii.1995., Turvi village ca. 98 Kms. north west of Barmer, exs.1 S, 2 W, Ex. Dry stump, N. S. Rathore coll.

Distribution : INDIA : Gujarat, Delhi, Rajasthan, Punjab. *Elsewhere* : Pakistan.

Remarks : It is one of the very widely distributed species of genus *Microtermes* in above-mentioned localities. It is soil dwelling species attacking living plants and cultivated crops. Swarming after first heavy rain in July at 8 PM in night and large number of alates are attracted to light, predated by House Lizard and Toad.

Microtermes obesi Holmgren

1912. *Microtermes obesi* Holmgren, *J. Bombay Nat. Hist. Soc.*, **21**(3) : 787-788. Imago, Type-locality : India : Maharashtra : Khandala (near Bombay).

1949. *Microtermes obesi* T. E. Snyder, *Smiths. Misc. Coll.*, **112** : 252.

1964. *Microtermes obesi* P. N. Chatterjee and M. L. Thakur, *Indian For. Rec.*, **10**(11) : 234-239.

Caste known : Soldier (S) and Worker (W) from DNP.

Material : Baisala ca. 34 Kms. north west of Barmer, exs. 4 S, 31 W, Ex. Dry Stem, 12.ii.1995., Pithla area ca. 28 Kms, from Jaisalmer, 50 exs. 7 S, 43 W, 24.vii.1995., Bhopa village ca.31 Kms. From Jaisalmer 20 exs. 2 S, 18 W, 25.vii.1995., Harsani ca. 85 Kms. north west of Barmer, 24 exs. 4 S, 20 W, 19.vii.1995, N. S. Rathore coll.

Distribution : All over India. Elsewhere : Pakistan, Bangladesh and Sri Lanka, Bhutan, Burma and Thailand.

Remarks : Very widely spread and versatile species, inflict economic damage to agriculture crops, fencing and fallen stem, twigs, etc.

Microtermes unicolor Snyder

1933. *Microtermes unicolor* Snyder, *Proc. Biol*; **46** : 92-93.Imago (dealated king and queen) Type-locality : India : Uttar Pradesh : Dehra Dun.

1949. *Microtermes unicolor*, T. E. Snyder, *Smiths Misc. coll.*, **112** : 254.

1964. *Microtermes unicolor*, P. N. Chatterjee and M. L. Thakur, *Indian For. Res.*, **10**(II) : 244-247.

Caste known : Alates (Al) Soldier (S), Worker (W) from DNP.

Material : Turvi ca. 93 Kms. north west of Barmer, 40 exs. 3 S, 37 W, 20.vii.1995, Bhopa village ca. 31 kms. from Jaisalmer 10 exs. 2 S, 8 W, 18.vii.1995, Jaisalmer, 20 exs. (Alates) 23.vii.1995, N. S. Rathore coll.

Distribution : INDIA : Gujarat, Rajasthan, Punjab, Himachal Pradesh, Jammu and Kashmir, Uttar Pradesh. *Elsewhere* : Pakistan : Punjab, N.W.F.P, Sind, and Bangladesh.

Remarks : In DNP area out of three known species of *Microtermes* this species is not very common. Swarming alates were collected at Jaisalmer from light source at 8 PM.

SUMMARY

In total, 16 species of termites have been reported from DNP, together with their taxonomic notes.

REFERENCES

Ahmad, M. 1955. Termites of West Pakistan, *Biologia*, Lahore **1**(2) : 202-264.

Rathore, N. S. 1998. Taxonomy and ecology of termites of Rajasthan : National Seminar on Entomology in 21st century. Entomological Society of India, R.C.A. Udaipur (Abstract No. 69).

Roonwal, M. L. 1969. Fauna of Rajasthan, India Part I : General Introduction, with a list of collecting localities and a bibliography of Rajasthan Zoology. *Rec. zool. Surv. India*, **61**(3 & 4) (1963) : 291-376.

Roonwal, M. L. and Bose, G. 1960. A new termite *Psammotermes rajasthanicus* sp. nov. from Rajasthan, India. *Sci. & cult.*, **26**(1) : 38-39.

Roonwal, M. L. and Bose, G. 1964. Termite fauna of Rajasthan, India. *Zoologica*, Stuttgart, **40**(3) (113) : VI 758, 5 pls.

Roonwal, M. L. and Bose, G. 1969. Fauna of Rajasthan, India part. 4. A checklist of Rajasthan termites. *Rec. zool. Surv. India,* **61**(3) : 437-450.

Roonwal, M. L. 1976. Field ecology and eco-biogeography of Rajasthan Termites : A study in desert environment. *Zool. Jb. Syst. Bd.*, **113** : 455-504.

Roonwal, M. L. and Verma, S. C. 1977. Re-survey of the termite fauna of Rajasthan, India and its Zoogeography. *Rec. zool. Surv. India*, **72** : 425-480.

Zool. Surv. India
Conservations Area Series **19**, *Fauna of Desert National Park,* : 79-80, 2004

INSECTA : DIPTERA

S. KUMAR
Desert Regional Station, Zoological Survey of India, Jodhpur, India

INTRODUCTION

The robber flies are common and abundant in arid and semi-arid regions of the world. The adult and larva are predaceous in nature and thus help to maintain the balance of phytophagous insect populations in their habitat. So far 4 species are known from the Thar Desert of which the DNP is a part in the extreme western region (Kumar & Kumar, 1996). Only one species was found inhabiting the region, which is earlier reported from the Nagaur district of Rajasthan (Joseph & Parui 1990).

SYSTEMATIC ACCOUNT

Order DIPTERA

Family ASILIDAE

Subfamily ASILINAE

Tribe ASILINI

Apoclea rajasthanensis Joseph and Parui, 1984

1984. *Apoclea rajasthanensis* Joseph and Parui, *Bull. zool. Surv. India*, **6**(1-3) : 247. Type-locality : Narana, Rajasthan.

Material examined : Balewa village, Barmer, 4 exs., 18.vii.1995; Pithla area, Jaisalmer, 1 ex., 24.vii.1995; Bhopa village, Jaisalmer, 2 exs., 25.vii.1995, Turvi, Barmer, 1 exs., 1.x.1996, N. S. Rathore. coll.

Distribution : INDIA : Rajasthan.

Remarks : It is endemic to Western Rajasthan, the Thar Desert.

REFERENCES

Joseph, A. N. T. and Parui, P. 1990. A review of the Asilidae ((Diptera) from India. *Rec. zool. Surv. India*, Occ. Paper No. 113 : 42-46.

Kumar, Sanjeev and Kumar, Seema 1996. Diptera Fauna of the Thar Desert. In : *Faunal Diversity in Thar Desert : Gaps in Research*. Ed. By A. K. Ghosh, Q. H. Baqri and I. Prakash. 241-251. Scientific Publisher, Jodhpur.

Zool. Surv. India
Conservations Area Series **19**, *Fauna of Desert National Park,* : 81-84, 2004

INSECTA : LEPIDOPTERA

D. R. MAULIK

Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053

INTRODUCTION

The Papilionidae, Pieridae and Danaidae, Nymphalidae belong to the well-known butterfly group of the highly specialized insect order Lepidoptera. The Papilionidae represent the largest and most magnificent of all the Indian butterflies. The remarkable habit of the family Pieridae is its migration in large number. This characteristic attracted the attention of travelers and naturalists. The Danaides are tough, leathery equipped for survival. They are predominantly of tropical origin and found in dry humid niches.

The present work is based on the classification of Hancock (1983), Ackery & Vane-Wright (1984) and Varshney (1993), but infraspecific nomenclature used is that of Talbot (1939).

The paper deals with the three species belonging to the families Papilionidae, Pieridae and Nymphalidae from the Desert National Park, Rajasthan.

SYSTEMATIC ACCOUNT

Order LEPIDOPTERA

Suborder RHOPALOCERA

Family PAPILIONIDAE

Subfamily PAPILIONINAE

Genus ***Princeps*** Hubner

Princeps (Menelaides) polytes romulus (Cramer)

1758. *Papilio* Linnaeus, *Syst. Nat., ed.* **10**(1) : 458.

1983. *Princeps, (Menelaides) polytes* Hancock, *Smithersia,* **2** : 48 (spp. *romulus*, Talbot, 1939, p. 178, Figs. 46-48. Pl. I, Fig. 18a-b, 19).

1775. *Papilio romulus* Cramer, *Pap. Exot.*, **1** : 67, pl. 43, fig. A.

1997. *Princeps (Menelaides) polytes* (Linnaeus, 1758) *P.M.p. romulus* (Cramer), Mandal & Maulik, in *State fauna series*, West Bengal, **3**(7) : 771.

1999. *Princeps (Menelaides) polytes*, Mandal and Maulik, in *State fauna series*, Meghlaya, **4**(6) : 232.

Material examined : 1 ex., Girab, Barmer district, Rajasthan, 3.x.1996, coll. N. S. Rathore and party.

Diagnostic characters : Fore wing of male with prominent terminal white spot; upper side of hind wing discal white band of uniform width and underside sub marginal lunules red.

Distribution : Throughout India including Rajasthan, West China.

Family PIERIDAE

Subfamily PIERINAE

Genus *Colotis* Hubner

Colotis phisadia protractus (Buttler, 1876)

1819. *Colotis* Hubner, *Samml. Exot. Schmitt.*, **ii** : p. 97.

1876. *Teracolus protractus*, Buttler, *Proc zool. Soc. London.*, 137.

1939. *Colotis phisadia protractus*, Talbot, *Fauna Brit. India.* **1** : 456-57.

Material examined : 1 ex.; Sam area, Jaisalmer district, Rajasthan, 24.ix.1996, coll. N. S. Rathore and party.

Diagnostic characters : Base of fore wing of male bluish-grey; a costal black border jointed to marginal black area; a prominent oval disco cellular spot. Hind wing with distal half black, underside ochraceus pink.

Distribution : INDIA : Rajasthan, Gujarat (Kuchchh) and Sind to Baluchistan and Punjab.

Family NYMPHALIDAE

Subfamily DANAINAE

Genus *Danaus* Kluk

Danaus (Anodia) Chrysippus (Linnaeus 1758).

1802. *Danaus* Kluk, *Zwierzt Hist. Nat. Poez. Cospod.*, **4** : 84.

1984. *Danaus* Ackery & Vane-Wright, *Milkweed Butterflies*, P. 201.

1758. *Papilio chrysippus* Linnaeus, *Syst. Nat. ed.* **10** : 471.

Danaus (Anosia) chrysippus, Mandal & Maulik, in State Fauna Series, Meghalaya, part **6** : 223-242.

Material examined : 4 exs.; Girab, 37 Kms. from Barmer district, Rajasthan. 2.x.1996, coll. N. S. Rathore and party.

Diagnostic characters : Upper side of fore wing tawny, veins not black and four small black spot around end-cell, these being 3 in female : male with pouch.

Distribution : Throughout India, including Rajasthan and the rest of Peninsula.

SUMMARY

Six examples of Butterflies belonging to three species in three genera under three families are studied from the Desert National Park, Rajasthan, Distributional range in India and abroad have been furnished.

ACKNOWLEDGEMENTS

I am thankful to the Director, Zoological Survey of India, Calcutta, for providing the opportunity to carry out the study. I am also thankful to the Officer-in-Charge Desert Regional Station, Zoological Survey of India, Jodhpur. I am also grateful to Dr. R. K. Varshney, Scientist 'SG' and Dr. S. K. Mitra, Scientist 'SF', Zoological Survey of India, for giving various facilities.

REFERENCES

Ackery, P. R. and Vane-Wright, R. I. 1984. Milkweed Butterflies, their cladistics biology, being on account of the natural history of the Danainae, a Subfamily of the Lepidoptera, Nymphalidae, vii+425 pp. pls., figs., tables, London.

Butler, A. G. 1876. "A revision of the Lepidopterous genus *Teracolus* with description of the new species" *Proc. Zool. Soc. London.*, pp. 126-65, pls. vi, vii.

Hancock. G. L. 1983. Classification of the Papilionidae (Lepidoptera) : A phylogenetic approach, *Smitersia,* **2** : 1-48.

Mandal, D. K. and Maulik, D. R. 1997. Insecta : Lepidoptera : Rhopalocera : Papilionidae, Danaidae and Nymphalidae, *State Fauna Series*, 3 : Fauna of West Bengal, Part **7** : 755-793.

Mandal, D. K. and Maulik, D. R. 1999. Insecta : Lepidoptera : Papilioniodea : Papilionidae, Danainae and Nymphalidae, *State Fauna Series*, 6 : Fauna of Meghalaya, Part **6** : 223-242.

Talbot, G. 1939. The *Fauna of British India* including Ceylon and Burma, Butterflies 1 : XXXIX + 600 pp., figs. pls. London.

Varshney, R. K. 1993. Index Rhopalocera Indica Part III. Genera of Butterflies from India and Neighbouring Countries. Lepidoptera : (A) Papilionidae and Danaidae, *Oriental Insects*, **27** : 347-372.

Zool. Surv. India
Conservations Area Series **19**, *Fauna of Desert National Park,* : 85-90, 2004

INSECTA : HYMENOPTERA

N. TAK AND N. S. RATHORE
Desert Regional Station, Zoological Survey of India, Jodhpur, India

INTRODUCTION

This paper deals with ants of the Desert National Park, Rajasthan. One of the authors made an intensive collection of ants in this area for three years (1994 to 1996). The present communication is based on the study of this material only. Altogether 17 species belonging to 1 family and 3 sub families are reported here with two new records from Rajasthan.

SYSTEMATIC ACCOUNT

Family FORMICIDAE

Subfamily DORYLINAE Leach

Tribe DORYLINI Forel

Dorylus* (*Typhlopone*) *labiatus Shuckard

Material and Loc : 10 exs., 16.vii.1980, Bothia village, R. N. Bhargava coll., 25 exs., 19.vii.1995, Harsani village of Barmer district, N. S. Rathore coll.

Distribution : Widely distributed in India and known from Rajasthan state (Barmer, Jodhpur, Jaipur (Sambhar Lake and Rampur) districts.

Dorylus* (*Alaapone*) *orientalis Westwood

Material and Loc : 1 ex. (male), 22.vii.1995, Jaisalmer, N. S. Rathore coll.

Distribution : Throughout India and whole of Rajasthan. *Elsewhere* : Borneo, China, Java, Malaya, Myanmar, Nepal, Peninsula and Sri Lanka.

Subfamily FORMICINAE Lepleletier

Tribe CAMPONOTINI Forel

Camponotus* (*Tanaemyrmex*) *compressus Fabricius

Material and Loc. : 10 exs., 20.vii.1995, Harsani village of Barmer district, 3 exs., 27 exs. 27.ix.1996, Barna village of Jaisalmer district, N. S. Rathore coll.

Distribution : Throughout India. Rajasthan : Jodhpur, Jaisalmer, Jaipur, Dungarpur districts. *Elsewhere* : Arabia, Africa, Myanmar, Russia, Sri Lanka.

Camponotus* (*Tanaemyrmex*) *irritans Fr. Smith

Material and Loc. : 6 exs., 20.vii.1995, Harsani village Barmer district, N. S. Rathore coll.

Distribution : Throughout India. Rajasthan : Barmer and Jodhpur districts. *Elsewhere* : Bankok, Malaya, Peninsula and Sri Lanka.

Camponotus* (*Dinomyrmex*) *angusticollis Jerdon

Material and Loc. : 2 exs., 27.ix.1996, Barna village Jaisalmer district, N. S. Rathore coll.

Distribution : Western and Central India, Assam, Rajasthan : Jaisalmer and Jodhpur districts. *Elsewhere* : Myanmar.

Tribe FORMICINAE Forel

Cataglyphis bicolor setipes Emery

Material and Loc. : 1 ex., 10.ii.1995, Girab area, 6 exs., 13.ii.1995, Turvi village, 2 exs. 18.vii.1995, Balewa village, 2 exs., 20.vii.1995, Harsani village, 5 exs., 21.vii.1995, Girab area of Barmer district, 2 exs., 7.ix.1995, Sam dunal area, 1 ex., 8.ii.1995, Khuri village, 8 exs., 25.vii.1995, Bhopa village, 12 exs., 26.vii.1995, Barna village, 2 exs., 27.vii.1995, Khuri village, 4 exs., 28.ix.1996, Barna Sudasari road of Jaisalmer district, N. S. Rathore coll.

Distribution : Central India, Punjab. Rajasthan : Barmer, Bikaner, Jaisalmer, Jodhpur, Jaipur and Churu districts. *Elsewhere* : Persia, north-eastern and northern Africa, south Europe.

Remarks : This ant moves very fast and always keeps its abdomen at right angles to the thorax. It is resistant to the extreme heat of this area and seen running in the midday.

Tribe PLAGIOLEPIDINI Forel

Acantholepis frauenfeldi Subsp. ***bipartita*** Forel (*bipartita* Indian farm)

Material and Loc. : 50 exs., 11.ii.1995, Harsani village, 12 exs., 20.vii.1995, Harsani village, 15 exs., 21.vii.1995, Girab area, 5 exs., 1.x.1996, Turvi village, 2 exs., 2.x.1996, Girab Area, 10 exs., 3.x.1996, Girab area of Barmer district, 15 exs., 5.ii.1995, Pithla area, 8 exs., 24.vii.1995, Pithla area, 12 exs., 26.vii.1995, Barna village, 2 exs., 27.ix.1996, Barna village of Jaisalmer district, N. S. Rathore coll.

Distribution : Throughout India. Rajasthan : Barmer, Jaisalmer, Jodhpur, Sirohi (Mount Abu) districts. *Elsewhere* : Southern Europe and North Africa.

Subfamily MYRMICINAE Lepeletier

Tribe CREMATOGASTERINI Emery

Crematogaster (Acrocoelia) brunnea var. ***contemta*** Mayr

Material and Loc. : 10 exs., 18.vii.1995, Balewa village of Barmer district, 5 exs., 6.ii.1995, Nahar Singh Ki Dhani of Jaisalmer district, N. S. Rathore. coll.

Distribution : Western India, Bengal and Rajasthan : Barmer, Jaisalmer and Jodhpur districts. *Elsewhere* : Sri Lanka.

Tribe ANCYRIDIS Wheeler

Messor barbarus himalayanum Forel

Material and Loc. : 10 exs., 10.ii.1995, Girab area, 22 exs., 11.ii.1995, Harsani village, 12 exs., 13.ii.1995, Turvi village, 2 exs., 19.vii.1995, Harsani village, 1 ex., 21.vii.1995, Girab area of Barmer district, 10 exs., 8.ii.1995, Khuri, 30 exs., 24.vii.1995, Pithla area, 20 exs., 26.vii.1995, Barna village of Jaisalmer district, N. S. Rathore coll.

Distribuiton : INDIA : Punjab (Chandigarh), N. W. Himalaya, Dharamsala, Rajasthan : Barmer, Jaisalmer, Jodhpur, Bikaner, Ajmer, Bundi and Banswara districts. *Elsewhere* : Quetta.

Tribe SOLENOPSIDINI Forel

Monomorium (Holcomyrmex) glabrum Ern. Andre

Material and Loc. : 4 exs., 20.vii.1995, Harsani village, 10 exs., 1.x.1996, Turvi village of Barmer district, N. S. Rathore coll.

Distribution : Western and southern India. Rajasthan : Barmer and Jodhpur districts. *Elsewhere* : Sri Lanka and Myanmar.

Monomorium* (*Holcomyrmex*) *scabriceps Mayr

Material and Loc. : 15 exs., 3.x.1996, Girab area of Barmer district, 4 exs., 5.ii.1995, Pithla area of Jaisalmer district, N. S. Rathore coll.

Distribution : Through out India from Punjab to Cochin. Rajasthan : Barmer and Jaisalmer districts.

Monomorium* (*Xeromyrmex*) *salomonis indica Forel

Material and Loc. : 2 exs., 10.ii.1995, Girab area, 5 exs., 11.ii.1995, Harsani village, Many exs., 15.ii.1995, Turvi village, 7 exs., 18.vii.1995, Belwa village, 6 exs., 2.x.1996, Girab area, 5 exs., 3.x.1996, Girab area of Barmer district, 10 exs., 6.ii.1995, Nahar Singh Ki Dhani, 15 exs., 7.ii.1995, Sam Dunal area, 15 exs., 8.ii.1995, Khuri village, 3 exs., 23.vii.1995, Sam area, 2 exs., 26.vii.1995, Barna village, 10 exs., 27.vii.1995, Khuri area, 5 exs., 26.ix.1996, Sudasari, 20 exs., 28.ix.1996, Barna village, 2 exs., 28.ix.1996, Barna Sudasari road, 2 exs., 30.ix.1996, Mogra village of Jaisalmer district, N. S. Rathore coll.

Distribution : Throughout India. Rajasthan : Barmer, Jaisalmer, Jodhpur, Bikaner and Banswara districts. *Elsewhere* : Myanmar.

Monomorium* (*Parholcomyrmex*) *destructor Jerdon

Material and Loc. : 3 exs., 18.vii.1995, Balewa village, 5 exs., 19.vii.1995, Harsani village, 2 exs., 20.vii.1995, Harsani village of Barmer district, 6 exs. 26.vii.1995, Barna village of Jaisalmer district, N. S. Rathore coll.

Distribution : Throughout our limits to arid region of both hemisphere. Rajasthan : Barmer and Jaisalmer districts.

Remarks : This species is recorded for the first time from Rajasthan.

Monomorium (Parholcomyrmex) gracillimum var. ***mayri*** Forel

Material and Loc. : 12 exs., 10.ii.1995, Girab area, 10 exs., 18.vii.1995, Balewa village, 12 exs., 19.vii.1995, Harsani village, 3 exs., 3.x.1996, Girab area of Barmer district, 15 exs., 25.vii.1995, Bhopa village, 15 exs., 26.vii.1995, Barna village, 8 exs., 27.vii.1995, Khuri village, 4 exs., 26.ix.1996, Sudasari, 2 exs., 29.9.1996, Rupsi village of Jaisalmer district, N. S. Rathore coll.

Distribution : Throughout India. Rajasthan : Barmer, Jaisalmer and Jodhpur districts. *Elsewhere* : Sri lanka, North Africa, Arabia and through out Myanmar.

Tribe PHEIDOLINI Emery

Pheidole (Pheidole) sulcaticeps Roger

Material and Loc. : 5 exs., 8.ii.1995, Khuri village of Jaisalmer district, N. S. Rathore coll.

Distribution : Western India, N. W. Provinces, Bengal. Rajasthan : Jaisalmer district.

Pheidole (Pheidole) wroughtoni Forel

Material and Loc. : 2 exs., 13.ii.1995, Turvi village, 5 exs., 19.vii.1995, Harsani village, 5 exs., 2.x.1996, Girab area of Barmer district, N. S. Rathore coll.

Distribution : Western India and Karnataka. Rajasthan : Barmer, Jaisalmer and Jodhpur districts.

Tribe TETRAMORINI Emery

Tetramorium salvatum Forel

Material and Loc. : 5 exs., 19.vii.1995, Harsani village of Barmer district, N. S. Rathore coll.

Distribution : N. W. Himalaya and western India. Rajasthan : Barmer district.

Remarks : This species is recorded for the first time from Rajasthan.

SUMMARY

Altogether 17 species of Hymenoptera; Formicidae belonging to 9 genera under 3 subfamilies are reported from DNP with two new record from Rajasthan state. Collection data, distribution range within India and elsewhere have been provided.

REFERENCES

Bingham, C. T. 1903. *The Fauna of British India* (Hymenoptera) London **2** : XIX + 506, pl. 1.

Chapman, J. W. and Capco, S. R. 1951. *Checklist of the Ants (Hymenoptera : Formicidae) of Asia.* Monograph of the Institute of Science and Technology, Manila, No. **1** : 327 pp.

Chhotani, O. B. and Ray, K. K. 1976. Fauna of Rajasthan, India, Hymenoptera. *Rec. zool. Surv. India*, **71** : 13-49.

Tak, N. 1995. Studies on Ants (Formicidae) of Rajasthan-I Jodhpur. *Hexapoda*, **7**(1) : 17-28.

Tak, N. and Rathore, N. S. 1996. Ant (Formicidae) Fauna of Thar Desert. In : *Faunal Diversity in the Thar Desert : Gaps in Research*. Ed. by A. K. Ghosh, Q. H. Baqri and I. Prakash. 271-276. Scientific Publisher, Jodhpur.

Zool. Surv. India
Conservations Area Series **19**, *Fauna of Desert National Park,* : 91-99, 2004

INSECTA : HYMENOPTERA : ACULEATA

R. N. TIWARI, B. G. KUNDU, S. ROYCHOWDHURY AND S. N. GHOSH
Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053

INTRODUCTION

Hymenoptera is a fascinating group of insects and considered to be the most highly mentally developed of all insects. Some forms, *viz.*, ants, social bees and wasps, live in large communities, have organised division of classes and labour and frequently maintain complex social relationship with insects of other orders, as guests or parasites, harbour in their nests.

Insects of minute to large size, characterised by having two pairs of membranous wings, the hind pair smaller than the fore pair to which they are attached by a row of hooks. Mouthparts with biting mandibles and labium adapted for licking juices of flowers.

There are two suborders : (1) The symphyta, distinguished by having no marked constriction between thorax and abdomen. (2) The apocrita, the abdomen of which is deeply constricted or stalked at its base. The suborder Apocrita is divided into two subdivisions, (i) the Parasitic which parasitise other insects and (ii) the Aculeata-stinging hymenoptera.

Present paper deals with 7 species of Hymenoptera belonging to 5 families and 6 genera of suborder Apocrita. The families represented are : Apidae, Xylocopidae, Eumenidae, Sphecidae and Mutillidae. The key to the families, key to the genera and species are included along with their diagnostic characters. Besides this, attempt has been made to give a brief account of diagnostic characters of the families involved.

Abbreviations used in the text are M-Male, F-Female, W-Worker. The material studied has been deposited in the National Collection of Zoological Survey of India, Desert Regional Station, Jodhpur.

As this group is mainly dependent on juicy exudation of plants, especially on flowers, because of desert climatic condition, the occurrence of hymenopterans is comparatively thin,

compared to other group of Insects. Amongst the families reported here, the species of families Mutillidae and Formicidae have shown better adaptability to desert climatic condition, as they can stand extreme climatic conditions, particularly the heat and thus able to survive inspite of unfavorable climatic conditions. In order to establish the adaptability of the above families, a thorough survey of this group is desired in the state of Rajasthan, especially in the desert part.

SYSTEMATIC ACCOUNT

Family APIDAE

Genus ***Apis*** Linnaeus, 1767

Apis* (*Micrapis*) *florea Fabricius, 1787

Apis* (*Megapis*) *dorsta Fabricius, 1793

Family XYLOCOPIDAE

Genus ***Xylocopa*** Latreille

Xylocopa* (*Ctenoxylocopa*) *fenestrata (Fabricius, 1798)

Family EUMENIDAE

Genus ***Eumenes*** Latreille, 1805

Eumenes dimidiatipennis, Saussure, 1852

Family SPHECIDAE

Genus ***Chlorion*** Latreille, 1802–03

Chlorion regale Smith, 1873

Family MUTILLIDAE

Genus ***Apterogyna*** Latreille, 1809

Apterogyna mutilloidea Smith, 1855

Genus ***Mutilla*** Linnaeus, 1767

Mutilla sp.

Key to the Families

1. Pronotum transverse, its posterior lateral angles do not extended back to the base of wings 2
— Posterior lateral angles of pronotum extended back to the base of wings 4
2. Hairs on head and thorax plumose or branched; hind tarsi more or less dialated 3
— Hairs not plumose or branched; hind tarsi not dialated ..... SPHECIDAE
3. Social bees without apical spurs on hind tibiae; maxillary palp I-jointed ..... Apidae
— Solitary bees with apical spurs on hind tibiae; maxillary palpi 6-jointed ..... XYLOCOPIDAE
4. Wings folded longitudinally when at rest ..... EUMENIDAE
— Wings not folded longitudinally when at rest presence of velvety pubescence ..... MUTILLIDAE

Family APIDAE

The members of this family are unique examples of social insects and economically very much important. These are distinguished by having the tongue acute at the apex, never emarginate, generally narrow and sometimes remarkable long.

Genus *Apis* Linnaeus

1767. *Apis Linnaeus*, Syst. Nat., 1 : 953.

Type species : *A. mellifera* Linnaeus, 1767.

Diagnostic characters : Worker : Head as wide as thorax, eyes ovate, pubescent, antennae in a triangle on vertex. Thorax globular; fore wing long, narrow, redial cell rounded at apex; three cubial cells; legs stout; first two tibae with spine at apex; margins of posterior tibae fringed with long hairs curving inwards; 1st joint of tarsi fringed with long hairs, on inside with rows of stiff hairs. Abdomen more or less truncate at base, sting curved.

Key to the species of *Apis*

1. large in size, the basal three abdominal segments honey-yellow ..... *A. (Megapis) dorsata*
— Smaller in size; the basal three abdominal segments more or less red ..... *A. (Micrapis) florea*

Apis (Megapis) dorsata Fabricius

1793. *Apis dorsata* Fabricius, *Ent. Syst.*, **2** : 328.

1897. *Apis dorsata*, Bingham, *Fauna British India, Hymenoptera*, **1** : 557, M.E.W.

1904. *Apis (Megapis) dorsata*, Ashmead, *Proc. Ent. Soc.* Wash., **6** : 120.

1985. *Apis (Megapis) dorsata*, Roy and Kundu, *Rec. zool. Surv. India*, **82**(1-2) : 221.

Diagnostic Characters : Worker : length 16–18 mm. Head, thorax, legs and apical three segments of abdomen black; basal three abdominal segments honey-yellow. A short, medial, vertical grove below the anterior ocellus. Wings pale fuscous.

Material examined : 1 ex., 13.ii.1995, Turvi village, Barmer distt., Rajasthan, N. S. Rathore coll.

Distribution : Throughout India. *Elsewhere* : Myanmar, China, Indonesia, Malaysia, Sri Lanka.

Apis (Micrapis) florea Fabricius

1787. *Apis florea* Fabricius, *Mant. Ins.*, **1** : 305.

1897. *Apis florea*, Bingham, *Fauna British India,. Hymenoptera*, **1** : 559, W.E.M. Syns.

1904. *Apis (Micrapis) florea*, Ashmead, *Proc. Ent. Soc. Wash.*, **6** : 1.

1985. *Apis (Micrapis) florea*, Roy and Kundu, *Rec. zool Surv. India*, **82**(1-4) : 222.

Diagnostic characters : Worker : Length 8 mm. Black, basal two abdominal segments more or less red; pubescence on head and thorax white, on posterior tarsi ferruginous golden; dull and opaque. Presence of narrow transverse bands of silky white pale at the base of 2nd to 5th abdominal segments.

Material examined : 1 ex., 24.ix.1966, Sam area, Jaisalmer, N. S. Rathore coll.

Distribution : Rajasthan and throughout India. *Elsewhere* : Myanmar, Java, Malaya, Sri Lanka.

Family XYLOCOPIDAE

The Xylocopidae, carpenter bee, are among the commonest insects, often coming into houses with a loud buzzing. In thatched houses they frequently bore into the bamboo's laid below the thatch, cutting neat round holes as entrances. Solitary in habit. Colour of the body dark metallic with usually some whitish hairs; legs stout and densely hairy.

Genus *Xylocopa* Latreille

1802. *Xylocopa* Latreille, *Hist. Nat. Ins.*, **3** : 379.

Type species : *Apis violacea* Linnaeus, 1758.

Diagnostic characters : Head transvers; ocelli in a triangle just below vertex; antennae geniculate; mandibles short, stout, grooved exteriorly, the apex with 2 or 3 teeth. Thorax short, fore wing with radial cell elongate, acute at apex; anterior and intermediate tibae with one apical spur, posterior tibiae and tarsi densely pubescent, the former with two simple spines at apex. Abdomen either elongate or broad and flat, fringed with long hairs on the sides.

Xylocopa (Ctenoxylocopa) fenestrata (Fabricius)

1798. *Apis fenestrata* Fabricius, *Ent. Syst. Suppl* : 273, M.

1897. *Xylocopa fenestrata*, Bingham, *Fauna British India, Hymenoptera*, **1** : 539, F. M.

1963. *Xylocopa* (*Ctenoxylocopa*) *fenestrata*; Hurd and Moure, *Univ. Calif. Pub. Ent.*, **29** : 175.

Diagnostic characters : FEMALE : Length 22–24 mm. Black, shining; pubescence black, ferruginous along the apex of anal abdominal segment, sparse, but dense and long on intermediate and posterior legs; wings dark fuscous with purple coppery effulgence and obscure hyaline lines between nervures at base. Head thorax and abdomen punctured; clypeus nearly flat, widely emarginate anteriorly; mesonotum with three parallel, longitudinally impressed lines. MALE : More or less similar with female, but body narrow in shape, the wings paler, with the hyaline lines.

Material examined : 1 ex., 2.x.1996, Girab, 97 Kms. from Barmer, N. S. Rathore coll.

Distribution : Rajasthan and throughout India. *Elsewhere* : Myanmar, Sri Lanka, Indonesia.

Family EUMENIDAE

These insects are commonly called 'potter wasp' The tongue elongate, projecting beyond the mandible's or folded back against the sternum. Head variable, wider or narrower than thorax. Legs slender, feebly armed, intermediate with one spine at apex, claws dentate.

Genus *Eumenes* Latreille

1805. *Eumenes* Latreille, *Hist. Nat. Crust. Ins.* **13** : 344.

1897. *Eumenes*, Bingham, *Fauna British India, Hymenoptera*, **1** : 333.

1979. *Eumenes*, Krombein, *Cat. of Hym.* In America and North of Mexico **2** : 1507.

Type species : *Vespa coarctata* Linnaeus, 1761.

Diagnostic characters : Head flat; eyes large, prominent; flagellum of antennae incrassate in female; apex in male hooked, curved or spirally rolled inserted high up in the middle of the face. Most of the species make jug like mud nests, provisioned with caterpillars as food for their larvae, usually at twigs, corner of the walls.

Eumenes dimidiatipennis Saussure

1852. *Eumenes dimidiatipennis* Saussure, *Mon. Guep. Sol.* : 51, F. M.

1897. *Eumene dimidiatipennis*, Bingham, *Fauna British India, Hymenoptera,* **1** : 342.

1997. *Eumenes dimidiatipennis*, Gupta, *State Fauna series* 6 : *Fauna of Delhi*, Zoological Survey of India, p. 431.

Diagnostic characters : FEMALE : Length 24–27 mm. Obscure dull red, the base of petiole and apical half of the 2nd and the whole of the following abdominal segments black; wings ferruginous, apical half of fore wing fuscous, having a purple effulgence. Head, thorax and abdomen smooth and shining. Median segment with a median longitudinal furrow, indistinct at base, widening and deepening into a triangular hollow at apex. MALE : Length 22–25 mm. Similar, but smaller; head black, orbitus of eyes red; mesonotum black.

Material examined : 1 ex., 3.X.1996, Girab, Barmer, N. S. Rathore coll.

Distribution : INDIA : Rajasthan, Delhi, Gujarat, Maharashtra, Punjab, Uttar Pradesh. *Elsewhere* : Africa, Arabia, Pakistan.

Family SPHECIDAE

The Sphecidae are characterised mainly by transverse pronotum lateral angles of which do not prolonged back to the base of the wings. These insects have been making use of protected places as nest sites. They are mainly beneficial to man and are relatively harmless.

Genus ***Chlorion*** Letreille

1802-03 *Chlorion* Latreille, *Hist. Nat. Gen Part. Crust. Insects.*, **3** : 333.

1906. *Chlorion* Schulz, *Spolia Hym.*; 193.

Type species : *Sphex lobatus* Fabricius, 1775.

Diagnostic characters : Length 16–17 mm. Body with metallic blue or green colour. Head broader than high; vertex usually elevated much above ocelli in female; frons glabrous to densely setose; propodeum long with U-shaped dorsal enclosure defined atleast postered by a semicircular sulcus or furrow; spiracular groove present, female clypeus short with 5 large teeth, rarely only 2 or 4 teeth; male clypeus about twice as wide as high; occipital carina complete; mid coxae separated by a distance about equal to petiole width; hind femur fusiform, thickest near base; tibiae spinose; claw tooth basal or subbasal; lower half of inner oribit straight. Abdomen petiolate.

Chlorion regale Smith

1877. *Clorion regalis* Smith, *Ann. Mag. Nat. Hist.*, (4)**12** : 291.

1890. *Sphex regalis*, Kohl. *Ann. Nat. Hofmus Wien.*, **5** : 179 F. M.

1897. *Sphex regalis*, Bingham, *Fauna British India, Hymenoptera*, **1** : 243, F.

1976. *Chlorion regale*, Bohart and Menke, *Univ. Calif. Press* : 90.

Diagnostic characters : FEMALE : Length 26–34 mm. Head, thorax in front, femora, tibiae and tarsi dull brick red; median segment, coxae, trochanters and abdomen brilliant effulgent purple. Head broader than thorax, a vertically impressed line before and behind anterior ocellus; pronotum bituberculate; abdomen polished and shining.

Material examined : 1 ex., 2.x.1996, Girab 97 Kms. from Barmer, N. S. Rathore coll.

Distribution : INDIA : Rajasthan. *Elsewhere* : Afganisthan, Africa, Pakistan (Karachi, Sind), Sudan.

Family MUTILLIDAE

These are commonly called 'solitary ants' though they have no very close affinity with true ants. Sexes, male and female, are separate; no neuters. The male is winged; pronotum produced back at its lateral angles to the base of wings. The female is apterous; legs stout, fitted for digging.

Key to the Genera of *Mutillidae*

1. Abdomen with deep constrictions between 1st and 2nd and 2nd and 3rd segments .... *Apterogyna*

— Abdomen with no such constrictions; if constricted the constriction only between the 1st and 2nd segments ..... *Mutilla*

Genus *Apterogyna* Latreille

1809. *Apterogyna* Latreille, *Gen. Crust. Ins.*, **4** : 121.

Type species : *A. olivieri* Laltreille, 1809.

Diagnostic characters : Antennae setaceous, nearly as long as the head and body united; scape elongate; mandibles arched, subdentate; abdomen in male and female with deep constrictions between 1st and 2nd and 3rd segments.

Apterogyna mutilloides Smith

1855. *Apterogyna mutilloides* Smith, *Cat. Sym Brit. Mus.* **3** : 64, F. M.

1897. *Apterogyna mutilloides*, Bingham, *Fauna British India, Hymenoptera*, **1** : 2. F. M.

Diagnostic characters : FEMALE : Length 17 mm. Black; the antennae, vertex and front of head, occiput, thorax and 1st abdominal segment red; the whole body covered with glistening silvery white pubescence and coarsely punctures. MALE : Length 12 mm. Head nearly black; antennae longer, more filiform and darker; pubescence on the apical segments of abdomen more dense; wings hyalins with a brownish tint.

Material examined : 1ex., 26.ix.1996, Sudasari, Jaisalmer, N. S. Rathore coll.

Genus ***Mutilla*** Linnaeus

1767. *Mutilla* Linnaeus, *Syst. Nat.*, **1** : 966.

Type species : *M. europoea* Linnaeus, 1767.

Diagnostic characters : FEMALE : Antennae subfilliform, rarely setaceous, inserted low down just above the very short clypeus, abdomen ovate, 1st segment occassionally petiolate.

Mutilla sp.

Diagnostic characters : FEMALE : Length 7 mm. Head, thorax and legs ferruginous; abdomen black. Head as broad as thorax. Thorax roughly punctured. 2nd abdominal segment having a central spot of white pubescence.

Material examined : 1 female, 6.ii.1995, Nahar Singh Ki Dhani, Jaisalmer, N. S. Rathore coll.

Distribution : INDIA : Rajasthan.

Remarks : Due to non-availability of greater number of specimen, this could not be identified up to the specific level.

SUMMARY

Present paper deals with 7 species of Hymenoptera belonging to 5 families, 6 genera and are exclusively representatives of Aculeata, belonging to suborder Apocrita. The families represented are : Apidae, Xylocopidae, Eumenidae, Sphecidae and Mutillidae. The key to the families, key to the genera and species are included along with the diagnostic characters of species and genera. Besides this, attempt has been made to give a brief account of diagnostic characters of the families involved.

ACKNOWLEDGEMENTS

Authors are very much grateful to Dr. J. R. B. Alfred, Director, Zoological survey of India for providing necessary facilities for the study of the material. Sincere thanks are also due

to Dr. Q. H. Baqri, Scientist-F and Officer-in-Charge, Desert Regional Station, Jodhpur for providing opportunities to produce this paper. Thanks are also due to Dr. P. N. Roy for setting and pinning the material for the purpose of study.

REFERENCES

Ashmead, W. H. 1904. Remarks on Honey bees (Hymenoptera). *Proc. Ent. Soc. Washington,* **6** : 120-123.

Bingham, C. T. 1897. *The Fauna of British India* including Ceylon and Burma. *Hymenoptera.* **1** : 1-579. pls., Figs.

Bingham, C. T. 1903. *The Fauna of British India* including Ceylon and Burma. *Hymenoptera.* **2** : 1-506. pls. figs.

Bohart, R. M. and Menke, A. S. 1976. Sphecid wasps of the world, a generic revision. *University of California press, California,* U.S.A. : 1-695.

Hard, P. D. and Moure, J. S. 1963. A classification of the large Carpenter bees (xylocopini) (Hymenoptera : Apoidea). *Univ. Clif. Pub. Ent. (Univ. Clif. Press).* **29** : 1-342. Figs.

Kirkpatrik, T. W. 1957. *Insect Life in the Tropics,* Longman, 1-311.

Roy, S. B. and Kundu, B. G. 1985. Fauna of Namdhapa, Arunachal Pradesh (Insecta : Hymenoptera). *Rec. zool. Surv. India,* **82**(1-4) : 221-229.

Zool. Surv. India
Conservations Area Series **19**, *Fauna of Desert National Park,* : 101-103, 2004

ARACHNIDA : SCORPIONS

D. B. BASTAWADE
Western Regional Station, Zoological Survey of India, Pune

INTRODUCTION

The Scorpion fauna of India has precisely been dealt by Tikader and Bastawade (1983). Indian Scorpio-fauna consists of about 106 annotated species divisible under five families namely Buthidae, Chaerilidae, Scorpiopsinidae (=Vaejovidae), Ischnuridae and Scorpionidae. Amongst these the families Buthidae, Ischnuridae and Scorpionidae have so far been reported from Rajasthan and the remaining two are totally absent from the state. Interestingly the genus *Vachonus* has been described from Jaisalmer and represented by two species. This genus and the species are considered to be endemic to the Thar area as there is no information available from the Pakistan side of the desert.

The Scorpion fauna of this state is peculiar and the species like *Androctonus australis finitimus* (Pocock), *Odontobuthus doriae odonturus* (Pocock), *Vachonus rajasthanicus* Tikader and Bastawade, *Vachonus astrostriatus* (Pocock), *Orthochirus krishnai* Tikader and Bastawade *Orthochirus pallidus* (Pocock), *Orthochirus melanurus* (Kesseler), *Compsobuthus acutecarinatus rugosus* (Pocock) and *Mesobuthus tamulus* (Pocock) (Sub-species are not considered), have mostly been confined to the state of Rajasthan.

The present studies are based mainly on the scorpion collections available from DNP area of Jaisalmer and Barmer districts of Rajasthan.

SYSTEMATIC ACCOUNT

Phylum ARTHROPODA

Class ARACHNIDA

Order SCORPIONIDA

Family BUTHIDAE

Mesobuthus tamulus sindicus (Pocock)

Loc. : Pithla area on Khuri Road 28 kms. from Jaisalmer, 5.ii.1995, 1 ex., N. S. Rathore coll.

Vachonus astrostriatus (Pocock)

Loc. : Pithla area on khuri Road 28 Kms from Jaisalmer, 6.ii.1995, 4 exs., Sam area 43 kms. W. of Jaisalmer, 7.ii.1995, 1 ex., Baisala area ca. 34 Kms. NW. of Barmer, 12.ii.1995, 1 ex., Sam area ca. 43 kms. W. of Jaisalmer, 23.vii.1995, 4 exs., Pithla area ca. 28 kms. from Jaisalmer, 24.vii.1995, 2 exs., Bhopa Vill. ca. 31 Kms. from Jaisalmer, 25.vii.1995, 1 ex., Khuri DNP area about 49 kms. from Jaisalmer, 27.vii.1995, 1 ex., Turvi ca. 93 kms. NW of Barmer, 20.vii.1995, 1 ex., N. S. Rathore coll.

Androctonus australis finitimus (Pocock)

Loc. : Sam area ca. 42 kms.W. of Jaisalmer 23.vii.1995, 2 exs., N. S. Rathore coll.

Orthochirus Krishnai Tikader and Bastawade

Loc. : Sam area ca. 42 kms. W. of Jaisalmer, 23.vii.1995, 2 exs., Pithla area ca. 28 kms. from Jaisalmer, 24.vii.1995, 1 ex., Khuri area of DNP 49 kms. from Jaisalmer, 27.vii.1995, 1 ex., N. S. Rathore coll.

Orthchirus pallidus (Pocock)

Loc. : Pithla area on Khuri road 28 kms. from Jaisalmer, 1 ex. 5.ii.1995, Turvi ca. 93 kms. NW of Barmer, 1 ex., 20.vii.1995., Sam area ca. 42 kms. W. of Jaisalmer, 23.vii.1995, 2 exs., Pithla area ca. 28 kms. from Jaisalmer, 24.vii.1995, 6 exs., Bhopa Vill. ca. 31 kms. from Jaisalmer, 25.vii.1995. 5 exs., Barna Vill. ca. 40 kms. from Jaisalmer, 26.vii.1995, 5 exs., Khuri area of DNP 49 kms from Jaisalmer, 27.vii.1995, 10 exs., N. S. Rathore coll.

Vachonus rajasthanicus Tikader and Bastawade

Loc. : Pithla area on Khuri road 28 kms from Jaisalmer, 5.ii.1995, 1 ex., N. S. Rathore coll.

Compsobuthus acutecarinatus rugosus (Pocock)

Loc. : Turvi ca. 93 kms. NW of Barmer, 20.vii.1995, 1 ex., N. S. Rathore coll.

Vochonus sp.

Loc. : Pithla area on Khuri road 28 kms. from Jaisalmer, 6.ii.1995, 1 ex., N. S. Rathore coll.

SUMMAY

The paper deals with 8 species of scorpions from DNP. Of these, one genus *Vachonus* and its two species are endemic to this area.

ACKNOWLEDGEMENTS

My sincere thanks are due to Dr. Q. H. Baqri, Scientist 'F' and Officer-in-Charge and Dr. N. S. Rathore, Scientist 'E', Zoological Survey of India, Desert Regional Station, Jodhpur for initiating the problem and making available the rare collections of Scorpion materials for studies at my disposal and also allowing me to contribute the publication. I am most indebted to Dr. J. R. B. Alfred, Director, Zoological Survey of India, Calcutta for his keen interest and encouragement to undertake and complete the work. I am also thankful to Dr. M. S. Pradhan, Scientist 'E', ZSI, Western Regional Station, Pune for the laboratory facilities.

REFERENCE

Tikader, B. K. and Bastawade, D. B. 1983. *Fauna of India; Scorpions*, Vol **III** pp. 1-671.

Zool. Surv. India
Conservations Area Series **19**, *Fauna of Desert National Park,* : 105-108, 2004

ACARINA : METASTIGMATA

A. K. SANYAL AND S. K. DE
Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053

INTRODUCTION

The ticks are small group of acarines occurring throughout the world. They are of great medical and veterinary importance. Many of the viral and Rickettsial diseases like haemorrhagic fever, Q-fever, *etc.* of man and domestic animals are caused by the ticks. Considering the immense importance of this group of arthropods, scientists all over the world made extensive studies on the ticks since the days of Linnaeus (1746–1767).

The Indian tick was first described by Linnaeus (1758) and later several scientists took up this study and contributed a lot in the field. But till date no study on ticks of Indian desert ecosystem was done except by Kaul *et al.* (1978) and Sanyal and De (1996) who recorded the genus *Hyalomma* from Rajasthan.

The present work is based on a small collection of hard ticks *i.e.*, ixodids, made from Jaisalmer and Barmer districts of Rajasthan by Dr. A. K. Sanyal and Dr. N. S. Rathore in 1994 and 1995 respectively.

The paper includes 2 species under the genus of ixodid ticks hitherto known from Jaisalmer and Barmer. The original and recent references, diagnostic features, distribution of species in India and key to the identification of the species known from the area have been incorporated. The specimens studied for this work are deposited in the National Zoological Collection, Zoological Survey of India, Calcutta.

SYSTEMATIC ACCOUNT

Family IXODIDAE

Genus ***Hyalomma*** Koch

H. anatolicum anatolicum Koch

H. dromedarii Koch

Genus ***Hyalomma*** Koch

1844. *Hyalomma* Koch, *Arch. Naturgesh,* **10** : 223-231.

Key to the species of *Hyalomma*

MALE :

1(2) Subanal shields situated lateral to the adanal; posteromedian groove reaching parma ..... *dromedarii*

2(1) Subanal shields situated directly posterior to the adanal; posteromediangroove not reaching parma ..... *anatolicum anatolicum*

FEMALE :

1(2) Genital operculum elongately triangular; usually legs with rings ..... *dromedarii*

2(1) Genital operculum small knob like; usually legs without rings..... *anatolicum anatolicum*

Hyalomma anatolicum anatolicum Koch

1844. *Hyalomma anatolicum anatolicum* Koch, *Arch. Naturgesh,* **10**(1) : 220.

1984. *Hyalomma anatolicum anatolicum*, Kaiser and Hoogstraal, *Acrologia,* **6**(2) : 271.

1987. *Hyalomma anatolicum anatolicum*, Geeverghese and Dhanda, ICAR, New Delhi : 31.

Diagnosis : MALE : Lightly punctated scutum; lateral grooved short but distinct; posteromedian groove not reaching the parma; subanal shields placed directly posterior of adanals, small; basis capituli dorsally with slightly concave poterior margin, never angular; legs without ring. FEMALE : Scutum longer than wide with narrowly rounded posterior margin; punctations large in scapular areas; operculum short.

Material examined : Barmer : 2 ♀ ♀, Baisala, from ground, 12.ii.1995, N. S. Rathore coll.

Host : No host is recorded.

Distribution : Rajasthan (Barmer, Kota, Jalore, Alwar), Andhra Pradesh, Assam, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Tamil Nadu, Uttar Pradesh, West Bengal.

Remarks : The species is very common in occurrence throughout India. The chief host of the species is cattle.

Hyalomma dromedarii Koch

1844. *Hyalomma dromedarii* Koch, *Arch. Naturgesch,* **10**(1) : 220.

1928. *Hyalomma aegyptium dromedarii*, Sharif, *Rec. Indian Mus.*, : 30.

1964. *Hyalomma dromedarii*, Kaiser and Hoogstraal, *Acarologia*, **6**(2) : 274.

1957. *Hyalomma dromedarii*, Geeverghese and Dhanda, ICAR : New Delhi : 60.

Diagnosis : MALE : Scutum wide, narrowed anteriorly, punctations large, more dense in the margins; posteromedian groove reaches parma, paramedian groove rugose; adanal shields curved posteriorly; subanal shields displaced laterally. FEMALE : Operculum elongately triangular; legs lightan with whitish bands at the joints.

Material examined : Jaisalmer : 1♂, Sam, from sand dunes or probably dropped from the body of camel, 24.xii.1994, A. K. Sanyal coll; 2♂♂, Pithla on Jaisalmer-Khuri road, from ground, 5.ii.1995, 3♀♀, 1♂, from ground, 7.ii.1995, 1♂, Bhopa, from ground, 25.vii.1995; 2♀♀, 1♂, Barna, under stone, 26.vii.1995; 1♀, Khuri, from ground, 27.vii.1995; 1♂, Turvi, from ground, 1.x.1996, N. S. Rathore coll.

DISCUSSION

The first account of tick fauna from Jaisalmer and Barmer districts of Western Rajasthan indicates that the tick fauna was not extensively explored and studied. The scientists made attempts to collect ticks from all possible hosts and habitats but failed to check domestic and wild animals. It is also interesting to note that only two species under the genus *Hyalomma* which usually live as host of cattle have been recorded in the present study. These ticks may be considered as common and abundant in the districts.

SUMMARY

The paper deals with the ixodid tick fauna of Jaisalmer and Barmer districts of western Rajasthan. One genus *Hyalomma* with 2 species *viz., anatolicum anatolicum* and *dromedarii* are recorded. Both the species are recorded for the first time from the state. The genus *Hyalomma* was known earlier from Jaisalmer. The first and important references, diagnostic features, distribution of the species in India and key to the identification of species have been incorporated in the paper.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. J. R. B. Alfred, Director, Zoological Survey of India for providing facilities. They also express sincere gratitude to Dr. Q. H. Baqri, Scientist-F and Dr. N. S. Rathore, Scientist-'E', Desert Regional Station, Zoological Survey of India, Jodhpur for taking sincere efforts in collecting the specimens and providing them to the authors for the study.

REFERENCES

Geeverghese, G. and Dhanda, V. 1987. The Indian *Hyalomma* ticks (Ixodoidea : Ixodidae). ICAR. Krishi Anusandhan Bhavan, New Delhi : 119.

Kaiser, M. N. and Hoogstraal, H. 1964. The *Hyalomma* ticks (Ixodoidea : Ixodidae). of Pakistan, India and Ceylon with keys to subgenera and species. *Acarologia,* **6**(2) : 257-86.

Kaul, H. N., Dhanda, V., Kulkarni, S. M. and Guttikar, S. N. 1978. Ectoparasitic arthropods of birds and mammals from Rajasthan State, India. *Indian J. Parasit.*, **2**(1) : 19-25.

Koch, C. L. 1944. Systematicshe Ubersicht uber ardung der zecken. *Arch. Naturgesch*, **10**(1) : 217-239.

Sanyal, A. K. and De, S. K. 1992. Ixodid ticks (Acari : Ixodidae). State Fauna Series 3 : Fauna of West Bengal, Part 3 : 17-60.

Sanyal, A. K. And De, S. K. 1996. Ticks (Acarina : Metastigmata) fauna in the Thar desert. *In : Faunal Diversity in the Thar Desert : Gaps in Research.* Ed. by A. K. Ghosh, Q. H. Baqri and I. Prakash. 81-87. Scientific Publisher, Jodhpur.

Sharif, M. 1928. A revision of the Indian Ixodidae with special reference to the collection in the Indian Museum. *Rec. Indian Mus.*, **30** : 217-344.

Zool. Surv. India
Conservations Area Series **19**, *Fauna of Desert National Park,* : 109-110, 2004

AMPHIBIA

S. K. CHANDA
Zoological Survey of India, FPS Building, Kolkata-700 016

INTRODUCTION

Mc. Cann (1943) was the first to publish a short account of frog fauna in the Abu hills of Rajasthan. Later Mansukhani and Murthy (1964) gave a detailed account of frogs and toads of Rajasthan. Similarly, Bohra *et al.* (1983) attempted to provide an illustrated key to field identification of frogs and toad of Indian Desert. The present account is based on the collections brought exclusively from DNP area.

SYSTEMATIC ACCOUNT

Order ANURA

Family BUFONIDAE

Genus ***Bufo***

Bufo stomaticus Lutken

Locality : Turvi, Barmer, 3 exs., 1.x.1996, Magra village, N. S. Rathore coll., Jaisalmer, 3 exs., 30.ix.1996; N. S. Rathore coll., Jaisalmer DNP area, 2 exs., P. L. Kankane coll., 5.ii.1997.

Remarks : There are no permanent water tanks in the DNP area. Only temporary water is accumulated in small ponds or nadies during rainy season and they also dry up within two to three months. Therefore only *Rana cynophylictis* (frog) was commonly seen during rainy season in these ponds. Later they go deep in mud-crevices. Similarly, toad also took shelter in moist mud crevices of these ephemeral ponds.

REFERENCES

Bohra, P., Tak, N., Bhargava, R. N. and Rathore, N. S. 1983. Frogs of the Indian Desert with illustrated key to their field identification–*Trans. Isdt. & Ucds.*, **8**(2) : 113-118.

Mc. Cann, C. 1943. A "Bushman's holiday" in the Abu hills.– *J. Bombay nat. Hist. Soc.*, **43**(2) : 206-217.

Mansukhani, M. R. and Murthy, T. S. N. 1964. Fauna of Rajasthan India Part 6. Amphibia– *Rec. zool. Surv. India*, **62**(1-4) : 51-60 + 1 pl.

Zool. Surv. India
Conservations Area Series **19**, *Fauna of Desert National Park,* : 111-117, 2004

REPTILIA

R. C. SHARMA AND N. S. RATHORE
Desert Regional Station, Zoological Survey of India, Jodhpur, India

INTRODUCTION

Some earlier publications are available on the herpetofauna of Indian region including the Thar desert by Blanford (1879), Murray (1884), Dave (1960), Krishna (1975), Krishna and Dave (1960), Smith (1935, 1945), Rathore (1970), Prakash (1972), Sharma (1978, 1996), etc.

This paper deals with a small collection of reptiles made from Desert National Park area of Jaisalmer and Barmer districts from 1994 to 1996. A total of 13 species including 11 lizards and 2 snakes belonging to seven families have been reported, as follows.

SYSTEMATIC ACCOUNT

Order SQUAMATA

Subfamily SAURIA

Family GEKKONIDAE

Genus ***Cyrtodactylus*** Gray 1827

Cyrtodactylus scaber (Heyden 1827)

(Keeled Rock Gecko)

Material examined : Nahar Singh Ki Dhani ca. 23 kms. from Jaisalmer; 1 ex., 6.ii.1995, Ex. Under stone, N. S. Rathore coll.

Distribution : INDIA : Western Rajasthan. The range of this species extends from Egypt to Western Rajasthan.

Genus ***Stenodactylus*** Fitzinger 1826

Stenodactylus orientalis Blanford 1826.

(Rajasthan sand Gecko or Sind sand Gecko)

Material examined : Turvi vill. ca. 90 kms. north west of Barmer, 1 ex., 13.ii.1995, Ex. Under heap of dry sand, N. S. Rathore coll.

Distribution : In India this Gecko has been recorded from Jodhpur, Jaisalmer and Barmer districts of Rajasthan. *Elsewhere* : Pakistan (Sind), Thar desert (along the coast to about the mouth of the Hingol River and inland to base of the Kirthar range).

Family AGAMIDAE

Genus ***Calotes*** Refinesque 1815

Calotes versicolor (Daudin 1802)

(Indian garden lizard)

Material examined : Harsani ca. 80 kms North West of Barmer, 2 exs., 13.ii.1995, Ex. On Accacia bush, N. S. Rathore coll.

Distribution : Commonly seen in DNP area and whole of India. *Elsewhere* : Sumatra to South China, Sri Lanka, Pakistan and Afghanistan.

Remarks : Arboreal species in a true sense, available where shrubs, bushes and trees are present.

These lizards are mainly insectivorous and consume different groups of insects. But during monsoon period these lizards were observed devouvering large number of termite alates of *Microcerotermes raja* and *Odontotermes sp.* while swarming from ground in DNP area.

Genus ***Agama*** Daudin 1802.

Agama agilis Oliver 1807.

(Desert Agama)

Material examined : On the way from Turvi to Girab ca. 95 kms. from Barmer, 3 exs., 21.vii.1995, Ex. Aak plantation, N. S. Rathore coll.

Distribution : INDIA : Rajasthan : Jodhpur, Barmer. *Elsewhere* : Afghanistan, Arabia, Iran, Iraq, Pakistan.

Remarks : This species is commonly seen in DNP area during monsoon time near Aak and other bushes.

Genus ***Phrynocephalus*** Kaup 1825

Phrynocephalus laungwalansis Sharma 1978

(Jaisalmer Toad Agama)

Material examined : Sam ca. 42 kms. from North West of Jaisalmer, 3 exs., 24.ix.1996, Ex. Sand dune, N. S. Rathore coll.

Distribution : INDIA : Rajasthan : Laungwala, Sam, Lunar (all in Jaisalmer district).

Remarks : It is a diurnal lizard and inhabits the sandy area. Its food mainly comprises of small insects. But during monsoon period it was seen feeding on the termite alates of *Eremotermes paradoxalis* at Sam area of Jaisalmer.

Genus ***Uromastix*** Merrem 1820

Uromastix hardwicki Gray 1827

(Indian spiny-tailed lizard)

Material examined : Pithla to Sudasari area ca. 40 kms. from Jaisalmer, 10 exs., 24.vii.1995, seen many lizards in open field near their burrows.

Distribution : INDIA : Andhra Pradesh, Gujarat, Uttar Pradesh, Rajasthan. *Elsewhere* : Pakistan.

Family SCINCIDAE

Genus ***Ophiomorus*** Dum. and Bibr. 1839

Ophimorus tridactylus (Blyth 1855)

(Indian sand fish)

Material examined : Pithla area ca. 28 kms. from Jaisalmer, 2 exs., 5.ii.1995, Ex. from Sand, Balewa village ca. 74 kms. from Barmer, 1 ex., 18.vii.1995, Ex. Sand dune, N. S. Rathore coll.

Distribution : INDIA : Gujarat (Kuchchh), Rajasthan. *Elsewhere* : Afghanistan, Iran, Pakistan.

Remarks : It is insectivorous, fossorial (saltatorial) and nocturnal species. It lives in the sand with perfect ease; can swim and dive in loose sand.

Family LACERTIDAE

Genus ***Acanthodactylus*** Wiegmann 1834

Acanthodactylus cantoris contoris Gunther 1864

(Indian fringe-toed lizard)

Material examined : Khuri village ca. 40 kms. from Jaisalmer, 3 exs., 8.ii.1995, Ex. Sandy ground, N. S. Rahtore coll.

Distribution : INDIA : Gujarat, Haryana, Punjab, Rajasthan, Uttar Pradesh. *Elsewhere* : Pakistan, Eastern Iraq, Saudi Arabia, Southern Afghanistan and Iran.

Genus ***Ophiosops*** Menetries 1832

Ophiosops jerdoni Blyth 1853

(Punjab snake-eyed Lacerta)

Material examined : Baisala area ca. 34 kms. North West of Barmer, 1 ex., 12.ii.1995, Ex. : sandy ground. Nahar Singh Ki Dhani ca. 23 kms. from Jaisalmer, 1 ex., 6.ii.1995, Ex. : from ground. Bhopa Vill. ca. 31 kms. from Jaisalmer, 1 ex., 25.vii.1995, Ex. : from ground. Pithla area ca. 28 kms. from Jaisalmer, 1 ex., 24.vii.1995, Ex. : from ground. N. S. Rathore coll.

Distribution : INDIA : Andhra Pradesh, Maharashtra, Gujarat (Kuchchh), Madhya Pradesh (Sarai, Rewa), Rajasthan and Tamil Nadu. *Elsewhere* : Pakistan.

Remarks : Commonly seen in day time on loose sandy soil in DNP area.

Family VARANIIDAE

Genus ***Varanus*** Merrem 1820

Varanus bengalensis (Linnaeus) 1758

(Indian monitor)

Material examined : In the way from Turvi to Girab ca. 90 kms. from Barmer, 2 exs., 21.vii.1995, Ex. ground.

Distribution : The common monitor seen throughout the Indian subcontinent.

Remarks : It is dark brown coloured monitor with a very strong long and compressed tail. It was observed and seen in DNP area. It lives in cluster of bushes and thick vegetational habitat. But during rainy season it can be seen moving here and there in search of food in daytime.

Varanus griseus (Daudin 1803)

(Indian desert monitor)

Material examined : Khuri village area ca. 49 kms. from Jaisalmer, 2 exs., 24.ix.1996, seen one lizard slowly moving in grasses and Accasia bushes.

Distribution : It occurs in the drier parts of Madhya Pradesh, Maharashtra, Rajasthan and Punjab, in India. *Elsewhere* : Pakistan, Afghanistan, Iran and North Africa.

Remarks : This large monitor lives in burrows in undulating sandy ground with vegetation cover. It is very commonly seen in DNP area during monsoon period (July-August). It is sandy, brownish yellow or occasionally greenish yellow in colour and tail is rounded and whip-like.

Family BOIDAE

Genus ***Eryx***

Eryx johni (Russell)

(Johnis sand Boe)

Material examined : Bersiya in the way from Sudasari to Maizalar, Jaisalmer, 2 exs., 16.x.1995, P. L. Kankane coll.

Distribution : INDIA : Gujarat (Junagarh, Bhavnagar, Kutchchh, Dangs. Vedodara, Panchmahal and Gandhinagar districts), Andhra Pradesh, Maharashtra, Tamil Nadu, Punjab, Rajasthan and Uttar Pradesh. *Elsewhere* : Sri Lanka, Pakistan, Afghanistan and Iran.

Remarks : This is a most common snake throughout its range, it is very docile, gentle, strongly borrowing, sluggish and nocturnal in habits and prefers to live in flat arid area with loose clay soil with sparse grass. It is not common in extreme sandy area, and is rare or absent in rocky and damp places. The breeding season starts in June and extends up to September, it is a viviparous snake and 5 to 14 young ones are produced. Its food includes small mammals, birds and insects.

Suborder SERPENTES

Family VIPERIDAE

Echis carinatus Schneider

Material examined : In the way from Turvi to Girab Barmer, 1 ex., 21.vii.1995, (from ground), Khuri village, ca. 49 kms. from Jaisalmer, 1 ex., 27.ii.1995 (from ground), Beroiya

in the way from Sudasari to Miazalar, Jaisalmer, 1 ex., 16.x.1995 (from ground.), N. S. Rathore and P. L. Kamkane coll.

Distribution : INDIA : Gujarat, Andhra Pradesh, Goa, Maharashtra, Karnataka, Tamil Nadu, Rajasthan, Jammu and Kashmir. *Elsewhere* : Arabia, Ghana, Kenya, Nigeria, Sri Lanka, Iran, whole of middle east, South Russia, Pakistan and Iraq.

Remarks : Most common viper adaptable in a variety of habitat like sandy, alluvial, rocky, semi-arid or arid environment with grass, bushes, shrubs, xerophytic and other vegetation, mainly nocturnal; food comprises amphibians, small mammals, lizards and arthropods; viviparous, produces 9–14 young ones at a time, in July-August.

SUMMARY

In total 13 species of reptiles have been reported from DNP, together with remark notes.

ACKNOWLEDGEMENTS

Authors are very much grateful to Dr. J. R. B. Alfred, Director, Zoological Survey of India, Calcutta for providing the opportunity to carry out the study. We are also thankful to Dr. Q. H. Baqri, Scientist-F and Officer-in-Charge, Desert Regional Station, Zoological Survey of India, Jodhpur for providing laboratory and other facilities.

REFERENCES

Biswas, S. and Sanyal, D. P. 1977. Fauna of Rajasthan, Reptilia. *Rec. zool. Surv. India,* **73**(1-4) : 247-269.

Krishna, D. and Dave, K. C. 1960. A note on the reptiles of the desert of Rajasthan, *Vijnana Parishad Anusandhan Patrika,* Allahabad, **3**(4) : 215-231.

Prakash, I. 1972. Notes on little known lizards from Rajasthan Desert.– *J. Bombay nat. Hist. Soc.,* **69**(2) : 424-428.

Rathore, M. S. 1970. Notes on the Indian sand skink *Ophiomorus tridactylus* (Blyth).– *J. Bombay nat. Hist. Soc.,* **67**(2) : 334.

Sharma, R. C. 1978. A new species of *phrynocephlaus* kaup (Reptilia : Agamidae) from the Rajasthan desert, India, with notes on its ecology.– *Bull. zool. Surv. India,* **1**(31) : 291-294.

Sharma, R. C. 1996. Herpetology of the Thar Desert In *: Faunal diversity in the Thar Desert: Gaps in Research*. Ed. by A. K. Ghosh, Q. H. Baqri and I. Prakash. 297-306. Scientific Publisher, Jodhpur.

Smith, M. A. 1935. *The Fauna of British India including Ceylon and Burma. Reptilia and Amphibia*, Vol. **2**, Sauria. Taylor and Francis, London.

Smith, M. A. 1943. *The Fauna of British India including Ceylon and Burma, Reptilia and Amphibia*, Vol. **3**, Serpentes. Taylor and Francis, London.

Zool. Surv. India
Conservations Area Series **19**, *Fauna of Desert National Park,* : 119-130, 2004

AVES

P. L. KANKANE

Desert Regional Station, Zoological Survey of India, Jodhpur, India

INTRODUCTION

Although a number of workers such as Ali (1975); Ali (1981); Barnes (1886 & 1891); Butler (1878); Doig (1879 & 1880); Mukherjee (1995); Rahmani (1989, 1996, 1997a & 1997b); Roberts (1991–92); Ticehurst (1922–24) and Whistler (1938) have contributed towards avian diversity of the Thar desert However, except Rahmani (1996 & 1997a) no detailed study was carried out on the birds of Desert National Park (DNP).

This paper contains a list of 107 species and subspecies of birds belonging to 73 genera, 32 families and 14 orders mainly based on field notes and collection brought by survey parties, including present author (two week each in october 95 and February 97) from the study area.

Systematics have been treated after Ali and Ripley (1987), Roberts (1991–92) and Manakadan & Pittie (2001).

SYSTEMATIC ACCOUNT

AVES

Order CICONIFORMES

Family ARDEIDAE

1. ***Bubulcus ibis*** (Linnaeus) – Cattle Egret

   Rahmani (1996) reported its sighting from Desert National Park.

2. ***Egretta garzetta*** (Linnaeus) – Little Egret

   Rahmani (1997a) reported sighting of this bird (10 nos.) flying over grasslands of Sudasari on 24.7.1993.

Order ANSERIFORMES

Family ANATIDAE

3. ***Aythya nyroca*** (Guldenstadt) – Ferruginous Pochard

   Rahmani (1996) reported sighting of this bird from DNP but while elaborating Rahmani (1997b) has not mentioned any locality from DNP proper.

4. ***Aythya fuligula*** (Linnaeus) – Tufted Pochard

   A bird of deep water body. Rahmani (1996) reported its sighting from DNP. No record by ZSI party.

Order FALCONIFORMES

Family ACCIPITRIDAE

5. ***Elanus caeruleus*** (Desfontaines) – Black-shouldered Kite

   Common throughout the Thar-sighted by ZSI party at many places in the park.

6. ***Milvus migrans govinda*** (Sykes) – Black Kite

   Sighted by ZSI party in winter. Rahmani (1996) also reported its sightings from DNP.

7. ***Accipiter badius*** (Gmelin) – Shikra

   Though Rahmani (1996) has not reported its occurrence from DNP, Kankane (1999) sighted and identified through a dead specimen from DNP southwest of Jaisalmer.

8. ***Buteo rufinus*** (Cretzschmar) – Long-legged Buzzard

   The author sighted the buzzard near Niba on 15.10.1995 and two near Bandra in February, 1997. Rahmani (1996) also reported its sighting from DNP.

9. ***Buteo buteo vulpinus*** (Gloger) – Common Buzzard

   The author sighted one near Girab on 31.3.1993. Rahmani (1996) also reported its sighting.

10. ***Butastur teesa*** (Franklin) – White-eyed Buzzard

    The author sighted three birds during October, 1995 around Baran. Rahmani (1996) reported its sighting from DNP.

11. ***Aquila rapax vindhiana*** (Franklin) – Tawny Eagle

    Two birds sighted in two places in DNP on 2–3 April, 1993.

12. ***Aquila nipalensis*** Hodgson – Steppe Eagle

    Seen around Sudasari on March 13, 1995.

13. ***Aquila pomarina*** Brehm – Lesser Spotted Eagle

Rahmani (1996) reported it sighting in DNP, though very rare (Rahmani, 1997b)

14. ***Sarcogyps calvus*** (Scopoli) – Red-headed Vulture

Seen one on October 16 on way to Khariya. Rahmani (1997b) also reported its nesting near Sudasari and Ujlan.

15. ***Aegypius monachus*** (Linnaeus) – Cinereous Vulture

Rahmani (1996) sighted and reported from DNP.

16. ***Gyps indicus*** (Scopoli) – Long-billed Vulture

Sighted a group of twenty-one near Girab on 7.2.1997. Rahmani (1996) also reported its sighting from DNP.

17. ***Gyps bengalensis*** (Gmelin) – Indian White-backed Vulture

Seen nesting with young ones near Khaltana village about 3 kms. from Miajlar on 8th Feb. 1997.

18. ***Neophron percnopterus*** (Linnaeus) – Egyptian Vulture

Sighted in group as well as individual, near Bindha (October 15, 1995) and Bandra (February 8, 1997) respectively.

19. ***Circus macrourus*** (Gmelin) – Pallid Harrier

Sighted near Dhagari in DNP on February 7, 1997.

20. ***Circus pygargus*** (Linnaeus) – Montagu's Harrier

Sighted near sudasari on October 16, 1995.

21. ***Circus aeruginosus*** (Linnaeus) – Western Marsh Harrier

Rahmani (1996) reported seen it in DNP.

22. ***Circaethus gallicus*** Gmelin – Short-toed Snake Eagle

Sighted one each near Bandra and Girab on February 8, 1997.

Family FALCONIDAE

23. ***Falco jugger*** J. E. Grey – Laggar Falcon

Sighted during winter survey near sudasari in DNP.

24. ***Falco chicquera*** Daudin – Red-headed Falcon

Rahmani (1996) reported seen in DNP.

25. ***Falco tinnunculus*** Linnaeus – Common Kestrel

Seen during winter survey near Sudasari.

Order GALLIFORMES

Family PHASIANIDAE

26. ***Francolinus pondicerianus*** (Gmelin) – Grey Francolin
    Most common, sighted many in agriculture fields in the northern part of the park.
27. ***Coturnix coturnix*** (Linnaeus) – Common Quail
    Sighted during winter survey in the northern part of the park.
28. ***Coturnix coromandelica*** (Gmelin) – Rain Quail
    Rahmani (1996) reported seen in DNP.
29. ***Pavo cristatus*** Linnaeus – Indian Peafowl
    Forest department reported its occurrence in the park.

Order GRUIFORMES

Family GRUIDAE

30. ***Grus grus*** Linnaeus – Common crane
    Rahmani (1996) reported it seen from DNP.
31. ***Grus virgo*** (Linnaeus) – Demoiselle crane
    Rahmani (1996) reported seen from DNP.

Family OTIDIDAE

32. ***Ardeotis nigriceps*** (Vigors) – Great Indian Bustard
    Total sightings in the DNP are three at three places including one at Ramdeora (5.4.1993) enclosure, the other two were sighted near Bindha (15.10.1995), Rahmani (1997a) reported its distribution from Sam, Sudasari, Khuri, Miajlar, Khinya and Shankara from the park.
33. ***Chlamydotis undulata*** Jacquin – Houbara
    Rahmani (1996) reported it seen from DNP.

Order CHARADRIIFORMES

Family BURHINIDAE

34. ***Burhinus oedicnemus*** (Linnaeus) – Stone-Curlew
    Single sightings near Miajlar on February 5, 1997.

Family CHARADRIIDAE

35. ***Vanellus indicus*** (Boddaert) – Red-wattled Lapwing

Common in agricultural fields. Many sightings throughout the park especially nearby human habitats.

36. ***Charadrius alexandrinus*** Linnaeus – Kentish Plover

Rahmani (1996) reported its sighting from DNP.

37. ***Charadrius mongolus*** Pallas – Lesser Sand Plover

Rahmani (1997b) reported sighting of two birds 7 kms. before Kanoi villalge which is on the border of the park.

38. ***Charadrius dubius*** Scopoli – Little Ringed Plover

Rahmani (1996) reported it seen from DNP.

Family GLAREOLIDAE

39. ***Cursorius cursor*** (Latham) – Cream-coloured Courser

A flock of five seen on February 9, 1997 in the Miajlar enclosure.

40. ***Cursorius coromendelicus*** (Gmelin) – Indian Courser

Rahmani (1996) reported its sighting from DNP.

41. ***Glareola pratincola*** (Linnaeus) – Collared Pratincole

Rahmani (1996) reported its sightings from DNP.

Family SCOLOPACIDAE

42. ***Calidris minuta*** (Leisler) – Little Stint

Rahmani (1996) reported it seen from DNP.

43. ***Calidris temminckii*** (Leisler) – Temminck's Stint

Rahmani (1996) reported it seen from DNP.

Order COLUMBIFORMES

Family PTEROCLIDIDAE

44. ***Pterocles exustus*** Temminck – Chestnut-bellied Sandgrouse

Most common bird of the park seen numerous.

45. ***Pterocles senegallus*** (Linnaeus) – Spotted Sandgrouse

Sighted near Sundra-Miajlar road on February 5, 1997.

46. ***Pterocles orientalis orientalis*** (Linnaeus) – Imperial sandgrouse
Rahmani (1996, 1997b) reported it seen from DNP.

Family COLUMBIDAE

47. ***Columba livia*** Gmelin – Blue Rock Pigeon
Most common bird in and around settlements especially where grains were provided for birds.

48. ***Streptopelia decaocto*** (Frivaldszky) – Urasian Collared Dove
Commonly found around human settlements especially where water was available (tube well sites etc.) in the park.

49. ***Streptopelia senegalensis combayensis*** (Gmelin) – Little Brown Dove
Rahmani (1996) reported it seen from DNP.

Order CUCULIFORMES

Family CUCULIDAE

50. ***Clamator jacobinus*** (Boddaert) – Pied Crested Cuckoo
Rahmani (1996) reported it seen from DNP.

Order STRIGIFORMES

Family STRIGIDAE

51. ***Asio flammeus flammeus*** (Pontoppidan) – Short-eared Owl
Rahmani (1996) reported it seen from DNP.

52. ***Athene brama*** (Temminck) – Spotted Owlet
Sighted two on way to Bindha about 2 kms. from Sudasari on a ***Zizyphus*** tree.

Order CORACIFORMES

Family MEROPIDAE

53. ***Merops orientalis*** Latham – Small Green Bee Eater
One of the common species of birds especially seen near human habitation.

54. ***Merops persicus*** Pallas – Blue-checked Bee-Eater
Rahmani (1996) reported it seen from DNP.

Family CORACIIDAE

55. ***Coracias garrulus semenowi*** Loudon & Tschudi – European Roller
Rahmani (1996) reported it seen from DNP.

56. ***Coracias benghalensis*** (Linnaeus) – Indian Roller
Rahmani (1996) reported it seen from DNP.

Family UPUPIDAE

57. ***Upupa epops*** Linnaeus – Common Hoopoe
Single sighting near Kanoi on the periphery of the park during winter survey.

Order PICIFORMES

Family PICIDAE

58. ***Jynx troquilla*** Linnaeus – Eurasian Wryneck
Single sighting near Kanoi village from DNP during winter survey.

59. ***Dendrocopos maharatthensis*** (Latham) – Yellow-fronted Pied Wood pecker
Rahmani (1996) reported seen from DNP.

Order PASSERIFORMES

Family ALAUDIDAE

60. ***Eremopterix nigriceps*** Gould – Black-crowned Sparrow Lark
One of the common birds observed several times throughout the park.

61. ***Eremopterix grisea*** (Scopoli) – Ashy-crowned Sparrow Lark
Sighted near Miajlar in the park on February 7, 1999.

62. ***Ammomanes phoenicurus phoenicurus*** (Franklin) – Rufous-tailed Finch Lark
Rahmani (1996) reported it seen from the park.

63. ***Alaemon alaudipes*** (Desfontaines) – Greater Hoopoe Lark
A representative of typical desert environment. The bird was seen near Satto village on Miajlar-Satto road.

64. ***Calandrella brachydactyla*** (Leisler) – Greater Short-toed Lark
Syn. *Calandrella cinerea longipennis* (Eversmann)
A large flock of this lark was sighted near Sudasari on March 31, 1993.

65. ***Melanocorypha bimaculata torquata*** Blyth – Eastern Calandra Lark

Rahmani (1996) reported its sighting from the park.

66. ***Galerida cristat*** (Linnaeus) – Common Crested Lark

Rahmani (1996) reported its sighting from the park.

67. ***Mirafra erythroptera*** Blyth – Red-winged Bush Lark

Not seen by the author. However, Rahmani (1996) reported it from the park.

68. ***Eremopterix grisea*** (Scopoli) – Ashy-crowned Finch Lark

Family HIRUNDINIDAE

69. ***Hirundo rustica*** Linnaeus – Common Swallow

Rahmani (1996) reported this Swallow from the park.

Family LANIIDAE

70. ***Lanius excubitor*** (Linnaeus) – Great Grey Shrike

Most common bird on roadsides. Sighted many throughout the park during field surveys.

71. ***Lanius vittatus*** Valenciennes – Bay-backed Shrike

Rahmani (1996) reported its occurrence from DNP. Author has no record of its sightings.

Family STURNIDAE

72. ***Sturnus roseus*** (Linnaeus) – Rosy Starling

Common migratory (winter) species Rahmani (1996) reported its occurrence from DNP. Author has no record of its sighting from the park.

73. ***Sturnus vulgaris*** Linnaeus – Common Starling

Common winter migrant but not seen by author. Rahmani (1996) reported its occurrence from DNP.

74. ***Acridotheres tristis*** (Linnaeus) – Common Myna

One of the most common birds associated with human settlements inside the park. Sighted many during field surveys.

75. ***Acridotheres ginginianus*** (Latham) – Bank Myna

Rahmani (1196) reported its occurrence form DNP. No sighting by the author.

Family DICRURIDAE

76. ***Ducrurus leucophaeus*** Vieillot – King-crow or Black Drongo

One of the common birds of the Park. Sightings many especially associated with human habitations and their sheep.

Family CORVIDAE

77. ***Corvus corax*** Linnaeus – Common Raven

A total of 5 birds sighted near Bandra, Girab and Harsani area of the park.

Family PYCNONOTIDAE

78. ***Pycnonotus leucotis*** (Gould) – White-checked Bulbul

One of the common bird of the park. Sightings many throughout the park.

79. ***Pycnonotus cafer*** (Linnaeus) – Red-vented Bulbul

Most common bird of the park. Sightings many throughout the park.

Family MUSCICAPIDAE

80. ***Turdoides caudatus*** (Dumont) – Common Babbler

Most common bird of the park. Sightings many throughout the park.

81. ***Turdoides malcolmi*** (Sykes) – Large Grey Babbler

Rahmani (1996) reported its occurrence from DNP. However author has no sighting records.

82. ***Luscinia svecica*** (Linnaeus) – Bluethroat

[Syn. *Erithacus svecicus* (Linnaeus)]

Rahmani (1996) reported its occurrence from DNP. No sighting by the author.

83. ***Cercotrichas galactotes*** (Temminck) – Rufous-tailed Scrub Robin

[Syn. *Erythropygia galactotes* familiaris (Menetries)]

Rahmani (1996) reported its occurrence from DNP. No sighting by the author.

84. ***Phoenicurus ochruros*** (Gmelin) – Black Redstart

Rahmani (1996) reported its occurrence from DNP. No sighting by author.

85. ***Saxicola macrorhyncha*** (Stoliczka) – Stoliczka's Bushchat

Rahmani (1996) reported its occurrence from DNP. No sighting by present author.

86. ***Saxicola torquata*** (Linnaeus) – Common Stonechat

Rahmani (1996) reported its occurrence from DNP. No sighting by author in the park.

87. ***Saxicola caprata*** (Linnaeus) – Pied Bushchat

Sighting records mostly from northern part of DNP.

88. ***Oenanthe isabellina*** (Temminck) – Isabelline Wheatear

Winter visitor to the park. Sighting records are from Miajlar and Satto area of the park.

89. ***Oenanthe deserti*** (Temminck) – Desert Wheatear

One of the common bird of the desert. Sighting records were from throughout the park especially during winter.

90. ***Oenanthe picata*** (Blyth) – Variable Wheatear

One of the common winter migrant of the park. Sighting records were many.

91. ***Oenanthe xanthoprymna kingi*** (Hume) – Rufous Wheatear

Rahmani (1996) reported its occurrence from DNP. No sighting by the author.

Family SYLVIIDAE

92. ***Prinia inornata*** (Gmelin) – Plain Prinia

Rahmani (1996) reported its occurrence from DNP.

93. ***Prinia gracilis*** (Lichtenstein) – Graceful Prinia

Rahmani (1996) reported its occurrence from DNP.

94. ***Sylvia hortensis jerdoni*** (Blyth) – Orphean Warbler

Rahmani (1996) reported its occurrence from DNP.

95. ***Sylvia curruca minula*** Hume – Common Lesser Whitethroat

Rahmani (1996) reported its occurrence from DNP.

95. ***Sylvia curruca minula*** Hume – Common Lesser Whitethroat

Rahmani (1996) reported its occurrence from DNP.

96. ***Sylvia nana*** (Hemprich & Ehrenberg) – Desert Warbler

A common winter bird of the park. Sightings many.

97. ***Cristicola juncidis*** (Rafinesque) – Streaked Fantail Warbler

Rahmani (1996) reported its occurrence form DNP.

98. ***Hippolais caligata*** (Lichtenstein) – Booted Warbler

Rahmani (1996) reported its occurrence form DNP.

99. ***Phylloscopus collybita*** (Vieillot) – Common Chiffchaff

Rahmani (1996) reported its occurrence from DNP. No sighting by the author.

99. ***Phylloscopus collybita*** (Vieillot) – Common Chiffchaff

Rahmani (1996) reported its occurrence from DNP. No sighting by the author.

100. ***Anthus campestris*** (Linnaeus) – Tawny Pipit

One of the common birds of the park during winter. A few sightings in Sudasari during October, 1995.

101. ***Anthus similis*** Jerdon – Brown Rock Pipit

Rahmani (1996) reported its occurrence from DNP.

102. ***Motacilla flava*** Linnaeus – Yellow Wagtail

Rahmani (1996) reported its occurrence from DNP.

Family NECTARINIIDAE

103. ***Nectorinia asiatica*** (Latham) – Purple Sunbird

Rahmani (1996) reported its occurrence from DNP.

Family ESTRILDIDAE

104. ***Lonchura malabarica*** (Linneues) – White-throated Munia

Rahmani (1996) reported its occurrence from DNP.

105. ***Amandava farmosa*** (Latham) – Green Munia

Rahmani (1996) reported its occurrence from DNP.

Family PASSERIDAE

106. ***Passer domesticus*** (Linnaeus) – House Sparrow

One of the common bird around human settlements. Many sightings throughout the park.

107. ***Petronia xanthocollis*** (Burton) – Yellow-throated Sparrow

One of a common birds around human settlements especially areas with old trees.

REFERENCES

Ali, S. 1975. On some birds of Indian desert. *In* : *Environmental Analysis of the Thar Desert.* R. K. Gupta and I. Prakash (Eds.). English Book Depot, Dehra Dun.

Ali, S. and Ripley S. D. 1987. Compact Hand book of the Birds of India and Pakistan. 2nd edn. Oxford University Press, New Delhi.

Ali, S. M. 1981. A note on the Great Indian Bustard. *In* : *Bustards in Decline* Paul D. Goriup and Harsh Vardhan (Eds.) pp. 122-126. Tourism and wildlife society of India, Jaipur.

Barnes, H. E. 1886. Birds nesting in Rajputana *J. Bombay nat. Hist. Soc.*, **1** : 38-62.

Barnes, H. E. 1891. Nesting in Western India. *J. Bombay nat. Hist. Soc.*, **6** : 1-25.

Butler, E. A. 1878. My last notes on the avifauna of Sind. *Stray feathers,* **7** : 173-191.

Doig, S. 1879. Birds Nesting on the Eastern Nara (Sind.) *Stray Feathers,* **8** : 369-379.

Doig, S. 1880. Birds Nesting on the Eastern Nara (Sind) Additions and Alterations. *Stray Feathers,* **9** : 277-282.

Kankane, P. L. 1999. The strange death of Shikra. *J. Bombay nat. Hist. Soc.*, **89**(1) :

Manakadan, Ranjit and Pittie, Aasheesh 2001. Standardised common and scientific names of the birds of the Indian subcontinent. *Buceros,* **6**(1) : 1-37.

Mukherjee, A. K. 1995. *Birds of the arid and semiarid tracts, Rec. zool. Surv. India, Occ. Paper No.* **142** : 1-303. Director, Zoological Survey of India, Calcutta.

Rahmani, A. R. 1989. The Uncertain future of the Desert National Park in Rajasthan. India. *Environmental Conservation,* **16**(3) : 237-244.

Rahmani, A. R. 1996. Changing avifauna of the Thar desert. *In* : *Faunal Diversity in the Thar Desert : Gaps in Research.* Ed. by A. K. Ghosh, Q. H.Baqri, I. Prakash. pp. 307-323. Scientific Publishers, Jodhpur.

Rahmani, A. R. 1997a. *Wildlife situation in the Thar.* World Wide Fund-India. pp. 1-100 WWF, New Delhi.

Rahmani, A. R. 1997b. The effect of Indira Gandhi Nahar project on the avifauna of the Thar desert. *J. Bombay nat. Hist. Soc.*, **92**(2) : 233-266.

Roberts, T. J. 1991–92. The birds of Pakistan 2 Vols. Oxford University press. Karachi.

Ticehurst, C. B. 1922–24. The birds of Sind. Pt. I-VIII *Ibis.*

Whistler, H. 1938. The ornithological survey of Jodhpur State. *J. Bombay nat. Hist. Soc.*, **40** : 213-235.

Zool. Surv. India
Conservations Area Series **19**, *Fauna of Desert National Park*, : 131-135, 2004

MAMMALIA

P. L. KANKANE
Desert Regional Station, Zoological Survey of India, Jodhpur, India

INTRODUCTION

A number of accounts on mammals of the Thar Desert are available especially on their conservation and ecology (for details please see Introduction). However, there are few studies on the taxonomic aspect of mammalian fauna of the Thar, in general by Alfred and Agrawal (1996); Agrawal(1967); Biswas and Ghosh (1968); Bahadur (1925); Ghosh (1976); Gupta (1962); Gupta and Agrawal (1966); Prakash (1959, 1962, 1963a, 1963b, 1971 1974, 1975, 1994 & 1995), Rahmani (1997); Roberts (1977); Sinha (1980 & 1981)Thomas (1921); and Verma (1962) in recent times but none on Desert National Park (DNP) in Particular.

This paper enlists 21 species of mammalian fauna from Desert National Park belonging to 18 genera, 10 families and 5 orders. It is mainly prepared on the basis of data available in literature supplemented by field records/field collections by various parties visited the study area including present author (two week each in October 95 and February 97).

Classification followed here has been adopted after Ellerman and Morrison-Scott (1951) and Honaki *et al.* (1982).

SYSTEMATIC ACCOUNT

Order INSECTIVORA

Family ERINACEIDAE

1. ***Hemiechinus auritus*** (Gmelin) – Long-eared Hedgehog

   Commonly seen throughout the park.

2. ***Paraechinus micropus*** (Blyth) – Pale Hedgehog

   Not as common as the Long-eared Hedgehog.

Family SORICIDAE

3. ***Suncus murinus*** (Linnaeus) – Grey shrew

Order CARNIVORA

Family CANIDAE

4. ***Canis aureus*** Linnaeus – Asiatic Jackal

   Reported by Forest Department.

5. ***Vulpes vulpes pusilla*** Blyth – Desert Fox or Common Red Fox

   Common throughout the park, seen many. Observed one dead speciemen at Myajlar in DNP.

6. ***Vulpes bengalensis*** (Shaw) – Indian Fox

   Common throughout the park, seen many.

Family HERPESTIDAE

7. ***Herpestes auropunctatus*** (Hodgson) – Small Indian Mongoose

   Reported throughout the park by the Forest Department.

8. ***Herpestes edwardsi*** (Geoffroy) – Common Mongoose

   Reported throughout the park by Forest Department.

Family FELIDAE

9. ***Felis silvestris ornata*** Schreber – Desert Cat

   Two sightings near Miajlar and one near Sam.

Order ARTIODACTYLA

Family BOVIDAE

10. ***Gazella bennetti*** (Sykes) – Indian Gazelle

    Frequently seen in the southern part of park.

11. ***Boselaphus tragocamelus*** (Pallas) – Blue bull

    Rahmani (1997) reported one Blue bull sighted in Sudasari.

Order LAGOMORPHA

Family LEPORIDAE

12. ***Lepus nigricollis dayanus*** Blanford – Desert Hare
Sighted frequently in the agriculture area.

Order RODENTIA

Family HYSTRICIDAE

13. ***Hystrix indica*** Kerr – Crested Indian porcupine
Prakash (1975) reported its occurrence west of DNP.

Family SCIURIDAE

14. ***Funambulus pennanti*** Wroughton – Five stripped Palm Squirrel
More frequent in eastern part.

Family MURIDAE

Subfamily GERBILLINAE

15. ***Gerbillus nanus*** Blanford – Baluchistan's gerbil
Mostly found in the sandy plains.

16. ***Gerbillus gleadowi*** Murray – Hairy-Footed Gerbil
Mostly found in sandy plains and sand dunes.

17. ***Tatera indica*** (Hardwicke) – Indian Gerbil
Mostly found in sandy plains.

18. ***Meriones hurrianae*** Jerdon – Indian Desert Gerbil
Mostly found in sandy plains, slopes and interdunal areas.

Subfamily MURINAE

19. ***Mus musculus*** Linnaeus – House Mouse
Mostly associated with human habitation.

20. ***Rattus rattus*** (Linnaeus) – Common House Rat
Mostly associated with human habitation.

21. ***Millardia gleadowi*** (Murray) – Sand-coloured Rat.

REFERENCES

Agrawal, V. C. 1967. New mammal records from Rajasthan. *Lubdev J. Sci. Tech.*, Kanpur, **5** : 342-344.

Alfred, J. R. B. and Agrawal, V. C. 1996. The mammal Diversity of the Indian Desert. *In : Faunal Diversity in the Thar Desert : Gaps in Research.* Ed. by A. K. Ghosh, Q. H. Baqri, I. Prakash.. Scientific Publishers, Jodhpur.

Bahadur, S. S. 1925. A hybrid black buck (*A. cervicapra*) and Chinkara (*G. bennetti*). *J. Bombay nat. Hist. Soc.*, **30**(4) : 911-912.

Biswas, B. and Ghosh, R. K. 1968. New record of mammals from Rajasthan India. *J. Bombay nat. Hist. Soc.*, **65** : 481-482.

Blanford, W. T. 1901. The distribution of vertebrate animals in India, Ceylon and Burma. *Phil. Trans. Roy. Soc. Lond.*, London (B) **194** : 335-436.

Ellerman, J. R. and T. C. S. Morrison-Scott. 1951. Checklist of Palaearctic and Indian mammals, 1758-1946. *Br. Mus. Nat. Hist.*, London, 810 pp.

Ghosh, R. K. 1976. Further new records of mammals from Rajasthan, India. *J. zool. Soc. India*, **26** : 149-150.

Gupta, B. B. 1962. Distribution of nodes and tracts in the skull of Indian hedgehog, *Paraechinus micropus micropus* Blyth. *Zool. Polon, Warshan*, **11**(1) : 85-87.

Gupta, P. D. and Agrawal, V. C. 1966. Geographical distribution of Indian Hairy-Footed gerbil, *Gerbillis gleadowi* Murray *Sci. & Cult.*, **32** : 470-471.

Honacki, J. H.; Kinman, K. E. and Koeppl, J. W. 1982. Mammal species of the world. Allen Press Inc. Kansas. USA.

Krishna, D. and Prakash, I. 1955. Hedgehogs of the desert of Rajasthan. I. Distribution and fossorial habits. *J. Bombay nat. Hist. Soc.*, **52**(1) : 38-43.

Prakash, I. 1959. Checklist of the mammals of Rajasthan desert. Univ. Rajasthan Stud. (Biol. Sci.) Jaipur, (B) **6** : 30-56.

Prakash, I. 1962. Ecology of gerbils of the Rajasthan desert, India. *Mammalia*, **26** : 311-331.

Prakash, I. 1963a. Taxonomical and Biological observations on the bats of Rajasthan Desert. *Records of the Indian Museum.* **59**(Part 1 & 2) : 149-170.

Prakash, I. 1963b. Taxonomical and Ecological account of the Mammals of Rajasthan Desert. *Annals of Arid Zone* **1** : 142-162; **2** : 151-161.

Prakash, I. 1974. The ecology of vertebrates of the Indian desert. *In : Ecology and Biogeography in India.* M. S. Mani (Ed.) Dr. Junk Verlag, The Hague, pp. 96-121.

Prakash, I. 1975. The ecology and zoogeography of mammals. In *Environmental Analysis of Thar Desert.* Gupta, R. K. & Prakash, I. (Eds.) pp. 448-467.

Prakash, I. 1994. The mammals of the Thar Desert, Scientific publishers, Jodhpur.

Prakash, I. 1995. Invasion of peninsular small mammals towards the Aravalli ranges and the Thar desert. *Intt. J. Ecol. & envtal. Sci.*, **21** : 17-24.

Prakash, I., Jain, A. P. and Rana, B. D. 1971. New Records of Rodents from Rajasthan Desert. *J. Bombay nat. Hist. Soc.*, **68**(2) : 447-449.

Rahmani, Asad R. 1997. Wildlife in the Thar. World Wide Fund for Nature-India. pp. 1-100. WWF, New Delhi.

Roberts, T. J. 1977. The mammals of Pakistan. Earnest Benn Ltd. London and Tonbridge.

Sinha, Y P. 1980. Bats of Rajasthan : Taxonomy & Zoogeography. *Rec. zool. Surv. India,* **76** : 7-63.

Sinha, Y. P. 1981. New records of black-beareded Tomb bat, *Taphozous melanopogon melanopogon* Temminck from Rajasthan. *Geobios,* **8** : 225-226.

Thomas, O. 1915. Scientific results from the mammal survey No. 11. *J. Bombay nat. Hist. Soc.*, **24**(1) : 29-65.

Thomas, O. 1921. Scientific results from the mammal Survey No. 30. The mangooses of the *Herpestes smithi* group. *J. Bombay nat. Hist. Soc.*, **28**(1) : 23-26.

Thomas, O. and Wroughton, R. C. 1916. Scientific results from the mammal Survey No. 12. *J. Bombay nat. Hist. Soc.*, **24**(2) : 224-243.

Verma, Kusum. 1962. On the structure of the skull of Indian hedgehogs. *Mammalia*, **26**(3) : 362-401.

Wroughton, R. C. 1912–20. Summary of the results from the Indian mammal Survey of the Bombay Natural History Society. *J. Bombay nat. Hist. Soc.*, Pt III **26**(2) : 338-379; Pt IV **26**(3) : 776-802; Pt V **26**(4) : 955-967; Pt VI **27**(1) : 57-85.

PLATE I

Fig. 1. : A panoramic view of Stabilized Sand dune with vegetation

Fig. 2. : Barren Sand dune

PLATE II

Fig. 3. : *Varanus griseus* (Daudin).
(Desert Monitor)

Fig. 4. : *Varanus bengalensis* (Linnaeus).
(Indian Monitor)

PLATE III

Fig. 5. : *Phrynocephalus laungwalansis* Sharma.
(Jaisalmer Toad Agama)

Fig. 6. : *Uromastix hardwicki* Gray.
(Indian spiny-tailed lizard)

PLATE IV

Fig. 7. : *Ardeotis nigriceps* (Vigors).
(Great Indian Bustard)

Fig. 8. : *Hieraaetus fasciatus* (Vieillot).

PLATE V

Fig. 9. : *Vulpes bengalensis* (Shaw).
(The Indian fox)

Fig. 10. : *Gazella bennetti* (Sykes).
(Chinkara)