

VOL 78 PARTS 1-4 PAGES 1-172

**A Journal of Indian Zoology**

**RECORDS  
OF THE  
ZOOLOGICAL SURVEY OF INDIA**

**Vol. 78 (1-4)**



**सत्यमेव जयते**

*Edited by the Director, Zoological Survey of India*

*1981*

© *Copyright 1981, Government of India.*

**Published in December, 1981**

**PRINTED IN INDIA AT SANGAM PRESS PVT, LTD. 17B KOTHRUD, POONA 411 029  
AND PUBLISHED BY THE DIRECTOR, ZOOLOGICAL SURVEY OF INDIA,  
CALCUTTA-700 012.**

**RECORDS**  
**OF THE**  
**ZOOLOGICAL SURVEY OF INDIA**

**A JOURNAL OF INDIAN ZOOLOGY**

---

**Vol. 78 (1—4)**

**Pages 1-171**

---

**C O N T E N T S**

	<b>Pages</b>
<b>RAO, K. R.</b> —Studies on the Leaf Hopper Fauna of Meghalaya and adjacent areas II. Cicadaliid collections from Manas and Dibrugarh (Assam) Surveys	1
<b>KHAJURIA, H.</b> —Studies on Wild Life of Narbada valley I. General Introduction and Summary of Results.	7
<b>KHAJURIA, H. and AGARWAL, H. P.</b> —Studies on Wild Life of Narbada valley Part II. Reptelia.	21
<b>VASANTHA RANGARAJU and DAS, E. N.</b> —On a new species of the genus <i>Oligacanttrorhynchus</i> <i>travassor</i> , 1915 ( <i>Acanthocephala</i> : <i>Oligacanthorhynchidae</i> ) from India.	37
<b>BASU, C. R., BHAUMIK and SENGUPTA, T.</b> —Chrysomelidae (Coleoptera) of Tripura, India.	41
<b>DANIEL, A. and KRISHNAMURTHY, P.</b> —Zooplankton biomass and its constituents from 100.0M and from near seabed to OM at shallow stations in the Northern Arabian Sea during December, 1973—May, 1974.	63
<b>ROONWAL, M. L. and MAKWANA, S. C.</b> —Tail carriage in the Hanuman langur, <i>Presbytis entellus entellus</i> (Primates; cercopithecidae) in the <del>Indian</del> Desert.	87

- SINHA, Y. P.—Studies on bats of Gujarat. .. 101
- BANERJEE, S. and GHOSH, M.—Prehistoric Fauna of Kausambi,  
near Allahabad, U. P. India. 114
- SOOTA, T. D. and DEY SARKAR, S. R.—On some nematodes  
parasitic in vertebrate hosts from Bihar India. .. 121
- GUPTA, P. D.—On lateral testes in the Genus *Ganeo* Klein, 1905  
with remarks on synonymy of *G. gastricus* Srivastava,  
1933 and *G. srinagerensis* Kaw, 1950 with *G. tigrinum*  
Mehra and Negi, 1928 (Trematoda : Lecithodendriidae) 129
- SENGUPTA, C. K. and SENGUPTA, T.—Cerambycidae (Coleoptera)  
of Arunachal Pradesh. 133
- CHATTERJEE, S. K. and SAHA, G. N.—On a collection of Scarabaeidae (Insecta : Coleoptera from Arunachal Pradesh with a description of a new species. 155
- GUPTA, P. D.—Intraspecific Variations in *Pleurogenoides sitapurii*  
(Srivastava, 1934) (Trematoda : Lecithodendriidae) 169

STUDIES ON THE LEAF HOPPER FAUNA OF  
MEGHALAYA AND ADJACENT AREAS  
II, CICADELLID COLLECTIONS FROM MANAS  
AND DIBRUGARH (ASSAM) SURVEYS

By

K. R. RAO

*Eastern Regional Station, Zoological Survey of India, Shillong*

(With one Text-figure)

The present study deals with the collections of Manas Survey 1974 made by the author and that of Dibrugarh Survey 1974 made by Mr. S. K. Chanda. In all 12 species are reported of which 6 species are recorded for the first time from Assam viz., *Arya rubrolineata* Dist., *Phrynomorphus indicus* (Dist.), *Nephotettix malayanus* Ishihara & Kawase, *Deltocephalus dorsalis* Motch; *Deltocephalus distinctus* Motsch. and *Nephotettix malayanus* I. & K. Variations found in the colour of tegmen and vertex have been described. Two different kinds of peculiar males found in the same species are also described and illustrated.

SYSTEMATIC ACCOUNT

Family CICADELLIDAE

1. *Tettigoniella spectra* (Distant)

1853. *Tettigonia albida* (nec walker) Signoret, *Ann. Soc. Ent. Fr. t. 21, & 3* : 663.

1908. *Tettigoniella spectra* Distant. New name for *Tettigonia albida* Signoret 1853 not *Tettigonia albida* Walker 1851. *Fauna Br. India* 4 : 211.

*Material*.—8 ♂♂, 12 ♀♀; Patacharkuchi (Kamrup), 20.xii.74 K. R. Rao; 9 ♂♂, 10 ♀♀ Saikhowa R. F. Dirak, Dibrugarh 7.xi.74, S. K. Chanda.

*Notes*.— Basal spot on vertex variable in shape. Eye brown, tegmen pale ochraceous. Reported from Calcutta, Pusa, MALDIVE islands, Minikoi, SRI LANKA and the PHILIPPINES.

2. *Hecalus porrectus* (Walker)

1858. *Acocephalus porrectus* Walker, *List. Hom. Suppl.* : 262.

1908. *Thomsoniella porrecta* (Walker) : Distant, *Fauna Br. India* 4 : 278.  
 1918. *Parabolocratus porrectus* (Walker) : Distant, *Fauna Br. India* 7 : 31.  
 1973. *Hecalus porrectus* (Walker) : Morrison, *Pacif. Ins.* 15 : 379-438.

*Material.*— 2 ♀ ♀ ; Dibru R. F. Srijan, 20.xi. 74, S. K. Chanda.

*Notes.*— Pronotum, vertex and scutellum with pale orange red fasciae; vertex beneath with a black line at the anterior margin. This species is recorded from Maharashtra, Calcutta, Assam, Manipur, BURMA, PHILIPPINES, and Queens land.

### 3. *Hecalus albomaculatus* (Distant)

1908. *Thomsoniella albomaculata* Distant, *Fauna Br. India*, 4 : 280.  
 1918. *Parabolocratus albomaculatus* (Distant) : Distant, *Fauna Br. India*, 7 : 32.  
 1973. *Parabolocratus albomaculatus* (Distant): Rao, *Zool. Anz.*, 19 (1/2) 94.  
 1973. *Hecalus albomaculatus* (Distant) : Morrison, *Pacif. Ins.* 15 : 379-438.

*Material.*— 2 ♀ ♀ , Dibru R. F. Srijana, Dibrugarh, 20.xi. 74, S. K. Chanda.

*Notes.*— Apical areas of tegmen dark brown with white spots. Scutellum with an angulate line before apex.

This is reported from Maharashtra, Bengal, Assam and Manipur.

### 4. *Arya rubrolineata* Distant

1908. *Arya rubrolineata* Distant, *Fauna Br. India*, 4 : 338.  
 1967. *Arya rubrolineata* Distant; Rao *J. Bombay nat. Hist. Soc.* 64 (1) : 130.

*Material.*— 1 ♀ ; Kahitana, Manas, 16.xii. 74, K. R. Rao.

*Notes.*— Scutellum with three linear discal spots. Oblique spots on the vertex sanguineous. Abdomen beneath pale yellow with median round black spots.

Previously known from W. Bengal and Manipur. From Assam it is recorded for the first time.

### 5. *Phrynomorphus indicus* (Distant)

1908. *Athysanus indicus* Distant, *Fauna Br. India*, 4 : 344.  
 1918. *Phrynomorphus indicus* (Distant): *Fauna Br. India*, 7 : 51.

*Material.*— 1 ♀ ; Kahitama (Kamrup), Mairiver, 16.xii.74, K. R. Rao.

*Notes.*— Face devoid of granules. An arcuate impressed line on the anterior area of pronotum on which small piceous spots occur.

Previously recorded from Maharashtra, Punjab, NEPAL, Pusa, Bengal and Manipur. It is reported for the first time from Assam.

#### 6. *Nephotettix virescens* (Distant)

1908. *Selenocephalus virescens* Distant, *Fauna Br. India* 4 : 291.  
 1908. *Nephotettix vipunctatus* (Fabr.), Distant, *Fauna Br. India*, 4 : 359.  
 1971. *Nephotettix virescens* (Distant): Ghauri, *Bull. Ent. Res.*, 60 : 484.

*Material*.— 3 ♀ ♀, Patacharkuchu, 20.xii. 74, K. R. Rao; 4 ♂ ♂, 6 ♀ ♀, Saikhowa R. F. Dirak, 7.xi.74. S. K. Chanda.

*Notes*.—Vertex unmarked and with a distinct ridge anteriorly much longer in middle than next to eye.

Reported from INDIA, PAKISTAN and the FAR EAST.

#### 7. *Nephotettix nigropictus* (Sta<sup>o</sup>l)

1870. *Thamnotettix nigropicta* Sta<sup>o</sup>l, *ebv. vet. AK. Farh*; 740.  
 1908. *Nephotettix apicalis* (Sta<sup>o</sup>l): Distant, *Fauna Br. India*, 4 : 360.  
 1971. *Nephotettix nigropictus* (Sta<sup>o</sup>l): Ghauri, *Bull. Ent. Res.* 60 (3) : 491.

*Material*.— 15 ♂ ♂, 25 ♀ ♀; Patacharkuchi, 21.xii. 74, K. R. Rao; 2 ♂ ♂, 6 ♀ ♀ Kahitama, Phura river, 12.xii.74, K. R. Rao; 15 ♂ ♂, 25 ♀ ♀, Srihowa R. F. Dirak, 7.xi.74, S. K. Chanda.

*Notes*.— Vertex with a distinct ridge anteriorly and much longer in middle than next to eye.

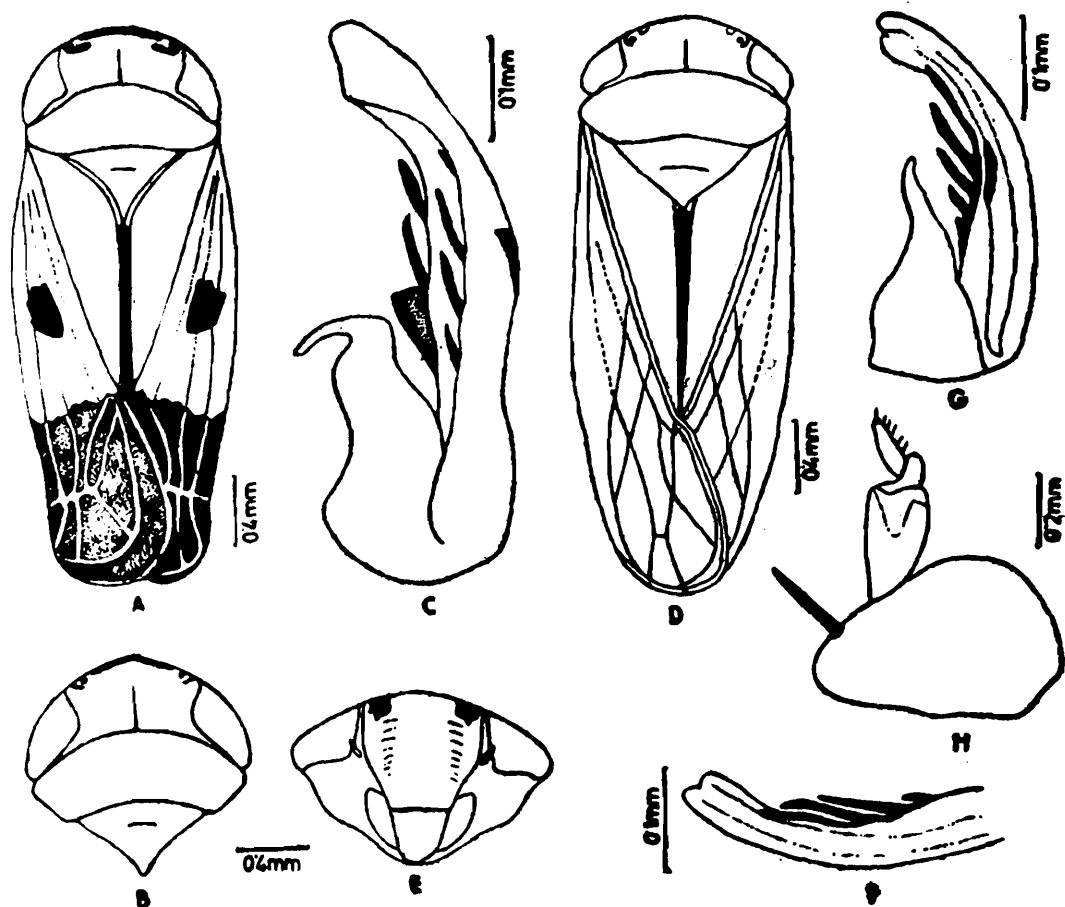
Reported from PALESTINE, INDIA and the FAR EAST

#### 8. *Nephotettix malayanus* Ishihara & Kawase

1968. *Nephotettix malayanus* Ishihara & Kawase, *Appl. Ent. Zool.*, 3 : 119.  
 1971. *Nephotettix malayanus* Ishihara & Kawase: Ghauri, *Bull. Ent. Res.*, 60(3) : 496.

*Material*.— 7 ♂ ♂, 7 ♀ ♀, Kahitana Phura river, 15.xii. 74, K. R. Rao.

*Notes*.—Ishihara and Kawase (1968) while describing the species mention the presence or absence of a central black spot on tegmen and aedeagles as having 4-5 spines on each side. Ghauri (1971) redescribing the species mentions four pairs of spines only on the aedeagus. The author in the present study has come across four normal males (Text-fig. 1A) where the tegmen has a central black spot and the submarginal band of the vertex represented by short transverse traces behind the ocelli, the aedeagus having four pairs of spines. Here two peculiar males are also met with, where the submarginal band is in the form of short streaks obliquely placed behind the ocelli (Text-fig. 1B) and the aedeagus with 4+3 spines (Text-fig. 1C), Regarding, the second peculiar kind



Text-fig. 1— *Nephotettix malayanus* Ishihara & Kawase, A-Dorsal view of normal ♂ Semidiagramatic, B—A Peculiar ♂ Head and thorax-Dorsal view, C—Aedeagus of the above ♂ — latero-ventral view, D—Dorsal view of a second peculiar ♂ — Semi diagramatic, E—Face of the above ♂, F & G— Lateral views of its aedeagus, H—Pygofer with anal tube- lateral view.

studied here, the male shows two small round black spots on the anterior margin of vertex (Text-figs. 1D & E), sub-marginal band as short traces behind the ocelli, marginal band being absent, head pronotum and scutellum immaculate, aedeagus (Text-fig. 1F, G) with 4+5 spines, basal plate arms with hook like projection on the outer side, distodorsal and distoventral corners of pygofers round (Text-fig. 1H), pygofer spine single. Seven females of the species studied here conform to the description given by Ghauri.

### 9. *Cicadula montanus* (Distant)

1908. *Deltocephalus montanus* Distant, *Fauna Br. India*, 4 : 384.

1930. *Cicadula montanus* (Distant): Pruthi, *Mem. Indian Mus.*, 11(1) : 56.

*Material*—1 ♂, 2 ♀, Kahitama, Phura river, 12.xii. 74, K. R. Rao.

*Notes*.— Vertex anteriorly obtuse. Pronotum transversely striated. Scutellum with minute dark spots front of the transverse impression. So far known from Simla, Khashi, Dalhousie and Muree hills. Recorded here for the first time from Assam.

10. *Cicadula maculatus* Pruthi

1930. *Cicadula maculatus* Pruthi, *Mem. Indian Mus.*, 11(1) : 58.

*Material.*— 1 ♂, Kahitama, Phura river, 12. xii. 74, K. R. Rao.

*Notes.*— Vertex with three black spots near the apex. Scutellum with a black spot near each basal angle. The outer branch of the first vein reaching the apex of tegmina. Reported from Calcutta, Darjiling and Gangtok.

11. *Deltocephalus dorsalis* Motsch

1859. *Deltocephalus dorsalis* Motsch; *Ftud. Ent.* : 114.

1908. *Deltocephalus dorsalis* Motsch.: Distant, *Fauna Br. India*, 4 : 380.

1918. *Deltocephalus dorsalis* Motsch.: Distant, *Fauna Br. India* 7 : 81.

*Material.*— 3 ♂♂, 1 ♀, Shaikhowa R. F. Dirak, 7.xi. 74, S. K. Chanda.

*Notes.*— Vertex with two cross shaped spots at the transverse impression. Pronotum with four obscure longitudinal fasciaw, Scutellum clear. Previously known from Bengal, South India and BURMA. Recorded from Assam for the first time.

12. *Deltocephalus distinctus* Motsch.

1859. *Deltocephalus distinctus* Motsch; *Etud. Ent.* : 112.

1908. *Deltocephalus distinctus* Motsch.: Distant, *Fauna Br. India*, 4 : 382.

*Material.*— 1 ♂, Kahitama, Mai river, Phalguri, 16.xii.74, K. R. Rao.

*Notes.*— Anterior margin of vertex black with five spots. Tegmen without macular shadings.

Previously recorded from SRI LANKA. It is reported for the first time from Assam.

ACKNOWLEDGEMENTS

I thank the Officer-in-Charge, Dr. A. K. Ghosh, Eastern Regional Station, Zoological Survey of India, Shillong for all the facilities offered to carry out this work.

SUMMARY

In all 159 examples belonging to twelve species have been studied from the collections made from Manas and Dibrugarh surveys. Four new records from Assam have been established. Redescription of the species *Nephotettix malayanus* Ishihara and Kawase was done. Distributional records for all the species have been provided.

## REFERENCES

- DISTANT, W. L. 1908. *The fauna of British India including Ceylon and Burma*, Rhynchota, 4, XV-501 pp; 282 figs. London (Taylor & Francis).
- DISTANT, W. L. 1918. *The fauna of British India including Ceylon and Burma*. Rhynchota, 7, VIII+210 pp; 90 figs. London (Taylor & Francis).
- GHAURI, M. S. K. 1971. Revision of the genus *Nephotettix* Matsumura (Homoptera : Cicadelloidea : Euscelidae). *Bull. Ent. Res.*, 60 : 481.
- ISHIHARA, T and KAWASE, E. 1968. Two new malayan species of the genus *Nephotettix* (Hemiptera : Cicadellidae) *Appl. Ent. Zool.*, 3: 119-123.
- PRUTHI, H. S. 1930. Studies on the Indian Jassidae (Homoptera). Introductory and description of some new genera and species *Mem. Indian Mus.*, 11 (1) : 1-69.
- RAO, K. R. 1967. A note on *Arya rubrolineata* Dist. (Jassidae, Homoptera) from Kalyani. *J. Bombay nat. Hist. Soc.* 64 (1) : 130.
- RAO, K. R. 1973. Studies on a small collections of Jassids from Poona (Homoptera : Cicadellidae), *Zool. Anz.* 191 (1/2) : 93-98.

# STUDIES ON WILDLIFE OF NARBADA VALLEY

## I. GENERAL INTRODUCTION AND SUMMARY OF RESULTS

*By*

H. KHAJURIA

*Central Regional Station, Zoological Survey of India, Jabalpur*

(With one Text-figure and three plates)

### OBJECT AND SCOPE

Central Regional Station, Zoological Survey of India was established in Jabalpur, Madhya Pradesh, in 1960 and includes under its jurisdiction whole of Madhya Pradesh, the largest state in Indian Union and adjoining six districts of Maharashtra, the area which is generally known as Central India. Because of vast extent of the area, and varied ecological conditions, it was decided to collect knowledge of at least a cross section of the fauna within about ten years by undertaking the survey of the Narbada river, the largest and the most important river of the area which roughly divides Central India into two halves originating in north east of the area and flowing towards west practically for whole of its length within the area except a small portion within Gujarat state. Also several important smaller rivers and streams of the area are its tributaries and, have practically same fauna as the Narbada. In order to have a good knowledge of terrestrial fauna of Narbada valley also, the area on the either side of the river within a distance of about 15 km. from the river was also included in the survey. However, Jabalpur district was surveyed within 40 km radius of Jabalpur city.

Studies on wildlife in Kanha National Park, which is drained by tributaries of the Narbada river though not within the limits Narbada Valley, were also carried out.

This report deals only with wildlife terrestrial vertebrates of the Narbada valley. A thick populated and agriculturally important area of Central India. Although Narbada valley is considered to lie between Satpura and Vindiyachal Hill ranges starting from Jabalpur dist., the portion outside the main valley along the river has also been included. The wildlife as here understood (Khajuria, 1975a) includes terrestrial

vertebrates only, *i. e.*, terrestrial reptiles, birds and mammals but in the case of reptiles chelonians have also been included because only a couple of species are involved. The important points which have been kept in view are: present status of the species, success of conservation measures, ecological distribution, discovery of new taxa, field studies of common species and intergration in subspecies, the area being a well known intergrading zone particularly the northern and southern races, geographical and individual variations with special reference to age groups.

The surveys were undertaken after the rainy season, which is rather heavy, in view of transport facilities on forest roads and when the staff was reasonably free from administrative and other duties at the headquarters. The period covered was from October to March. However the Jabalpur district, where the Central Regional Station is situated, is more or less midway between the origin and fall of the river was surveyed in all seasons to make the survey more thorough. Only one survey in a year lasting for about four weeks could be undertaken in view of other programmes in hand. The period covered was from 1962 to 1972 but because of some administrative difficulties no survey was carried out during 1966, 1967 and 1968 except in Japalpur district. In which survey were carried out for much longer period (1960-1976).

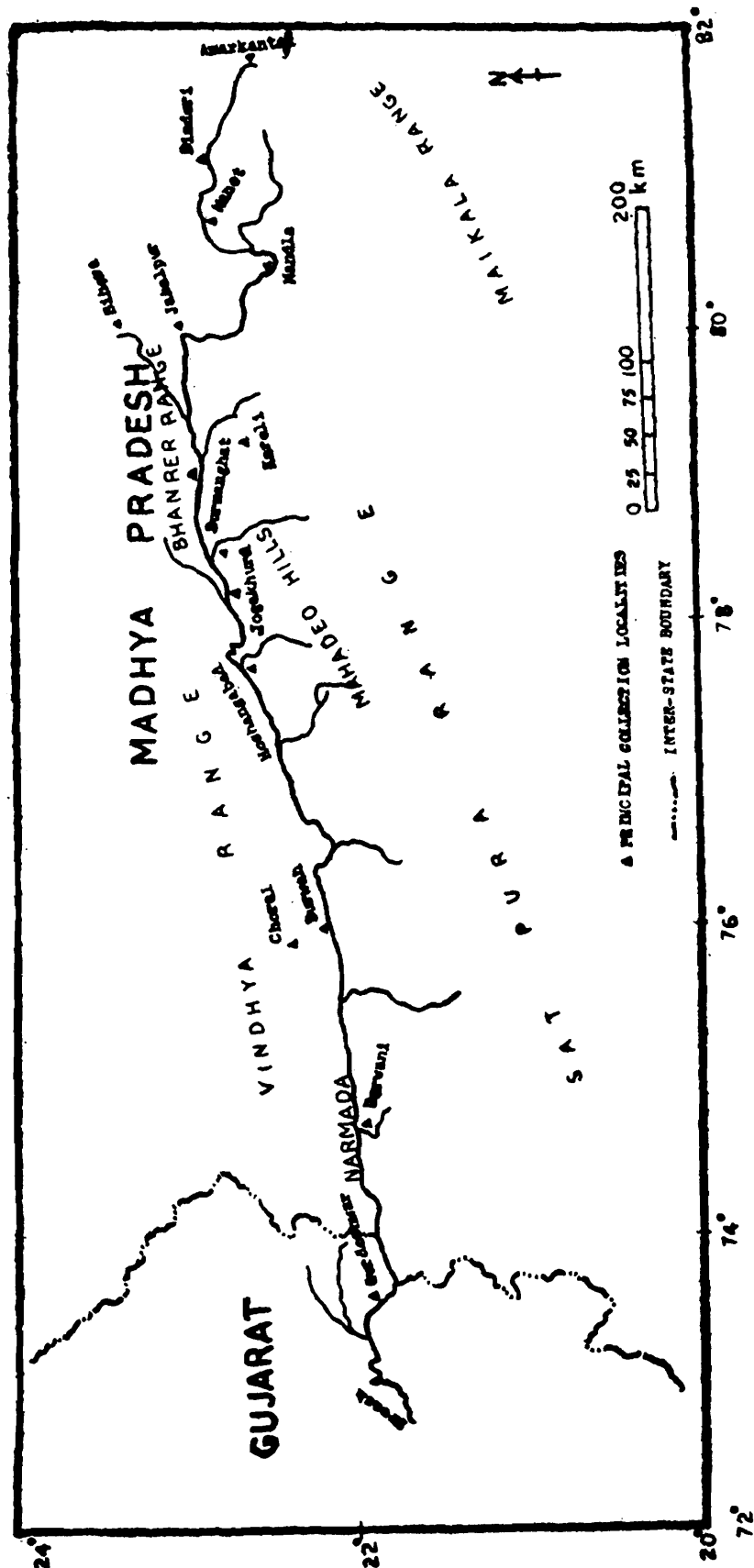
The portions of the area falling in the following districts were surveyed with principal halting stations indicated within brackets Shadol (Amar-kantak), Mandla, (Dindori, Manot), Jabalpur (*ca* 60 stations) Narsinghpur, (Karelidi, Burmanghat), Hoshangabad, Khandwa (Joga Khurd,) Khargone (Burwah) Indore (Choral), Dhar, (Barwani) and Broach (Broach, and Gurdeswar). The last district although not in area of jurisdiction of the station (because it is in Gujarat state) had to be surveyed to complete the survey programme.

#### PREVIOUS SURVEYS OF THE AREA BY OTHER PARTIES

The parties from the head office of the Zoological Survey of India conducted short surveys mainly of the aquatic fauna of the river in 1926 (one survey), 1927 (three surveys), 1941-42 (two surveys), 1974 (one survey) but very little information was collected on the groups under report as the main object was the aquatic fauna. No recent published information on the subject appear to be available except some old short reports given under the head "references" at the end of various parts of this report and *fauna of India*, which, however, do not cover exclusively the area under report.

#### BRIEF DESCRIPTION OF THE AREA

The area falls within 21.40 -22.40 N. lat. and 73.02-81.48E long. The total length of the river is 1290 km out of which about 4/5 fall within



Text-fig. 1. Sketch map of the Narbada river showing principal collecting localities.

the area of jurisdiction of Central Regional Station. The number of districts traversed by the river are twelve out of which two could not be visited because of lack of communication facilities. They were also not much of ecological interest. The altitude varies from 1050 m. (Amarkantak) to sea level (Broach district.) The detailed climatic data could

only be collected in Jabalpur city (*vide* Khajuria, in press c) The other data as found in available district gazetteers is as follows:

Hoshangabad: highest temp. 118.5 lowest 39.1 average rainfall 4.7.  
Broach: Average rainfall 4.8 temp. in winter 98 to 60 p-1 (of notes)  
average rainfall 3.3.

### *Description of Narbada river*

The Narbada river from its origin in Amarkantak to its fall in the gulf of Cambay covers a distance of about 1290 km with a catchment area of about 90,000 sq. kms. The river is usually divided into five parts with different ecological conditions. The first part, about 320 km, lies between Amarkantak and Jabalpur district or more or less upto the origin of Vindiyachal hill ranges from the northern bank of the river. Basalt is exposed at numerous places with marble here and there in the river bed. The river starts as a very small stream but gradually increases in flow after receiving tributaries big and small, The fall from Amarkantak (Maikal range) (Pl. I, fig. 1) is steep. There are a number of falls like Doodh Dhara and Kapil dhara (Pl. I, fig. 2 & 3). After leaving Maikal range it takes a tortuous course from Dandori on rocky bed on the right side of Satpura hills. There is important fall of Shahastardhara (Pl. I, fig. 4) near Mandla from where it follows a more or less straight course to the wellknown marble rocks (pl. II, fig. 1) near Jabalpur. After the origin of the Vindiyachal range in Jabalpur District, the real Narbada valley starts. About 320 km. stretch of the river between marble rocks and Handia town is bordered by highly fertile valley which is supposed to be a lake at one time. From Handia to Haran fall, the river loses in altitude considerably on its rocky bed with a few falls. From Haran fall to Makrai fall there are numerous cataracts and rapids before it reaches the plain of Gujarat after traversing a distance of about 400 km. Near Broach it becomes an estuary with banks separated near the fall by a stretch of muddy bed of about 20 m.

A notable feature of the river is that all its banks and even bed where they are alluvial are under cultivations particularly of vegetables. Because of high fertility of alluvium, the crops are very good. A peculiar feature of this alluvium is that in dry season it shows wide cracks in which several animals seek refuge (Pl. II, fig. 2). Formation of numerous islands, both rocky and sandy is also peculiar feature of the river because of scanty flow before the rains (Pl. II, figs. 3 & 4). Several human settlements including important towns of Mandla, Jabalpur, Narsinghpur, Hoshangabad and Barwani are on its banks or in close vicinity. As a result the river is highly polluted though at the same time being the best worshipped river in India. It is one of a couple of rivers which flows from east to west.

Amarkantak is perhaps the best worshipped place being the origin of the river. Parties of pilgrims who take a full round of the whole river on foot are sometimes seen. The river is also worshipped at numerous ghats where there are numerous temples which serve as good roosts of bats and some other animals. These ghats are veritable sanctuaries because no animals are killed. Even marsh crocodiles have succeeded in survival near these ghats (e.g. Beraghat) because of the protection.

Some constructions including forts (e.g. Joga khurd fort) are constructed on big hilly islands on the bed of the river.

The flora of the area can be divided into eastern sal forest zone and western less humid teak forest zone merging in middle near Narsinghpur District. Near about Barwani, a semi arid area starts extending westward. The salinity in Narbada water conspicuous in Broach district.

#### BRIEF NOTES ON PRINCIPAL COLLECTING LOCALITIES

##### A. Shadol District. M.P. (1962)

(1) *Kund or the point of the origin of the Narbada river at Amarkantak:-* The place of the origin of the Narbada river is situated at an altitude of 1850 metres at Amarkantak village (Pl. I, fig. 1) in a clearing at the top of a thickly forested hill (Maikal range) in Shadol District, Madhya Pradesh. The place is visited by numerous pilgrims. The actual point of origin is called 'Kund' and is in the form of a pacca tank about 300 sq. metres in area with rather an irregular outline inside a spacious pacca enclosure which contains 8 temples out of which 5 are inside the tank, the water in the tank is at places about 12 m. deep. The bottom of the tank although cemented is very muddy at places. Because of the scanty discharge and use of the tank for bathing by numerous pilgrims every day, the water is very dirty and replete with plankton giving it greenish brown appearance. The portion of the wall of the tank inside the water are overgrown with abundant algal vegetation. Temperature of water at the surface taken at 9.30 A.M. was 24°C (May) No other fauna except plankton and two forms of small fish was met with in the Kund.

Just outside the kund, the discharge passes for about 50 metres through a spacious channel with pucca bottom where the water is again collected at places into shallow dirty tanks for unceremonial bathing and washing.

##### (ii) *Portion of the river between Kund and first waterfall*

The portion of the river between Kund and first waterfall called Kapildhara, is in the form of a small stream about 8 km. long and from about 1 to 3 metres wide with muddy or rocky bottom. The discharge of water is scanty in the beginning but gradually increases because of the confluence of several spring-fed streams. Water temperature taken

between 11 A.M. to 12 A.M. varied from 24-31°C (May). Aquatic vegetation is met with at places. On either side of the stream are spacious pasture lands bordered by thick Sal forest. B. Mandla Dist. M.P. (1963)

*Narbada river, flowing on E. side of Bindori, Mandla distt.*

(i) *Din dori* Lat. 22° 57' N. Long 81° 4' 30" E. Alt ca 2185<sup>1</sup>.

Width of river 70-90 m., 0.5-1m deep. Water muddy, but at places clear. Vegetation in water consists of tufts of long grass projecting from surface of water. Bottom rocky with a good amount of silt and often some scum on surface of rocks. The water being very shallow, at many places, portions of rocky bottom can be seen above the surface of water. Banks rocky, ca 5-10m. high, slope variable from 30-90. Vegetation near banks contains small grass. Water moderately fast flowing. People of Dindori bathe and wash clothes on the western bank of the river.

(ii) *Narbada river at Manot, Mandla Distt.*

Lat. 22° 44' N Long. 80° 31' E.

About 1.5 km. from Manot upstream the Narbada appears to be a hill stream with stony and sandy banks and fairly fast current, but after that the bed becomes muddy and sandy and the current rather slow with reedy islands here and there. The water is about 2 mts deep at places near Manot bridge. Bed may also consists of Deccan trap however the nature of bed goes on changing.

(iii) *Right bank of Narbada river at Manot*

The right bank is forested and contains trees like *Dolbergia*, *sesso*, *Fiscus*, *Acacia*, Plant locally called Amla, Saja and Mahua etc and a tree locally known as Chota Jamun. The bank is broken up by a number of seasonal streams. Cultivated fields growing wheat, rice mustard, jute and vegetables are common. Even the main bed of the streams where the water has receded grows raddish, tomato, potatoes, cauliflower, brinjal etc. lantana bushes are very common. Forested hill ranges begins about 3 km. upstream.

C. Jahalpur District (1960-1976). The details of ecological conditions have been given by Khajuria (in press)

(NARSINGHPUR & HOSHANGABAD DISTRICT, M.P. 1964.)

(i) Kareli— Lat. 22° 10' N; Long. 79° 3' E; Alt. 240 mts approx.

Kareli is a small town in Narsinghpur district. The collection was mostly made within about 40 km. radius of Kareli.

The Narbada river is about 15 km. towards north flowing from east to west. The width of the river bed varies from 50-60 metres deep at places. The nature of bed and banks varies. They may be sandy muddy,

stony, or rocky at places. Very little aquatic vegetation was seen. The river receives a number of tributaries with similar ecological conditions.

The forest wherever present is scanty and is confined to hills. It consists mainly of the teak, the bamboo, species of *Ficus* and *Acacia* with shrubby undergrowth here and there. Some other species of trees are also common. Termatoria are common.

Most of the area is under cultivation and the blackish soil devoid of stones grows mainly various kinds of cereals.

(ii) Barmanghat-Lat.  $23^{\circ} 1\frac{1}{2}'$  N; Long.  $79^{\circ} 1\frac{1}{2}'$  E; Alt. 240 mts. approx.

Barmanghat is a village in Narsinghpur Dist. and is situated on the right bank of the Narbada river. The ecological conditions of the river and the banks within about 5 km. radius are more or less similar to those described earlier except the river bed is wider reaching about 100 metres or more in width at places and down stream the bed is more sandy or alluvial with extensive cultivations of vegetables such as tomato, bringal, chilie, etc. The current is also slower and deeper. At places there are extensive grassy and shrubby plains around. A few trees and shrubs (*Lantana* bushes) are found scattered on the banks. The river bifurcates into two branches near Barmanghat and forms a large island before the two branches rejoin each other. There are numerous temples, some of them located on the highest point on the island.

D. Hoshangabad and Sehore Dists. M. P. 1964-66)

(i) Hoshangabad and Budini Lat.  $22^{\circ} 42'$  N; Long  $77^{\circ} 42'$  E; Alt. 235. mts. approx.

Hoshangabad is a large town and district headquarters and is situated on the right bank of the Narbada river while Budin is a smaller town with Tehsil headquarters in Sehore district on the left bank of the river more or less opposite to Hoshangabad. The area within about 10 Km radius present the following ecological conditons.

The bed of the Narbada river attains a width of about 200 mts with current only about 100 metres wide. The bed is mostly sandy or alluvial with bare rock only at few places. The current is slow with water at places 5 to 6 mts deep. The river is spanned over by a bridge.

The forest is mainly on the left bank and consists mostly of teak, *Acacia sp.* *Butia sp.* *Ficus sp.* rosewood etc. *Lantana* bushes are common.

The cultivated fields, with greyish black soil grow mainly maize and pulses, 'tit', ground nut, mustard and wheat.

(ii) Joga Khurd - Lat.  $76^{\circ} 45'$  N;  $22^{\circ} 40'$  E; Alt. ca 200 metres approx.

Joga Khurd is small forest village situated on the left bank of the Narbada river in the Harda subdivision of Hoshangabad Dist., Madhya

Pradesh. The collections were made within about 40 km. radius of the village.

The Narbada river flows from north to south. The width of the bed reaches about to 100 mts. The current is moderately fast with water upto about 6 mts. deep at places aquatic vegetation is scanty. The bed may be sandy, muddy, stony or rocky. There are several islands of varying dimensions. Shrubs and herb locally known as Tamalaya, Karoti, Danola, Jurun and Jharu are common on dry river bed. On one of the islands a dilapidated fort built in 18th century A. D. is situated. The river receives several tributaries with similar ecological conditions.

On the banks of the river, particularly on the left one, is a teak forest. Other trees locally known as Tendu, Kalry, Sarai and Palas are also common. The undergrowth is thin, and soil is alluvial with a few stones.

In the cultivated fields which are patchily spread in the forest, the brownish alluvial soil devoid of stones mainly grows cotton, maize, wheat, pulses and oil seeds.

(iii) Handia villege - Lat 77° N; 22° 30' E; Alt ca 200 mts.

Handia is a fairly large village in Harda subdivision of Hoshangabad distt., M.P. and is situated on the right bank of the Narbada river. On the other side of the river is Nemawar village. The river flows from east to west direction with width of about 1 km., hardly reaching a depth of about 0.5m. There are small rocky islands here and there. The banks are mostly sandy. There is some algal aquatic vegetation, Jamun bushes and Dongle plants are common on the river bed. On either sides of river trees locally known as Maru, Fepar, Neepi, Jugulas are common. *Mangifera indica*, *Ficus religiosa* and *Azadiracta* are also found. Fields of wheat, cotton, til, pulses, jawar and maize are frequently met with.

E. Indore Dist, M. P. (1969)

(i) Choral : Lat. 22° 30' N.; Long. 75° 46' E.

It is a small village surrounded by hills and forest. The forest consists mainly of planted teak, *Arjan*, *Acacia*, bamboos etc. with sparse undergrowth. Forest is thin everywhere and spacious grassy, patches are present frequently.

The area which is under cultivation has blackish soil which is devoid of stones and grows mainly millet, pulses and cotton. Railway line and a metted road passes through the village.

Nearby there is a good-sized hill stream, called the Choral river. It is a tributary of the Narbada. The width of the river bed varies from place to place, but its maximum width is about 60 mts. near the village. The current is moderately fast with water about 0.5m. deep at places, forming pools of nearly stagnant water separated by fast flowing shallow

current. The bed and the bank of the stream is mainly stony with rocks showing up here and there. Very little aquatic vegetation was seen.

F. Khandwa Dist., M. P. (1969-1971)

(ii) Burwah Lat. 22° 25' N; Long. 75° 40' E.

Burwah town is subdivisional headquarters and is situated at about 2 kms. distance from right bank of Narbada river.

The ecological conditions of the river are same as described under the Burwani station ( p. 13).

(ii) *Barwani* : Long 74° 54' E.; Lat. 22° 01' N.

Barwani is a small town (a subdivisional headquarters) in Khargone dist. about 5 km. on the left bank of Narbada river. The area around Barwani presents typical semiarid environment. The black and red soil, are common. The sparse vegetation consists mainly of *Acacia*, Palms, Jujube, Dhatura, Thistle, tamarind, *Ficus* sps. The cultivated fields mainly grow barley, millet, pulses, wheat, maize, sweet potato, groundnuts and cotton. The area appears to be poor in fauna.

G. Broach Dist. Gujarat state (1971)

(1) *Garudeshwar*:—21° 58' N. Lat. 73° E. Long.

A small village *ca* 105 km. E. of Broach on the right bank of the Narbada river. Ground undulating with a few hillocks on right bank and a range of hills (the Satpuras) *ca* 4-5 kms. from left bank.

Vegetation consists mainly of Palmyra palms, Gulmohr, *Acacia* spp., *Opantia* spp., *Zizyphus* spp., *Azadirachta* spp. and some other xerophytes. Cultivated fields grow mainly cotton, pulses and maize but those on the alluvial bank of the river grow sometimes in addition some rice. The lower branches of all palmyra palms are chopped off depriving some bats of their favourite roosts. The hills contain mainly teak forest.

The bed of the Narbada river is alluvial, sandy. stony and rocky at places with water at places with 7-8 metres deep.

(ii) *Broach town*:—73° 05' E Long. 21° 45' N. Lat.

A town with a population of 2.5 lakhs on the bank of Narbada river. The river is about 2.5 km. wide. In this season about half of the river bed is exposed and covered by alluvial and sandy soil. The exposed areas are used for cultivation of pulses, jawar and for brick manufacture. Fishing is extensively carried out by the help of boats. Water is saline in taste. Several pools of water are common on alluvial and sandy bed.

## SUMMARY OF RESULTS

The collection consists of about 470 specimens including 171 taxa (Reptilia, 25; Aves, 115, Mammals 36). In addition to this collection over 2,000 specimens of Chiroptera including twenty taxa were collected in Jabalpur District and the result of investigation are published in a separate monograph. Practically all larger species already recorded from the area were seen but not collected, except a few specimens for museum exhibition, because of their rarity and enforcement of wildlife conservation measures. Detailed ecological observations were made by the author on the following species (see references). Mammals received special attention for ecological investigation as the author was specially interested in the group. One lizard *Chamaeleon zelanicus*, was however studied by other workers [ Durve and Sharma (1975) ]

1. *Mammalia*:

- (i) Insectivora: *suncus m. murinus* Linn. *Crocidura* sp., *Talpa* sp.
- (ii) Chiroptera : *Pteropus g. giganteus* Brunn, *Rousettus l. leschenaulti* Desm., *Cynopterus sphinx gangeticus* K. Anderson, *Rhinopoma h. hardwickei* Gray, *Taphozous m. melanopogon* Temminck, *T. theobaldi secatus* Thomas, *T. l. longimanus* Hardwicke, *T. k. kachhensis* Dobson, *Megaderma l. lyra* E. Geoffroy, *Rhinolophus l. lepidus* Blyth, *Hipposideros bicolor fulvus* Gray, *H. cineraceus durgadasi* Khajuria, *H. yabricus brachyotus*, Dobson *H. lankadiva unitus* K. Anderson, *Myotis peshwa* Thomas *Pipistrellus c. coromandra* Gray, *P. m. mimus* Wroughton, *P. ceylonicus indicus* Dobson, *Scotozous d. dormeri* Dobson, *Scotophilus temmincki wrightoni* Thomas, *s. heathi* Horsfield.
- (iii) Carnivora : *Cuon alpinus dukhunensis* Sykes (the wild dog). *Panthera t. tigris* Linn (the tiger).
- (iv) Artiodactyla : *Cervus duvauceli branderi* Pocock (the central Indian swamp deer), *Tetraceros quadricornis* Blainville (the four horned antelope).
- (v) Rodentia : *Rattus blanfordi* Thomas, *Vandeleuria o. oleracea* Bennet, *Tatera i. indica* Bechstein.

Special mention may be made of very important studies on the wild dog, the tiger and the swamp deer which aim at the discovery of limiting factors in their population dynamics with the object of manipulation of their numbers. Chiroptera were studied in more detail and include the following investigations:

New methods of collections and observations, taxonomy, location of type material, synonymy, all kinds of morphological characters which a taxonomist can possibly study (general body form, colouration, fur, tests, external genitalia including bacula, skull dentition, tongue, form of stomach, etc.), distribution, habitat selection, general habits (inter-specific and intraspecific relationships, daily activity, methods of flight, suspension, crawling, swimming, sounds produced, means of defence, hibernation, etc.), breeding habits, feeding habits, movements, enemies, parasites and disease, population dynamics and economic importance. A detailed discussion on the various adaptations shown by the bats is given. The work is profusely illustrated.

2. Aves : *Centropus sinensis* Stephens, *Vanellus i. indicus* Boddaerk, *Tyto alba* (Scopoli), *Otus backamaena marathi* Ticehurst, *Athene brama indica* Franklin, *Bubo c. coromandus* Latham, *Dinopium b. benghalensis* Linne, *Acridotheres t. tristis* Linn, *Passer domesticus* Linn, *Megalaima haemacephala* (Ph. S Muller).
3. Reptilia : *Mabuya macularia* Blyth, *Calotes versicolor* Daudin, *Chamaelon zelanicus* Linn.

One new taxon of Chiropters was discovered, one of birds and one of reptiles were discovered but not named for want of sufficient material. Intergradation of number of taxa has been discussed. Geographical and individual variations with special reference to age groups particularly young specimens have been described. Photographs of small animals which are not generally available or provided in their natural habitat.

Some other works by the author on Indian wildlife including the area under report are Khajuria (1953, 1955 a, b, 1956, 1963, 1966, 1970 a, b, 1971 b, 1972 a, 1973 b, 1975 a, b, 1976 a).

Wildlife conservation :- The animals which are hunted for their meal, hides, fur trophies are rare everywhere, except in protected places, National park, wildlife sanctuary, places of worship etc., although no reliable census figures are available except in very rare cases, e.g. swamp deer. Although destruction of wildlife is strictly prohibited. The measures for prevention of poaching are very inadequate. In some places inhabited by tribals even the smaller species were rare as they hurt them for food.

#### ACKNOWLEDGEMENTS

Sincere thanks are due to the Director, Zoological Survey of India for approving the survey programme and the forest authorities for providing survey and accommodation facilities within reserve forests.

Outside reserve forests collectors of the districts and P. W. D. authorities were very helpful, the latter with respect to accommodation. Shri Atal Paul, Photographer and Shri D. N. Basu Taxidermist who accompanied the field parties were responsible for photographs, and preparation of study skins of birds and mammals. Shri D. K. Ghosal who joined in survey in last three tours was also helpful in preparation of study skins.

## REFERENCES

- AGARWAL, H. P. 1970. On a collection of snakes from Jabalpur (Reptilia: Ophidia). *J. zool. Soc. India*, **22** (1 & 2) : 41-46.
- DURVE, V. S. AND SHARMA, H. S. 1975. Some observations on colour changes in India Chamaeleon. *J. Bombay nat. Hist. Soc.*, **72** (1) : 107-109.
- KHAJURIA, H. 1953. Taxonomic studies on some Indian Chiropters. *Rec. Indian Mus.*, **50** (1) : 113-138.
- KHAJURIA, H. 1955a. Mammalian fauna of semiarid track of deccan and its bearing on the appearance of aridity in the region. *Sci. & Cult.*, **21** : 293-295.
- KHAJURIA, H. 1955b. (Annotated) Catalogue of mammals in the Indian Museum (zool. surv.). II. Primate: Cercopithecidae. *Rec. Indian Mus.*, **50** : 101-127. 2 pls. (1954).
- KHAJURIA, H. 1956. (Annotated) Catalogue or mammals in the Indian Museum (zool. Surv.). *Rec. Indian Mus.*, **52** : 195-220.
- KHAJURIA, H. 1963a. *India's wild life* (Book) published by Publication Division, Ministry of Information and Broadcasting, Government of India 62 pp. set in two columns, 35 illustrations.
- KHAJURIA, H. 1963b. The Wild dog and the Tiger, *J. Bombay nat. Hist. Soc.*, 1963, **60** (2) : 448-449.
- KHAJURIA, H. 1965a. A novel method of capture of Indian flying fox (*Pteropus g. giganteus* Brünnich) for meat, fur and control. *Cheetal*, **8** (1) : 37-39.
- KHAJURIA, H. 1965b. Young of the Indian Gerbil. *Tatera indica* Bochestein. *Ibid.*, **62** (1) : 150-151, i pl.
- KHAJURIA, H. 1966. *Book of Indian Mammals* (H. S. Prater). 2nd edition. A critical review. *Cheetal*, **8** (2) : 72-73.
- KHAJURIA, H. 1968a. On the genus *Scotozous* Dobson. *Curr. Sci.*, **34** (22): 640-642.
- KHAJURIA, H. 1968b. Fledgelings of the dusky horned owl, *Bub c. coromandus* (Latham). *Cheetal*, **10** (2) : 50-51.

- KHAJURIA, H. 1970a. Wild life conservation in India in relation to production and other benefits. *Hippocampus*, 1 : 28-30.
- KHAJURIA, H. 1970b. Nestling of the Red-wattled Lapwing, *Vanellus i. indicus* (Roddaert), *Pavo*, 8 (1 & 2) : 82-83.
- KHAJURIA, H. 1970. Feeding habits of the central Indian collared Scops, Owl, *Otus bakkamoana marathi* Ticehurst, *Pavo*, 8(1 & 2) : 81.
- KHAJURIA, H. 1971a. On the habits of the Indian flying fox. *Pteropus giganteus gigauteus* Brünnich. *Cheetal*, 14 (2) : 12-16.
- KHAJURIA, 1971b H. A new leaf-nosed bat from central India. *Mammalia*, Paris, 34 (2) : 622-627.
- KHAJURIA, H. 1971c. Classification of genus *Macaca* based on cranial characters. *Proc. Indian Sci. Congress*. pp. 23-24.
- KHAJURIA, H. 1972a. Recent developments in Indian Wildlife Policy. *Hippocampus*, 2 (2) : 2-7.
- KHAJURIA, H. 1972b. A note on the young of the house shrew (*Sunous s. murinus* Linnaeus), *Cheetal*, 51 (1) : 97.
- KHAJURIA, H. 1972c. On occurrence of genera *Crocidura* and *Tala* (Mammalia : Insectivors) in Central India, *Cheetal*, 51 (1) : 46-47.
- KHAJURIA, H. 1973a. Role of the wild dog in depletion of the wildlife in Kanha National Park: Seminar on environmental studies and wildlife conservation, Rewa University. 1973, pp 1-8.
- KHAJURIA, H. 1973b. Wildlife in Pench National Park. Rewa University Seminar. 1975 pp 9-16.
- KHAJURIA, H. 1973c. Studies on breeding behaviour of Indian bats. *Proc. Indian Sci. Congress Symposium*, p. 14.
- KHAJURIA, H. 1973d. Courtship and mating in *Rhinopoma h. hardwicki* Gray (Chiroptera : Rhinopomatidae) *Mammalia*, 36 : 307-309.
- KHAJURIA, H. 1974a. Sounds of bats. *Hippocampus*, 3 (3) : 23-25.
- KHAJURIA, H. 1974b. Albinism in *Rhinopoma h. hardwicki* Gray. *J. Bombay nat Hist. Soc.*, 70 (1) : 1972 pp.
- KHAJURIA, H. 1974c. A note on the four-horned antelope, *Tatraceros ausdricopnis* (Blainville). *Cheetal*, 14 (1) :
- KHAJURIA, H. 1975a. A plan for management of wildlife with special reference to Indian conditions. *Hippocampus*, 5 (3) : 1-3.
- KHAJURIA, H. 1975b. A book of Indian animal (H. S. Prater) 3rd edition. A critical review. *Zool, Surv, India News. letter*, 1 (1)
- KHAJURIA, H. 1975c. Fledgelings of the northern spotted owlet, *Athena brama indica* (Franklin) *Pavo*, : 1-2, i. pl.
- KHAJURIA, H. 1975d. Some observations on the breeding habits of the Indian and Bank mynas, *Pavo*, 11 (1 & 2) : 104-108.
- KHAJURIA, H. 1976a. On scope of applied ecology. *Hippocampus*, 6 (6) : 30-31.

- KHAJURIA, H. 1976b. Courtship and mating in *Rhinopoma h. hardwieki* Gray (Chiroptera : Rhinopomatidae) *Mammalia*, 36 : 307-309.
- KHAJURIA, H. 1976c. New methods of collection of rare bats *J. Bombay nat. Hist. Soc.*, 71 : 600-601.
- KHAJURIA, H. 1976a. Methods of suspension, crawling, swimming and defecation in Indian bats with remarks on possible causes of Chiropteran head downward suspension *J. zool. Soc. Com. Vol.*, 1 : 99-105.
- KHAJURIA, H. 1976e. Answer to bat riddles. *Hippocampus*, : 13-16.
- KHAJURIA, H. AND GHOSAL, D. K. 1970. Small mammals eaten by the Barn Owl. *Tyto alba* (Scopoli), *Mammalia*, 34 (4) : 718-720.
- KHAJURIA, H. (In press a) Bats of Jabalpur city and environs, Madhya Pradesh, India. pt. I. Families Pteropidae, Rhinopomatidae and Emballomuridae. *Rec. zool. Surv. Occ. pap.*
- KHAJURIA, H. (In press b) Bats of Jabalpur city and environs, Madhya Pradesh, India. Part II. Families Megadermatidae, Rhinolophidae, and Vespertilionidae. *Rec. Zool. Surv. India Occ. pap.*
- KHAJURIA, H. (In press c) Extension of ranges of some rare South Indian bats. *Cheetal.*
- KHAJURIA, H. (In press d) Erythrism in *Rhinolophus i. lepidus* Blyth.
- KHAJURIA, H. (In press e) Feeding and breeding habits of some Indian Microchiroptera. Proc. V Inter. Bat conf. (in press).
- KHAJURIA, H. (In press f). Effectiveness of Japanese mist nets for catching Indian bats. *J. zool. Soc.*
- KHAJURIA, H. (In press g). External genitalia and bacula of Indian Microchiroptera. Proc. V Inter Bat. conf.
- KHAJURIA, H. (In press h). Taxonomical researches on Indian Mammal, text-fig. 1 pl. pp. 26 in: *Zootaxonomy in India* (edited by V. C. Kapur).
- KHAJURIA, H. (In press i). Habits of the Blanford's Rat (*Rattus blanfordi* Thomas) *J. zool. Soc.*
- KHAJURIA, H. (In press j). The Crow-pheasant *Centropus sinensis* (Stephens) (Avers : Cuculidae) from Central and Eastern Madhya Pradesh. *IBID.*
- KHAJURIA, H. (In press k). Notes on some Central Indian Birds (ns). *Pavo.*
- KHAJURIA, H. (In press l). Habits of some Central Indian Lizards with description of a possible new race (MS). *J. zool. Soc.*
- KHAJURIA, H. AND SINHA, N. K. (In press). Limiting factors in population dynamics of the Central Indian Swamp deer. *Oryx. London.*
- KHAJURIA, H. AND AGARWAL, P. A. (In press). Wildlife of Narbada Valley. Part II Reptiles (MS) *Rec. zool. Surv. India.*
- KHAJURIA, H. AND GHOSAL, D. K. (In press) Wildlife of Narbada Valley. Part II & III Birds Mammals (MS) *IBID.*

## STUDIES ON WILD LIFE OF NARBADA VALLEY- PART II. REPTILIA

By

H. KHAJURIA AND H. P. AGRAWAL

*Central Regional Station, Zoological Survey of India, Jabalpur, M. P.*

(With two Plates)

### INTRODUCTION

This report deals with reptiles of Narbada Valley and is based on collection made during the survey of Narbada River from 1962 to 1972 and its adjoining areas within about 15 km. of the river from its origin in Amarkantak (Shahdol district, M. P.) to its fall in the Arabian Sea in Baroach district (Gujarat State). The collection was made under the leadership of the authors. There are 145 specimens comprising 25 species. Smith (1931, 1935, 1943) listed about 40 species of reptiles from the area. Several interesting individual variations have been recorded. Some of them may have a geographical significance if series of specimens are available for comparison in future. Melanism in *Sitana ponticeriana* and descriptions of young ones of a number of species are also recorded for the first time. An account of snakes of Jabalpur district has already been given by one of the author of this report Agrawal (1971).

One of the important objects of the investigation was to conduct a status survey of this interesting group, very important from the point of view of wild life conservation, in this centrally located, thickly populated, and agriculturally important area of Central India. The abundance or rarity of the species in the season of collection is generally indicated by the number of specimens collected. Except in Jabalpur Dist., the surveys were generally not undertaken during rainy season because of transport difficulty. In rainy season the snakes are more commonly seen and easy to collect.

Only important variations as noted in comparison with descrip-

---

\*Part I of this report which deals with general introduction and summary of the results and Part III which covers Birds and Mammals are being published in the same journal.

tions given by Smith are recorded. Field notes are given wherever possible. The photographs of species which were not illustrated by Smith are given from preserved specimens. Some photographs of live specimens have also been provided.

Measurements are taken of the largest specimens and are in millimetres. The scale count are given after method followed of Smith. Standard length is measured from snout to vent and total length from snout to tail tip. The abbreviations used are : A.— Anals; C.— Caudals; and V— Ventrals.

We are thankful to the Director, Zoological Survey of India, Calcutta for the facilities provided to carry out this work, to Sarvashri S. Biswas and D. P. Sanyal of reptile section of Zoological Survey of India, Calcutta for help in identification of some species and to Shri Atal Paul, departmental photographer in taking photographs.

#### SYSTEMATIC ACCOUNT

##### Order LORICATA

##### Family CROCODYLIDAE

#### 1. *Crocodylus Palustris* Lesson

(Pl. iv, fig. 1.)

*Crocodylus palustris* Lesson, 1834, in *Belang. Voy. Ind. Or., Zool.*, p. 305 (Type loc. : Ganges).

*Material* : 1 ex. (young), Pariat tank, exhibited.

*Measurements* : Standard Length, 615.0, total length, 1235.0.

*Morphological and field notes* : The characters of the young do not appear to have been recorded. The specimen is young and was collected in the water supply tank about 30 km. from Jabalpur city. It is a mounted specimen and thus the external characters cannot be made out with accuracy. There are 18 teeth in the upper jaw instead of 19 mentioned for the adult by Smith (1935). The number of longitudinal rows of scutes with enlarged keels on the dorsal surface varies from 2 to 9 reaching the maximum on the middle of the back. In the posterior part of the tail, the two rows of scutes have converged to form a single ridge for about two third of the posterior portion of tail. There are four rows of scutes with enlarged keels on the dorsal surface. A gradual enlargement of the keel can be seen on the lateral sides of this portion of the tail. On the neck, four such scutes can be recognised while on the shoulder six such scutes are present arranged in two rows, four scutes in the anterior row and two in the posterior row. A serrated fin on the outer side of the limbs is visible in one of the leg only.

These crocodiles were reported to be quite common in the Narbada

River but now have been hunted down except in protected places of religious or tourist interest. At Bheraghat, a tourist resort, a few can generally be seen while boating. There are no authentic records of attack on humans by these animals. The present record shows that it may rarely be found in smaller streams and tanks. The collecting locality is a deep water reservoir formed by damming stream for water supply to Jabalpur city and is far away from human habitations. It is surrounded by low forested hills and is a holiday resort.

### Order TESTUDINES

#### Family TRIONYCHIDAE

#### 2. *Lissemys punctata granosa* (Schoepff)

*Testudo granosa* Schoepff, 1992, *Hist. Test.*, p. 127, pls. XXX A and B (Type loc. : Coromandel coast).

*Material* : Jabalpur district : 2 ex., Narbada river at Gwarighat, 14. x. 1962, Coll. R. C. Sharma; 1 ex., Sita Pahad, 22. i. 1965, *Purchased*; 1 ex., Pachpedi, Jabalpur, 13. viii. 1965, Coll. H. Khajuria; 1 ex., Budagar tank, 27. iv. 1974, Coll. D. S. Mathur; 1 ex., 24. v. 1974, *purchased*.

*Measurements of largest specimen* : Length of carapace, 17.5; Breadth, 16.7.

*Morphological and field notes* : The collection shows three steps in growth from the young to the adult. The smallest specimen is reddish on the under surface and dark brown on the dorsal surface without any indication of plastral callosities, green spots and black streaks on the head. The dorsal disc is longitudinally striated or plated. In two larger specimens, the plastral callosities are present, but the entoplastral callosity is small (length 7.5 mm., breadth 3.5 mm.) and is semicircular. The granulation of the adult is slightly visible. The carapace shows lateral striation but the dorsal region is faintly granulated. The colour of older specimens resembles more or less that of the smallest specimen given above. In the largest specimen the colour and marking of the adult are visible. There are three black streaks on either side of the head in one of the adult specimen. The lower most streak is a furrow radiating from the snout. The uppermost is zigzag. The granulation of plastral callosities is very irregular and is confined to a few spots. Two callosities are entirely free from granulation. The entoplastral callosity is smaller than shown by Smith (1931, p. 146). Plastron of one of the specimen is more extensively granulated than in others where it is confined to a few worn out spots. The later specimen is paler than the others. The tortoise is sold in the market for the table. As it is easily caught, it is rare and needs protection.

## Order SQUAMATA

## Family GEKKONIDAE

3. *Hemidactylus Brooki* Gray

(The House Gecko)

*Hemidactylus brooki* Gray, 1845, *Cat. Liz. Brit. Mus.*, p. 153 (Type loc: Borneo; London).

**Material :** Jabalpur district: 1 ex., Pachpedi, Jabalpur city, 21. vii. 1960, Coll. R. C. Sharma; 1 Ex., Lodhiana mohalla, Jabalpur city, 27. x. 1960, Coll. P. Singh; 1 ex., Bargi Hills, 28. xii. 1960, 1 ex., Bijadandi vill., 2. i. 1961, 1 ex., Pachpedi, Jabalpur city, 9. i. 1961.

1 ex., Padaria vill., 17. II 1961, Coll. S. Chakrapany. 1 ex., Lamataghat, 22. vii. 1961, Coll. S. Chakrapany; 1 ex., Madan Mahal, 27. xi. 1961; Coll. R. C. Sharma; 1 ex., Rani Durgavati Samadhi Road, 22. iii. 1962, Coll.: S. Chakrapany; 1 ex., Sibia vill., 23. vii. 1962, Coll. P. Singh; 6 ex., 5th mile stone on Jabalpur Rani Durgavati Samadhi road, 23. ii. 1962, Coll. P. Singh; 2 ex., Khamaria vill., 24. ii. 1962, Coll. H. Khajuria; 1 ex., Ghat area, Nagpur road, 26. iii. 1962 Coll. P. Singh; 4 ex., Gwarighat, 23. vii. 1962, Coll. S. Chakrapany; 5 ex., Udaipur vill., 24. vii. 1962, Coll. P. Singh; 2 ex., Madan Mahal, 26. vii. 1962, Coll. S. Chakrapany; 1 ex., near Sone nanda river (Shahdol distt.), 8. v. 1962, Coll. P. Singh; 1 ex., Bhriagu Kamandal (Shahdol Distt.), 27. v. 1962, Coll. S. Chakrapany.

**Measurements of largest specimen :** Standard length, 61; Total length, 96.

**Remarks :** In recently preserved specimens which appear to be subadult, a dark streak along the side of the head cannot easily be made out. Specimens are brownish with dark brown spots. In contrast, specimens from Nidigul and Nandikanda (Nagarjunsagar area) are milky white, with dark brown spots on the dorsum and the sides (Sharma, 1971). Characters of the tail present a bewildering variety, possibly due to its loss and regeneration. It is rare in most of the specimens examined. There are very few specimens with verticellate tail. In the newly hatched young, the tail length and head length are proportionately much longer than in the adults. It is a common species in the area.

4. *Hemidactylus leschenaulti* Dum. & Bibr. (Pl. IV, fig. 2)

(The Tree Gecko)

*Hemidactylus leschenaulti* Dum. & Bibr., 1836, *Exp. Gen.*, IV, p. 364 (Type loc. : Ceylon; Paris).

**Material :** Jabalpur district : 1. ex., Pachpedi, Jabalpur city, 24. iv. 1960, Coll. H. Khajuria; 1 ex., Napier Town, Jabalpur city, 23. iii. 1961, Coll. R. C. Sharma.

*Measurements of largest specimen* : Standard length, 63-Total length, 89.

*Remarks* : In one of the specimen the inner pair of post mentals is indistinct. Whole of the undersurface of the head is covered with small scales and the granules on the back are indistinct. However, it appears that the specimen is apparently moulting because some of its parts are covered by whitish mould. The details of colouration cannot be made out, possibly because of action of preservative. The identification of specimens has been confirmed by the head office (Reptile Section). The measurements given by Smith (1935) are: snout to vent- 83 mm., tail also 83 mm.

### 5. *Hemidactylus flaviviridis* Ruppell. (Pl. IV, fig. 3.)

*Hemidactylus flaviviridis* Ruppell, 1835, *Neue Wirb. Faun Abyss.*, p. 18, pl. VI, fig. 2 (Type loc.; Massana I ).

*Material* : Jabalpur district; 1 ex., Pachpedi. Jabalpur city, 2. v. 1961, Coll. S. Chakrapany; 2 ex., Lamataghat, 26. vi. 1961, Coll. S. Chakrapany; 1 ex., Pachpedi, Jabalpur city, 28. vi. 1961, Coll. H. Khajuria; 1 ex., Lamataghat, 29- ix. 1961, Coll. S. Chakrapany.

*Measurements of largest specimen* : Standard length; 77, Total length, 147.

*Remarks* : Enlarged tubercles on the back are indistinct. The colouration has faded probably due to the action of preservative.

## Family AGAMIDAE

### 6. *Calotes versicolor* (Daudin)

(Garden lizard : Bloodsucker)

*Agama versicolor* Daudin, 1802, *Hist. Nat, Rept.*, III : 395, Pl. XLIV (Type loc. : India ; Paris).

*Material* : Jabalpur district: 1 ex., Lodiana Mohalla, Jabalpur city, 26. ix., 1960; 2 ex., Chamanpura, Jabalpur city. 27. ix. 1960; 1 ex., Godwana village, 11. x. 1960; 2 ex., Lodiana Mohalla, Jabalpur city, 27. x. 1960, Coll. P. Singh; 1 ex., Napier Town, 14. xi. 1960, Coll. R. C. Sharma; 2 ex., Chamanpura, 29. xi. 1960, 5 ex., Garha, 23. xii. 1960, Coll. P. Singh; 2 ex., Pachpedi, 2. v. 1961, Coll. P. Singh, 1 ex., Lamataghat, 6. iv. 1961, Coll. H. Khajuria; 1 ex., Mergong, 25. v. 1961. Coll. P. Singh; 1 ex., Kundan village, 30. v. 1961, 1 ex., Balsagar, 30. v. 1961, 1 ex., Amkhas village, 28. viii. 1961, Coll. S. Chakrapany; 1 ex., Sita Hill, 18. i. 1962, Coll. P. Singh; 1 ex., Rani Durgavati Samadhi, 15. xii. 1962, Coll. J. S. Bhatti; 1 ex., Pachpedi. 11. iii. 1968, Coll. M. L. Koshta; Baroach dist.: 1 ex., Gavana village, 5 km. N. E. of Garudeshwar, 3. i.

1972, Coll. *D. K. Ghosal*; Hoshangabad distt: 1 ex., Joga Forest ca. about 1 km. of Joga forest rest house, 12.xii.1965, Coll. *H. P. Agrawal*.

*Measurements of largest specimen* : Total length, 350; Standard length, 117.

*Remarks* : Dark spots or bars and caudal annulate are generally confined to younger individuals. Some of the gular pouches were found to be darker in colouration. Because of the action of the preservative further details of colouration cannot be noted. In one case there is a distinct lighter band around the root of the tail and in another more than half of the tail is of lighter colour distally. The double spines above the tympanum, an important distinguishing character of the species, may be broken in some cases or there may be a group of smaller spines around the longer ones.

It is a common species around Jabalpur district and can often be observed in the gardens at a very close range. Khajuria (in press) has given a (Tiwari and Sharma, 1970) found it common in Maharashtra. detailed account of its feeding and breeding habits in Jabalpur city.

#### 7. *Psammophilus blanfordanus* (Stoliczka), (Pl. IV, fig. 4.)

*Charasia blanfordanus* Stoliczka? *Proc. Asist. Soc. Bengal*, p. 194 (type loc. : Central India).

*Material* : Jabalpur district: 1 ex., Dhobi vill., 11.x.1961, Coll. *P. Singh*; 1 ex., Balsagar, 17.ii.1962, Coll. *P. Singh*; 1 ex. Madan Mahal, 21.iv.1962, Coll. *S. Chakrapany*; 26.vii.1962, Coll. *S. Chakrapany*; 1 ex., Amkhas village, 23.v.1968, Coll. *H. S. Sharma*; Shahdol dist.: 1 ex., 3 km. from the origin of Narbada river, 30.v.1962, Coll. *S. Chakrapany*; 1 ex., Doodhadhara, Narbada river, 25.v.1962, Coll. *S. Chakrapany*; 1 ex., Panchdhara, Amarkantak, 30.v.1962, Coll. *P. Singh*; Hoshangabad dist. : 1 ex., Sonctaline village ca about 20 km E of Joga Forest Rest House, Coll. *H. P. Agarwal*.

*Measurements of largest specimen* : Standard length, 99; Total length, 210.

*Remarks* : In all the specimens there is a black spot usually with one or more smaller spots on either side on the snout between the inner borders of the eye. In the largest specimen of which measurements are given above, the colour pattern has faded away except on the tail. In this specimen as well as in some other larger specimens there are prominent swellings below the ears converging on the undersurface of the head. There is a newly born young measuring—Total length, 64.0; standard length, 23.0 collected on 11.x.1961. If the breeding season is in May (Smith, 1935 p. 10) the incubation period appears to be prolonged.

8. *Agama minor* Hardwicke & Gray

*Agama Minor* Hardwicke & Gray, 1827, *Zool. Journ.* III : 218 (Type loc. : 1 Chittagong).

*Material* : 6 ex., Madan Mahal (Jabalpur Distt.), 19.iv.1961, Coll. R. C. Sharma.

*Measurements of largest specimen* : Standard Length, 88; Total length, 168.

*Remarks* : In these specimens fold in front of the shoulder extend far down to throat almost joining with the one from opposite side. The colour pattern on the back is not distinct possibly due to action of preservative, although the white streak from the angle of the mouth can be made out in some specimens. The one on each side of the nape is indistinct. In the younger specimens the colour pattern is more distinct on the hinder part of the body and the tail.

9. *Sitana ponticeriana* Cuvier (Pl. IV, fig. 5.)  
(The Sargota lizard)

*Sitana ponticeriana* Cuvier, 1844, *Guerian, Icon. Reg. Anim., Rept.*, pl. X. fig. 2 (Type loc. : pondicherry: Paris)

*Material* : 1 ex., Chapla village on Mandla Road, 20.xii.1969, Coll. S. Chakrapany; 1 ex., Chopda village on Madan Mahal, 19.iv.1961, Coll. R. C. Sharma; 1 ex., Padaria village, 27.ix.1961, Coll. S. Chakrapany; 1 ex., Rani Durgavati Samadhi Road, 25.iv.1962, Coll. R. C. Sharma; 2 ex., Padaria village, 27.ix.1961, Coll. R. C. Sharma; 1 ex., Ghat area on Nagpur road, 26.iii.1962, Coll. P. Singh; 1 ex., Padaria village, 25.iv.1962, Coll. P. Singh; 1 ex., Ghat area on Nagpur road, 28.vii.1962, Coll. P. Singh; Khargone distt.: 5 ex., A slope of hill 3 km. N. of Barwani. 7.ii.1971, Coll. V. V. Rao; 2 ex., Eastern face of hill behind Barwani rest house, 18.ii.1971, Coll. D. K. Ghosal; Baroach distt: 5 ex., a small canal about 2 km. N of Gurudeshwar 18.xii.1971, Col. H. Khajuria.

*Remarks* : The largest specimen in the collection (measurements given above) has a gular appendage. In a specimen collected on 25th April the gular appendage extends from the throat to a point about 5 mm. posterior to exila. Gular fold as well as the underside of the head and chest are sharply marked off by their dirty yellowish colouration from rest of the undersurface which is much lighter. Also a broad edge bordering the underside of the lower jaw is contrasted from the dirty yellow area described above by its light yellow colouration. In an another specimen collected on the some date but 10 years later, a differently coloured area on the lower jaw is distinct but there is no gular fold. Two specimens collected in the end of February and March are melanistic.

The one collected on 21.ii.1961 in Jabalpur district is very dark all over with obliteration of all colour patterns but the underside is slightly paler. The youngest specimen measuring 59 mm. in total length has been collected in September in Jabalpur district. A number of juveniles has been collected in Broach district, Gujarat and Khargone district, M. P. in February. In most of the these young individuals colour pattern except on the head and neck is distinguishable but in others colour pattern particularly the dorsal stripes are indistinct. In many specimens a white stripe starting from below the eye and extending to the sides of neck can be distinguished but it is entirely absent in the young specimens. Some of the keels on the lateral scales in adults project as spine like structures. Chopra (1964) has made interesting studies on its breeding habits, ecology and behaviour of this lizard.

Family CHAMAELEONIDAE

10. *Chamaeleon zeylanicus* Laurenti

*Chamaeleon zeylanicus*, Laurenti 1768, *Syn. Rept.* p. 46 (based on Seba, i, pl. 82, fig. 3) *J. Asiat. Soc.*

*Material* : 1 ex. Near Jabalpur city.

Family SCINCIDAE

11. *Mabuya dissimilis* (Hallowell)

*Euprepis dissimilis* Hallowell, 1857, *Tran. Amer. Phil. Soc.*, (2) XI : 78. (Type loc. : Bengal; philadelphia).

*Material* : 1 ex., near Madhawari village (Mandla Distt.), 4.xi.1963, Coll. J. S. Bhatti.

*Measurements* : Standard length, 99; Total length, 226.

*Remarks* : The vertebral stripe is distinct. The black lines are broken up into spots which are arranged in longitudinal rows but the black lines along the left lateral white stripes is distinct. There is a greenish tinge on the ventral parts.

12. *Mabuya macularia* (Blyth), (Pl. IV, fig 6.)

*Euprepes macularius* Blyth, 1853, *J. Asiat. Soc. Bengal*, XXII. 652 (Type loc. : Rangpur, Bengal).

*Material* : Jabalpur district : 1 ex., Panagar village, 25.x.1960, Coll. P. Singh; 2 ex., Nagaghati, 22.xii.1961, Coll. R. C. Sharma; 1 ex., Gwarighat, 23. vii. 1962, Coll. S. Chakrapany; Shahdol dist.: 1 ex., Panchdhara, Amarkantak, 30.v.1962, Coll. P. Singh.

*Measurements of largest specimen* : Standard length, 70, Total length, 167.

*Remarks* : A pair of nuchals are present. A minute postnasal is present in some specimens. Ear opening is almost circular. Two young specimens are very dark while two including the largest are much paler. This colour variation does not appear to be due to season or age or to the action of preservative. There is also considerable variation in the distribution of spots and stripes (HQ. identification). Khajuria (in press) has given an account of its habits.

### 13. *Mabuya carinata* (Schneider)

*Scincus carinatus* Schneider, 1801, *Hist. Amphib. II* : 183,

*Material* : Jabalpur district : 1 ex., Garha, Jabalpur city, 16.xii.1960, Coll. P. Singh; 1 ex., Bargi village, 28.xii.1960, Coll. S. Chakrapany; 1 ex., 30 km. on Jabalpur-Nagpur road, 31.i.1961, Coll. R. C. Sharma.

*Measurements of largest specimen* : Standard length, 95; Total length, 172.

*Remarks* : In the lower eyelid no enlarged central scales can be distinguished. In the largest specimen one of the eye lid shows a circular spot. Ear opening is smaller than a middle lateral scale. Only few temporal scales are feebly keeled. No longitudinal streaks along the lateral margin of the scales can be distinguished. Frontoparietals are distinct. It is a common species.

### Family LACERTIDAE

#### 14. *Ophisops jerdoni* Blyth (Pl. IV, fig. 7.)

*Ophisops jerdonii* Blyth, 1853, *J. Asiat. Soc. Bengal*, XXII : 653 (Type loc.: Mhow, Indore).

*Material* : Jabalpur district: 1 ex., Katangi village, 15.vi.1966, Coll. H. S. Sharma.

*Measurements* : Standard length, 42, Total length, 125.

### Family VARANIDAE

#### 15. *Varanus bengalensis* (Daudin), (Pl. V, fig. 1.)

*Tupinambis bengalensis* Daudin, 1802, *Hist. Nat. Rept. III*: 67 (Type loc.: Bengal; Paris).

*Material* : Jabalpur district: 1 ex., Pachpedi, Jabalpur city, 30.iii.1960, Coll. D. P. Sanyal; 1 ex., Pachpedi, 14.vi.1961, *Purchased*; 1 ex., Pachpedi, 18.vi.1963, *purchased*; 1 ex., Ricchai village, 2.viii.1963, Coll. D. N. Basu; Hoshangabad district: 1 ex., Bijanwada village, 6.xii.1974, Coll. Haridas.

*Measurements of the largest specimen* : Standard length, 426, Total length, 960.

*Morphological and field notes* : The six specimens listed above represent a good series of age groups. There is a considerable variation in colour pattern. In the youngest the undersurface (chest, abdomen and anterior parts of the tail) are whitish with reddish tinge but the undersurface of head and neck is marked with loop-shaped dark bands which are bent in opposite direction from the middle of undersurface of head. On the dorsal side there are transverse rows of black bars separated by rings of white spots. In one of the older young specimen the pattern on the ventral side is more or less the same (though more dark spots on the throat are present), but on the dorsal sides the whole body is covered with irregularly shaped dark spots generally arranged in transverse rows particularly on the back where rows of such spots with whitish centre alternate with rows of dark spots. The underside is markedly yellowish with irregularly arranged dark spots. However, the underside of the head and neck is much darker. On the dorsal side of this specimen the spots are much lighter. In the adults also the intensity of spotting varies considerably, collections of very young ones in June shows that porturition appears to take place mostly in summer.

The stomach contents of two youngest specimens showed a lizard and some insects. The species is caught by villagers for its hide and also by some tribals for its meat. It is reported to be getting rare.

#### Family TYPHLOPIDAE

16. *Typhlops braminus* (Daudin), (Pl. V, fig. 3.)  
(Common blind snake; Brahming blind snake)

*Eryx braminus* Daudin, 1803, *Hist. Nat. Rept.*, VII : 279.

*Material* : Jabalpur district: 1 ex., Gwarighat, 19th July, Coll. H. P. Agrawal.

*Measurements* : Total length, 178, Tail length, 57.

*Scale counts* : 20 scales round the body; 292 transverse rows.

#### Family BOIDAE

17. *Python molurus* (Linnaeus), (Pl. IV, fig. 8.)  
(Indian Python : Rock Python)

*Coluber molurus* Linnaeus, 1758, *Syst. Nat.* 10th ed., p. 225. (Type loc. : India)

*Material*: Jabalpur dist. 1 ex., (exhibited), Jabalpur city, 8.ii.1965, purchased.

*Measurements* : Total length, 1480; Tail length, 186.

*Scale counts* : 67 scales round the body; V 251; C. 68.

*Remarks* : A number of important variations from the description given by Smith (1935) have been found in this specimen which on

account of its geographical distribution is referable to the nominate race *molurus* : (i) 6th and 7th superlabials are separated from the eye by suboculars an important character of *P. m. bivittatus*., (ii) instead of being pitted, posterior infralabials are prominently grooved (length of groove is 18 mm. on the right infralabial and 13 mm. on the left); (iii) there is a pit on 3rd supralabial; and (iv) there are 19 infralabials. Besides there are following other important variations (i) no longitudinal division on the frontal; (ii) mental groove in preserved specimen is 3 mm. wide; (iii) 3 infralabials pitted, (iv) anal is having a wide depression in the middle; (v) the dark spots on the border of the outermost row of scales on the ventral side irregularly disposed; (iv) there are several dark spots on the dorsal side with much paler portions in the middle. The species is very rare in unprotected areas and is extensively collected for its skin despite legal protection. Only young specimens were seen.

18. *Eryx conicus* (Schneider)  
(Russell's sand Boa)

*Boa conica* Schneider, 1801, *Hist-Amphib.*, II : 268 (type loc: Madras).

*Material* : Jabalpur Dist. 1 ex., immature, 1 ex., adult, Jabalpur city, 31.viii.1970, Coll. *D. K. Ghosal*. 1 ex., immature, Jabalpur city. 10.iv.1968, Coll. *purchased*.

*Measurements of largest specimen* : Total length, 713, Tail length 52.

*Scale counts* : Scales in 45 to 52 rows; V 169-185; C. 17-21.

*Remarks*: The outer scale rows on lower parts in the adult specimen are marked with black spots and not with brown only as recorded by Smith (1943). The variation in colour may be due to the action of preservative. The large amount of orange fat was found inside the adult specimen. The intestine showed numerous lumps of hairs and bones of small mammals possibly of rats, mice and shrews.

The adult female appears to be collected along with immature specimen as shown by the collection data. There does not appear to be any record of the description of the young of this species. The immature specimen which appears to have been collected with the adult female has been practically acquired the characters of the adult. Another immature specimen collected on 10th April and provisionally referred to this form is very different in colour pattern (plate 1 fig. 8). The colour is light brown on the dorsal side marked by black-edged irregular whitish spots. These spots originate from the ventral white surface on either side and encircle the dorsal surface mostly incompletely. 29 such bands can be distinguished. 6 of these have coalesced or practically so with the fellows of their opposite side on the dorsal surface, mostly towards the anterior portion. Many are, however, unpaired. If all the bands have coalesced with their fellows of opposite side, the result would have

been a series of whitish black-edged rings separated by about a centimeter of light-brown space. The tail on the dorsal surface and the snout is darker.

#### Family COLUBRIDAE

#### 19. *Elaphe helena* (Daudin), (Pl. IV, fig. 9.) (Trinket Snake)

*Coluber helena* Daudin, 1803, *Hist. Nat. Rept.*, VI : 277 (Type loc. : Vizagapatnam)

*Material* : Jabalpur dist. : 1 ex., adult unsexed (viscera removed), Jabalpur city, 10.viii.1962, purchased.

*Measurements* : Total length, 1322; Tail length, 212.

*Scale counts* : Midbody 25; V 247; C. 79; A.1

*Remarks* : Vertical stripe below the eye is indistinct. It is also not clearly visible in another specimen. Lower surface show with light blackish spots here and there anterior to vent. There are two longitudinal black stripes converging posteriorly on the neck are completely united anteriorly.

#### 20. *Ptyas mucosus* (Linn.) (Dhaman; Rat Snake)

*Colour mucosus* Linnaeus, 1758, *Syst. Nat.*, 10th Ed., P. 226 (type loc. : India).

*Material* : Jabalpur district: 1 ex., Pachpedi, Jabalpur 9.viii.1962, purchased. 1 ex., Pachpedi, Jabalpur, 30.vi.1967, Purchased; 1 ex., Pachpedi, Jabalpur, 30.vi.1967, purchased; 1 ex., Pachpedi, Jabalpur, 5.x.1967, Coll. M. L. Koshta; 1 ex., Pachpedi, Jabalpur, 1.viii.1970, Coll. Mohan; 1 ex., Pachpedi, Jabalpur, 10.xii.1970, purchased.

*Measurements of largest specimen* : Total length, 2438; Tail length, 650.

*Scale counts* : Midbody 18; V 197- 210; C. 116-127.

*Remarks* : In one of the young specimens there are five loreals on one side and four on the other side. In one of the larger specimens there are ten thick black bars encircling the ventral surface. In other specimens these black bars are more pronounced but not complete in the anterior and posterior ventral surface. In two young specimens the right and left halves of these bars fail to meet on the ventral side of the tail. In one young specimen the stomach content show a young gecko and in two others a part of the intestine showed blackish matter.

It is a very common species found in gardens and houses. It is very active during rains.

21. *Natrix stolata* (Linn.), (Pl. IV, fig. 10.)  
(Striped keel back)

*Coluber stolatus* Linn., 1758, *Syst. Nat.*, 10 Ed. P. 219.

*Material* : Jabalpur district : 2 ex., Mandla road, 10 km. from Jabalpur, 24.viii.1964, Coll. H. P. Agrawal; 1 ex., Panagar village, 19.vi.1968, Coll. H. P. Agrawal; 1 ex., Pachpedi, 12.viii. 1969, purchased.

*Measurements of largest specimen* : Total length, 578; Tail length, 132.

*Scale counts* : Scales in 19 rows: V. 162-183, C. 85-97.

*Remarks* : Smith (1943) has included this snake in his key p. 283, under category 3, with internasals broadly truncate anteriorly. However, under the same category, he includes this species with internasals much narrowed anteriorly. The constriction of frontals is distinct in our specimens. There are six supralabials, 3rd and 4th touching the eye. In three specimens out of four examined the black spots on the either side of the ventrals are distinct. The colour pattern is not clear because of action of preservative. However, one of the specimen without black spots on either side of the ventrals is more brightly tinge with much more distinct markings on the dorsal side and with yellowish white ventral surface. Dorsally white stripes in this specimen are marked with white spots which are more distinct anteriorly and the black stripes are marked with black spots which also fade away posteriorly. In other specimens this pattern is fainter. It is a common species.

22. *Natrix piscator* (Schneider)  
(Checkered keelback)

*Hydrus piscator* Schneider, 1799, *Hist. Amphe*, I : 247 (Type loc. : East Indies).

*Material* : Jabalpur dist.: 1 ex., adult, Jabalpur city, 5.viii.1963, purchased; 1 ex., adult, Gosalpur (Jabalpur distt., M. P.), 10.i.1968, Coll. H. S. Sharma, Indore dist.: 1 ex., adult, Choral, 5.xi.1969, Coll. H. Khajuria. Khargone dist.: 1 ex., left bank of Narbada river, 13.ii.1971, Coll. V V. Rao.

*Measurements of largest specimen* : Total length, 2422; Tail length, 275.

*Scale counts* : Scales in 19 rows; V. 144-152; C. 66-86.

*Remarks* : In the larger specimen the colour is much paler and the dark spots on the dorsal side are conspicuous. The rows of dark spots and their form and size is very variable. On the dorsal surface of the tail of the larger specimen the black spots are in the form of crescents while in case of another slightly smaller specimen they are practically absent on the tail posteriorly. In the smallest specimen provision-

ally referred to this form, the colour pattern is very different. On the dorsal surface, it is practically black with two rows of white spots, and a couple of lateral rows of black spots but the tail is free from these spots. Also the tail is comparatively longer, possibly the difference in colour pattern is related to age. Intestine of one of the specimen contained two toads (*Bufo* sp.) while in another the body cavity was full with large number of orange yellow masses of fat.

Family ELAPIDAE

23. *Naja naja* (Linn.) (Pl. V, figs, 4 and 5.)  
(Indian cobra)

*Coluber naja* Linn., 1758, *Syst. Nat.* 10th ed., p. 221.

*Material* : Jabalpur district: 1 adult, Jabalpur city. 18.vii.1967, purchased; 1 adult, Jabalpur city, 23.x.1962, purchased.

*Measurements of largest specimen* : Total length, 1087; Tail length, 220.

*Scale counts* : Head 22, 23; Midbody 19 to 22; V. 176 to 195; C. 60-62.

*Remarks* : Two black spots on the left side of the hood are present. The black cross bars on the belly behind the hood are indistinct but spectacle mark on the hood is distinct. In larger specimen, Reg. No. V 2726, the markings on the hood on the dorsal side are absent. Colour of preserved specimens is yellowish brown. Stomach contents of this specimen showed bones and remains of beetles and those of another a large toad. It is a common species.

24. *Bungarus caeruleus* (Schneider)  
(Common Indian Krait)

*Pseudoboa caeruleus* Schneider, 1801, *Hist. Amphib.*, II : 284.

*Material* : Jabalpur dist.: 1 ex., adult, Jabalpur city, 19.ix.1970, purchased; 1 ex., Jabalpur city 2.iv.1974, Coll. S. K. Misra.

*Measurements of largest specimen* : Total length, 870; Tail length, 115.

*Scale counts* : Mid body 15; V. 209-224; C. 51-63.

*Remarks*: There is no white preocular spot in both the specimens. In the younger specimen in the anterior one fourth of the body there are large whiter spots on the white ventral side on either side. In between each pair of white spots on the dorsal side there is a smaller white spot. In the posterior region the larger white spots break up into pairs of bars which completely encircle the body. In the older specimen the pairs of bars are visible only in the posterior region. In the anterior region their

presence is indicated by white mid dorsal spots which are either in pairs or in the form of coalesced pairs more or less forming a bar. In one case there are three spots instead of two. The older specimen has been collected in the act of swallowing a large toad (*Bufo* sp.) at least two and half times broader than its body. Only one of the hind leg of the toad have been swallowed. An interesting point to be noted is that the part of the leg of the toad which is inside the snake lacks both bones and muscles with skin intact.

#### Family VIPERIDAE

#### 25. *Vipera russelli* (Shaw), (Pl. IV, fig. 11) (Russell's viper; Daboia; Tic-Polonga)

*Coluber russelli* Shaw, 1797, *Nat. Misc.*, VIII, Pl. 291.

*Material* : Jabalpur dist.: 1 ex., adult, Jabalpur city, 24.xi.1967, purchased.

*Measurements* : Total length, 1265; Tail, 280.

*Scale counts* : Scales in 28 rows, V 165; C. 58.

*Remarks* : The ventral side is yellowish-white much lighter on the tail. Very few (only 4) semilunar markings are confined to the anterior most part of the body. There is, however, a number of larger black spots on the lateral side above the ventral scales but not on the tail region. Also there are three blackish large areas on the ventral side. The ventral side of the lower jaw is marked with numerous small black spots in this specimen. There are black spots on the sides of upper jaw also. The markings on the head are indistinct but a pair of curved black streaks can be recognised in the parietal region. The stomach contents of the specimen show some unidentifiable blackish matter and a young house shrew (*Suncus murinus* Linn.) in its intestine. The anterior part of the skull of the shrew was found missing. It is very rare.

#### REFERENCES

- AGRAWAL, H. P. 1970. On a collection of snakes from Jabalpur (Reptilia : Ophidia). *J. zool. Soc. India*, 22 (1 & 2) : 41-46.
- CHOPRA, R. N. 1964. Observations on the egg laying of the fanthroated lizard, (*Sitana ponticeriana* Cuv.) *J. Bombay nat. Hist. Soc.*, 61 : 170-191.
- KHAJURIA, H. (in press). Notes on some common Central Indian lizards.
- SMITH, M. A. 1931. *Fauna of British India, including Ceylon and Burma. Reptilia and Amphibia*, 1, Loricata, Testudines, XXVII + 185 pp., 2 pls., 1 map. London (Taylor and Francis).

- SMITH, M. A. 1935. *Fauna of British India, including Ceylon and Burma. Reptilia and Amphibia, 2, Sauria, XIII + 440 pp., 1 pl., 2 maps.* London (Taylor and Francis).
- SMITH, M. A. 1943. *Fauna of British India, including Ceylon and Burma. Reptilia and Amphibia, 3, Serpentes, xii + 583 pp., 1 map.* London (Taylor and Francis).
- SHARMA, R. C. 1974. The reptile fauna of the Nagarjunsagar Dam area (Andhra Pradesh, India). *Rec. zool. Surv. India, 63 : 77-93.*
- TIWARI, K. K. AND SHARMA, R. C. 1970. Reptiles of Western Maharashtra. *J. zool. Soc. India, 22 : 101-115.*

ON A NEW SPECIES OF THE GENUS  
*OLIGACANTHORHYNCHUS*  
TRAVASSOS, 1915 (ACANTHOCEPHALA  
OLIGACANTHORHYNCHIDAE) FROM INDIA

By

VASANTHA RENGARAJU AND E. N. DAS

*Department of Zoology, Sholapur College, Sholapur.*

(With one Text-figure)

INTRODUCTION

Three juvenile specimens were found encysted on the mesentery of a *Ptyas mucosus* and these, when freed and closely examined, were found to represent a new species of the genus *Oligacanthorhynchus* which is being reported for the first time from India. The blades of the hooks were grossly attenuated presumably due to the prolonged encystment in the paratenic host. It is common with the *Acanthocephalan* juveniles that the hooks degenerate first of all if the paratenic host is not taken up by the final host for a long time. However, from the presence of the basal parts of the hooks with their powerful roots and large anterior manubria, it is evident that the hooks were present. On the other hand it could never be that the hooks were in the stages of growth in the fully metamorphosed juvenile. Van Cleave (1937) states that by the time the larvae get fully metamorphosed into juveniles, they possess the definitive number, shape and size of hooks. Das, (1952, 1953, 1957) observed that in the developmental stages of certain *Palaeacanthocephalan* species, hooks and spines appear first and foremost during the course of morphogenesis and attain their shape and size by the time the metamorphosis is complete.

SYSTEMATIC ACCOUNT

*Oligacanthorhynchus indicus*, sp. n.

(Text-fig. 1)

*Material and methods:* Three ♀♀ juveniles. One was treated with lactophenol and preserved. The proboscis of the other was pressed under the cover slip for a close examination of the structure of the hooks

and their roots, the remaining part of its body was sectioned to observe the structure of the proboscis receptacle. The third with retracted proboscis was dissected to confirm certain observations.

*Diagnosis* : Globular proboscis, hooks subequal, 3 spiral rows of 6-8 hooks each.

*Description* : The female juvenile 5.75 mm. long; narrow anteriorly (0.95 mm. wide), broad posteriorly (1.60 mm. wide); surface wrinkled. Proboscis 0.80 × 0.79 mm. Hooks with large anterior manubria and powerful roots, roots of anterior hooks larger than those of posterior hooks, the largest root with manubrium 0.55 × 0.18 mm. Non-spinose region of proboscis 0.25 × 0.45 mm. Proboscis receptacle 1.0 × 0.75 with thick muscular wall. Lemnisci filiform, looped, posteriorly tapering, each about 5.1 mm. long, provided with a few giant nuclei, each about 100 microns in diameter.

*Discussion* : The description of the juveniles conform to the diagnostic characters of the genus *Oligacanthorhynchus*, cited by Yamaguti (1963) and revised by Schmidt (1972), consequently the juveniles belong to the family Oligacanthorhynchidae. This species can be separated (Table 1) from other *Oligacanthorhynchus* species recorded by Yamaguti (1963).

Table 1. — Number of rows and hooks in species of *Oligacanthorhynchus*

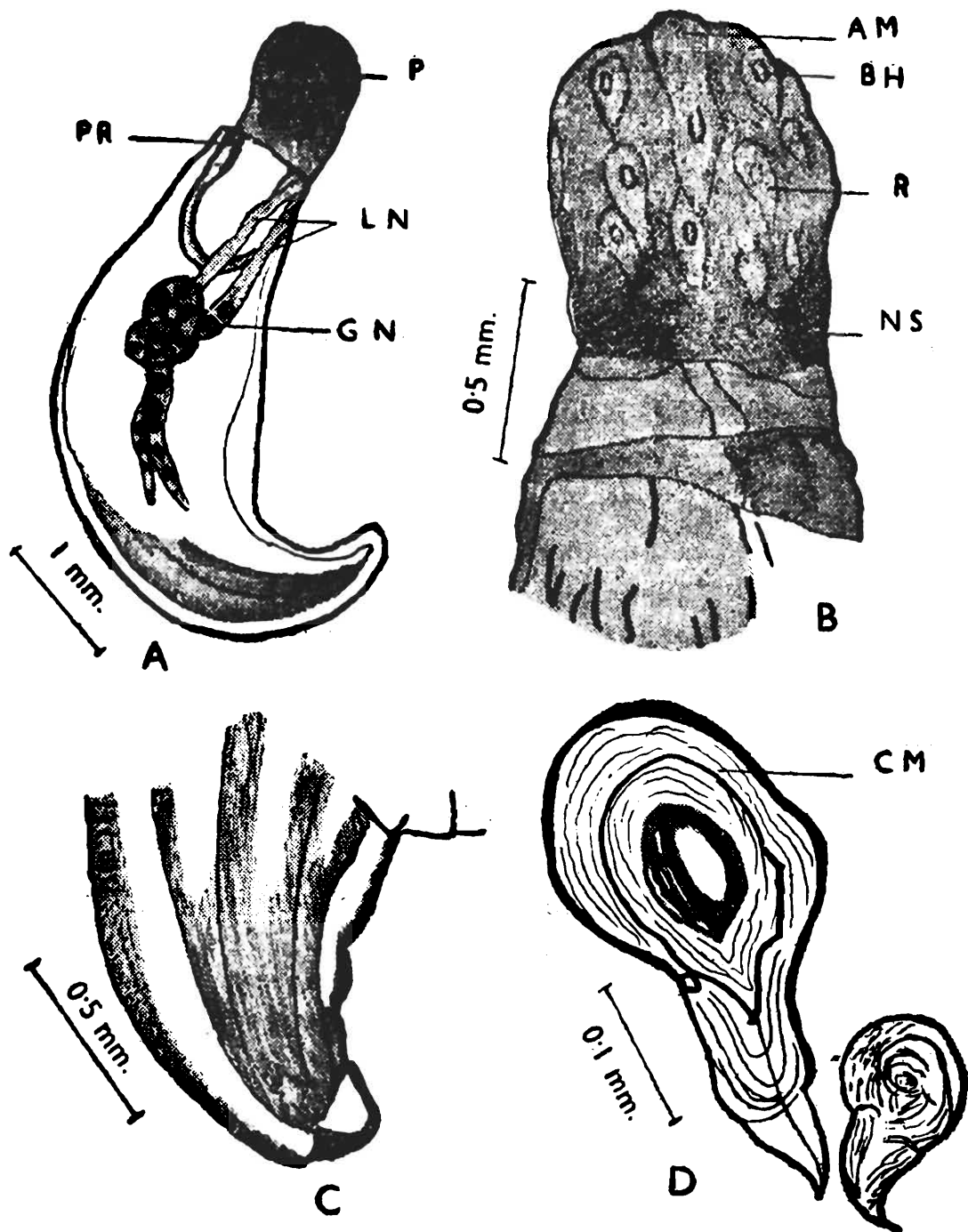
Species	No. of hooks
1. <i>O. compressus</i> (Rudolphi, 1802)	6 7 transverse rows
2. <i>O. iheringi</i> Travassos, 1917	6 spiral rows of 3 each
3. <i>O. lagaenaeformis</i> (Westrumb, 1821)	5 - 6 spiral rows
4. <i>O. oligacanthus</i> Rudolphi, 1819	6 × 2-4
5. <i>O. manifestus</i> (Leidy, 1851)	—————
6. <i>O. ricinoides</i> Rudolphi, 1808	12 × 3
7. <i>O. taenoides</i> Diesing, 1851	6 spiral rows of 3 each
8. <i>O. thumbi</i> Haffner, 1939	6 × 6
9. <i>O. indicus</i> , sp. n.	3 spiral rows of 6-8 hooks each; roots sub-equal

*O. indicus*, sp. n. differs from all other known species of the genus in having 3 spiral rows of 6-8 hooks each. This is also the first record of the occurrence of a species belonging to *Oligacanthorhynchus* in India.

*Type-specimen* : Holotype: (♀) deposited in the collection of the Department of Zoology, Vidharba Mahavidyalaya, Amravati. Registered No. A O/I, mounted on a slide.

*Type-locality* : Amravati, Maharashtra, INDIA.

*Type-host* : *Ptyas mucosus*



Text-fig.1. — *Oligacanthorhynchus indicus*, sp. nov.

A — Female juvenile; B — Proboscis enlarged; C — Posterior part of the ♀ juvenile; D — Basal part of a hook with root and anterior manubrium.

*AM* — anterior manubrium; *BH* — basal part of the attenuated hook; *CM* — concentric muscles embedding the manubrium and the root; *GN* — giant nuclei; *LN* — lemnisci; *NS* — non-spinose region of the proboscis; *P* — proboscis; *PR* — proboscis receptacle; *R* — root.

ACKNOWLEDGEMENT

The authors express their gratitude to Sholapur Science College, for providing necessary laboratory facilities.

## SUMMARY

A new species of the Acanthocephalan parasite *Oligacanthorhynchus indicus* (family Oligacanthorhynchidae) is described. Through this species, the genus *Oligacanthorhynchus* is recorded for the first time in India.

## REFERENCES

- DAS, E. N. 1952. On some interesting larval stages of an acanthocephalan, *Centrorhynchus batrachus* sp. nov. from the frog, *Rana tigrina* (Daud) from India. *Rec. Indian Mus.*, 50(2) : 147-156.
- DAS, E. N. 1953. On some interesting larval stages in the life-history of a new species of the acanthocephalan genus *Arhythmorhynchus* from the frog, *Rana tigrina* (Daud) from India. *Rec. Indian Mus.*, 51(1) : 39-50.
- DAS, E. N. 1957. Les stades larvaires de *Centrorhynchus falconis* Das, 1950. *Annls. Parasit. hum. comp.*, 32(1-2) : 71-82.
- SCHMIDT, G. D. 1972. Revision of the Class Archiacanthocephala Meyer 1931, (Phylum Acanthocephala), with emphasis on Oligacanthorhynchidae Southwell et Macfie, 1925. *J. Parasit.*, 58 (2) : 290-297.
- VAN CLEAVE, H. J. 1937. Developmental stages in Acanthocephalan life-histories. *Rabot. Gelmint. let K. I. Skrjabin, Moscow*, pp. 739-743.
- YAMAGUTI, S. 1963. Acanthocephala. *Systema Helminthum*, 5 : 423 pp. Inter-science Publ., John Wiley, N. Y. & Lond.

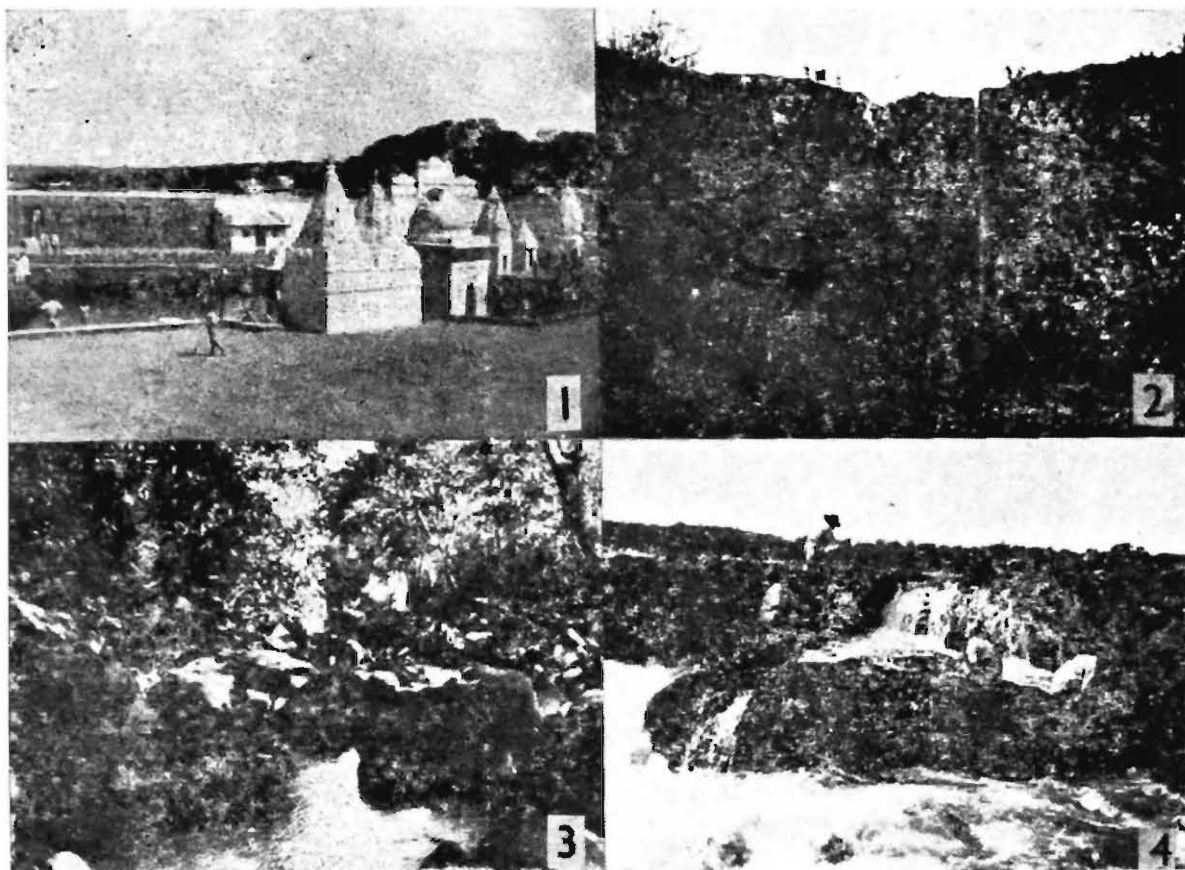
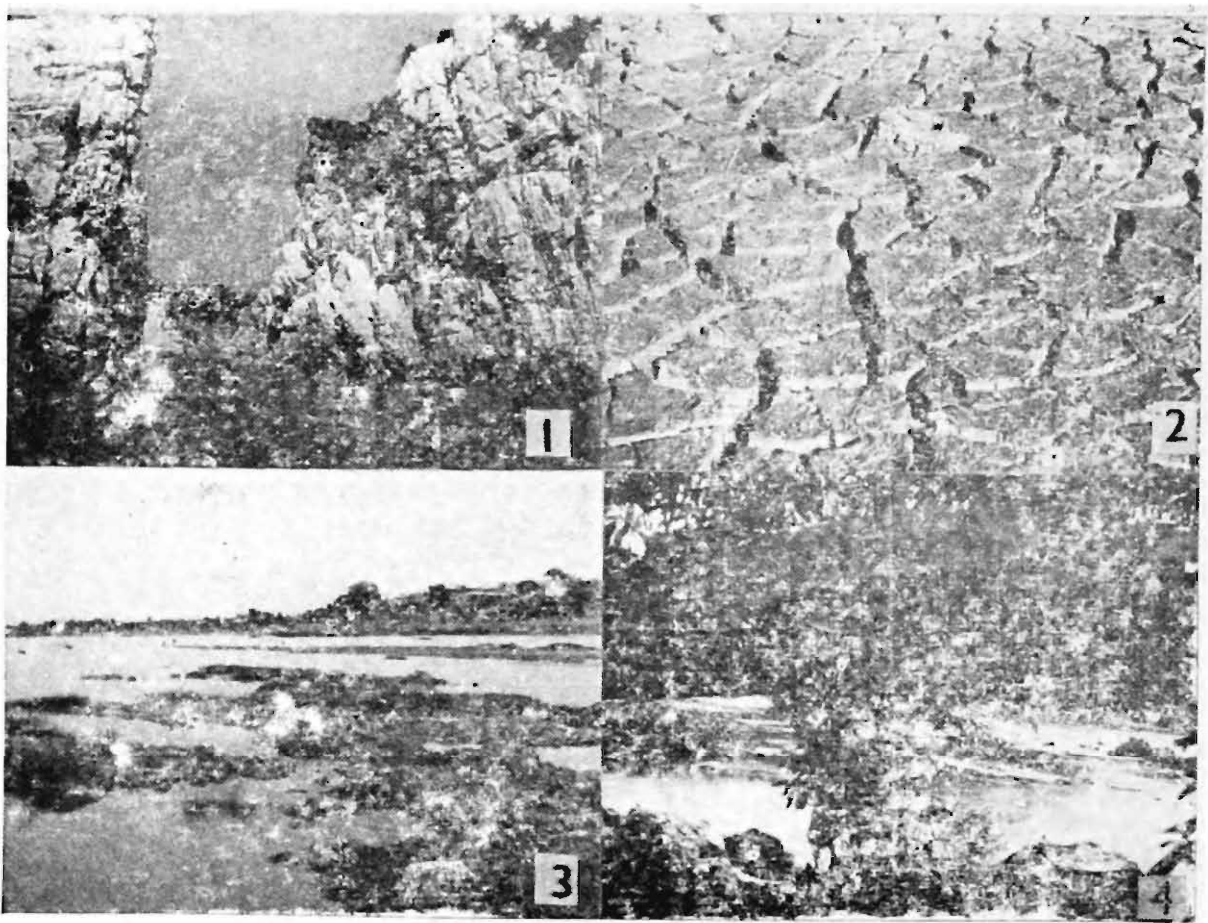


Fig. 1, Amarkantak, showing the origin of the Narbada; Figs. 2, 3. The first two waterfalls of the Narbada; Fig. 4, Shahastradhara waterfall near Mandla town.

**KHAJURIA & AGARWAL**

**PLATE II**



**Fig. 1.** Narbada river flowing through marble rocks. **Fig. 2.** cracked Narbada alluvium; **Figs. 3 & 4,** rocky and sandy islands in the bed of the Narbada.

KHAJURIA & AGARWAL

PLATE III

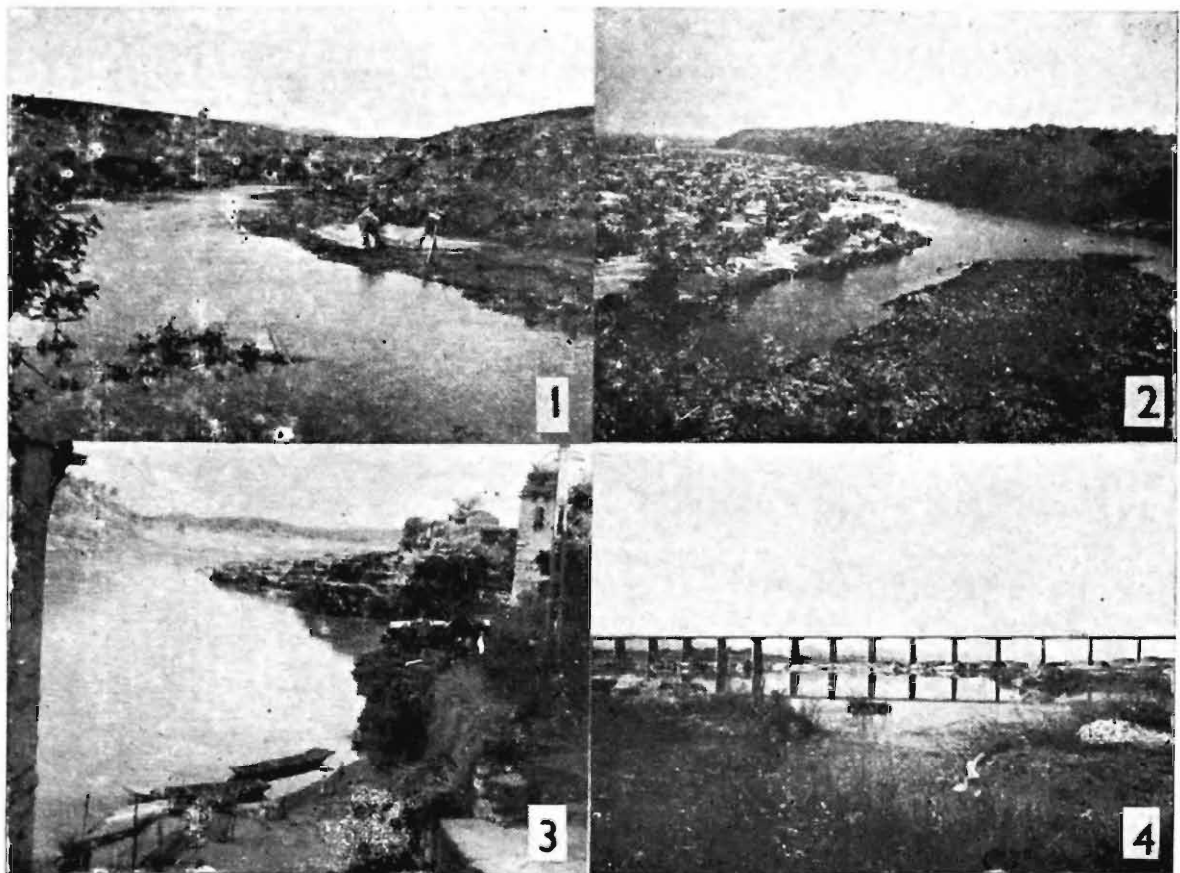
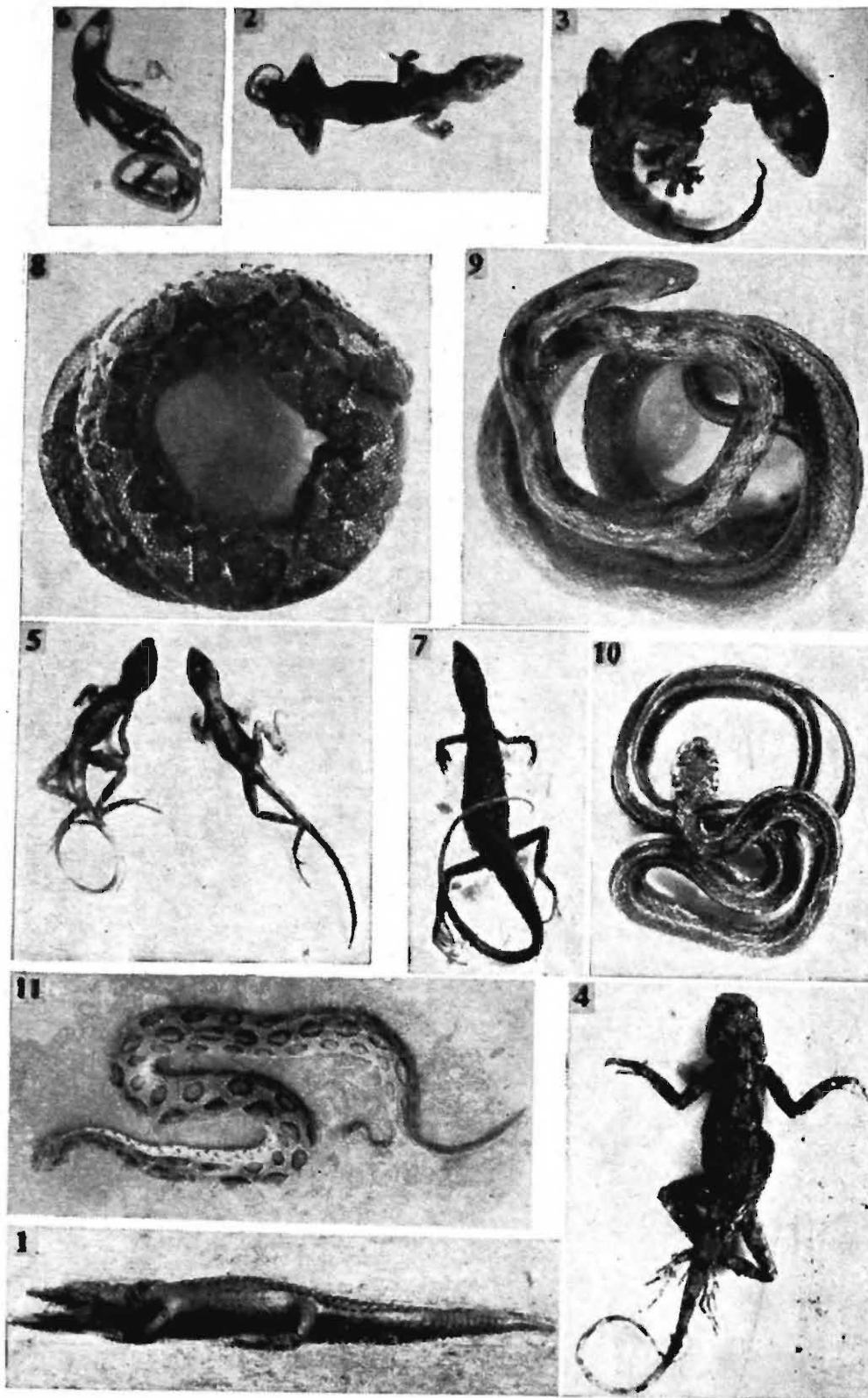
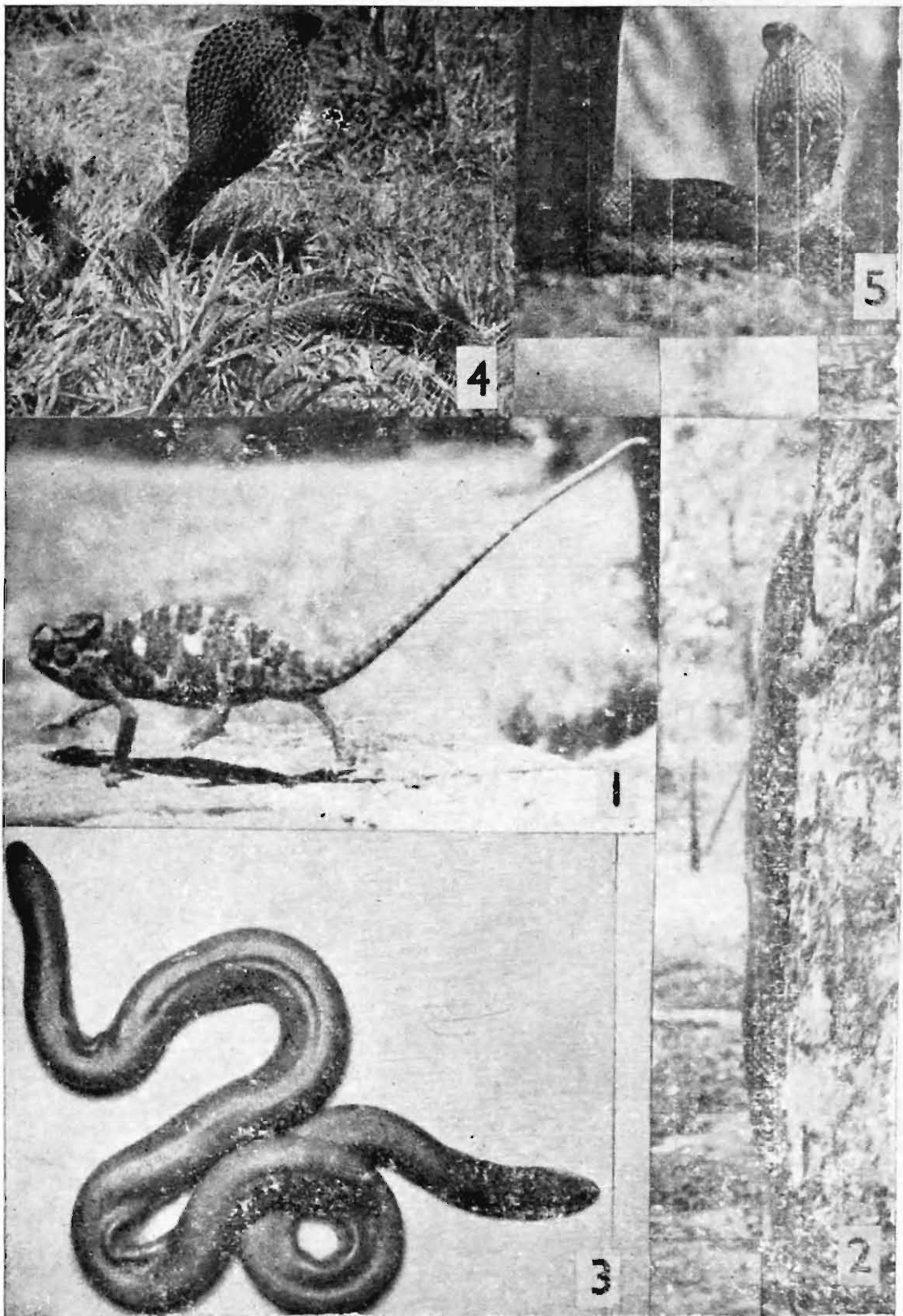


Fig. 1, collection in progress in Narbada river; Fig. 2, forested hills on the banks of the river, Fig. 3 a temple on the river; Fig. 4, one of the numerous bridges on the river



1 — *Crocodilus palustris* Lesson; 2 — *Hemitadactylus leschenaulti* Dum. & Bibr.; 3 — *H. flaviviridis* Ruppell; 4 — *Psammophilus blanfordanus* (Stoliczka); 5 — *Sitana ponticeriana* Cuvier; 6 — *Mabuya macularia* (Blyth); 7 — *Ophisop jerdoni* Blyth; 8 — *Eryx conicus* (Schneider); 9 — *Elaphe helena* (Daudin); 10 — *Natrix stolata* (Linn.); 11 — *Vipera russelli* (Shaw).



Photographs of living specimens. 1 *Chamaeleon zelanicus* Laurenti; 2—*Varanus benghlensis* (Dauhin); 3—*Typhlops bramini* (Daudin); 4 & 5—*Naja naja* (Linn.) showing absence and presence of hood markings.

## CHRYSOMELIDAE (COLEOPTERA) OF TRIPURA (INDIA)

By

C. R. BASU, A. R. BHAUMIK AND T. SENGUPTA

*Zoological Survey of India, Calcutta.*

(With two Text-figures)

Chrysomelidae comprises small to medium sized beetles, ranging from about 1 mm to 20 mm long, usually live on foliage and are commonly known as leaf beetles. Shape various, usually elongated cylindrical to flat and oval and generally brightly coloured. To agriculturists this family is very destructive, to the collectors it is very interesting and to the systematists it is very difficult. Both adults and larvae are phytophagous, usually feed on root, stems, leaves of herbaceous plant and mine the leaves of woody plant.

Chrysomelidae is one of the largest families of Coleoptera. Jacoby (1908) and Maulik (1919, 1926, 1936) dealt this family extensively from Indian subregion where they included 2101 species. Published reports show that nobody has ever made any record of Chrysomelidae from Tripura. The present report is chiefly based on the collection of 518 examples made by V. C. Agrawal and M. S. Shishodia from the Zoological Survey of India during 1969-74. The collection comprises 25 species spread over 12 genera under 6 subfamilies. All the species dealt here are being recorded for the first time from Tripura and in addition to these, two species of the genera *Longitarsus* Latreille and *Phyllotreta* Stephens are described as new to science.

### LIST OF SPECIES

#### Subfamily CRIOCERINAE

1. *Lema* sp. nr. *lacertosa* Lacordaire

#### Subfamily EUMOLPINAE

2. *Pagria kanaraensis* (Jacoby)

#### Subfamily GALERUCINAE

3. *Hoplasoma nilgiriensis* Jacoby
4. *Hoplasoma unicolor* (Illiger)

5. *Aulacophora foveicollis* (Lucas)
6. *Aulacophora frontalis* Baly
7. *Monolepta* sp. nr. *signata* (Olivier)
8. *Monolepta lineata* Weise
9. *Monolepta signata* (Olivier)

Subfamily ALTICINAE

10. *Chaetocnema* (*Tlanoma*) *basalis* Baly
11. *Chaetocnema* (*Tlanoma*) *indica* Jacoby
12. *Chaetocnema* (*Tlanoma*) *longipunctata* Maulik
13. *Chaetocnema* (*Chaetocnema*) *concinnipennis* Baly
14. *Chaetocnema* (*Chaetocnema*) *cognata* Baly
15. *Longitarsus indicus* sp. nov.
16. *Longitarsus belgaumensis* Jacoby
17. *Longitarsus* sp. nr. *pandura* Maulik
18. *Luperomorpha vittata* Duvivier
19. *Phyllotreta striolata* (Fabricius)
20. *Phyllotreta chotanica* Duvivier
21. *Phyllotreta tripuraensis* sp. nov.

Subfamily HISPINAE

22. *Rhadinosa laghua* Maulik
23. *Dicladispa armigera* (Olivier)

Subfamily CASSIDINAE

24. *Cassida* (*Taiwania*) *circumdata* Herbst
25. *Cassida* sp. nr. *conspurcata* Boheman

Subfamily CRIOCERINAE

This is a small subfamily of Chrysomelidae. Jacoby (1908) included 146 species under 7 genera from Indian subregion. The representative of this subfamily are distinguished by the following characters.

General appearance more or less elongate and size small to medium. Head often constricted behind eyes, antennal insertions widely separated and placed in front of eyes, antennae filiform and often stout. Prothorax subcylindrical or quadrate, lateral sides often constricted at middle and without distinct margin. Elytra usually with regular rows of punctures. Tarsal claws free or joined at base and rarely bifid or appendiculate.

Genus *Lema* Fabricius

*Lema* Fabricius, 1798, *Ent. Syst. Suppl.* : 90 (Type : *L. cyanea* Fabricius from India); Jacoby, 1908, *Fauna British India*, Coleoptera, Chrysomelidae, 1 : 15-71; Gressitt & Kimoto, 1961, *Pac. Ins. Mon.* 1A : 64-75.

This is the largest genus of Criocerinae. Jacoby (1908) included 116 species from Indian subregion. In the present study one species of

the genus *Lema* is recorded from Tripura. The representatives of this genus can be separated from the other genera by their head being constricted posteriorly, lateral sides of prothorax not tuberculate and tarsal claws joined at base.

#### 1. *Lema* sp. near *L. lacertosa* Lacordaire

*Material examined* : 1 ex., Chailengta, 22.xii.1972, V C. Agrawal, (Z. S. I. Coll.).

The specimen studied here is similar to *L. lacertosa* Lacordaire but differs from the latter by its antennae being black and pronotum with a few punctures.

General appearance elongated, reddish brown; antennae, labrum, sterna, posterior two pairs of legs and the tarsi of front legs black. punctures strong. Antennae long and stout. Elytral punctures strong and arranged in rows.

#### Subfamily EUMOLPINAE

This is a large subfamily, includes small to medium size, oblong, convex and brilliantly coloured beetles. Jacoby (1908) included 438 species under 51 genera from Indian subregion. The chief distinguishing characters of this subfamily are:

Head somewhat reflexed, deeply inserted into the prothorax and not usually visible from above, eyes moderately large, antennae long filiform and their insertions widely separated. Prothorax usually subglobular. Elytra often with metallic lustre, having distinct humeral angles and usually clothed with pubescence or scales.

#### Genus *Pagria* Lefevre

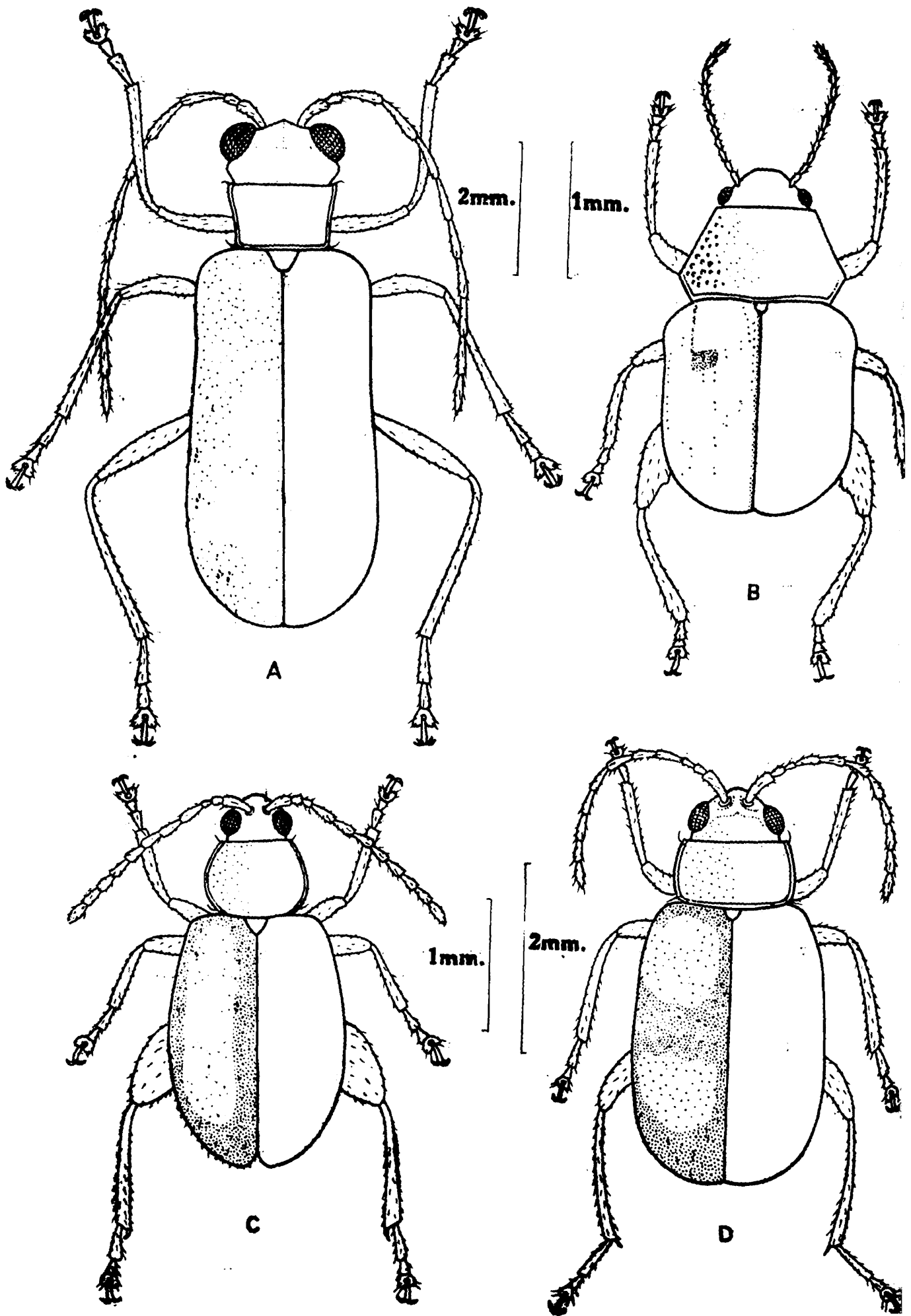
*Pagria* Lefevre, 1884, *Bull. Soc. ent. France* : 67 (Type : *P. suturalis* Lefev. from Africa); Jacoby, 1908, *Fauna British India*, Coleoptera, Chrysomelidae, 1 : 356-361.

Jacoby (1908) included 11 species from Indian subregion. In the present study one species of *Pagria* is recorded from Tripura. The representatives of this genus are characterised by the following characters:

General appearance small, ovate and convex; lateral sides of prothorax angulated at middle, femora with a small median tooth and hind tibiae emarginate apically.

#### 2. *Pagria kanaraensis* (Jacoby) (Text-Fig. 1 B)

*Nodostoma kanaraensis* Jacoby, 1895, *Ann. Soc. ent. Belg.*, 39 : 279. *Pagria kanaraensis* : Jacoby, 1908, *Fauna British India*, Coleoptera, Chrysomelidae, 1 : 360.



Text-fig. 1. Dorsal views, A. *Hoplasoma unicolor* (Illiger), B. *Pagria kanaraensis* (Jacoby), C. *Luperomorpha vittata* Duvivier, D. *Monolepta signata* (Olivier),

*Material examined* : 8 exs., Garjee, 1.xii.1969; 13 exs., Perathia, 30.xi.1969; 11 exs., Abhoya (Barpathari), 4.xii.1969; 1 ex., Abhoya Rest House, 10.xii.1969; 2 exs., Chailengta, 21.xii.1972, all collected by V. C. Agrawal, (Z. S. I. Coll.).

*Distribution* : India: Tripura, Maharashtra and Karnataka.

*Remarks* : So far, this species was recorded from southern India, in the present study this is being recorded for the first time from North East India (Tripura).

This species is near *P. signata* Motschulsky and can be easily separated from the latter species by its pronotum with distinctly golden green lustre and its front margin brownish yellow, basal part of elytra slightly raised, and punctured, and humeral callus impunctate.

General appearance small (2.00 mm) and oblong; head and pronotum black, elytra yellowish brown, its sutural margins, lateral margins and a small spot within basal depression black. Dorsal surface deeply punctured, those of elytra black and arranged in rows.

#### Subfamily GALERUCINAE

This is a large subfamily, members of which live exclusively on foliage. Maulik (1936) included 440 species under 90 genera from the Indian subregion. The representatives of this subfamily can be easily separated from the others by the following characters:

Shape usually oval or oblong; size highly variable, usually dull brown, sometimes shining black and blue or spotted. Head exposed, antennae long, slender and their insertions closely situated. Pronotum usually with distinct lateral margins, front coxae conical and contiguous. Hind femora usually slender and unlike alticinae when thickened without the jumping organ.

#### Genus *Hoplasoma* Jacoby

*Hoplasoma* Jacoby, 1884, *Notes Leyden Mus.*, 6 : 233 (Type : *H. apicalis* Jacoby from Celebes); Maulik, 1936, *Fauna British India*, Coleoptera, Chrysomelidae (Galerucinae): 151-167; Gressitt & Kimoto, 1963, *Pac. Ins. Mon.*, 1B:497-499.

This is a small genus, and Maulik (1936) included 7 species from the Indian subregion. In the present study 2 species of *Hoplasoma* are recorded from Tripura. The representatives of this genus are characterised by their shape being oblong, narrow and almost parallel-sided; prothorax markedly narrower than the base of elytra, dorsal surface shiny, elytra more or less confusedly punctured; antennae long and slender with two basal segments smooth.

### 3. *Hoplasoma nilgiriensis* Jacoby

*Hoplasoma nilgiriensis* Jacoby, 1904, *Ann. Soc., ent. Belg.*, 48 : 396; Maulik, 1936, *Fauna British India*, Coleoptera, Chrysomelidae (Galerucinae): 160-161.

*Material examined* : 1 ex., Chandmari, Agartala, 10.xi.1969, V C. Agrawal, (Z. S. I. Coll.).

*Distribution* : India: Tripura and Tamil Nadu.

*Remarks* : This species was so far known only from southern India, in the present study this is being recorded for the first time from North East India (Tripura).

This species is near *H. unicolor* (Illiger) but can be easily separated from the latter species by its abdominal process in male being short and flat, sloping apical surface of last visible abdominal sternite depressed and with a prominent median elevation; in female last visible sternite without a cavity near apex.

General appearance oblong, narrow and almost parallel-sided. Dorsal surface shining yellowish brown, antennae long and slender, head and pronotum shiny and impunctate, elytra finely and confusedly punctured.

### 4. *Hoplasoma unicolor* (Illiger) (Text-fig. 1 A)

*Galleruca unicolor* Illiger, 1800, In Weidem., *Arch. fuer Zool. u. Zoot.*, 1(2) : 135.

*Hoplasoma unicolor* : Allard, (1888), *Ann. Soc. ent. France*, (6) 8 : 327; Maulik, 1936, *Fauna British India*. Coleoptera, Chrysomelidae (Galerucinae) : 161-167; Gressitt & Kimoto, 1963, *Pac. Ins. Mon.*, 1B : 499.

*Material examined* : 1 ex., Chailengta, 20.xii.1972; 1 ex., Platian Centre F. R. H., 22.xi.1969; 1 ex., Agartala Charilom, 16.xi.1969, all collected by V. C. Agrawal, (Z. S. I. Coll.).

*Distribution* : India : Tripura, Arunachal Pradesh, Assam, Sikkim, West Bengal, Orissa, Bihar, Uttar Pradesh, Maharashtra, Karnataka, Kerala, Tamil Nadu and Andaman Islands.

This species is near *H. nilgiriensis* Jacoby but can be easily separated from the latter species in having its abdominal process of male long and rounded, sloping surface of last visible abdominal sternite not depressed and with a slightly prominent median elevation; in female, last visible sternite with a cavity near apex.

General appearance oblong, narrow and almost parallel-sided, dorsal surface shining yellowish brown and eyes black. Head and pronotum smooth and impunctate, elytra finely and confusedly punctured.

Genus *Aulacophora* Chevrolat

*Aulacophora* Chevrolat, 1842, In d'Orbigny, *Dict. Univ. Hist. Nat.* 2 : 337 (Type, *Galleruca quadraria* Oliver from Java; Maulik, 1936, *Fauna British India* Coleoptera, Chrysomelidae (Galerucinae):167-198; Gressitt & Kimoto, 1963, *Pac. Ins. Mon.* 1B : 482-490.

Maulik (1936) included 25 species from the Indian subregion. In the present study 2 species of *Aulacophora* are recorded from Tripura. The representatives of this genus can be easily separated from others by the following characters: Oblong, somewhat broadened posteriorly. Colour varies from yellowish brown to black and decorated with black spots or bands. Pronotum broader than long, epipleura abbreviated and incomplete.

5. *Aulacophora foveicollis* (Lucas)  
(Text-Fig. 2 D)

*Galeruca foveicollis* Lucas, 1849, *Explor. Alger. Ent.* : 542, pl. 44, f. 9, ♂  
*Aulacophora foveicollis* : Baly, 1879, *Cist. Ent.*, 2 : 445; Maulik, 1936, *Fauna British India*, Coleoptera, Chrysomelidae (Galerucinae) : 173-176.

*Material examined* : 1 ex., Fatik Roy (Kumarghat), 25.xii. 1972, V C. Agrawal, (Z. S. I. Coll.)

*Distribution* : India : Tripura, Assam, Bihar, Orissa, Uttar-Pradesh, Punjab, Maharashtra, Gujarat, Tamil Nadu and Andaman Islands.

This species is near *A. cornuta* Baly but can be separated from the latter species by its elytra being shiny, form smaller (6.75 mm.), and in male humerus covered with erect hairs.

General appearance oblong, moderately large size (6-7 mm), dorsal surface orange-red to brown and shiny. Eyes black and strongly convex, antennae moderately long and slender, head impunctate, pronotum and elytra minutely and confusedly punctured.

6. *Aulacophora frontalis* Baly

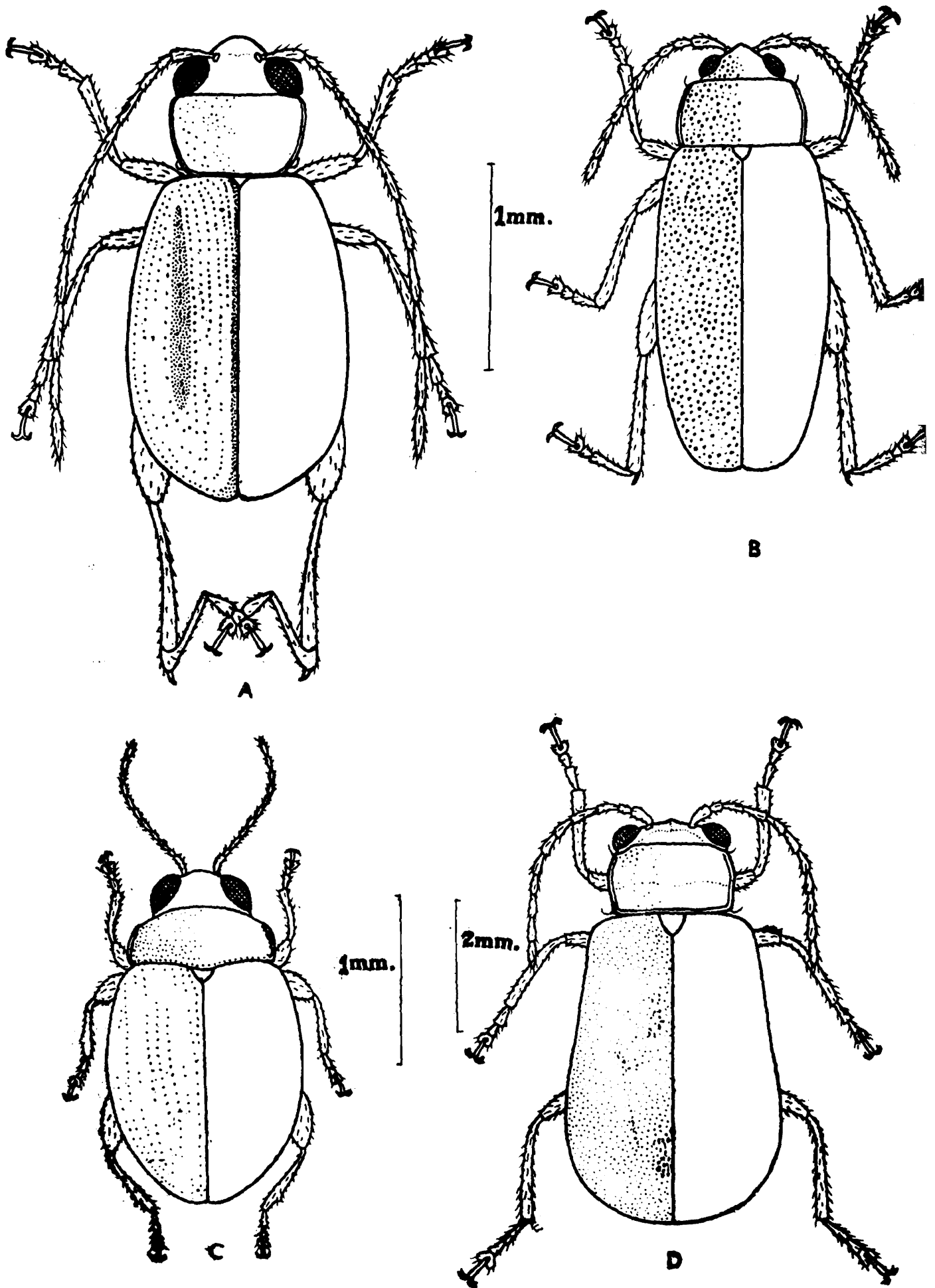
*Aulacophora frontalis* Baly, 1888, *Journ. linn. Soc. Lond.*, 20 : 176 & 181; Maulik 1936, *Fauna British India*, Coleoptera, Chrysomelidae (Galerucinae) : 183-184; Gressitt & Kimoto, 1963, *Pac. Ins. Mon.*, 1B : 487-488.

*Material examined* : 1 ex., Fatik Roy (Kumarghat), 25.xii.1972, V C. Agrawal, (Z. S. I. Coll.)

*Distribution* : India : Tripura, Maharashtra and Karnataka.

*Remarks* : This species was so far recorded from Southern India and in the present study it is recorded for the first time from North East India (Tripura).

This species is near *A. jacobyi* Weise but can be easily separated from the latter species by its antennal segments 3 being longer than segment 4, and in male, gular region of head excavated.



Text-fig. 2. Dorsal views, A. *Longitarsus indicus* sp. nov., B. *Phyllotreta tripuraensis* sp. nov., C. *Chaetocnema (Tianomo) basalis* Baly, D. *Aulacophora foveicollis* (Lucas)

General appearance oblong, moderately large (5.75 mm) head, antennae and pronotum brown elytra black. Antennae moderately long, segments 3-5 strongly thickened and dilated, vertex of head impunctate, pronotum and elytra finely and confusedly punctured.

### Genus *Monolepta* Erichson

*Monolepta* Erichson, 1843, *Arch. Naturgesch.*, 9(1) : 265 (Type : *Galeruca (Monolepta) pauperata* Erichson from Africa); Maulik 1936, *Fauna British India*, Coleoptera, Chrysomelidae (Galerucinae): 373-446; Gressitt & Kimoto, 1963, *Pac. Ins. Mon.*, 1B : 602-639.

This is the largest genus of the subfamily Galerucinae, Maulik (1936) included 78 species from the Indian subregion. In the present study 3 species of *Monolepta* are recorded from Tripura. Members of this genus are generally ovate, moderately convex, slightly narrowed in front and behind, dorsal surface smooth, shiny and finely punctured, segment 1 of hind tarsi markedly long and claws appendiculate.

#### 7. *Monolepta* sp. ~~no~~ *signata* (Olivier)

*Material examined* : 1 ex., Abhoya (Barpathari), 4.xii.1969, V. C. Agrawal, (Z. S. I. Coll.).

The single specimen studied here is similar to *M. signata* (Olivier) but differs from the latter in having antennae short and pale yellowish, scutellum broader than long with the apical margin broadly rounded, elytral puncturation fine and the sutural margin pale yellowish. No attempt is made here to establish this sole specimen as a new species.

General appearance oblong, narrow, small (2.50 mm) and pale yellowish. Antennae short and extending upto the middle of elytra. Prothorax broader than long, posterior angles rounded, surface finely punctate. Elytral pattern similar to *signata* but its suture being pale yellowish, puncturation fine and confused.

#### 8. *Monolepta lineata* Weise

*Monolepta lineata* Weise, 1915, *Ergebnisse 2. Dtsch. Zentr. Afr. Exp. Zool.*, 1 : 177; Maulik, 1936, *Fauna British India*, Coleoptera, Chrysomelidae (Galerucinae) : 398-399.

*Material examined* : 1 ex., Chailengata, 23.xii.1972, V. C. Agrawal, (Z. S. I. Coll.).

*Distribution* : India: Tripura and Tamil Nadu

*Remarks* : This species was so far known only from southern India: Tamil Nadu. Now it is being recorded for the first time from North East India (Tripura).

This species is near *M. javana* Jacoby but can be easily separated from the latter species by its pronotum being unicoloured and form larger (3 mm), elytra strongly and coarsely punctured.

General appearance oblong-ovate, small (3 mm), brown, antennae black with three basal segments dark brown and apical segments fringed with stiff hairs. Dorsal surface closely and strongly punctured, elytra with a longitudinal black stripe extending from humerus to near apex.

### 9. *Monolepta signata* (Olivier). (Text-fig. 1 D)

*Galeruca signata*. Olivier, 1808, *Entomologie*, 6 : 665, No. 93, pl. 5, fig. 85.

*Monolepta signata* : Jacoby, 1889, *Ann. Mus. Civ. stor. nat. Genova*, 27 : 229; Maulik, 1936, *Fauna British India*, Coleoptera, Chrysomelidae (Galerucinae) : 410-411; Kimoto, 1972, *Ent. Rev. Japan*, 24 ( 1-2 ) : 43.

*Material examined*: 3 exs., Perathia, 30.xi.1969, 5 exs., Abhoya Barpathari, 4.xii.1969; 11 exs., Garjee, 1.xii.1969; 2 exs., Forest Rest House, 8.xii.1969; 9 exs., Chailengta, 8.xii.1972; 9 exs., Ambassa, 4.1.1972; 10 exs., Chailengta (Manu), 23.xii.1972; 34 exs., Fatik Roy (Kumarghat), 25.xii.1972; 1 ex., Saydabari (Fatik Roy), 29.xii.1972; 1 ex., Hathalia, 5.xii.1969, all collected by V. C. Agrawal, (Z. S. I. Coll.).

*Distribution* : India : Tripura, Assam, Uttar Pradesh, Orissa, Karnataka, and Tamil Nadu.

General appearance oblong-ovate, moderately convex and dorsal surface shiny with fine punctures; head, pronotum and abdominal sternites reddish brown, antennae long and blackish with three basal segments brown, elytra usually pale brown with black stripes and a transverse band across the middle.

### Subfamily ALTICINAE

This is the largest subfamily of Chrysomelidae which is commonly known as flea-beetles, and can be easily recognised for its markedly thickened hind femora which are modified for jumping. Maulik (1926) included 316 species under 70 genera from the Indian subregion. In the present study 12 species under 4 genera are being recorded from Tripura. The representatives of this subfamily can be distinguished by the following characters:

General appearance usually oval or elongate, small to medium sized. Head exposed, antennae usually long and slender, inserted on the frons between the eyes and rather closely situated. Prothorax broad, emarginate in front and lateral sides usually distinctly margined. Front coxae usually not conically prominent and their cavities open or closed behind. Hind leg markedly developed and tibiae with a distinct apical spur.

Genus *Chaetocnema* Stephens

*Chaetocnema* Stephens, 1831, *Illustr. Brit. Ent. Mandib.* 4 : 325 (Type : *Altica hortensis* Geoffroy, 1785 = *Galeruca ridella* Paykull, 1799); Maulik, 1926: *Fauna British India*, Coleoptera, Chrysomelidae (Chrysomelinae and Halticinae) : 202-220; Kimoto, 1965, *Kyushu Univ. J. Fac. Agri.*, 13(3) : 411-416.

Maulik (1926) included 21 species from Indian subregion and subsequently Scherer (1969) added 7 more species. In the present study 5 species of *Chaetocnema* are recorded from Tripura. Members of this genus are small (1.50 mm to 3.50 mm), ovate, narrowed in front and behind, generally dark, often green with bronzy reflections. Dorsal surface usually punctate. Antennae shorter than the body, prothorax broader than long, usually narrowed in front and punctate. Elytra always punctate striate. Front coxal cavities closed behind. Legs with middle and hind tibiae excavated on its outer edge near apex.

Of the two subgenera *Tlanoma* Motschulsky and *Chaetocnema* s. str., the former is characterised by its vertex of head being impunctate, inter-antennal space distinctly raised and impunctate, and subgenus *Chaetocnema* s. str. can be distinguished by its vertex of head distinctly punctate, inter-antennal space flat and strongly punctate.

Subgenus *Tlanoma* Motschulsky10. *Chaetocnema* (*Tlanoma*) *basalis* Baly  
(Text-fig. 2 C)

*Chaetocnema basalis* Baly, 1877, *Trans. ent. Soc. Lond.*: 310; Maulik, 1926, *Fauna British India*, Coleoptera, Chrysomelidae (Chrysomelinae & Halticinae): 209-210.

*Chaetocnema* (*Tlanoma*) *basalis* : Heikertinger, 1951, *Kol. Rundsch.*, 32 : 72; Kimoto, 1972, *Ent. Rev. Japan*, 24 (1-2) : 46.

*Material examined* : 25 exs., Chailengta (Manu), 17.xii.1972); 1 ex., 12.xii.1972; 1 ex., 30.xii.1972; 1 ex., 18.xii.1972; 18 exs., Chailengta, 23.xii.1972; 1 ex., 20.xii.1972; 1 ex., 21.xii.1972; 2 exs., Khowaipur, 15.xii.1972; 5 exs., Ganganagar, 15.xii.1972; 3 exs., Perathia, 30.xi.1969; 14 exs., Hathalia, 15.xii.1969; 3 exs., Abhoya Rest House, 10.xii.1969. 3 exs., Abhoya (Barpathari), 4.xii.1969; 1 ex., Ambassa, 4.i.1973; 1 ex., Garjee, 28.xi.1969; 2 exs., Kumarghat, 28.xii.1972, all collected by V C. Agrawal, (Z. S. I. Coll.).

*Distribution* : India : Tripura, Assam, West Bengal, Maharashtra and Tamil Nadu.

*Remarks* : This species was reported by Maulik (1926) as a pest of paddy.

This species is near *C. duvivieri* Jacoby but can be recognised by its size being smaller (1.50 mm to 2.00 mm), colour black, pronotum finely and uniformly punctured, and elytral interstices indistinctly punctured.

General appearance ovate, black and shiny. Head impunctate and finely granulated. Pronotum densely punctured, basal border distinctly margined and with a transverse row of strong punctures. Elytra regularly punctate-striate, punctures stronger than those on the pronotum and elytral interstices indistinctly punctured.

### 11. *Chaetocnema (Tlanoma) indica* Weise

*Chaetocnema indica* Weise, 1916, *Dtsch. ent. Z.*, : 39; Heikertinger & Csiki, 1940, *Col. Cat., Berl.*, 25 (169) : 410.

*Chaetocnema minuta* Jacoby, 1896, *Ann. Soc. ent. Belg.*, 40 : 271; Maulik, 1926, *Fauna British India, Coleoptera, Chrysomelidae (Chrysomelinae & Halticinae)* 214-215.

*Material examined* : 1 ex., Khowaipur, 10.xii.1972; 1 ex., Ganganagar, 11.xii.1972, V. C. Agrawal, (Z. S. I. Coll.).

*Distribution* : India : Tripura and Maharashtra. Nepal.

*Remarks* : This species was so far recorded only from Maharashtra (Belgaum) is now being recorded for the first time from North East India (Tripura).

This species is near *C. longipunctata* Maulik and *C. kanika* Maulik but can be separated by its pronotum being distinctly narrowed in front and its puncturation denser, and the size smaller (less than 1.75 mm).

General appearance ovate, narrowed in front and behind and bright brassy or golden green. Head finely granulate with a few punctures on the inter-ocular space, pronotum finely granulate and densely punctate. Elytra rather strongly punctate-striate, and interstices finely punctate and costate at lateral sides.

### 12. *Chaetocnema (Tlanoma) longipunctata* Maulik

*Chaetocnema longipunctata* Maulik, 1926, *Fauna British India, Coleoptera Chrysomelidae (Chrysomelinae & Halticinae)* : 215.

*Material examined* : 1 ex., Ganganagar, 11.xii.1972, V. C. Agrawal, (Z. S. I. Coll.).

*Distribution* : India : Tripura

*Remarks* : This species was recorded so far from Ceylon, it is now recorded for the first time from India (Tripura).

This species is near *C. kanika* Maulik but can be separated from the latter species by its pronotal punctures being elongated, at least those near the base.

General appearance ovate, black, and antennae with five or six basal segments brown. Head impunctate and finely granulate, pronotum granulate and finely punctate, those near the base elongated. Elytra

regularly punctate-striate, punctures larger than those on pronotum and interstices finely punctate and costate towards apex.

Subgenus *Chaetocnema* s. str.

13. *Chaetocnema* (*Chaetocnema*) *concinnipennis* Baly

*Chaetocnema concinnipennis* Baly 1877, *Trans. ent. Soc. Lond.* : 170; Maulik, 1926, *Fauna British India*, Coleoptera, Chrysomelidae (Chrysomelinae & Halticinae) : 207-208.

*Chaetocnema* (*Chaetocnema*) *concinnipennis* : Kimoto, 1972, *Ent. Rev. Japan*, 24 (1-2) : 46.

*Material examined* : 1 ex., Chailengta (Manu), 17.xii.1972; 1 ex., Ambassa, 2.i.1973; 1 ex., Chailengta, 17.xi.1969; 1 ex., Forest Rest House, 8.xii.1969; 1 ex., Garjee, 29.xii.1969; 2 exs., Abhoya Barpathari, 4.xii.1969 all collected by V. C. Agrawal, (Z.S.I. Coll.).

*Distribution* : India: Tripura, West Bengal, Sikkim, Bihar, Orissa and Tamil Nadu.

*Remarks* : Maulik (1926) noted that this species is a pest of seedling paddy.

This species is near *C. birmanica* Jacoby but can be easily separated from the latter by its size being small (3.00 mm) and elytral punctures less prominent.

General appearance ovate and shining brassy-greenish or bluish. Head finely granulated and punctured, pronotum strongly punctured, elytra strongly punctate-striate, each puncture wider than the width of interstices and latter subcostate along the lateral and apical margins.

14. *Chaetocnema* (*Chaetocnema*) *cognata* Baly

*Chaetocnema cognata* Baly, 1877, *Trans. ent. Soc. Lond.* : 168; Maulik, 1926, *Fauna British India*, Coleoptera, Chrysomelidae (Chrysomelinae & Halticinae) : 216-217.

*Chaetocnema* (*Chaetocnema*) *cognata* : Kimoto, 1972, *Ent. Rev., Japan*, 24 (1-2) : 46.

*Material examined* : 3 exs., Chailengta (Manu), 17-18.xii.1972, 1 ex., Garjee, 28.xi.1969, V. C. Agrawal, (Z.S.I. Coll.).

*Distribution* : India : Tripura, West Bengal, Bihar, Orissa, Uttar Pradesh, Karnataka and Tamil Nadu.

This species is nearest to *C. alticola* Maulik and *C. belli* Jacoby, but can be separated by its dorsal surface being shining coppery or greenish with slight bronzy tinge.

General appearance ovate, shining coppery or brassy green with slight bronzy tinge. Head finely granulate and strongly punctate, pronotum finely granulate, distinctly and sparsely punctate. Elytra punctate-striate, interstices finely granulate and impunctate, interstices towards the apex and sides somewhat costate.

Genus *Longitarsus* Latreille

*Longitarsus* Latreille, 1829, Cuvier's *Regn. Anim.* 2 ed. 5 : 155, (Type: *Chrysomela atricilla* L. from Europe); Maulik, 1926, *Fauna British India*, Coleoptera, Chrysomelidae (Chrysomelinae & Halticinae) : 333-361; Gressitt & Kimoto, 1963, *Pac. Ins. Mon.*, 1B : 851-860.

This is one of the largest genera of the subfamily Alticinae Maulik (1926) included 38 species from Indian subregion and subsequently Scherer (1969) added 4 more species. The present study records 3 species from Tripura. Members of this genus are generally small, oblong or ovate, antennae long and slender, prothorax always broader than long, pronotum usually punctate, elytra usually confusedly punctate, sometimes the punctures arranged in irregular rows. Front coxal cavities open behind. Legs slender, outer margin of hind tibiae not channelled and with a distinct well developed spine at the apex. Sometimes species are apterous.

15. *Longitarsus incicaus* sp. nov. (Text-fig. 2 A)

General appearance oblong, dorsal surface brown with elytral suture blackish, each elytron with a longitudinal blackish stripe extending to half of its length and the punctures on the elytra blackish. Antenna black with segments 1-3, 10 and the basal part of segment 11 brown. Ventral surface brown with legs pale yellowish, hind femora brown with its apical part blackish. *Head* (Text-fig. 2 A) with vertex impunctate, frontal tubercles indistinct, interantennal carina distinctly elevated and eyes moderately convex. Antennae extending almost to the apex of elytra, segment 3 distinctly longer than segment 2, segment 4 one and one-third times longer than segment 3, segment 4-10 subequal, segment 11 long and obliquely truncated. *Prothorax* (Text-fig. 2 A) one and half times broader than long, lateral margins almost straight, front angles oblique, pronotum convex and indistinctly punctate. Scutellum triangular and impunctate. Elytra (Text-fig. 2 A) broader than prothorax, disc finely punctate, puncturation forming longitudinal rows at lateral sides. Ventral surface shining. Segment 1 of hind tarsi longer than half of the corresponding tibiae.

*Measurement of holotype* : Length 2.40 mm, width of head across eyes 0.65 mm, length of antennae 2.40 mm, width of prothorax across middle 0.70 mm, length of elytra 1.75 mm and width of elytra across middle 1.20 mm.

*Holotype* 1 ex., INDIA : TRIPURA, Abhoya Rest House, 10.xii. 1969, V. C. Agrawal, *Paratype* 1 ex., INDIA : TRIPURA, Garjee, 28.xi. 1969, V. C. Agrawal (In the collection of Zoological Survey of India, Calcutta).

Kimoto (1965) described a new species *Longitarsus boharti* from

Ryukyu Island, the new species described above is closely related to this, but can be easily separated from the latter species for its pronotum being finely and indistinctly punctured, prothorax one and half times broader than long and its lateral margins almost straight, antennae almost as long as its length of the body, segment 4 and 5 subequal, segment 10 and basal part of segment 11 brown, and elytral punctures black.

16. *Longitarsus belgaumensis* Jacoby

*Longitarsus belgaumensis* Jacoby, 1896, *Ann. Soc. ent. Belg.*, 40 : 260; Maulik, 1926, *Fauna British India*, Coleoptera, Chrysomelidae (Chrysomelinae & Halticinae) : 348-349; Kimoto, 1972, *Ent. Rev. Japan*, 24 (1-2): 47.

*Material examined* : 1 ex., Chailengta (Manu), 17.xii.1972, V. C. Agrawal, (Z.S.I. Coll.).

*Distribution* : India: Manipur, Tripura, Bihar, Orissa, Uttar Pradesh, Maharashtra, Karnataka and Tamil Nadu.

This species is near *L. hina* Maulik but can be separated from the latter species by its elytra being confusedly punctured and form larger (2.50 mm).

General appearance oblong, almost parallel-sided, dorsal surface pale brown with the sutural margin blackish. Head impunctate, antennae long and slender. Prothorax slightly broader than long, pronotum with a few fine punctures and its basal part with fine longitudinal wrinkles. Elytra subcylindrical, granulate and confusedly punctured.

17. *Longitarsus* sp. nr. *pandura* Maulik

*Material examined* : 1 ex., Kumarghat, 18.xii.1972, V. C. Agrawal, (Z.S.I. Coll.).

General appearance ovate, narrow, small and brown. Head with vertex impunctate. Antennae long, densely hairy and segment 3 almost equal to segment 2. Pronotum finely and distinctly punctate. Elytra finely and confusedly punctate. Segment 1 of hind tarsi longer than half the length of tibiae.

Genus *Luperomorpha* Weise

*Luperomorpha* Weise, 1887, Weigmann's *Arch. Naturgesch.*, 53(1) : 202, (Type : *Luperomorpha trivialis* Weise from Siberia); Maulik, 1926, *Fauna British India* Coleoptera, Chrysomelidae (Chrysomelinae & Halticinae) : 361-366; Kimoto 1972, *Ent. Rev. Japan*, 24 (1-2): 47.

Heikertinger and Csiki (1939) listed 7 species from Indian subregion and subsequently Scherer (1969) added 5 more species. In the present study one species of *Luperomorpha* is recorded from Tripura. The re-

representatives of this genus are generally oblong and shiny, antennae long and its segment 2 and 3 are always small. Prothorax usually broader than head and almost quadrate, often finely granulate and punctate, pre-basal impressions absent. Elytra almost parallel-sided, usually with stronger punctures than those of pronotum, and apical part with a few scattered setae. Front coxal cavities open behind.

#### 18. *Luperomorpha vittata* Duvivier (Text-fig. 1 C)

*Luperomorpha vittata* Duvivier, 1892, *Ann. Soc. ent. Belg.*, 36 : 427; Maulik, 1926, *Fauna British India*, Coleoptera, Chrysomelidae (Chrysomelinae & Halticinae) : 365.

*Material examined* : 31 exs., Garjee bazar, 26.xi.1969; 5 exs., Garjee, 24.xi.-1.xii.1969; 8 exs., Perathia, 30.xi.1969; 9 exs., Agartala, Indranagar, 11.xi.1969; 1 ex., Chailengta, 20.xii.1972, all collected by V. C. Agrawal, (Z.S.I. Coll.),

*Distribution* : India : Tripura, Bihar and West Bengal.

General appearance oblong; head, prothorax and ventral surface fawn-coloured, elytra brownish black with an yellowish large longitudinal stripe. Head finely granulate. Prothorax almost quadrate and pronotum finely punctate. Elytra granulate and finely punctate and its apical part with a few scattered setae.

#### Genus *Phyllotreta* Stephens

*Phyllotreta* Stephens, 1839, *Manual Brit. Col.*, : 291 (Type : *Chrysomela nemorum* L., 1758, *Syst. Nat. ed. 10* : 373; Europe); Maulik, 1926, *Fauna British India*, Coleoptera, Chrysomelidae (Chrysomelinae & Halticinae) : 377-381; Kimoto, 1965, *Kyushu Univ. J. Fac. Agri.*, 13(3) : 605-609.

This is a small genus, Heikertinger and Csiki (1939) listed 7 species from Indian subregion and subsequently Scherer (1969) added 2 more species. In the present work 3 species of *Phyllotreta* are recorded from Tripura, of which one is described as new to science.

*Material examined* : 66 exs. Chailengta. 19-21.xii.1972; 2 exs., Chailengta (Manu), 19.xii.1972; 1 ex., Khowaipur, 10.xii.1972, 2 exs., Ambassa 4.i.1973; 6 exs., Fatik Roy (Kumarghat) 25.xii.1972 all collected by V. C. Agrawal, (Z.S.I. Coll.).

*Distribution* : India : Tripura and Sikkim.

This species is near *P. birmanica* Harold but it can be easily separated for its dorsal surface being black with longitudinal yellowish stripe on elytra and pronotum with strong punctures.

General appearance ovate, black, each elytron with a longitudinal yellowish stripe, antennae long and black with segments 1-3 brown, dorsal surface finely and strongly punctured.

20. *Phyllotreta chotanica* Duvivier

*Phyllotreta chotanica* Duvivier, 1892, *Ann. Soc. ent. Belg.*, 36 : 426; Maulik, 1926, *Fauna British India*, Coleoptera, Chrysomelidae (Chrysomelinae & Halticinae) : 379-380; Scherer, 1969, *Pacif. Ins. Monogr.* 22 : 37.

*Material examined* : 1 ex., Fatik Roy (Kumarghat), 25.xii.1972, V C. Agrawal, (Z.S.I. Coll.).

*Distribution* : India : Tripura and West Bengal.

This species is near *P. downesi* Baly but unlike latter species elytra devoid of apical ribs.

General appearance oblong, narrow and small (2.00 mm) dorsal surface metallic bronze with greenish or bluish reflections, antennae and ventral surface black, and tarsi brownish. Head shiny and impunctate. Antennae moderately long. Pronotum finely granulate and densely punctate. Elytral puncturation similar to those on the pronotum.

21. *Phyllotreta tripuraensis* sp. nov. (Text-fig. 2 B)

General appearance oblong, small, narrow and shining black, sometimes brown or blackish brown with metallic bronze tinge on head and pronotum. Antennae short, blackish with segments 1-3 brown. Dorsal surface strongly and confusedly punctate. *Head* (Text-fig. 2 B.) narrow, vertex strongly punctate, inter-antennal carina prominent and frontal tubercles absent. Antennae short and reaching middle of the elytra, scape long and thick, pedicel thick and almost equal to segment 3 and 4, segments 5-11 subequal, segments 7-11 thicker and densely pubescent. *Prothorax* (Text-fig. 2 B.) almost twice as broad as long, distinctly narrowed anteriorly, anterior and posterior margins straight, lateral margins gently rounded, anterior angles thickened, posterior angle rounded pronotum finely granulate and strongly punctured. *Scutellum* small, triangular with apex rounded, and surface impunctate. Elytra (Text-fig. 2 B.) closely covered with strong punctures as on pronotum.

*Measurements of holotype* : Length 2.20 mm, width of head across eyes 0.45 mm, length of antennae 1.10 mm, width of prothorax across middle 0.70 mm, length of elytra 1.60 mm and width of elytra across middle 1.00 mm.

*Holotype* 1 ex., INDIA : TRIPURA, Fatik Roy (Kumarghat) 25.xii.1972, V C. Agrawal; *Paratypes* INDIA : TRIPURA, 48 exs. Ambassa, 4.i.1973; 2 exs., 7.i.1973; 58 exs., Fatik Roy (Kumarghat) 25.xii.1972; 21 exs., Chailengta, 21.xii.1972; 8 exs., 20.xii.1972; 1 ex. 23.xii.1972; 5 exs., Chailengta (Manu), 10.xii.1972, all collected by V. C. Agrawal, (In the Zoological Survey of India, Calcutta).

This species is near *P. chotanica* Duvivier but can be easily separated from the latter species by its vertex of head strongly punctate, prothorax

more transverse and distinctly narrowed anteriorly, dorsal surface more strongly punctured than those of *P. chotanica*.

#### Subfamily HISPINAE

This is a moderately large subfamily. Maulik (1919) included 236 species under 27 genera from Indian subregion. In the present study 2 species under 2 genera are recorded from Tripura. The representatives of this subfamily are distinguished by the following characters:

General appearance oblong-elongated, wedge-shaped, small to medium sized. Dorsal surface smooth or deeply punctate or with elevated costae or spines. Head exposed with prominent frons, antennae short, straight and closely inserted between the eyes. Prothorax truncate or emarginate in front. Elytra distinctly broader than prothorax and truncated at apex.

#### Genus *Rhadinosa* Weise

*Rhadinosa* Weise, 1905, *Dtsch. ent. Z.*: 318 (Type: *Rhadinosa nigrocyanea* Motschulsky from Altai, Manchuria, Japan); Maulik, 1919, *Fauna British India*, Coleoptera, Chrysomelidae (Hispinæ & Cassidinae): 164-168; Gressitt & Kimoto, 1963, *Pac. Ins. Mon.* 1B : 917-920.

This is a small genus of the subfamily Hispinæ. Maulik (1919) included 5 species from Indian subregion. In the present study one species of *Rhadinosa* is recorded from Tripura. The representatives of this genus are elongate and small. Antennae short, stout and cylindrical, and segment 1 with a dorsal spine. Pronotum usually rugose and with transverse depressions, and front margin armed with two pairs of spines and each lateral margin with three spines. Elytra spiny and punctate-striate. Tarsal claws free and equal.

#### 22. *Rhadinosa laghua* Maulik

*Rhadinosa laghua* Maulik, 1915, *Rec. Indian Mus.* : 376; Maulik, 1919, *Fauna, British India*, Coleoptera, Chrysomelidae (Hispinæ & Cassidinae) : 166-167.

*Material examined*: 3 exs., Chailengta, 23.xii.1969; 1 ex., *Abhoya Barpathari*, 4.xii.1969; 1 ex., Chailengta (Manu), 18.xii.1972; V. C. Agrawal. 1 ex., Kanjmura, Teliamura, 14.xi.1974; 1 ex., Teliamura, 11.xi.1974; 1 ex., Kanchannagar, Ambassa, 20.xi.1974. M. S. Shishodia, (Z.S.I. Coll.).

*Distribution* : India : Tripura, Assam and West Bengal.

This species is near *R. lebongensis* Maulik but can be separated from the latter species by its last five segments of antennae being distinctly clubbed and segment 3 not longer than segment 5 but of almost equal in length, and species black.

General appearance oblong, small, black and covered with white adpressed hairs. Antennae short and cylindrical, segment 1 with a dorsal spine, segments 7-11 forming a club. Prothorax quadrate with 5 pairs of spines and rugosely punctate. Elytra punctate-striate and with long spines.

### Genus *Dicladispa* Gestro

*Hispa* Chapuis (nec. Linnaeus), 1875, *Gen. Col.*, 11 : 334; Maulik, 1919, *Fauna British India*, Coleoptera, Chrysomelidae (Hispinae & Cassidinae) : 247-256. *Dicladispa* Gestro, 1897, *Ann. Mus. Civ. stor. Nat. Genova*, 38 : 81 (Type : *Hispa testacea* L. from Europe); Gressitt & Kimoto, 1963, *Pac. Ins. Mon.* 1B : 935.

This is a small genus, and Maulik (1919) included 7 species from Indian subregion. In the present study one species of this genus is recorded from Tripura. The representatives of this genus are somewhat oblong and subparallel-sided. Antennae 11-segmented, prothorax with a group of spines at lateral sides near apical angles and a single near basal angles. Elytra broader than prothorax, punctate-striate and with spines.

### 23. *Dicladispa armigera* (Olivier)

*Hispa armigera* Olivier, 1808, *Ent.*, 6 : 763; Maulik, 1919, *Fauna British India*, Coleoptera, Chrysomelidae (Hispinae & Cassidinae) : 249-250. *Dicladispa armigera*: Uhmann, 1952, *Treubia*, 21 : 236; Gressitt & Kimoto, 1963, *Pac. Ins. Mon.*, 1B : 936; Kimoto, 1972, *Ent. Rev. Japan*, 24 (1/2) : 48.

*Material examined* : 1 ex., Abhoya Barpathari, 4.xii.1969; 1 ex., Lakshmipur, 6.xii.1969; 1 ex., Nandnagar, 13.xi.1969; 1 ex., Hathalia, 5.xii.1969; 1 ex., Garjee, 1.xii.1969; 1 ex., Chailengta, 16.xi.1969; 1 ex., Sheikh Bari, 3.xii.1969, all collected by V C. Agrawal, (Z.S.I. Coll.).

*Distribution* : India : Tripura, Assam, West Bengal, Orissa and Tamil Nadu.

*Remarks* : This species is recorded by Maulik (1919) as a serious pest of paddy.

This species is near *D. birendra* (Maulik) but can be easily separated from the latter species by its prothoracic spines being straight, short and almost equal in length with the two basal segments of the antennae.

General appearance oblong, shiny and blue black. Head longitudinally sulcated, antennae moderately long, slender and slightly thickened towards apex. Prothorax broader than long, subcylindrical and rugosely punctate. Elytra strongly punctate-striate with strong and erect spines.

### Subfamily CASSIDINAE

This is a small subfamily, in which 152 species under 16 genera were recorded by Maulik (1919) from Indian subregion. Present study

includes 2 species under 1 genus from Tripura. The representatives of this subfamily are commonly known as Tortoise beetles as their shape are broadly oval or circular with an explanate margins. Head deflexed and the whole body hidden under the explanate margin of prothorax and elytra, and its epipleura markedly broad.

### Genus *Cassida* Linnaeus

*Cassida* L., 1758, *Syst. Nat. ed.*, 10, 1 : 362 (Type : *Cassida nebulosa* L. from Europe); Maulik, 1919, *Fauna British India*, Coleoptera, Chrysomelidae (Hispiinae & Cassidinae) : 361-411; Gressitt & Kimoto, 1963, *Pac. Ins. Mon.*, 1B : 963-983.

This is the largest genus of the subfamily Cassidinae in which 58 species were recorded by Maulik (1919) from Indian subregion. In the present study 2 species of *Cassida* are recorded from Tripura. The representatives of this genus are usually ovate and convex. Head concealed under explanate front margin of prothorax, and without any channel for antennal reception, prothorax elliptical and transverse. Elytra convex, generally punctate-striate, interstices usually plain and never strongly costate or rugose. Tarsal claws devoid of comblike structure at base.

#### 24. *Cassida* (*Taiwania*) *circumdata* Herbst

*Cassida circumdata* Herbst, 1799, *Natursyst. Kaf.*, 8 : 268, pl. 132, f. 11; Maulik, 1919, *Fauna British India*, Coleoptera, Chrysomelidae (Hispiinae & Cassidinae): 404-405.

*Cassida* (*Taiwania*) *circumdata* : Gressitt, 1952, *Proc. Calif. Acad. Sci. ser. 4*, 27 : 489, pl. 28, fig. 2, pl. 36, figs. 6, 9; Gressitt & Kimoto, 1963, *Pac. Ins. Mon.* 1B : 970.

*Material examined* : 1 ex., Abhoya (Barpathari), 4.xii.1969, V. C. Agrawal, (Z.S.I. Coll.).

*Distribution* : India : Tripura, West Bengal, Orissa and Tamil Nadu.

This species is near *C. varians* Herbst but can be separated from the latter species by its elytra with a U-shaped black marking and with a short black stripe at base along the suture, which sometimes extending on the pronotum.

General appearance ovate, yellowish brown, sometimes with greenish tinge, elytra with a U-shaped black stripe. Head and clypeus flat, smooth and impunctate, elytra strongly punctate-striate.

#### 25. *Cassida* sp. nr. *conspurcata* Boheman

*Material examined* : 2 exs., Saydabari (Fatik Roy), 29.xii.1972, V. C. Agrawal, (Z.S.I. Coll.).

The specimens studied here are similar to *C. conspurcata* Boheman, but it differs from the latter in having transparent disc of pronotum just above head being finely punctate and in its explanate margins without honeycomb structure as in *C. conspurcata*.

General appearance ovate, shining yellowish brown with several black spots on elytra, pronotum finely and confusedly punctate, elytra strongly punctate-striate.

#### SUMMARY

The present study deals with 25 species spread over 12 genera under 6 subfamilies. Two new species *Longitarsus indicus* and *Phyllotreta tripuraensis* are described. The diagnostic characters of the subfamilies, genera and species, and their relationship and distribution are given. All the species, included in this paper, are being recorded for the first time from Tripura.

#### ACKNOWLEDGEMENTS

The authors are grateful to the Director, Zoological Survey of India, Calcutta, for providing laboratory facilities during this work.

#### REFERENCES

- HEIKERTINGER, F. and CSIKI, E. 1939. Chrysomelidae (Halticinae 1). In Junk's *Coleopt. Cat., Berl.*, **25** (166) : 1-336.
- KIMOTO, S. 1965. The Chrysomelidae of Japan and Ryukyu Is. IX. (Alticinae II). *Kyushu Univ. J. Fac. Agr.*, **13** (3) : 431-459.
- JACOBY, M. 1908. *The Fauna of British India including Ceylon and Burma*. Coleoptera, Chrysomelidae, **1** : xx + 534 pp.
- MAULIK, S. 1919. *The Fauna of British India including Ceylon and Burma*. Coleoptera, Chrysomelidae (Hispinæ and Cassidinae): xi + 439 pp.
- MAULIK, S. 1926. *The Fauna of British India including Ceylon and Burma*. Coleoptera, Chrysomelidae (Chrysomelinae and Halticinae) xiv + 442 pp.
- MAULIK, S. 1936. *The Fauna of British India including Ceylon and Burma*. Coleoptera, Chrysomelidae (Galerucinae) : xiv + 648 pp.
- SCHERER, G. 1969. Die Alticinae des indischen Subkontinentes (Coleoptera : Chrysomelidae). *Pacific Insects Monograph*, **22** : 1-251.



ZOOPLANKTON BIOMASS AND ITS CONSTITUENTS FROM 100-0 M AND FROM NEAR SEABED TO 0 M AT SHALLOW STATIONS IN THE NORTHERN ARABIAN SEA DURING DECEMBER, 1973-MAY, 1974.

By

A. DANIEL AND P. KRISHNAMOORTHY

*Marine Biological Station, Zoological Survey of India, Madras*

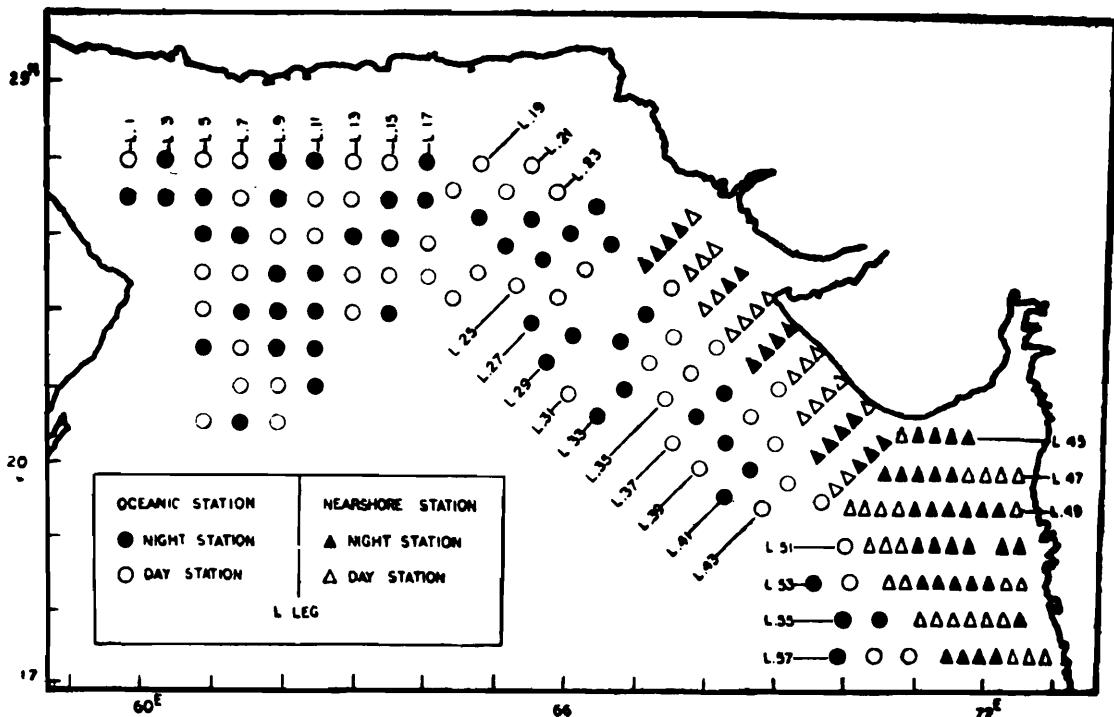
(With five Text-figures)

INTRODUCTION

It is well known that the distribution of plankton in the sea is an index of fertility not only of the water column but also of the sea bottom (Prasad, 1969). The distribution of zooplankton biomass of the inshore and offshore waters of the Arabian Sea and the Bay of Bengal upto 1965, is known in great detail. These results were based mainly on the samples of oceanographic expeditions (Sewell, 1948—John Murray Expedition; Foxton, 1957—R. R. S. Discovery; Bogorov and Vinogradov, 1961, Ponomarov and Novamor, 1962, Daniel and Premkumar, 1965—USSR R. V. Vityaz; Prasad, 1969—International Indian Ocean Expedition collections lodged at the Indian Ocean Biological Centre). Of these, Ponomorav and Novamov's (1962) work is a short account for the period of monsoon change of the Arabian Sea and Bay of Bengal and the only comprehensive account of the plankton biomass of these two regions covering all the seasons is by Prasad (1969). The grid system followed during these expeditions were wide apart and the results were based on samples collected upto 1965.

Several planktonologists have emphasized the unevenness (patchiness) in the distribution of plankton, as evidenced by the irregularity in the volumetric distribution from station to station between localities only a few miles apart during different seasons and years (Hardy and Gunther, 1935; Clarke, 1946; Hardy, 1956; Raymont, 1963). Therefore, during the Oceanographic Expedition on the I. N. S. DARSHAK in the Northern Arabian Sea from December, 1973 to May, 1974 studies were made on the standing crop (biomass) of zooplankton and variations

ZOOPLANKTON STATIONS FROM 100-OMTS IN THE OCEANIC REGION (100 STNS) AND FROM NEAR SEABED TO SURFACE FROM SHALLOW NEAR SHORE STATIONS (94 STNS).



Text-fig. 1

in the abundance of major constituents from 100-0 metres in the oceanic regions at 100 stations and from near seabed to surface at 94 shallow nearshore stations, following a close grid (Text-fig. 1). This paper summarizes these investigations.

#### MATERIAL AND METHODS

Zooplankton samples were collected with a Nansen type "standard" plankton net of 50 cms mouth diameter/225 cms total net length of bolting silk 60 meshes per linear centimetre, hauled vertically at a speed of one metre per second over a davit from 100 metres to surface at 100 oceanic stations (52 day and 48 night stations) and from near seabed to surface at 94 shallow near shore stations (46 day and 48 night stations). The total displacement volumes of samples were obtained following the technique of Foxtan (1957), Daniel and Premkumar (1965). The displacement volumes have been considered to be equivalent to total biomass of the samples (Prasad, 1969). Text-fig. 1 indicates the 194 stations (100 day and 94 night stations) occupied for the collection of these samples. The values obtained for each degree square were averaged. While averaging the values in each one degree square, in a few cases displacement volumes obtained from stations established in adjoining squares were included when day or night stations were not established in that square. The mean values thus obtained are presented as the dis-

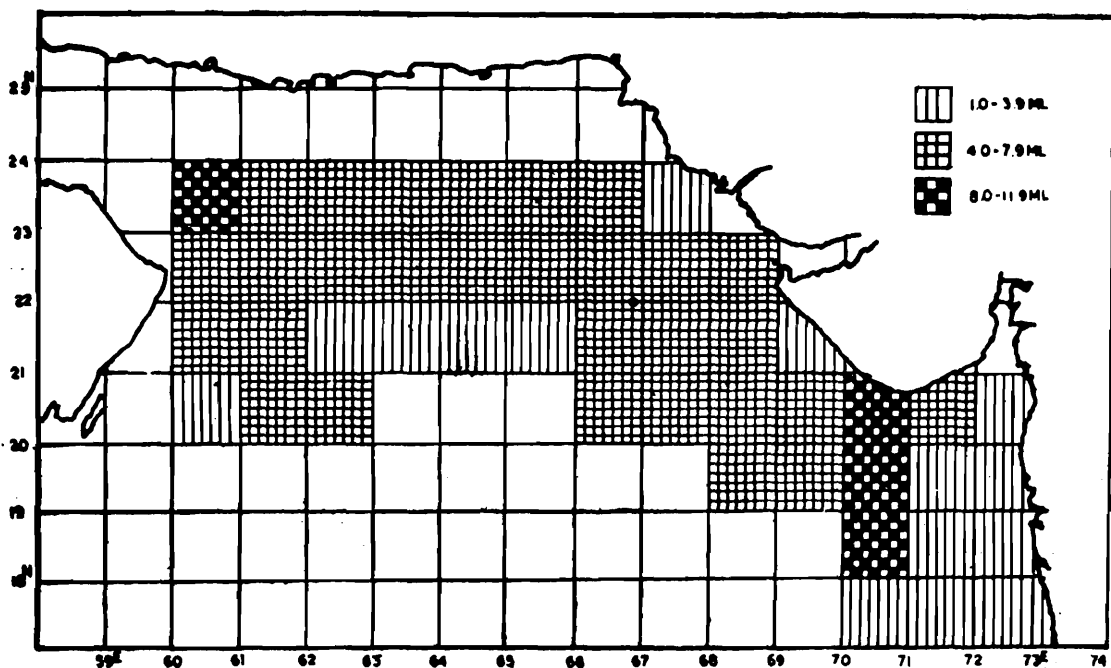
tribution of plankton biomass in generalised charts. The longitudinal and latitudinal variations of the plankton biomass were obtained by taking the averages of values between  $1^\circ$  increment of longitude and each  $1^\circ$  increment of latitude during the night and day periods. The numbers of each zooconstituent occurring in the entire plankton sample were analysed for estimating the numbers of different constituents in a haul.

### OBSERVATIONS

#### *Day and Night variations of Plankton Biomass*

The distribution of zooplankton biomass as calculated from 96 night stations (48 oceanic and 48 shallow stations) and 98 day stations (52 oceanic and 46 shallow stations) in  $1^\circ$  squares bounded by latitudes  $17^\circ$  N to  $24^\circ$  N and longitudes  $60^\circ$  E to  $73^\circ$  E covering the sea area sampled during the oceanographic expedition on I. N. S. DARSHAK are presented in Text-figures 2 and 3. Data on date, time, latitudinal and longitudinal position, total depth of each station, depth and displacement volumes of each zooplankton haul for the 96 night and 98 day stations are presented in Tables 1 and 2. It is evident from Figures 2 and 3 and Tables 1 and 2 that zooplankton biomass from 100 metres depth in the oceanic region and from near seabed in the shallow coastal region was far more abundant during the night, ranging from 8.0 ml per vertical haul reaching peak values of 12 ml and above per vertical haul in three distinct regions: (i) off Kathiavar Peninsula, and the Gulf of Kutch'

DISTRIBUTION OF ZOOPLANKTON BIOMASS FROM 100-00MTS (96 STNS) AND FROM NEAR SEABED TO SURFACE (94 STNS). DAY.

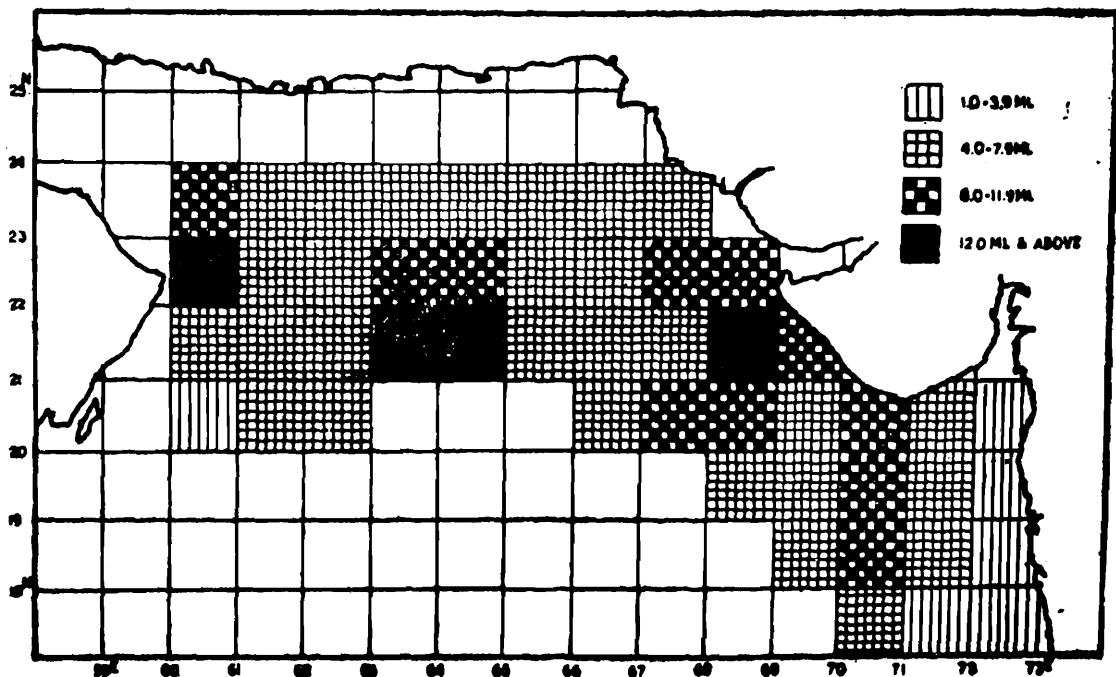


Text-fig. 2

(ii) oceanic regions in the central part of the northern Arabian sea bounded by latitudes  $21^{\circ}$ - $23^{\circ}$  North and longitudes  $63^{\circ}$ - $65^{\circ}$  East and (iii) off Ras-Al-Hadd at the mouth of Gulf of Oman. During the day, maximal biomass values of 8 to 11.9 ml per vertical haul occurred in a narrow belt in the off shore areas off the north west coast of India between  $70^{\circ}$ - $71^{\circ}$  E longitudes and off Ras-Al-Hadd in the Gulf of Oman where the night biomass values were also the same.

Low plankton biomass of 1 to 3.9 ml per haul occurred as a narrow belt between  $72^{\circ}$  E to  $73^{\circ}$  E longitudes in the inshore areas bordering the north west coast of India both during the night and day. This region of low biomass extended upto  $71^{\circ}$  E longitudes during the day. Similar low biomass values of 1 to 3.9 ml occurred during the day (i) along the central part of the Northern Arabian sea bounded by latitudes  $21^{\circ}$  to  $22^{\circ}$  North and longitudes  $62^{\circ}$  to  $66^{\circ}$  East and (ii) as three small patches: (a) at the mouth of the River Indus, (b) off Porbandar in Gujarat and (c) the offshore waters of Masira off Oman.

DISTRIBUTION OF ZOOPLANKTON BIOMASS FROM 100-0 MTS (00 STNS)  
AND FROM NEAR SEABED TO SURFACE (94 STNS). NIGHT



Text-fig. 3

The biomass values during the night at Masira off Oman was also very low ranging from 1 to 3.9 per haul. Areas of moderately rich plankton biomass varying from 4 to 7.9 ml per vertical haul occurred extensively in the remaining oceanic regions sampled during the Expedition both during the day and night (Figs. 2 & 3). A perusal of Tables I and II also reveal that the 27 stations (i.e. 16 night stations: 0303, 0505, 0901, 1509, 1701, 2307, 2905, 3703, 3706, 3708, 4305, 4906, 4907, 5104, 5105, 5107,

Table 1. Showing the details of the night stations established and displacement volume in ml.

Station	Date	Time	Latitude N	Longitude E	Depth of the station	Depth of haul	Displacement volume in ml.
1	2	3	4	5	6	7	8
01.03	9.2.1974	00.25	23.30	59.46	3270	100-0	8.0
03.01	10.2	03.10	24.00	60.21	3250	100-0	5.0
03.03	9.2	19.12	23.29	60.17	3240	100-0	11.0
05.03	10.2	18.30	23.23	60.50	3250	100-0	9.0
05.05	11.2	01.16	23.00	60.50	3254	100-0	13.0
05.11	12.1	18.05	21.30	61.23	3060-3100	100-0	7.5
07.05	11.2	23.50	23.00	61.22	3250	100-0	7.0
07.09	15.1	03.00	21.59	61.23	3060	100-0	8.0
07.15	8.1	23.45	20.29	61.23	—	100-0	7.5
09.01	12.2	22.20	24.00	61.55	3244	100-0	11.0
09.03	13.2	05.35	23.29	61.55	3270	100-0	5.0
09.07	13.2	20.00	22.30	61.48	3000	100-0	9.0
09.09	14.1	21.10	21.59	61.52	0930	100-0	5.0
09.11	12.1	03.35	21.30	61.56	2160-2180	100-0	5.0
11.01	15.2	00.27	24.00	62.27	3200	100-0	4.5
11.07	14.2	03.00	22.30	62.26	2740	100-0	8.0
11.09	14.1	13.45	22.00	62.28	3160	100-0	5.0
11.11	11.1	20.05	21.31	62.24	3160-3280	100-0	5.0
11.13	10.1	03.30	21.03	62.23	3354	100-0	4.0
13.05	15.2	22.45	23.00	63.01	2840	100-0	4.0

Table 1. *Contd.*

1	2	3	4	5	6	7	8
15.03	17.2	05.08	23.27	63.32	2240	100-0	9.0
15.05	16.2	21.57	23.00	63.33	4120	100-0	8.0
15.09	14.1	00.50	21.57	63.33	2860-2900	100-0	18.0
17.01	17.2	19.38	24.00	64.05	3054	100-0	11.5
17.03	18.2	02.15	23.30	64.05	2500	100-0	4.0
21.05	08.4	21.42	23.15	64.33	3140	100-0	7.5
23.05	06.4	21.50	23.19	65.21	—	100-0	6.0
23.07	07.4	03.05	22.58	65.00	—	100-0	11.8
25.01	26.3	18.48	23.31	66.18	0237	100-0	4.5
25.03	26.3	23.10	23.10	65.57	1400	100-0	9.5
25.05	27.3	04.55	22.48	65.38	2840	100-0	3.5
27.03	25.3	03.25	23.02	66.35	0455	100-0	5.0
27.09	25.3	22.16	21.56	65.22	2800	100-0	9.0
29.02	22.3	19.37	23.19	67.30	0026	20-0	7.0
29.03	22.3	21.08	23.10	67.23	0030	25-0	5.0
29.04	22.3	22.45	23.00	67.16	0032	25-0	7.8
29.05	23.3	01.25	22.51	67.09	0097	90-0	14.5
29.11	23.3	19.46	21.43	66.00	2300	100-0	9.0
29.13	24.3	03.25	21.27	65.37	0455	100-0	5.0
31.07	20.3	19.45	22.04	67.05	1790	100-0	6.0
31.09	21.3	02.25	21.42	66.39	1870	100-0	5.0
33.01	18.1	21.00	22.39	68.29	0030	20-0	9.0
33.02	18.1	18.20	22.28	68.17	0060	40-0	9.0

Table 1. *Contd.*

1	2	3	4	5	6	7	8
33.10	18.1	22.02	21.03	46.00	2186	100-0	8.0
33.12	19.3	03.36	20.40	66.22	2320	100-0	6.0
37.01	18.1	02.00	21.53	69.08	0030	25-0	1.5
37.02	17.1	23.45	21.45	69.00	0054	50-0	9.0
37.03	17.1	21.45	21.34	68.49	0065	50-0	25.0
37.04	17.1	18.45	21.24	68.38	0100	75-0	9.0
37.06	23.2	19.52	21.03	68.13	2370	100-0	15.0
37.08	24.2	02.54	20.41	67.51	2860	100-0	10.0
39.08	26.2	01.58	20.25	68.19	2960	100-0	9.0
41.08	27.2	22.15	20.03	68.39	2540	100-0	4.5
41.10	28.2	03.12	19.42	68.18	3100	100-0	8.5
43.02	27.1	03.45	20.40	70.10	0047	30-0	7.0
43.03	27.1	01.32	20.32	69.58	0070	20-0	3.0
43.04	26.1	22.30	20.24	69.46	0065	50-0	1.0
43.05	26.1	19.07	19.53	69.12	0102	50-0	16.0
45.01	23.12.1973	01.30	20.30	71.36	0027	15-0	0.5
45.02	23.12	23.00	20.30	71.36	0025	15-0	0.5
45.03	23.12	21.00	20.30	71.21	0025	15-0	1.0
45.04	22.12	04.00	20.29	71.04	0034	20-0	1.0
45.06	25.12	23.15	20.30	70.35	0051.5	40-0	6.0
45.07	25.12	21.15	20.19	70.24	0084	70-0	8.0
45.08	25.12	18.45	20.07	70.10	0070	70-0	8.0
47.05	23.1.1974	04.30	19.56	71.34	0035	25-0	5.0

Table 1. *Contd.*

1	2	3	4	5.	6	7	8
47.06	23.1	02.10	19.57	71.17	0038	20-0	3.0
47.07	23.1	23.50	19.58	71.02	0050	40-0	8.0
47.08	22.1	21.25	19.59	70.46	0075	40-0	6.5
47.09	22.1	18.00	19.58	70.25	0078	70-0	6.0
49.02	25.1	04.35	19.30	72.13	0028	20-0	1.0
49.03	25.1	02.50	19.30	71.58	0032	20-0	2.5
49.04	25.1	01.00	19.30	71.44	0046	30-0	4.0
49.05	24.1	23.10	19.30	71.29	0062	50-0	6.0
49.06	24.1	21.20	19.30	71.12	0068	50-0	13.0
49.07	24.1	18.30	19.31	70.48	0081	60-0	13.0
51.01	29.1	05.25	18.58	72.38	0024	15-0	6.0
51.02	29.1	03.08	19.00	72.23	0040	30-0	5.0
51.04	04.1	20.15	19.00	72.51	0067	50-0	33.0
51.05	04.1	23.15	19.00	71.34	0075	50-0	35.0
51.06	05.1	01.30	19.00	71.17	0080	70-0	9.0
51.07	05.1	05.05	19.00	71.01	0084	70-0	25.0
53.03	03.5	19.50	18.31	72.16	0048	40-0	1.0
53.04	03.5	22.56	18.30	71.58	0076	65-0	1.5
53.05	04.5	00.57	18.29	71.43	0084	70-0	1.5
53.06	04.5	03.07	18.27	71.28	0083.5	75-0	1.5
53.07	04.5	05.30	18.27	71.15	0086	80-0	3.0
53.13	04.5	21.52	18.30	69.40	1230	100-0	6.0
55.02	06.5	04.20	18.00	72.36	0039	35-0	4.0

Table 1. *Contd.*

1	2	3	4	5	6	7	8
55.10	06.5	21.05	18.01	70.32	1572	100-0	8.5
55.12	07.5	04.25	17.58	70.01	2830	100-0	8.5
57.04	08.5	19.40	17.30	72.18	0094.5	85-0	2.0
57.05	08.5	22.20	17.31	72.00	0101	90-0	1.5
57.06	09.5	01.00	17.31	71.44	0096	85-0	1.5
57.07	09.5	04.00	17.32	71.28	0099	90-0	2.0
57.13	09.5	09.18	17.31	70.57	—	100-0	7.5

Table - 2. Showing the details of the day stations established and displacement volume in ml.

Station	Date	Time	Latitude N	Longitude E	Depth of the station	Depth of haul	Displacement volume in ml.
1	2	3	4	5	6	7	8
01.01	9.2.1974	06.20	24.01	59.45	3240	100-0	5.0
05.01	10.2	09.32	24.00	60.51	3230	100-0	10.0
05.07	11.2	08.50	22.30	60.51	3002	100-0	11.0
05.09	15.1	07.55	21.58	60.52	2920	100-0	4.0
05.15	9.1	08.05	20.27	60.56	—	100-0	3.0
07.01	12.2	15.00	24.00	61.23	3246	100-0	4.5
07.03	12.2	07.38	23.32	61.23	3270	100-0	10.0
07.07	11.2	16.05	22.29	61.23	3130	100-0	8.0
07.11	12.1	09.40	21.30	61.23	2980	100-0	5.0
07.13	10.1	15.30	21.00	20.8	2660-2720	100-0	4.0
09.05	13.2	12.50	23.01	61.50	3140	100-0	7.5
09.13	10.1	10.00	20.59	61.55	3320	100-0	3.0
09.15	8.1	16.00	20.30	61.55	0273	100-0	6.0
11.03	14.2	16.55	23.29	62.26	3246	100-0	8.0
11.05	14.2	10.10	23.00	62.28	2720	100-0	7.5
13.01	15.2	08.30	23.59	63.00	3200	100-0	5.5
13.03	15.2	15.13	23.29	63.00	2620	100-0	3.0
13.07	16.2	06.10	22.30	63.01	4000	100-0	4.0
13.09	14.1	06.15	22.57	63.33	1640	100-0	2.0
15.01	17.2	12.31	24.00	63.33	3160	100-0	4.5

Table 2. *Contd.*

1	2	3	4	5	6	7	8
15.07	16.2	14.55	22.31	63.33	2306	100-0	6.0
17.05	18.2	08.56	23.00	64.05	1980	100-0	8.5
17.07	18.2	15.50	22.30	64.04	522	100-0	10.0
19.01	09.4	11.30	24.00	64.39	2860	100-0	5.0
19.03	09.4	17.17	23.44	64.20	2020	100-0	6.0
21.01	08.4	08.12	23.59	65.22	1600	100-0	8.0
21.03	08.4	13.52	23.39	65.00	2880	100-0	4.0
23.03	06.4	16.55	23.40	65.44	—	100-0	5.0
23.09	07.4	08.05	22.35	64.35	2320	100-0	5.5
23.11	07.4	14.06	22.20	64.17	2700	100-0	3.8
25.07	27.3	11.50	22.32	65.11	2270	100-0	3.5
27.05	25.3	09.14	22.37	66.08	1780	100-0	7.0
27.07	25.3	16.40	22.19	65.48	2560	100-0	3.5
29.01	22.3	17.50	23.29	67.42	0020	18-0	1.5
31.02	20.3	08.30	23.57	68.01	0027	20-0	3.0
31.03	20.3	10.30	22.46	67.50	0041	33-0	4.0
31.04	20.3	13.51	22.36	67.38	0094	85-0	4.5
31.05	20.3	16.02	22.25	67.27	0113	100-0	5.0
31.13	21.3	15.35	21.00	65.59	2498	100-0	4.0
33.03	18.1	16.15	22.18	68.04	0085	70-0	2.5
33.04	17.1	10.00	22.07	67.53	0100	90-0	4.5
33.06	18.3	09.00	21.46	67.31	1820	100-0	5.5
33.08	18.3	14.46	21.26	67.09	2180	100-0	4.0

Table 2. *Contd.*

1	2	3	4	5	6	7	8
35.01	18.1	06.45	22.18	68.49	0030	20-0	75
35.02	18.1	08.00	22.09	68.40	0037	25-0	.50
35.03	18.1	10.35	21.58	68.29	0064	50-0	2.0
35.04	18.1	12.30	21.49	68.18	0090	75-0	1.5
35.05	17.1	14.35	21.38	68.07	0139	100-0	3.0
35.07	22.2	15.02	21.18	67.46	1680	100-0	12.0
35.09	22.2	07.10	21.02	67.25	2414	100-0	6.0
37.10	24.2	10.10	20.16	67.28	2930	100-0	2.0
39.01	25.2	08.05	21.34	69.32	0031	20-0	1.5
39.02	25.2	10.15	21.26	64.24	0044	30-0	3.5
39.03	25.2	12.27	21.52	69.12	0070	50-0	7.0
39.04	25.2	14.28	21.04	68.59	0130	100-0	8.5
39.06	25.2	11.16	20.41	68.34	2780	100-0	5.0
39.10	26.2	09.52	20.03	67.55	3020	100-0	5.0
41.01	27.2	06.08	21.11	69.53	0028	15-0	2.5
41.02	27.2	08.20	21.04	69.45	0046	35-0	2.0
41.03	27.2	09.55	20.54	69.34	0066	50-0	2.5
41.04	27.2	11.28	20.44	69.23	0084	70-0	6.5
41.06	27.2	14.58	20.24	69.01	1348	100-0	7.0
43.01	27.1	06.50	20.54	70.20	0024	20-0	10.0
43.07	26.1	13.45	19.53	69.12	1500	100-0	8.0
43.09	26.1	08.05	19.31	68.50	2538	100-0	4.0
45.05	22.12.1973	07.45	20.29	71.04	0041	20-0	.5

Table 2. *Contd.*

1	2	3	4	5	6	7	8
45.09	25.12	16.30	19.58	70.01	0082	70-0	20.0
45.10	25.12	13.20	19.47	69.50	0093	50-0	9.0
45.11	25.12	10.00	19.36	69.41	0128	100-0	5.0
47.01	23.1.1974	13.25	20.00	72.35	0020	20-0	1.5
47.02	23.1	11.05	19.58	72.21	0035	20-0	1.0
47.03	23.1	09.00	19.58	72.05	0035	20-0	1.0
47.04	23.1	06.45	19.55	71.51	0032	20-0	3.0
49.01	25.1	07.00	19.29	72.29	0020	10-0	1.5
49.08	24.1	16.20	19.30	70.34	0076	60-0	3.5
49.09	24.1	14.00	19.30	71.29	0080	60-0	4.0
49.10	24.1	11.25	19.30	70.04	0080	60-0	3.5
49.11	24.1	09.25	19.30	69.52	0096	70-0	6.5
51.08	05.1	07.30	19.00	71.44	0088	70-0	16.5
51.09	05.1	09.40	19.00	71.50	0098	75-0	20.0
51.10	05.1	12.40	19.00	71.01	0085.5	70-0	19.5
51.11	05.1	15.10	19.00	70.15	0273	100-0	21.5
53.01	03.5	15.17	18.30	72.42	0022	20-0	.5
53.02	03.5	17.07	30.05	72.28	0040	30-0	1.0
53.08	04.5	08.40	18.27	72.59	0087	70-0	1.5
53.09	04.5	11.55	18.28	70.44	0094.5	85-0	1.5
53.11	04.5	15.40	18.28	70.12	1230	100-0	2.0
55.03	06.5	06.17	18.00	72.20	0052	45-0	1.2
55.04	06.5	08.35	18.00	72.04	0090	80-0	2.0

Table 2. *Contd.*

1	2	3	4	5	6	7	8
55.05	06.5	10.58	18.00	71.48	0095.5	80-0	3.0
55.06	06.5	12.55	18.01	71.32	0093	80-0	2.5
55.07	06.5	14.55	18.01	71.16	0085.1	75-0	75
55.08	06.5	17.29	18.00	71.01	0089	80-0	1.5
57.01	08.5	10.05	17.30	72.59	0026	20-0	1.0
57.02	08.5	14.48	17.30	72.47	—	35-0	1.5
57.03	08.5	17.13	17.30	72.33	0079	70-0	1.5
57.09	09.5	08.45	17.31	70.57	—	100-0	1.5
57.11	09.5	16.58	17.31	70.27	—	100-0	1.5

11 day stations: 0501, 0507, 0703, 1707, 3507, 4301, 4509, 5108, 5109, 5110 and 5111) at which the zooplankton biomass was high ranging from 10.0 ml and above/vertical haul were established during the different periods of day and night. Even the twelve stations (i. e., 8 night stations: Sta. Nos. 1509, 2905, 3703, 3706, 4305, 5104; 5105, 5107, 5 day stations: 4509, 5108, 5109, 5110 and 5111) at which peak biomass values occurred were established in morning, midday, evening or night. Further, the zooplankton biomass was very poor at 5 stations (1107, 4501, 4904, 5305 and 5706) established during midnight.

*Longitudinal and Latitudinal variations of Plankton Biomass.*

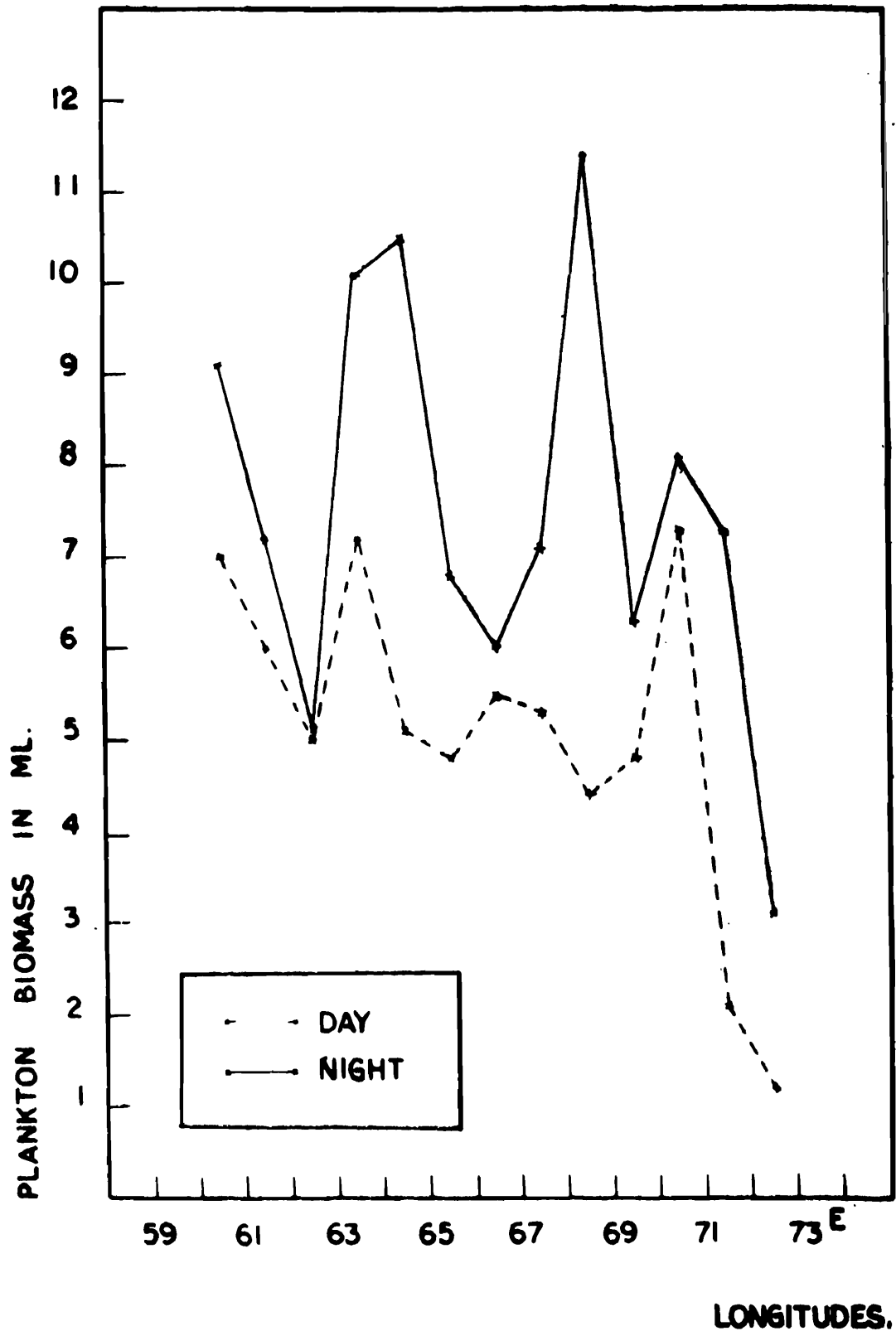
Text-figures 4 and 5 show longitudinal and latitudinal variations in the plankton biomass from 100 metres depth/seabed during day/night periods for 1° intervals. From Text-figure 4 it is seen that higher plankton biomass occurred during the night than during the day in all the longitudes. Very high concentrations of plankton occurred during the night between 60°-61° E, 63°-65°E and 68°-69°E longitudes. It was observed that the plankton biomass was comparatively very low during the day between longitudes 71°-73°E. In the zones between longitudes 62°-63°, 66°-67° and 70°-71° E the concentrations of plankton biomass in the night were only slightly denser than during the day.

Text-figure 5 shows that the plankton biomass during the night in all the latitudes is far denser than during the day. It is also seen that there is a peak biomass value of 10.4 ml per vertical haul during the night and 9.3 ml per vertical haul during the day in the latitudinal zone between 18°-19°N which is due to very high displacement volumes at stations 5108, 5109, 5110, 5111 during the day and 5104, 5105 and 5107 during the night on 4th and 5th January 1974. Similarly, the high value of 10.1 ml and/vertical haul during night between latitudes 19° and 20°N is due to the high biomass values of 13.1 ml/ vertical haul obtained at the night stations 4906 and 4907 on 24th January 1974.

*Constituents of plankton at 16 night and 11 day stations  
with an increase in total biomass.*

Out of the 96 night and 98 day plankton stations established, it was found that at 16 night and 11 day stations, swarming of species of siphonophores, medusae, ostracods, copepods, mysids, amphipods and salps were responsible for increased total biomass value. (Data are presented in Table 3.) A perusal of Table 3 shows that the copepoda constituted mainly by species of the genera *Eucalanus*, *Rhincalanus*, *Acrocalanus* and *Clausocalanus* formed the dominant group at 11 night stations (0505, 0901, 1509, 2307, 2905, 3703, 3708, 4906, 5104, 5105, 5107) and 6 day stations (0501, 0507, 1707, 5109, 5110, 5111). In these 17 stations, the ostracods, *Cypridina dentata* (Muller) also occurred in

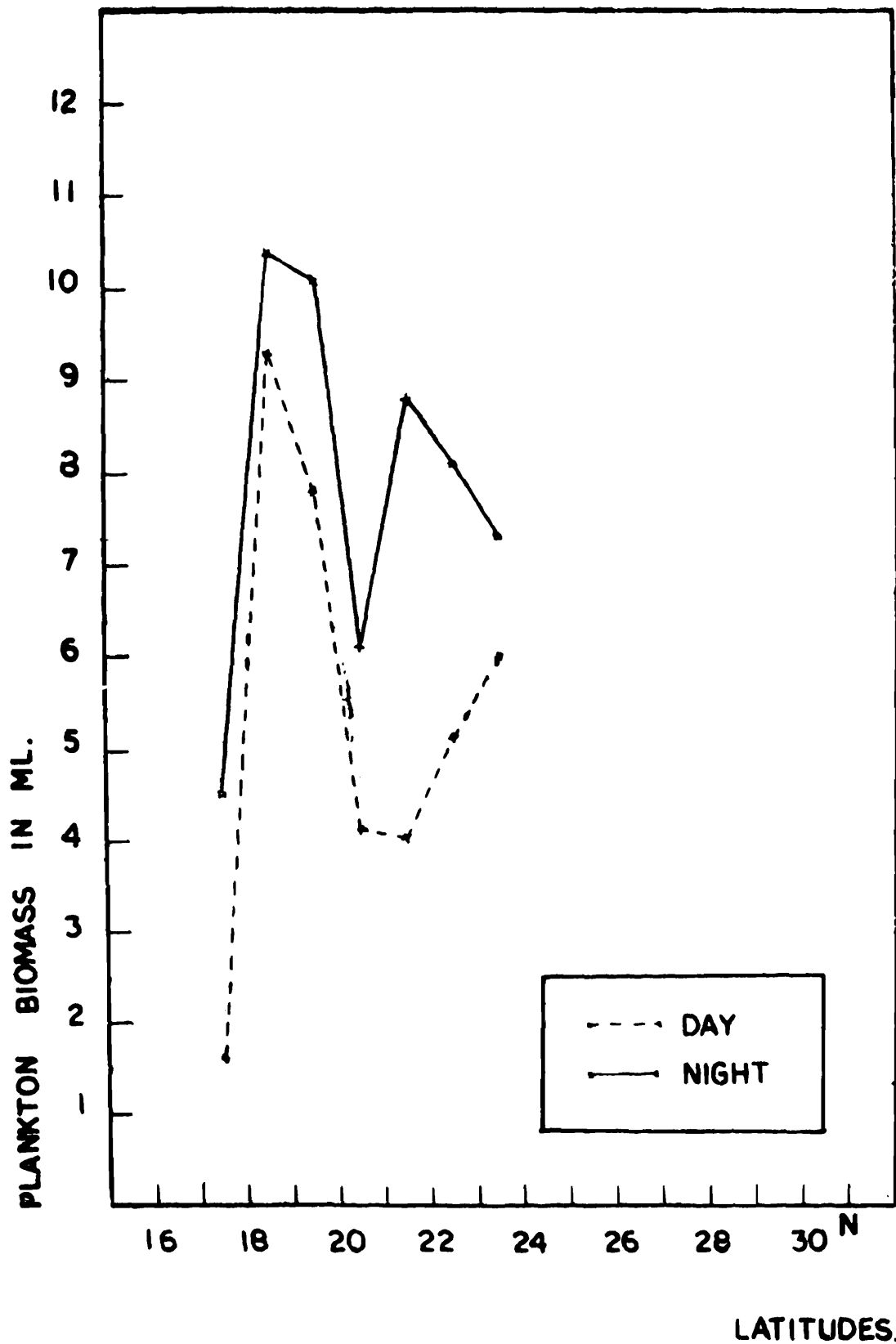
LONGITUDINAL VARIATIONS IN THE PLANKTON BIOMASS  
DURING DAY/ NIGHT PERIODS FOR 1 INTERVALS.



Text-fig. 4

high numbers. The increase in total biomass was contributed mainly by the swarming of ostracods *Cypridina dentata* at 5 night stations (0303, 1701, 3706, 4305, 4907) and 3 day stations (0703, 3507, 4301).

LATITUDINAL VARIATIONS IN THE PLANKTON BIOMASS  
DURING DAY/ NIGHT PERIODS FOR 1° INTERVALS.



Text-fig. 5

At these stations the ostracods outnumbered even the copepods. Swarms of large sized salps (*Pegea confoedrata* (Forskal) *Iasis zonaria* (Pellas) *Metacalfia hexagona* (Quoy & Gaimard) occurred at 5 night stations

(4906, 4907, 5104, 5105, 5107) and 5 day stations (4509, 5108, 5109, 5110, 5111). Swarms of scyphomedusae (*Pelagia noctiluca* Peron & Lesueur), Hydromedusae (*Liriope* sp.), siphonophores [*Diphyes chamunissonis* Huxley *Lensia hotspur* Totton, *Muggiaea atlantica* Cunningham] ostracods (*Cypridina dentata*), euphausiids (*Euphausia* spp.) and salps (*Metacalfina hexagona*, *Iasis zonaria* and *Pegea confoedrata*) occurred at 3 night stations (5104, 5105, 5107) and 4 day stations (5108, 5109, 5110 and 5111). Similarly, swarms of the same species of ostracods, euphausiids, and salps and the amphipod *Hyperia* sp, the neritic siphonophore *Lensia subtiloides* Lens & Van Riemsdijk and several species of copepods (*Eucalanus* spp, *Rhincalanus* spp, *Acrocalanus* spp and *Clausocalanus* spp) occurred at stations 4906 and 4907.

At station 4907 three specimens of the siphonophore, *Ceratocymba dentata* Bigelow which is a mid-ocean species usually inhabiting the depths of the ocean, occurred. This indicates that upwelling of cold deep water probably occurred in this region during January 1974.

#### REMARKS

A comparison of the data on zooplankton biomass from 100 metres depth in the oceanic stations and from seabed in the inshore stations obtained during this study with those of neuston biomass reported earlier by Daniel and Jothinayagam (1977) during the same expedition reveals that (i) neuston and plankton biomass are comparatively very rich at the surface extending upto 100 metres in the oceanic regions and upto the thermocline in the shallower inshore regions (Daniel and Jothinayagam, 1977), (ii) the regions where the lowest neuston biomass value of upto 3.9 ml per five minute haul occurred during the night contained the maximum plankton biomass ranging from 8.0 to 12.0 ml and above and (iii) the areas where the maximal neuston biomass ranging from 8.0 to 12.0 ml and above per five minute haul occurred during the night exhibited moderately rich zooplankton biomass. This is probably due to the reactions of the organisms constituting the neuston and plankton to different intensities of light during the night and day and to other factors such as changes in temperature, salinity, pH, oxygen tension, pressure and water mass movement in the environment which have been suggested as factors influencing the vertical movement and consequently the distribution of plankters (Raymont 1963, Banse 1964 and Daniel and Premkumar 1965). The occurrence of peak biomass values at stations established during the different periods of day and night during this study support the view that different organisms react differently to different intensities of illumination. Further, the biomass values being very poor at 5 midnight stations also support the view that certain planktonic organisms sink during midnight below 100 metres depth (Kikuchi, 1930; Banse, 1964; Daniel and Premkumar, 1965).

**Table—3. Showing the total displacement volumes (ml) with the numbers of each zoological constituents occurring in each haul at 16 night and 11 day stations**

S. No.	Station No.		Total volume	Siphonophores	Medusae	Polychaets	Ostracods	Copepods	Amphipods	Euphausid	Lucifer	Mysids	Shrimps	Decapod larvae	Mollusca	Chaetognaths	Salpa	Others
1.	03.03	N	11	186	25	15	9600	2500	45	35	20	80	20	15	20	50	20	20
2.	05.01	D	10	150	18	8	5650	8600	60	80	30	75	15	5	12	85	30	15
3.	05.05	N	13	180	16	12	8650	5500	25	170	25	40	5	10	35	30	10	30
4.	05.07	D	11	135	30	—	2500	4600	30	350	30	45	—	5	10	55	35	15
5.	07.03	D	10	240	15	10	6050	4500	40	200	10	60	15	16	25	45	25	20
6.	09.01	N	11	160	35	20	1500	5700	70	300	10	80	20	10	15	60	20	25
7.	15.09	N	18	815	40	15	1600	7600	25	450	60	75	40	20	36	45	10	18
8.	17.01	N	11.5	230	20	10	6500	1800	30	250	10	35	20	15	48	30	—	30
9.	17.07	D	10	95	36	20	2500	3600	45	160	50	40	24	18	40	55	30	26
10.	23.07	N	11.8	120	50	16	1200	3000	75	200	25	60	15	10	28	36	25	10
11.	29.05	N	14.5	200	70	12	1250	6700	50	250	26	57	18	27	55	40	30	15
12.	35.07	D	12	250	35	10	7500	1700	95	160	46	50	27	15	20	35	15	20
13.	37.03	N	25	750	120	20	2700	3800	20	600	50	35	20	28	40	25	30	15
14.	37.06	N	15	560	80	16	5800	1300	65	560	55	20	35	30	20	35	10	25
15.	37.08	N	10	230	25	10	2500	4800	40	200	45	60	20	15	10	40	15	20

Table 3. *Contd.*

S. No.	Station No.		Total volume	Siphonophores	Medusae	Polychaets	Ostracods	Copepods	Amphipods	Euphausiids	Lucifer	Mysids	Shrimps	Decapod larvae	Mollusca	Chaetognaths	Salps	Others
16.	43.01	D	10	215	36	12	7600	1500	20	150	25	40	10	20	36	45	20	15
17.	43.05	N	16	850	85	10	8600	2500	150	360	20	55	10	8	20	40	80	10
18.	45.09	D	20	760	75	15	4700	1800	110	800	15	60	25	20	45	30	150	20
19.	49.06	N	13	815	40	8	1250	3050	96	560	20	50	40	15	60	40	120	15
20.	49.07	N	13	910	35	16	1500	3000	120	450	50	80	30	10	70	55	108	10
21.	51.04	N	33	1270	98	10	4700	6800	75	1200	30	60	20	36	33	40	150	25
22.	51.05	N	35	1460	148	20	1850	6500	30	950	45	70	40	30	80	60	220	16
23.	51.07	N	25	1480	120	25	1960	8500	80	1200	40	60	20	25	80	50	180	20
24.	51.08	D	16.5	1125	180	30	1600	560	75	700	80	50	36	15	120	45	150	18
25.	51.09	D	20	1540	140	20	1250	8500	90	880	75	85	60	30	70	30	200	15
26.	51.10	D	19.5	1230	128	24	1800	7000	45	560	35	90	35	20	95	48	350	10
27.	51.11	D	21.5	1850	110	30	1600	3500	80	1500	60	75	40	35	66	55	250	15

N — Night Station

D — Day Station

The results obtained on zooplankton biomass from 200 metres depth in the northern Arabian sea based on the material collected during the International Indian Ocean Expedition (Prasad, 1969) generally agree with the distribution of zooplankton biomass from 100-0 metres depth obtained during this study. Further, the results of Paulinose and Aravindakshan (1977) on the zooplankton collections from 200 metres during the same Expedition wherein the highest intensity of zooplankton was from the region in between 20°-23°N latitude and 66°-70°E longitude, link up well with the distribution of biomass from 100-0 metres and from near seabed to surface obtained during the present study.

The occurrence of areas of very rich zooplankton in the oceanic regions of the central part of the Arabian sea in the 100-0 metres depth zone observed during this study is mainly due to the siphonophores, medusae and copepods. Similarly, the rich zooplankton biomass off Ras-Al-Hadd is contributed by the swarming of ostracods and copepods. The ostracods outnumbered even the copepods at eight stations, a remarkable feature unique for the northern Arabian sea. This unique feature has also been reported earlier by Daniel and Jothinayagam (1977) while studying the neuston and by Paulinose and Aravindakshan (1977) while studying the zooplankton collection from 200-0 metres depth during the same Expedition. Further, it is of interest to note that upwelling of deep cold water occurred at station 4907 during January 1974 replenishing this region by the nutrient rich deeper waters which probably contribute to the high intensity of zooplankton biomass between 70°-71°E longitudes.

#### SUMMARY

During the oceanographic expedition on the I. N. S. DARSHAK in the Northern Arabian Sea from December 1973 to May 1974 studies were made on the biomass of zooplankton and variations in abundance of major constituents from 100-0 metres in the oceanic regions at 100 stations and from near seabed to surface at 94 shallow nearshore stations following a close grid system. These studies revealed that (i) the zooplankton biomass was far more abundant during the night than during the day (ii) the regions where the maximum plankton biomass occurred contained the lowest neuston biomass (iii) the regions where moderately rich zooplankton occurred contained the maximal neuston biomass (iv) peak biomass values occurred at some stations established during different parts of day and night and poor zooplankton biomass occurred at some midnight stations for which explanations are given (v) the longitudinal and latitudinal variations of biomass and zooconstituents of plankton at stations with an increased total biomass and possible

upwelling of cold deepwater due to the occurrence of a siphonophore are discussed.

#### ACKNOWLEDGEMENTS

The authors are grateful to Captain K. L. Chopra, commanding Officer, Lt. Commander S. Issacs, Executive Officer and all officers and crew of the I. N. S. DARSHAK and other participating scientists for help, several courtesies, technical discussions and for collection of samples and data during the course of these investigations. The authors are also grateful to Dr. T. N. Ananthkrishnan, Director, Zoological Survey of India for encouragement, facilities given to undertake this work and for helpful suggestions in the preparation of this paper.

#### REFERENCES

- BANSE, K. 1964. On the vertical distribution of zooplankton in the sea. *In, Progress in Oceanography*, 2 : 55-125. Ed. Mary Sears, Pergamon Press, Oxford.
- BOGOROV, B. G., AND VINOGRADON, M. E. 1961. Certain peculiarities of the plankton biomass distribution in the surface waters of the Indian Ocean in winter 1959/60. *Acad. des. Sci. de l' URSS Comite de l' Annee Geophysique Internationale*, X Section of the IGY Programme (Oceanology), No. 4 : 66-77 (In Russian).
- CLARKE, G. L. 1946. Dynamics of production in a marine area. *Ecol. Monogr.*, 16 : 323-335.
- DANIEL, A. AND PREMKUMAR, V. K. 1965. The distribution of the standing crop of zooplankton in the eastern sector of the Indian Ocean during July-September, 1962. *J. mar. biol. Ass. India*, 7(2) : 440-452.
- DANIEL, A. AND JOTHINAYAGAM, J. T. 1977. Neuston biomass and variations in abundance of its major constituents in the northern Arabian sea during the oceanographic Expedition on I. N. S. Darshak (December, 1973-May, 1974)- Abstract No. 33 (Published). Full paper in *Proceedings Symposium on Warm water zooplankton* October, 1976, Goa, India (In press).
- FOXTON, P. 1957. The distribution of the standing crop of zooplankton in the Southern Ocean. *Discovery Repts.*, 28 : 193-235.
- HARDY, A. C. 1956. "The Open Sea: The World of plankton", Collins, London : XV + 335.
- HARDY, A. C. AND GUNTHER, E. R. 1935. The plankton of the South Georgia whaling grounds and adjacent waters, 1926-27. *Discovery Repts.*, 11 : 1-456.

- KIKUCHI, K. 1930. Diurnal migration of plankton Crustacea. *Quart. Rev. Biol.*, 5 : 189-206.
- PAULINOSE, V. T. AND ARAVINDAKSHAN, 1977. Zooplankton biomass, abundance and distribution in the north and northeastern Arabian sea. Abstract No. 13-published. Full paper in *Proceedings Symposium on Warm water zooplankton*, October 1976.
- PANOMAREVA, L. A. AND NAUMOV, A. G. 1962. Distribution of zooplankton biomass in the waters of the Arabian sea and the Bengalian Gulf at the period of monsoon alternation. *Dokl. Akad. Nauk., SSSR*, 142 : 449-452 (In Russian)
- PRASAD, R. R. 1969. Zooplankton biomass in the Arabian sea and the Bay of Bengal with a discussion on the fisheries of the regions. *Proc. Nat. Inst. Sci. India*. 35(5) : 8 : 399-437.
- RAYMONT, J. E. G. 1963. *Plankton and Productivity in the Oceans*. Pergamon Press.
- SEWELL, R. B. S. 1948. The free swimming planktonic copepoda-geographical distribution. *John Murray Expdn. 1933-34 Sci. Repts. B. M. (N. H.)*, 8 : 321-592.



TAIL CARRIAGE IN THE HANUMAN LANGUR,  
*PRESBYTIS ENTELLUS ENTELLUS*  
(PRIMATES, CERCOPITHECIDAE) IN THE  
INDIAN DESERT

By

M. L. ROONWAL

*Zoological Survey of India, Paota B Road, Jodhpur*

AND

S. C. MAKWANA

*Zoology Department, Jodhpur University, Jodhpur*

(With 5 Text-figures, 1 Plate and 3 Tables)

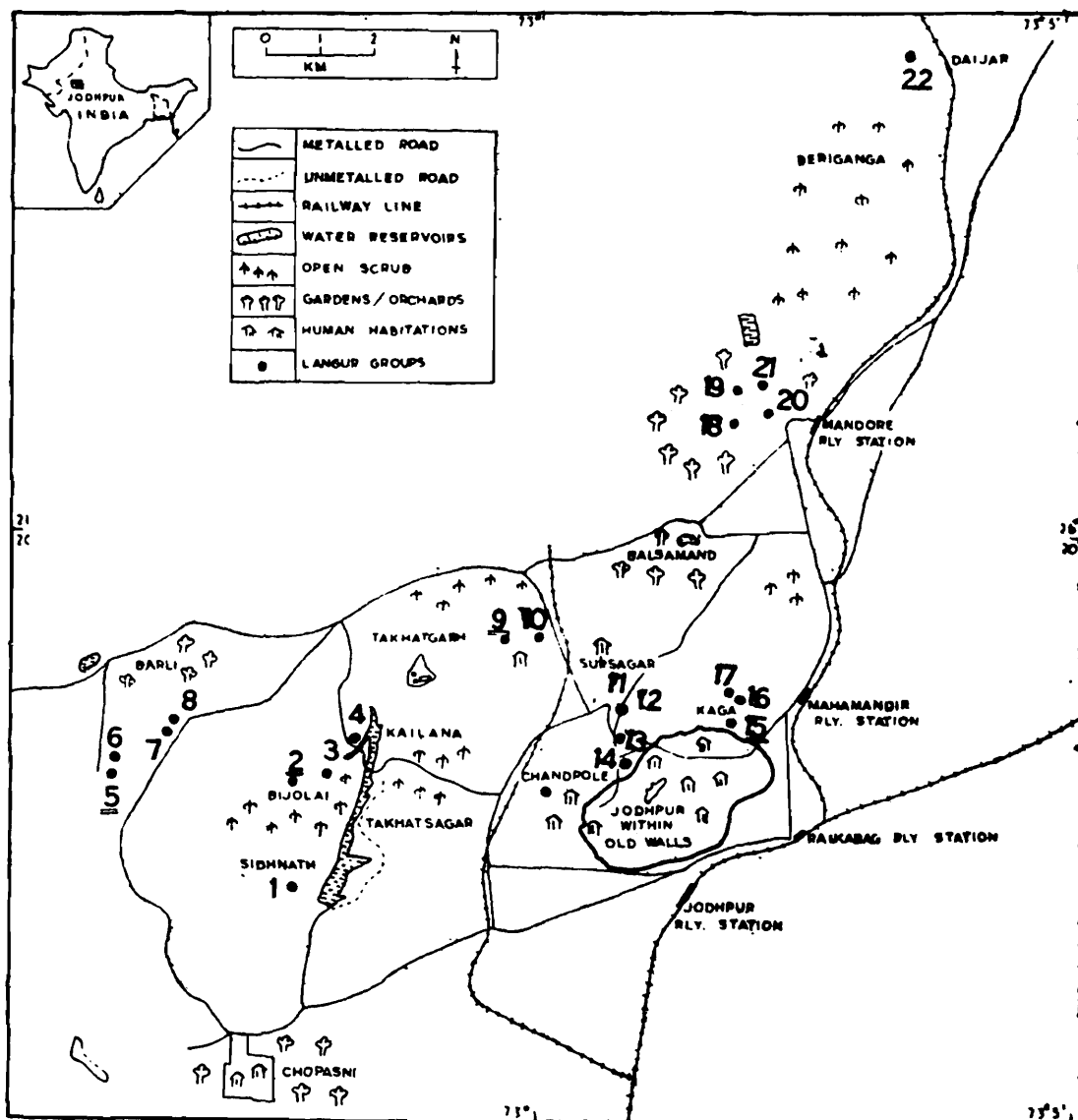
INTRODUCTION

Little attention has been given to the mode of tail carriage in Primates except in the Indian rhesus macaque, *Macaca mulatta* (Zimmerman), where the most dominant or alpha male carries the tail erect, while in other individuals it is pendant (Ojha, 1974). *Presbytis entellus* (Dufresne) (Cercopithecidae, Colobinae) is the common langur of India and Sri Lanka, and has 15 subspecies (Pocock, 1928*a, b*, 1939; summary in Roonwal and Mohnot, 1977). It has a long, powerful, rope-like tail which is about 50 percent longer than the head-and-body. Little is known of its tail carriage, but Roonwal (1976, and in press) has recently studied the occurrence of geographical, subspecific and clinal variations.

We present here the results of field study on the North Indian subspecies, *P. entellus entellus* (Dufresne), in an isolated population on the eastern fringe of the Great Indian Desert around Jodhpur (preliminary account in Roonwal and Makwana, 1976). The tail is normally (while standing or walking) looped forward. The problems studied were the nature and shape of the loop, the loop index, the position of the tail tip, the left-right stance of the tail, and sexual and other differences in tail carriage.

## MATERIAL AND METHODS

This study was carried out in the semi-desert, rocky country around Jodhpur (latitude 26 18' N, longitude 73 04' E) in western Rajasthan (Fig. 1), which, within an area of about 50 kms, harbours a wild, isolated population of about 900 langurs divided into some 32 groups (Mohnot, 1974). For over a hundred kilometres or more around there are no langurs or any other primates. Observations were made during a 2-year period on 68 separate individuals in 22 different groups (18 bisexual-unimale, 4 all-male; names and locations as in Text-Fig. 1) for about



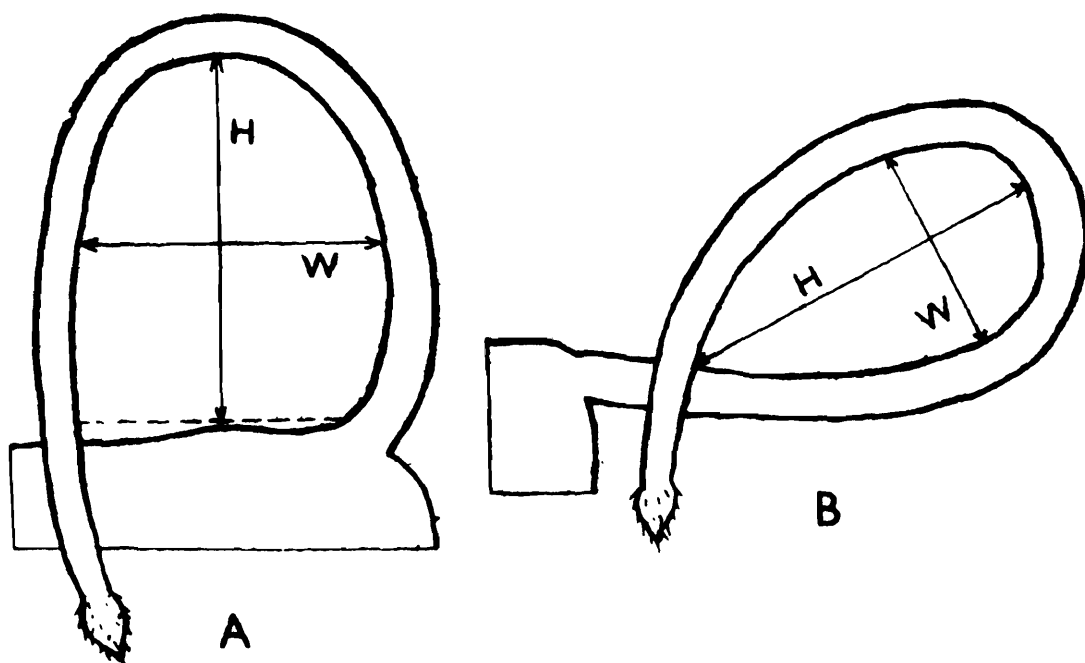
**Text-fig. 1.** Map of Jodhpur and vicinity, to show the location of groups of *Presbytis entellus entellus* which were studied for tail carriage. Groups were bisexual-unimale except where otherwise stated; all-male groups are double-underlined. *Group names* 1. Sidhnath. 2. Bijolai C (all-♂). 3. Bijolai A. 4. Bijolai B. 5. Bhadreswar A (all-♂). 6. Bhadreswar. 7. Kadamkandi A. 8. Kadamkandi B. 9. Chopar B (all-♂). 10. Chopar A. 11. Sursagar A. 12. Sursagar B. 13. Vidyasal A. 14. Vidyasal B. 15. Kaga B (all-♂) 16. Kaga A1. 17. Kaga A2. 18. Guest House. 19. Guest House A. 20. Nagadari. 21. Nagadari A. 22. Daijar.

104 observation-hours, on 4,899 individual 'episodes' (see below). Continuous observations on single animals lasted from brief periods to half an hour or more. (A pair of field binoculars were helpful in observing distant animals). Daily observations lasted several hours at a stretch to enable us to follow individuals and groups for long periods under various situations. The dominance status of males within all-male groups was determined by food offer tests.

The tail is normally looped. We have termed the looped period as an 'episode', and the intervening, unwound period as an 'interruption'. The two periods often alternate within seconds or minutes. To facilitate quick and continuous noting of the tail stance (see below), the following mode of recording of individual episodes and stance was adopted, the hour being noted at the commencement and the end and as often as possible in between :—

R /	R /	R /	R /	R /	L /	R /	R /	M /	R /	/
S	St	Rn	J	/	Rn	St	W	J	/	/
15.30					15.35					15.39
										(ran away)

The following abbreviations were used: J, jumping; L, left, M, middle, and R, right stance of tail loop; Rn, running; S, sitting; St standing; W, walking; /, an interruption between two looped periods or episodes. Other abbreviations used where necessary were: Ad, adult, SA, subadult; I, infant; Jn, juvenile.



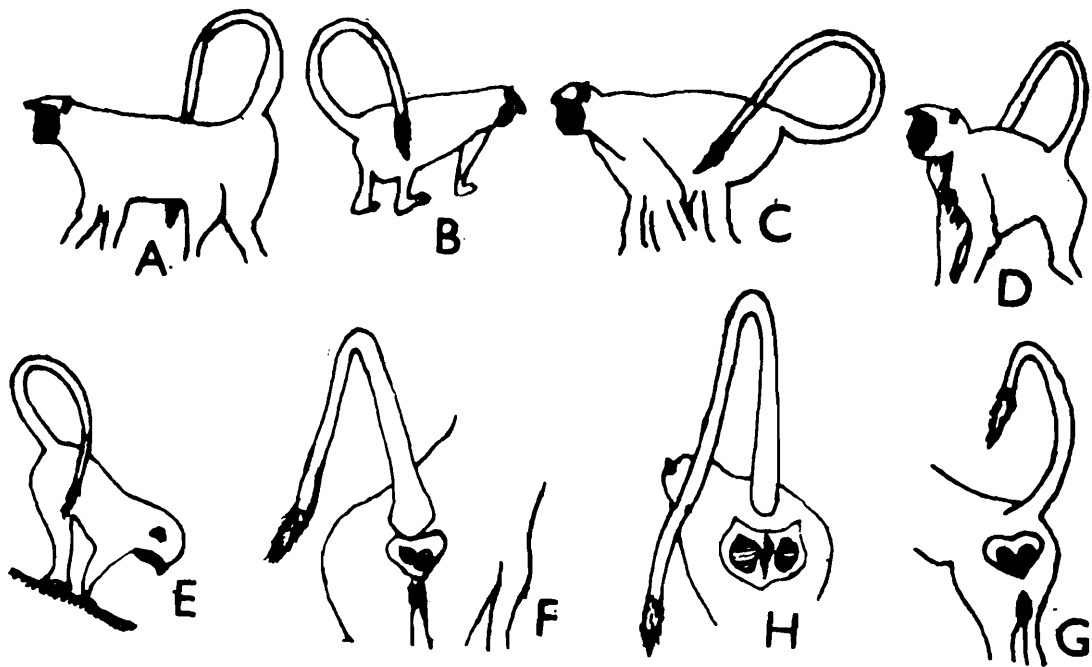
Text-fig. 2. Tail loops in adults of *Presbytis entellus entellus* at Jodhpur, to show method of measurement of height (H) and width (W), to determine at the Loop Index (W/H). and width (W), to determine at the Loop Index (W/H). (A) Normal, relaxed loop ('open'). (B) Temporary phase ('closed' loop).

The loop shape, which was studied in lateral photographs, is mostly round- to elongate-oval and can be expressed as the ratio Width/Height (Loop Index). The height is measured as the maximum length from a point on the inside of the tail opposite its insertion, and the width as the maximum width across the height line (Text-Fig. 2A). Occasionally, the loop is 'closed'; the height is then measured from the point of tail crossing (Text-Fig. 2B).

## RESULTS

### 1. Tail Carriage (General)

In adults and subadults the normal mode of tail carriage in relaxed, nonstress situations (standing, walking, slow running) is as an 'open', forwardly directed, upright loop (Text-Fig. 3 and Pl. VI,), with the distal part either just touching the back or trailing along the sides of the body to the left or right, and the tip reaching down to well below the belly (c. 15 cm or so). Under stress (fast running, fighting) the loop is partly or wholly unwound and the tail acquires a bow- or a S-shape (Pl. VI, Fig. 5). In repose, while sitting (Pl. VI, Figs. 3 and 4), the tail is either stretched



**Text-fig. 3.** Tail carriage in adults of *Presbytis entellus entellus* at Jodhpur, to show tail loop stance. (Outlines from photographs; H ex Mohnot, rest original). (A) ♂, walking, loop stance right. (B) ♂, standing, right stance. (C) Running, left stance. (D) ♀, running slow, right stance. (E) ♂, descending, right stance. (F) ♂, standing, left stance. (G) ♂, standing, middle stance. (H) ♀, standing, left stance.

flat on the ground (temporarily, for a very brief duration, it may form a closed loop by crossing in the distal half, Fig. 2A), or, if the animal is on a ledge or a tree branch, it hangs down limp and straight and may swing from side to side (Pl. IV, Fig. 4). (It is in the hanging position that infants



Photographs of *Presbytis entellus entellus* (all are adults except Fig. 4) at Jodhpur, to show tail carriage. (1) Walking ♀ with infant. (2) ♂, walking. (3) A group, in various positions. (4) Juvenile sitting on a ledge, the tail swinging slowly from side to side. (5) Three ♂♂, fighting; note that the tail loop has become unwound and assumed, a bow-shape. (Figs. 1, 2 ex Strain.)

TABLE 1. The frequency of occurrence (%) of tail position with respect to tail tip in adults of *Presbytis entellus entellus* at Jodhpur.

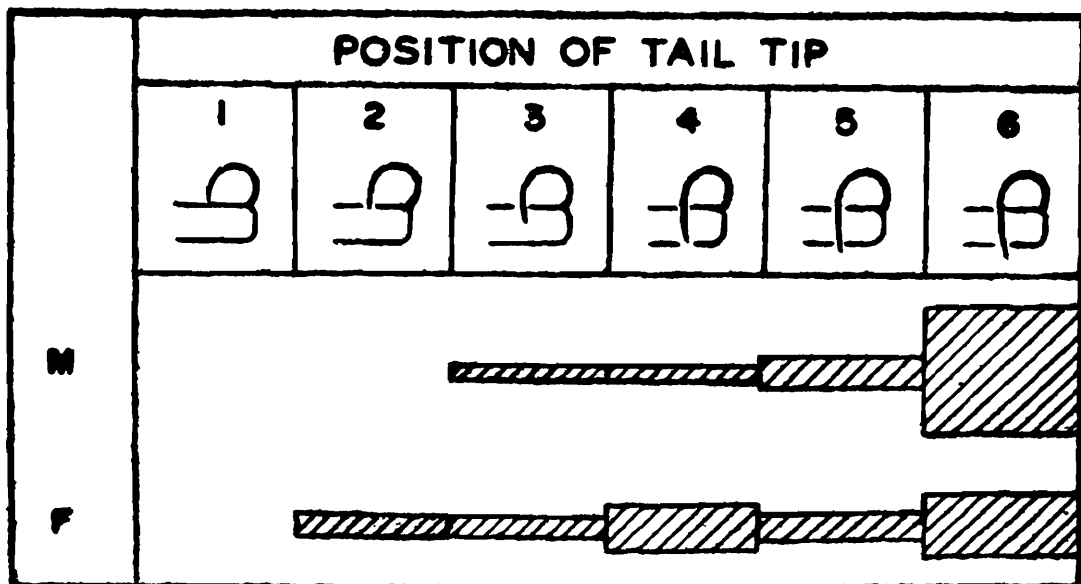
Position of tail tip	Percentage					
	1	2	3	4	5	6
	(a little above back)	(touching back)	(middle of back and belly)	(bottom of belly)	(a little below belly)	(well below belly)
20 ♂♂	0	0	5	5	10	80
25 ♀♀	0	7.4	7.4	22.2	18.5	44.5

and juveniles climb each other's and the mother's tail for swinging.) In *coupla* also the tails hang limp. The loop is reformed as soon as the animal gets up, and remains more or less in tact, though occasional unwinding and reforming may occur. Subadults carry the tail as in adults, while in infants and juveniles there is no fixed mode of tail carriage and the loop is generally wanting though it may sometimes be formed casually for a brief duration.

## 2. Position of the Tail Tip

(Text-Fig. 4; and Table 1)

The position of the tail tip was examined in 45 adults (20 males in 10 different groups, one all-male and the rest bisexual-unimale; and 25 females in 6 different groups, all bisexual-unimale). The number of adult males in a group ranged from 1 (in bisexual groups) to 7 (in all-male groups); that of females from 4 to 36. A total of 1,451 'episodes' were observed (1,027 in males, with 10-326 episodes for each individual; and 424 in females, with 4-65 episodes for each). Records were grouped into six categories with regard to the position of tail tip, thus: (1) A little above the back. (2) Touching the back. (3) Middle of the back and belly. (4) Bottom of the belly. (5) A little below the belly (up to 3 cm). (6) Well below the belly (3-15 cm). The following are the principal conclusions: (1) The tail tip always reaches the back, and often goes below it, in many cases well below (3-15 cm) the belly. (2) Variation ranged over five positions (Nos. 2-6, none being found in position No. 1 except very excep-



Text-fig. 4. *Presbytis entellus entellus*. Jodhpur. Variation in position of tail tip in adults (F, females; M, males). Size of shaded rectangles indicate approximate relative frequency of each position-type. Position of tail tip : 1. A little above the back (none). 2. Touching the back. 3. Middle of the back and belly. 4. Bottom of the belly. 5. A little below the belly. 6. Well below the belly.

tionally and temporarily). (3) Within this range, there is, in both sexes, a strong tendency for individual constancy, and in every episode the tip returns again and again to the position which is characteristic for that individual; exceptions were rare and occurred only in females. (4) A marked degree of sexual dimorphism is noticeable (Text-Fig. 4; and Table 1). Males ranged from positions 3-6 (with heavy concentration, 80%, in No. 6), and an almost absolute individual constancy. Females ranged from positions 2-6, still substantially concentrated (44.5%) in position No. 6, but the spread is more even (Table 1) and there is less, but still substantial, constancy than in males (out of 25 females, 23 had a 'single' position and the remaining two had two different but neighbouring positions, viz., Nos. 5, 6 and 4, 5).

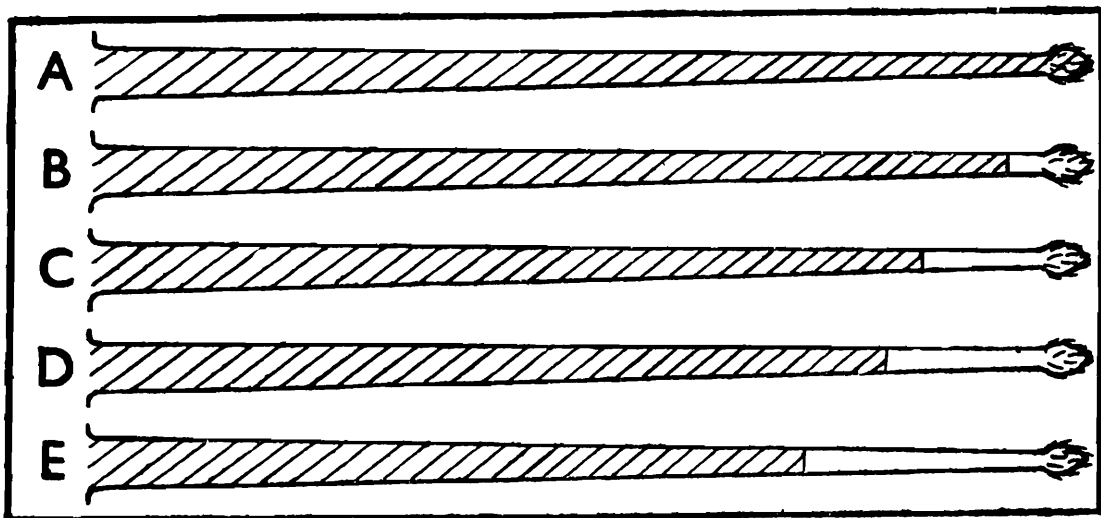
### 3. Tail Loop and the Left-Right Stance

#### (a) Loop shape and index

The normal upright, forwardly directed loop is of the 'open' type (Text-Figs. 2A and 3), i.e., the tail does not cross at any point. Occasionally, a 'crossed' loop may occur temporarily (Text-Fig. 2B). In 19 adults and subadults, the Loop Index (W/H) in open loops varied from 0.3-1.0, with the maximum concentration (83 %) well above 0.5 (0.6-0.9); the loop thus tends to be round-oval. Data are inadequate to determine sexual or other differences. (The crossed loop is also generally round-oval.)

#### (b) Extent and portion of tail involved in the loop

The extent and portion of the tail involved in the loop varies with



Text-fig. 5. The extent of tail involved in the loop (shaded part) in *Presbytis entellus entellus* at Jodhpur in various situations of tail tip (cf. Fig. 4). (A) Tip touching the back. (B) Tip a little below the back. (C) Tip at the middle of the back and belly. (D) Tip from bottom of the belly to a little below it. (E) Tip well below the belly.

TABLE 2. *Presbytis entellus entellus* at Jodhpur. A few examples (taken at random from among the 68 individuals studied) to illustrate the near-constancy (c. 80-100%) of tail loop stance in individuals.

Sl. No. of observations	Total No. of episodes observed	Tail stance, %			Remarks
		Left	Right	Middle	
(A) <i>Male (from a unimale- bisexual group, Bijolai A)</i>					
1	10	0	100	0	} Observed on 8 different days in 8 different sets of observations (period ranging from 5-45 min.)
2	23	17.4	82.6	0	
3	56	14.3	85.7	0	
4	16	0	100	0	
5	14	0	100	0	
6	43	4.7	95.3	0	
7	33	12.1	87.9	0	
8	38	5.2	94.8	0	
Total and Range	233	0-17.4	82.6-100	0	
(B) <i>Male (from an all-male group, Kaga B)</i>					
1	16	100	0	0	} Observed on 4 different days in 4 different sets of observations (period ranging from 15-40 min.)
2	28	82.2	17.8	0	
3	47	95.7	2.2	2.1	
4	19	95	0	5	
Total and Range	110	82.2-100	0-17.8	0-5	

(C) Female (from a unimale-bisexual group, Bijolai A)

1	20	85	15	0	} Observed on 7 different days in 7 different sets of observations (period ranging from 9-40 min.)
2	23	91.3	8.7	0	
3	10	100	0	0	
4	55	87.3	12.7	0	
5	40	100	0	0	
6	22	100	0	0	
7	10	100	0	0	
<b>Total and Range</b>	<b>180</b>	<b>85-100</b>	<b>0-15</b>	<b>0</b>	

TABLE 3. *Presbytis entellus entellus*, Jodhpur. Mean percentage of the frequency of occurrence of tail loop stance.

Category	Total No. of individuals observed	Total No. of episodes observed	Mean % ( $\pm$ S. E.) of tail loop stance		
			Left	Right	Middle
1. Adult males from unimale-bisexual groups)	18	2,769	45.96 $\pm$ 0.94	50.35 $\pm$ 0.94	3.69 $\pm$ 0.06
2. Adults males (from all-male groups)	27	682	64.40 $\pm$ 0.92	35.10 $\pm$ 0.91	0.50 $\pm$ 0.37
3. Subadult males (from all-male groups)	8	424	54.00 $\pm$ 1.76	43.40 $\pm$ 1.75	2.60 $\pm$ 0.55
(Males) :	(53)	(3,875)	(45.96-64.40)	(35.10-50.94)	(0.50-3.69)
4. Adult females (from unimale-bisexual groups)	15	1,024	90.40 $\pm$ 0.76	8.24 $\pm$ 0.70	1.35 $\pm$ 0.29
All individuals	68	4,899	61.74 $\pm$ 0.55	36.27 $\pm$ 0.54	1.08 $\pm$ 0.16

Chi-square tests showed significant differences, at 1% level of probability, between the following category-pairs:-

Adult males (from bisexual groups) vs. adult females.

Adult males (from all-male groups) vs. adult females.

Adult males (from all-male groups) vs. subadult males (from all-male groups).

Adult males (from bisexual groups) vs. adult males (from all-male groups).

the position, down the sides, reached by the tail tip. When the tip just reaches the back, the entire tail forms the loop. With the extension of the tail further down the sides, the portion of the tail (always the proximal) forming the loop gradually declines to about three-fourths of the tail length (Text-Fig. 5).

(c) *Loop stance*

Where the tail tip reaches below the back, the tail runs down the body sides to the right or left. In a few cases, where the tail just reaches the back (or temporarily remains a little above it), a 'middle' stance is observed. As noted in 4,899 'episodes' in 68 different langurs, individuals show a near-constancy (c. 80-100 %) of loop stance, and in episode after episode the tail resumes, after each 'interruption', the stance which is characteristic of that individual. This feature is illustrated in Table 2 in a few examples taken at random from among the 68 individuals studied. Strong tendencies of sexual differences, as well as differences between males from different types of groups, are noticeable ( $\chi^2$  tests) (Table 3).

(i) *Adult and subadult males*: Observations on 3,875 episodes in 53 males from 22 groups show (Table 3) the following characteristics:- (1) The loop stance is nearly evenly distributed between left and right (means: left (L) 45.96-64.40 %, right (R) 35.10-50.94 %, middle (M) 0.50-3.69 %.\* (2) Significant differences in the mean L : R : M proportions occur between adult males from bisexual groups and those from all-male groups, the former tending toward a right stance, the latter toward a left; the proportions are: bisexual 45.96: 50.35 : 3.69; all-male 64.40 : 35.10 : 0.50. (3) Males in all-male groups show a marked tendency towards intragroup † constancy. In Chopar B group all the 7 males had a wholly right stance, while in Bijolai C group all the 4 males had a largely left stance. In Kaga B group, with 15 males, all except one had a predominantly left stance; the exceptional male had an almost wholly *middle* stance (99.3 %; this was the sole exception of this kind in the entire material studies at Jodhpur).

(ii) *Adult females*: Observations on 1,024 episodes in 15 females from 12 groups (all bisexual-unimale) show (Table 3) the loop stance to be overwhelmingly left, the mean L : R : M proportions being 90.40 : 8.25 : 1.35. (In an exceptional female, in the Sidhnath group, it was mostly right, 86.5 %.) The middle stance is generally absent and was observed only occasionally in three females (2.6 %—9 %).

\* In the preliminary note (Roonwal and Makwana, 1976, the male stance was given as predominantly right, the mean L : R : M proportions being 32 : 57 : 11.

† In the preliminary note (Roonwal and Makwana, 1976 .p. 83) this was misprinted as "intergroup constancy".

(iii) *Younger stages*: Subadults tend to be like adults. Juveniles and infants show no constancy in tail carriage.

## DISCUSSION

### *The Jodhpur population*

The theoretical implications of the above mentioned findings on the Jodhpur population (*P. e. entellus*) can be fully understood only if complete information on genealogies of individuals and group-histories is available. Such information is almost impossible to obtain in large, wild populations. Some general tendencies may, however, be discussed as seen in adults (subadults have adult characteristics; but infants and juveniles have no constancy of tail carriage, and a study of the ontogeny of tail carriage should be of considerable interest).

In the relaxed state, at Jodhpur, the tail is looped forward in a large, suboval loop over the back. (The direction and shape of the loop shows geographical, subspecific and clinal variations, Roonwal 1979.) Under stress (fast running, fighting) the loop tends to become unwound. The near-constancy of loop stance (left or right) in individuals, and its sex-linkage (in females it is predominantly left, mean 90.4%; in males it is more evenly distributed) suggest a genetical origin. Furthermore, intergroup differences are noticeable. The loop stance in adult males from bisexual groups differs significantly from all-male groups; in the former the right stance is more common, in the latter the left. How these differences arise and are maintained is not clear. Intragroup constancy is noticed among males in all-male groups. The origin of this uniformity cannot be understood without a knowledge of genealogies. Does uniformity ensure recognition between group members and coherence within a group?

## ACKNOWLEDGEMENTS

We are indebted to the following persons for assistance:- To Dr. S. M. Mohnot (Jodhpur) for the loan of some photographs and literature; to Mr. J. S. Rao (Jodhpur) for help in statistical matters; to Mr. P. S. Chauhan (Jodhpur) for drawing the map (Text-Fig. 1); and to Mrs. Dawn Starin (U.S.A.) for the use of some photographs.

## SUMMARY

1. Tail carriage was studied in adults of an isolated population comprising about 900 individuals of *Presbytis entellus entellus* (Dufresne) in Jodhpur and its vicinity at the eastern fringe of the Great Indian Desert. A total of 68 individuals from 22 groups (both bisexual-unimale

and all-male) were studied in 4,899 different 'episodes' during a 2-year period.

2. In the relaxed state (standing, walking, slow running) the tail is carried in a large, round- to elongate-oval, forwardly directed loop over the body. Under stress (fast running, fighting) the loop tends to open out and the tail assumes a bow- or a S-shape. In repose (sitting) the tail is spread irregularly on the ground, or hangs limp.

3. The tail tip reaches the back and often runs further down the sides to well below the belly. In males the tip largely (80%) reaches well low the belly; females show a wider and more even spread.

4. Variations in the shape of the oval loop can be gauged by the Loop Index (Width W/ Height H) which ranges between c. 0.3-1.0, with the maximum concentration at 0.6-0.9.

5. The extent and portion of tail involved in the loop varies with the position, down the sides, reached by the tail tip, and is the least (about three-fourths of the tail length) when the tip is farthest down the belly.

6. Loop stance: The tail may run down the body sides to the left or right, or remain in the 'middle' (when it just reaches the back), the last condition being uncommon. Individuals show a near-constancy of loop stance. Sexual dimorphism and differences between types of groups are noticeable. In males the loop stance is nearly evenly distributed between the left and right; in females the stance is overwhelmingly left (c. 90 %).

7. Subadults tend to be like adults. Juveniles and infants show no constancy in tail carriage.

#### REFERENCES

- MOHNOT, S. M. 1974. *Ecology and Behaviour of the Common Indian Langur, Presbytis entellus (Dufresne)*. Ph. D. Thesis, Jodhpur University, Jodhpur, 299 pp., sev. figs.
- OJHA, P. R. 1974. Tail carriage and dominance in the rhesus monkey, *Macaca mulatta*. *Mammalia*, Paris, **38** : 163-170.
- POCOCK, R. I. 1928a. The langurs, or leaf-monkeys, of British India. (Part 1.) *J. Bombay nat. Hist. Soc.*, **32** : 472-504, 2 pls.
- POCOCK, R. I. 1928b. The langurs, or leaf-moneys, of British India. Part II. *J. Bombay nat. Hist. Soc.*, **32** : 660-677, 2 pls.
- POCOCK, R. I. 1939. *The Fauna of British India, including Ceylon and Burma. Mammalia* (2nd ed.). Vol. 1. *Primates and Carnivora (in part, Families Felidae and Viverridae)*. London : Taylor and Francis.
- ROONWAL, M. L. 1976. Dominance behaviour in South Asian Primates. *J. sci. & indust. Res.*, New Delhi, **35** : 244-260.

- ROONWAL, 1979 M. L. Field study of geographical, subspecific and clinal variations in tail carriage in the Hanuman langur, *Presbytis entellus* (Primates) in South Asia. *Zool. Anz.*, Jena, **202**: 235-255
- ROONWAL, M. L. AND MAKWANA, S. C. 1976. Preliminary note on tail carriage in the langur, *Presbytis entellus*, in Indian Desert. *Newsl. zool. Surv. India*, Calcutta, **2** (3) : 82-83.
- ROONWAL, M. L. AND MOHNOT, S. M. 1977. *Primates of South Asia : Ecology, Sociobiology and Behavior*. xx + 421 pp. Cambridge (Mass.): Harvard University Press.

## STUDIES ON BATS OF GUJARAT

*By*

Y. P. SINHA

*Gangetic Plains Regional Station,  
Zoological Survey of India, Patna.*

(With one Text-Figure)

This paper is based on the collections made by the author during September-October, 1976 and deposited in the Desert Regional Station of Zoological Survey of India, Jodhpur, and earlier collections in Zoological Survey of India, Calcutta from Kutch, Junagadh, Rajkot, Banas Kantha, Ahmadabad, Sabar Kantha, Kaira, Baroda, Broach, Surat and the Dangs districts of Gujarat. Some collections from Dadra and Nagar Haveli collected by the author are also included here for the first time.

Although some stray information on taxonomy, distribution and ecology of bats of these areas is available in the work of Wroughton (1918*a, b*), Ellerman and Morrison Scott (1951), Brosset (1962*a, b, c*) and Sinha (1970, 1975 and 1980), a comprehensive account of the bats is not available. In the present account, a list of 22 species and subspecies found in Gujarat is given including one new record. As a result of this study range of several species has been considerably extended. Besides this, important measurements and ecological notes are also appended wherever desirable. All measurements are in millimetres and those in parentheses refer to the mean values. The material of Z. S. I. Calcutta is indicated by Z. S. I. in parentheses.

### ACKNOWLEDGEMENTS

The author is grateful to Dr. T. N. Ananthakrishnan, former Director, Zoological Survey of India for providing facilities for this work and to Dr. P. D. Gupta Deputy Director, Gangetic Plains Regional Station, Patna for critically going through the manuscript.

### *Abbreviations*

$c-m^1$  or  $c-m^3$  length of upper tooth row;  $c-m_2$  or  $c-m_3$ , length of the lower tooth row;  $cw$ , width of braincase; D. R. St., Desert Regional Station;  $f.$ , length of forearm;  $ft.$ , length of foot including claw;  $l.$ , total length of skull;  $ml.$ , length of mandible;  $m^1-m^1$  or  $m^3-m^3$ , width of maxilla;

*t.*, length of tibia; *zw.*, zygomatic width; Z.S.I., Zoological Survey of India, Calcutta.

SYSTEMATIC ACCOUNT  
Order CHIROPTERA  
Suborder MEGACHIROPTERA  
Family PTEROPODIDAE

1. *Pteropus giganteus giganteus* (Brünnich)

1782. *Vespertilio gigantea* Brünnich, *Dyrenes Historie*, 1 : 45.

*Material* : Baroda Dist. : Baroda, 9.9.1976, 1 ♂, 1 ♀ ; Surat Dist. Sultanabad, 23.9.1976, 1 ♀ ; Dadra and Nagar Haveli.: Silvassa, 6.10.1976, 1 ♀ ; Sabar Kantha Dist. : Himatnagar, no date (Z.S.I.), 1 ♀ ; Rajkot Dist. : Rajkot, no date (Z.S.I.), 1 ♀ ;

*Measurements* : External : 1 ♂ : *f.*, 170; *t.*, 82; *ft.*, 55. 2 ♀ ♀ : *f.*, 160, 167; *t.*, 76, 77; *ft.*, 52, 55.

Skull: 1 ♂ : *l.*, 75.5; *zw.*, 41; *cw.*, 25.3; *m<sup>1</sup>-m<sup>1</sup>*, 21.6; *c-m<sup>1</sup>*, 28.1; *c-m<sub>2</sub>*, 32; *ml.*, 58.5. 1 ♀ : *l.*, 71.5; *zw.*, 37; *cw.*, 24.5; *m<sup>1</sup>-m<sup>1</sup>*, 20.3; *c-m<sup>1</sup>*, 27; *c-m<sub>2</sub>*, 31; *ml.*, 56.

*Remarks*: Hitherto known only from Kutch, Junagadh, Rajkot, Sabar-Kantha, Banas Kantha districts of Gujarat. Present material was collected from Baroda and Surat districts and Dadra and Nagal Haveli.

This large fruit bat is very common in Gujarat. It was collected from neem (*Azadirachta indica*) and tamarind (*Tamarindus indica*) trees. The size of colony was about 100-500 exs.

2. *Rousettus leschenaulti* (Desmarest)

1820. *Pteropus leschenaulti* Desmarest, *Encycl. Meth. Mammalia*, 1 : 110.

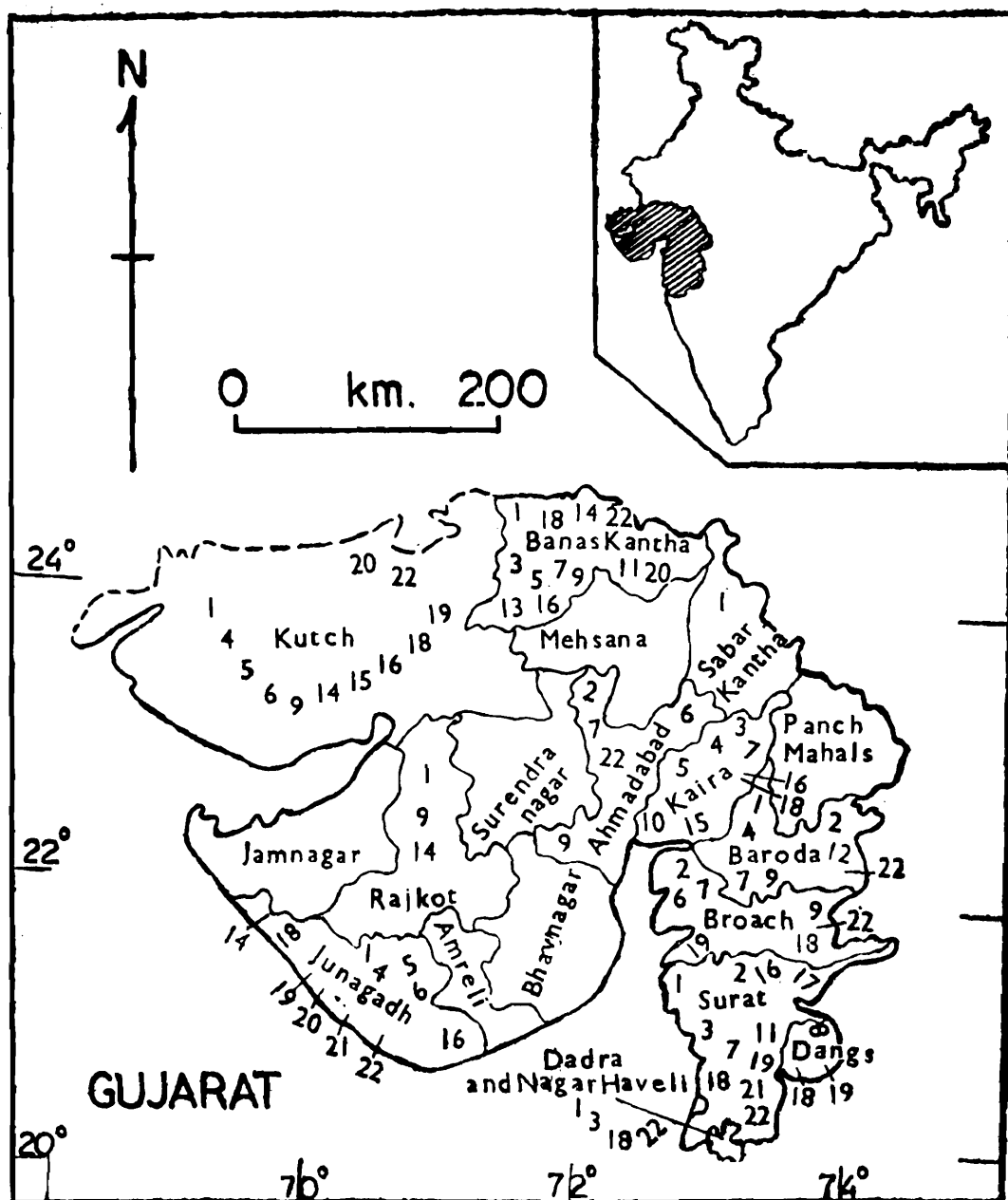
*Material*: Broach Dist. : Broach, 19.9.1976, 1 ♀

*Measurements* : External : 1 ♀ : *f.*, 80; *t.*, 37; *ft.*, 19.5.

Skull: 1 ♀ : *l.*, 36.5; *zw.*, 21.2; *cw.*, 15.5; *m<sup>1</sup>-m<sup>1</sup>*, 10.7; *c-m<sup>1</sup>*, 14; *c-m<sub>2</sub>*, 15.6; *ml.*, 28.5.

*Remarks* : Hitherto known only from Ahmadabad and Baroda districts. Present material was collected from Broach district.

This bat was collected from an old mosque. The colony size was about 40 exs. It was found in association with *Taphozous k. kachhensis*. In Surat and Baroda solitary example was seen hanging from roof of an old building but these could not be collected. A female (Broach, 19.9.1976) had single young in her arm. Brosset (1962a) found females with newly born young in March, August and October.



Text Fig. 1. Distribution of bats in Gujarat. 1. *Pteropus giganteus giganteus*. 2. *Rousettus leschenaulti*. 3. *Cynopterus sphinx sphinx*. 4. *Rhinopoma microphyllumkinneari*. 5. *Rhinopoma hardwickei hardwickei*. 6. *Taphozous perforatus perforatus*. 7. *Taphozous longimanus longimanus*. 8. *Taphozous melanopogon*. 9. *Taphozous kachhensis kachhensis*. 10. *Taphozous saecolatmus*. 11. *Megaderma lyra lyra*. 12. *Hipposideros speoris speoris*. 13. *Hipposideros galeritus brachyotus*. 14. *Hipposideros fulvus pallidus*. 15. *Tadarida aegyptiaca thomasi*. 16. *Pipistrellus mimus mimus*. 17. *Pipistrellus oromandra coromandra*. 18. *Pipistrellus dormeri dormeri*. 19. *Pipistrellus ceylonicus chrysothrix*. 20. *Pipistrellus ceylonicus subcanus*. 21. *Scotophilus kuhlii kuhlii*. 22. *Scotophilus heathi heathi*.

### 3. *Cynopterus sphinx sphinx* (Vahl)

1797. *Vespertilio sphinx* Vahl, *Skr. nat. selsk. Copenhagen.* 4(1) : 123.

1912. *Cynopterus sphinx gangeticus* Andersen, *Ann. Mag. nat. Hist.*, 6 : 623.

**Material :** Surat Dist.: Surat, 23.9.1976, 1♂; Dadra and Nagar Haveli: Silvassa, 4.10.1976, 1♂, 3♀♀, 1♀ (Young); Banas Kantha Dist.: Danta, no date (Z.S.I.), 1♂.

*Measurements* : External: 2♂♂: *f.*, 70, 74; *t.*, 28, 28; *ft.*, 16, 16.  
2♀♀: *f.*, 73, 75; *t.*, 26.5, 30; *ft.*, 15, 16.5.

Skull : 1♂: *l.*, 35; *zw.*, 22.5; *cw.*, 15; *m<sup>1</sup>-m<sup>1</sup>*, 11; *c-m<sup>1</sup>*, 12; *c-m<sub>2</sub>*, 13.5; *ml.*, 27. 1♀: *l.*, 34; *zw.*, 20.9; *cw.*, 14; *m<sup>1</sup>-m<sup>1</sup>*, 10.7; *c-m<sup>1</sup>*, 11.7; *c-m<sub>2</sub>*, 13; *ml.*, 25.5.

*Remarks* : Hitherto known only from Kaira and Banas Kantha districts. Present material was collected from Surat district and Dadra and Nagar Haveli.

The bat was found hanging solitarily from the roof of an old building in Surat; and from crown of palm tree in Silvassa concealed at the base of leaves. Brosset (1962a) states that in Gujarat it used banyan (*Ficus bengalensis*) and other *Ficus* tree where palms are not available. The colony size varies from 8-10 exs.

#### Suborder MICROCHIROPTERA

#### Family RHINOPOMATIDAE

#### 4. *Rhinopoma microphyllum kinneari* Wroughton

1912. *Rhinopoma kinneari* Wroughton, *J. Bombay nat Hist. Soc.*, 21 : 767.

*Material* : Baroda Dist.: Baroda, 13.9.1976, 40♂♂, 1; ♀ Junagadh Dist.: Junagadh, no date, (Z.S.I.), 4♂♂, 1♀

*Measurements* : External: 40♂♂: *f.*, 67-74 (70.3); *t.*, 25-30 (26.6); *ft.*, 17-19 (17.7); 1♀: *f.*, 73; *t.*, 28; *ft.*, 17.2.

Skull: 3♂♂: *l.*, 20.5-21.6 (21); *zw.*, 12.5-13 (12.2); *cw.*, 8.9-9.4 (9.2); *m<sup>3</sup>-m<sup>3</sup>*, 9.5-10 (9.7); *c-m<sup>3</sup>*, 7.7-8 (7.9); *c-m<sub>3</sub>*, 8.4-8.7 (8.5); *ml.*, 15.2-15.5 (15.3). 1♀: *l.*, 21; *zw.*, 12; *cw.*, 9; *m<sup>3</sup>-m<sup>3</sup>*, 9.1; *c-m<sup>3</sup>*, 7.5; *c-m<sub>3</sub>*, 8.5; *ml.*, 15.

*Remarks* : Hitherto known only from Kutch, Junagadh and Kaira districts. Present material was collected from Baroda.

This bat was collected from a semidark room of an old building. The size of colony was about 200 exs.

#### 5. *Rhinopoma hardwickei hardwickei* Gray

1831. *Rhinopoma hardwickei* Gray, *Zool. Misc.* (1831) : 37.

*Material* : Banas Kantha Dist.: Palanpur, no date, (Z.S.I.), 3♂♂, 5♀♀; Junagadh Dist.: Junagadh, no date, (Z.S.I.), 7♀♀.

*Measurements* : External: 10♂♂: *f.*, 57-64(61); *t.*, 26-33 (30); *ft.*, 13-17(15). 5♀♀: *f.*, 57-63(60); *t.*, 26-30 (28); *ft.*, 14-17 (16).

Skull : 10♂♂: *l.*, 17.7-20 (19); *zw.*, 11-12 (11.5); *cw.*, 8-9 (8.5);

$m^3-m^3$ , 8-9 (8.7);  $c-m^3$ , 6.1-7 (6.8);  $c-m_3$ , 7-7.9 (7.5);  $ml.$ , 12.5-14.4 (13.5).  
 2 ♀ ♀ :  $l.$ , 18, 19.5;  $zw.$ , 11, 12;  $cw.$ , 8, 9;  $m^3-m^3$ , 8, 9;  $c-m^3$ , 6.2, 7;  $c-m_3$ ,  
 7, 7.7;  $ml.$ , 12.4, 14.

*Remarks* : Hitherto known only from Kutch, Banas Kantha, Junagadh and Kaira districts of Gujarat.

I have not seen colony of this bat in Gujarat but in Rajasthan it lives in dark, deserted houses and temples and in caves and tunnel. Compared with *R. m. kinneari*, its colonies are small, not exceeding 50 exs.

#### Family EMBALLONURIDAE

### 6. *Taphozous perforatus perforatus* E. Geoffroy

1818. *Taphozous perforatus* Geoffroy, *Description de l' Egypte*, 221:6.

*Material* : Broach Dist.: Rajpipla, 17.9.1976, 1 ♂, 2 ♀ ♀ ; Rajkot Dist.: Rajkot, no date (Z.S.I.) 2 ♂ ♂, 4 ♀ ♀

*Measurements* : External: 1 ♂ :  $f.$ , 63;  $t.$ , 22.5;  $ft.$ , 12. 2 ♀ ♀ :  $f.$ , 63.2, 64.3;  $t.$ , 22.4, 22.5;  $ft.$ , 12.7, 13.2.

Skull: 1 ♂ :  $l.$ , 19.5;  $zw.$ , 12.4;  $cw.$ , 9.6;  $m^3-m^3$ , 8.7;  $c-m^3$ , 8.3;  $c-m_3$ , 9.2;  $ml.$ , 15.4; 2 ♀ ♀ :  $l.$ , 19.5, 20.2;  $zw.$ , 12.3, 12.4;  $cw.$ , 9.5, 9.6;  $m^3-m^3$ , 8.5, 8.9;  $c-m^3$ , 8.6, 9.1;  $c-m_3$ , 9.5, 9.7;  $ml.$ , 15.3, 15.3.

*Remarks* : Hitherto known only from Kutch, Junagadh and Ahmadabad districts. Present material was collected from Broach district.

In Rajpipla, Broach district, it was found in large numbers (colonies of 100-150 exs.) in ruined buildings hanging head down from roofs and walls.

### 7. *Taphozous longimanus longimanus* Hardwicke

1835. *Taphozous longimanus* Hardwicke, *Trans. Linn. Soc.*, 14 : 525.

*Material* : Baroda Dist.: Karaili Bag, Baroda, 11.9.1976, 1 ♂, 2 ♀ ♀ ; Broach Dist.: Kariya Street, Broach, 15.9.1976, 2 ♂ ♂, 2 ♀ ♀ ; Banas Kantha Dist.: Palanpur,<sup>5</sup> no date (Z.S.I.), 5 (unsexed).

*Measurements* : External: 2 ♂ ♂ :  $f.$ , 60, 61.5;  $t.$ , 24, 26;  $ft.$ , 12.5, 13.5. 2 ♀ ♀ :  $f.$ , 59, 61.5;  $t.$ , 24.2, 25.5;  $ft.$ , 12.5, 12.6.

Skull: 2 ♂ ♂ :  $l.$ , 18.9, 20;  $zw.$ , 12.5, 12.6;  $cw.$ , 9.8, 9.9;  $m^3-m^3$ , 8.4, 9;  $c-m^3$ , 8.5, 9;  $c-m_3$ , 9.4, 9.9;  $ml.$ , 15.5, 16. 2 ♀ ♀ :  $l.$ , 19.5, 20;  $zw.$ , 12.3, 12.3;  $cw.$ , 9.5, 9.6;  $m^3-m^3$ , 8.4, 8.9;  $c-m^3$ , 8.8, 8.9;  $c-m_3$ , 9.4, 10;  $ml.$ , 15, 15.8.

**Remarks :** Hitherto known only from Ahmadabad, Kaira, Surat and Banas Kantha districts. Present material was collected from Baroda and Broach districts.

In Baroda, it was observed in September in the hot sun on the wall of a house, under overhanging tiles, hanging in the usual way with the head down. In Broach, it was found in hollows of a banyan tree. It is very active when disturbed and tries to fly away in the open or escapes into narrow passages among tiles or hollows. It was never found in association with other bats. The colonies size varies from 6-40 exs.

### 8. *Taphozous melanopogon* Temminck,

1841. *Taphozous melanopogon* Temminck, *Mon. Mamm.*, 2 : 287.

**Material :** The Dangs Dist.: Bansda, 27.9.1976, 1♂, 1♀.

**Measurements :** External: 1♂ : *f.*, 64; *t.*, 25; *ft.*, 13.1. 1♀ : *f.*, 65; *t.*, 24.6; *ft.*, 14.

**Skull:** 1♂ : *l.*, 20.7; *zw.*, 12.5; *cw.*, 9.5; *m<sup>3</sup>-m<sup>3</sup>*, 8.6; *c-m<sup>3</sup>*, 9; *c-m<sub>3</sub>*, 9.6; *ml.*, 16.4. 1♀ : *l.*, 20.5; *zw.*, 12.5; *cw.*, 10; *m-m<sup>3</sup>*, 9; *c-m<sup>3</sup>*, 8.6; *c-m<sub>3</sub>*, 9.4; *ml.*, 15.3.

**Remarks :** This bat although wide spread in Java Malay States, Sumatra, Borneo, Laos, Vietnam, Tenasserim, Burma and Peninsular India has hitherto not been recorded from Gujarat. Recently I obtained a female from Bansda, The Dangs district, Gujarat. Brosset (1962a) mentioned that the closely allied species, *T perforatus* shares the ecological niche of *T melanopogon*.

It was collected from the semidark room of an old house. The size of colony was about 30 exs.

### 9. *Taphozous kachhensis kachhensis* Dobson

1872. *Taphozous kachhensis* Dobson, *J. Asiat. Soc. Beng.*, 41 : 221.

**Material :** Baroda Dist.: Rajmahal, Baroda, 10.9.1976, 8♂♂, 1♀; Nayai Mandir, Baroda, 12.9.1976, 2♂♂, 6♀♀ Broach Dist.: Broach, 15.9.1976, 2♂♂, 7♀♀ Junagadh Dist.: Junagadh, no date, (Z.S.I.), 7♂♂, 1♀ Kutch Dist.: Bhuj, no date (Z.S.I.), 1♀

**Measurements :** External : 19♂♂ : *f.*, 73-81 (75.5); *t.*, 30. 4-34 (31.8); *ft.*, 14-16.4 (15.5). 15♀♀ : *f.*, 69-74.4 (73); *t.*, 26-30.5 (28.5); *ft.*, 15-18.5 (17.2).

**Skull:** 5♂♂ : *l.*, 26.5-29 (27.6); *zw.*, 16.1-17.8 (16.7); *cw.*, 12-13 (12.7); *m<sup>3</sup>-m<sup>3</sup>*, 11-12 (11.3); *c-m<sup>3</sup>*, 11-12 (11.4); *c-m<sub>3</sub>*, 12.5-13.3 (12.9); *ml.*, 21-21.5 (21.3). 2♀♀ : *l.*, 26.1, 26.5; *zw.*, 16.5, 17.3; *cw.*, 13, 13; *m<sup>3</sup>-m<sup>3</sup>*, 11, 11.3; *c-m<sup>3</sup>*, 11, 11.2; *c-m<sub>3</sub>*, 12.5, 12.6; *ml.*, 21, 21.

**Remarks :** Hitherto known only from Kutch, Rajkot, Banas Kantha, Ahmadabad and Kaira districts of Gujarat. Present material is from Baroda and Broach districts.

It was found hanging head down on walls and roof of semi dark and ruined houses in Baroda and in an old mosque in Broach. Size of colony is small (4-5 exs.). It was observed in association with *Rousettus leschenaulti* in Broach and with *Hipposideros speoris speoris* in Baroda.

#### 10. *Taphozous saccolaimus* Temminck

1838. *Taphozous saccolaimus* Temminck, *Tijdschr. Natuur. Gesch.*, 5 : 14.

**Remarks :** I have not examined this bat from Gujarat but Brosset (1962a) recorded it from Anand (Kaira district). He did not mention its subspecies name.

#### Family MEGADERMATIDAE

#### 11. *Megaderma lyra lyra* Geoffroy

1810. *Megaderma lyra* E. Geoffroy, *Ann. Mus. Hist. nat. Paris*, 15 : 190.

**Material :** Surat Dist.: Dumas, 18 km. from Surat, 12.9.1976, 1 ♂, 5 ♀ ♀ ; Banas Kantha Dist.: Palanpur, no date, (Z.S.I.), 1 ♂.

**Measurements :** External: 1 ♂ : *f.*, 62.5; *t.*, 30.5; *ft.*, 19.1; 5 ♀ ♀ : *f.*, 63.5-65.1 (64.2); *t.*, 32-34.5 (32.5); *ft.*, 17-20 (18.3).

**Skull:** 1 ♂ : *l.*, 27.1; *zw.*, 16.3; *cw.*, 12.5; *m<sup>3</sup>-m<sup>3</sup>*, 10; *c-m<sup>3</sup>*, 11; *c-m<sub>3</sub>*, 12; *ml.*, 19.1. 3 ♀ ♀ : *l.*, 27 (in all exs.); *zw.*, 16-16.2 (16.1); *cw.*, 12 (in all exs.); *m<sup>3</sup>-m<sup>3</sup>*, 9.5 (in all exs.); *c-m<sup>3</sup>*, 10.8-11 (10.9); *c-m<sub>3</sub>*, 11.7-12 (11.8); *ml.*, 19-19.3 (19.1).

**Remarks :** Earlier record of this species from Banas Kantha and Surat districts. Present material was collected by me from a semidark room of an old discarded building in Dumas (Surat district). The colony size was about 50 exs.

#### Family RHINOLOPHIDAE

#### 12. *Hipposideros speoris speoris* (Schneider)

1800. *Vespertilio speoris* Schneider, in *Schreber's Säugeth.*, pl. 59b.

**Material :** Baroda Dist.: Rajmahal, Baroda, 10.9.1976, 4 ♂ ♂, 5 ♀ ♀

**Measurements :** External : 4 ♂ ♂ : *f.*, 47-50 (49.2); *t.*, 21-23 (22.23); *ft.*, 8.2-9 (8.6). 5 ♀ ♀ : *f.*, 48-51.1 (49.5); *t.*, 21.3-22.5 (22.1); *ft.*, 8-9.2 (8.6).

Skull: 2♂♂: *l.*, 18, 18.5; *zw.*, 10.5, 10.6; *cw.*, 9, 9.5; *m<sup>3</sup>-m<sup>3</sup>*, 7.3, 7.5; *c-m<sup>3</sup>*, 7, 7; *c-m<sub>3</sub>*, 7.6, 7.6; *ml.*, 11.7, 12.3. 2♀♀: *l.*, 18, 18; *zw.*, 10.3, 10.4; *cw.*, 9, 9; *m<sup>3</sup>-m<sup>3</sup>*, 7, 7.1; *c-m<sup>3</sup>*, 6.7, 6.7; *c-m<sub>3</sub>*, 7.2, 7.4; *ml.*, 11.8, 12.

*Remarks* : Brosset (1962) mentioned its absence in Gujarat. Sinha (1975) recorded its occurrence in Baroda on the basis of a single specimen collected in 1918, present in Z. S. I. Calcutta collection. The present material further confirms its presence in Baroda. It is felt that it must be occurring in other parts of Gujarat also.

This bat was obtained from the roof of a bowri in Baroda Rajmahal compound. It was in association with *Taphozous kachhensis*. Size of colony was about 100 exs.

### 13. *Hipposideros galeritus brachyotus* Dobson

1874. *Phyllorhina brachyota* Dobson, *J. Asiat. Soc. Beng.*, 43 : 237.

This species was not collected by me. Wroughton (1918) recorded it from Palanpur (Banas Kantha district).

### 14. *Hipposideros fulvus pallidus* Andersen

1918. *Hipposideros fulvus pallidus* Andersen, *Ann. Mag. nat. Hist.*, (9) 2 : 381.

*Material* : Junagadh Dist.: Junagadh, 24.9.1912, (Z.S.I.), 14♂♂, 16♀♀; Rajkot Dist.: Rajkot, 2.1.1913, (Z.S.I.), 1♀

*Measurements* : External: 14♂♂: *f.*, 39-40 (39.2); *t.*, 17.5-18, (17.8); *ft.*, 7.6-9 (8.2). 17♀♀: *f.*, 39-40.5 (39.9); *t.*, 17.8-19 (18.3); *ft.*, 7-8.1 (7.1).

Skull: 2♂♂: *l.*, 17, 17.3; *zw.*, 9.2, 9.5; *cw.*, 8.1, 8.5; *m<sup>3</sup>-m<sup>3</sup>*, 6.2, 6.5; *c-m<sup>3</sup>*, 6.2, 6.7; *c-m<sub>3</sub>*, 6.6, 7; *ml.*, 11.2, 12. 1♀: *l.*, 17.3; *zw.*, 9; *cw.*, 8.2; *m<sup>3</sup>-m<sup>3</sup>*, 6.5; *c-m<sup>3</sup>*, 6; *c-m<sub>3</sub>*, 6.6; *ml.*, 11.3.

*Remarks* : This species is known from Kutch, Junagadh, Rajkot and Banas Kantha districts of Gujarat.

## Family MOLOSSIDAE

### 15. *Tadarida aegyptiaca thomasi* Wroughton

1919. *Tadarida thomasi* Wroughton, *J. Bombay nat. Hist. Soc.*, 26 : 732.

I could not examine this bat from Gujarat. Wroughton (1919) described it from Bhuj (Kutch district) and Brosset (1962c) recorded it from Anand (Kaira district).

## Family VESPERTILIONIDAE

16. *Pipistrellus mimus mimus* Wroughton

1899. *Pipistrellus mimus* Wroughton, *J. Bombay nat. Hist. Soc.*, 12 : 722.

*Material* : Junagadh Dist.: Junagadh, no date, (Z.S.I.), 1 ♂, 1 ♀ ; Banas Kantha Dist.: Palanpur, no date, (Z.S.I.), 2 ♂ ♂.

*Measurements* : External: 3 ♂ ♂ : *f.* 25-28 (27); *t.*, 10-11 (10.7).

Skull: 3 ♂ ♂ : *l.*, 11-11.5 (11.3); *zw.*, 6.5-7.5 (7.2); *cw.*, 6 (in all exs.); *m<sup>3</sup>-m<sup>3</sup>*, 5-5.2 (5.1); *c-m<sup>3</sup>*, 3.6-3.8 (3.7); *c-m<sub>3</sub>*, 4.1-4.3 (4.2); *ml.*, 8.1-8.6 (8.4).

*Remarks* : Wroughton (1918) recorded it from Kutch, Junagadh and Banas Kantha districts of Gujarat and Brosset (1962c) from Kaira and Surat districts.

17. *Pipistrellus coromandra coromandra* (Gray)

1838. *Scotophilus coromandra* Gray, *Mag. Zool. Bot.*, 2 : 428.

*Remarks* : Wroughton (1918) and Brosset (1962) recorded this species from Surat District.

18. *Pipistrellus dormeri dormeri* (Dobson)

1875. *Scotozous dormeri* Dobson, *Proc. zool. Soc. London*, (1875) : 373.

*Material* : Broach Dist.: Fata Talab, Broach, 16.9.1976, 1 ♂, 3 ♀ ♀ ; Rajpipla, 17.9.1976, 2 ♀ ♀ ; Sukal Tirath, 19.9.1976, 3 ♂ ♂ 5 ♀ ♀ ; The Dang Dist.: Bansda, 27.9.1976, 20 ♂ ♂, 9 ♀ ♀ ; Surat Dist.: Tithal village near Bulsar, 30.9.1976, 11 ♂ ♂, 9 ♀ ♀ ; Dadra and Nagar Haveli: Silvassa, 4.10.1976, 1 ♂.

*Measurements* : External: 35 ♂ ♂ : *f.*, 34-37 (34.5); *t.*, 11.5-13.5 (12.6); *ft.*, 6.8-8 (7.5). 28 ♀ ♀ : *f.*, 33-37.1 (35.6); *t.*, 11-13.3 (12.1); *ft.*, 6.5-8 (7.3).

Skull: 2 ♂ ♂ : *l.*, 13.6, 14; *zw.*, 9.5, 9.8; *cw.*, 7.6, 7.7; *m<sup>3</sup>-m<sup>3</sup>*, 6.3, 6.5; *c-m<sup>3</sup>*, 5.4, 5.4; *c-m<sub>3</sub>*, 5.5, 5.6; *ml.*, 10, 10.5. 2 ♀ ♀ : *l.*, 14, 14.2; *zw.*, 9.4, 9.8; *cw.*, 7.5, 7.5; *m<sup>3</sup>-m<sup>3</sup>*, 6.5, 6.6; *c-m<sub>3</sub>*, 5.5, 5.5; *c-m<sup>3</sup>*, 5.7, 5.9; *ml.*, 10.2, 10.3.

*Remarks* : Hitherto known only from Kutch, Junagadh, Banas Kantha and Kaira districts (Wroughton, 1918; Brosset, 1962c). Present material was collected from Surat, The Dangs and Broach districts and Dadra and Nagar Haveli.

This bat was collected from cracks and crevices in roofs and walls of old houses and temple and from holes in large banyan trees (*Ficus bengalensis*). The colony size varies from 2 to 24 exs.

Females with one or two young ones were found in last week of September and first week of October in Baroda and Broach (Gujarat).

### 19. *Pipistrellus ceylonicus chrysothrix* Wroughton

1899. *Pipistrellus chrysothrix* Wroughton, *J. Bombay nat. Hist. Soc.*, 12 : 720.

**Material** : Broach Dist.: Broach Hospital, Broach, 18.9.1976, 4 ♀ ♀ ; Rajpipla, 17.9.1976, 1 ♀

**Measurements** : External: 5 ♀ ♀ : *f.*, 36.5-39 (38.1); *t.*, 14.2-15.2 (14.8); *ft.*, 7.6-8.2 (8).

**Skull**: 5 ♀ ♀ : *l.*, 14.6-15 (14.8); *zw.* 9.7-10.3 (10); *cw.*, 7.4-8 (7.7); *m<sup>3</sup>-m<sup>3</sup>*, 6.7-7.2 (6.9); *c-m<sup>3</sup>*, 5.4-5.5 (5.45); *c-m<sub>3</sub>*, 6 (in all exs.); *ml.*, 10.5-11.4 (10.9).

**Remarks** : Hitherto known only from Kutch, Junagadh, The Dangs and Surat districts. Present material is from Broach district.

This bat was also collected from crevices between wall and wooden fixtures of the roof of the hospital building.

### 20. *Pipistrellus ceylonicus subcanus* Thomas

1915. *Pipistrellus ceylonicus subcanus* Thomas, *J. Bombay nat. Hist. Soc.*, 24 : 30

**Remarks** : Wroughton (1918) further recorded this subspecies from Kutch and Banas Kantha districts. I did not come across this subspecies in Gujarat.

### 21. *Scotophilus kuhlii kuhlii* Leach

1821. *Scotophilus kuhlii* Leach, *Trans. Linn. Soc. Lond.*, 13 : 69.

1897. *Scotophilus wroughtoni* Thomas, *J. Bombay nat. Hist. Soc.*, 11 : 275.

**Remarks** : Hill and Thonglongya (1972) have synonymised *S. temmincki* with *S. kuhlii* Leach. Besides type locality "Kim, Surat district", Wroughton (1918a) reports *S. temmincki* from Junagadh. I could not obtain this species from Gujarat.

### 22. *Scotophilus heathi heathi* (Horsfield)

1831. *Nycticejus heathi* Horsfield, *Proc. zool. Soc. London*, (1831) : 113.

**Material** : Baroda Dist.: Kirti Mandir, Baroda, 11.9.1976, 2 ♂ ♂, 4 ♀ ♀ ; Broach Dist.: Fata Talab, Broach, 16.9.1976, 1 ♂, 3 ♀ ♀ ; Rajpipla, 17.9.1976, 3 ♂ ♂, 5 ♀ ♀ ; Dadra and Nagar Haveli: Silvassa, 4.10.1976, 1 ♂, 1 ♀ ; Banas Kantha Dist.: Palanpur, no date, (Z.S.I.), 2 ♀ ♀ ,

**Measurements** : External: 7 ♂♂ : *f.*, 55-56.5 (56); *t.*, 21-22 (21.7); *ft.*, 11.7-12.5 (12.1). 13 ♀♀ : *f.*, 56.8-60 (58.5); *t.*, 21.5-24.5 (23.3); *ft.*, 11-13 (11.8).

**Skull**: 1 ♂ : *l.*, 20; *zw.*, 14; *cw.*, 10.5; *m<sup>3</sup>-m<sup>3</sup>*, 9.3; *c-m<sup>3</sup>*, 7.5; *c-m<sub>3</sub>*, 8.4; *ml.*, 15. 6 ♀♀ : *l.*, 20.5-21.1 (20.8); *zw.*, 14.2-15 (14.7); *cw.*, 10-10.8 (10.3); *m<sup>3</sup>-m<sup>3</sup>*, 9.1-10 (9.7); *c-m<sup>3</sup>*, 7-7.4 (7.2); *c-m<sub>3</sub>*, 8-8.5 (8.3); *ml.*, 15-15.6 (15.2).

**Remarks** : Hitherto known only from Kutch, Junagadh, Banas Kantha, Ahmadabad, Surat and Kaira districts. Present material is from Baroda and Broach districts and Silvassa (Dadra and Nagar Haveli).

This bat was collected from cracks, crevices and holes in walls and ceiling of buildings in town.

#### SUMMARY

This paper deals with 22 species and subspecies of bats found in Gujarat, belonging to seven families namely—Pteropodidae, Rhinopomatidae, Emballonuridae, Megadermatidae, Rhinolophidae, Molossidae and Vespertilionidae.

*Taphozous melanopogon melanopogon* Temminck has been recorded for the first time from Gujarat. The occurrence of *Hipposideros speoris speoris* (Schneider) earlier recorded from Gujarat (Sinha, 1975) has been confirmed. The range of the nine other species in Gujarat has been considerably extended. The bat fauna of Dadra and Nagar Haveli was not known. Here four species have been studied from this area. Ecological notes on twelve species are added.

#### REFERENCES

- ANDERSEN, K. AND WROUGHTON, R. C. 1907. On the bats of the family Megadermatidae.- *Ann. Mag. nat. Hist.*, (7) 19 : 136.
- BROSSET, A. 1962a. The bats of Central and Western India. I. - *J. Bombay nat. Hist. Soc.*, 59 : 1-57.
- BROSSET, A. 1962b. The bats of Central and Western India. II. — *J. Bombay nat. Hist. Soc.*, 59 : 583-624.
- BROSSET, A. 1962c. The bats of Central and Western India. III. *J. Bombay nat. Hist. Soc.*, 5\* : 707-746.
- ELLERMAN, J. R. AND MORRISON-SCOTT, T. C. S. 1951. *Checklist of Palaearctic and Indian Mammals*. Brit. Mus., London.
- HILL, J. E. AND THONGLONGYA, K. 1972. Bats from Thailand and Cambodia.- *Bull Br. Mus. (nat. Hist.) Zool* 22 : 171-196.

- SINHA, Y P. 1970. Taxonomic notes on some Indian bats.- *Mammalia*, **34** : 81-92.
- SINHA, Y P. 1975. Notes on the status of the Noseleaf Bat, *Hipposideros speoris pulchellus* Andersen (Mammalia : Chiroptera : Rhinolophidae).- *J. Bombay nat. Hist. Soc.*, **72** : 523-524.
- SINHA, Y P. 1980 The bats of Rajasthan: Taxonomy and zoogeography. *Rec. zool. Surv. India*, **76** : 7-63.
- WROUGHTON, R. C. 1918a. Summary of the results from the Indian Mammal Survey of Bombay Natural History Society. I. Primates and Chiroptera (Part)., *J. Bombay nat. Hist. Soc.*, **25** : 547-598.
- WROUGHTON, R. C. 1918b. Summary of the results from the Indian Mammal Survey of Bombay Natural History Society. II. Chiroptera (concluded), Insectivora and Carnivora.- *J. Bombay nat. Hist. Soc.*, **26** : 19-58.
- WROUGHTON, R. C. 1919. On the genus *Tadarida* (Wrinkle - Lip Bats). *J. Bombay nat. Hist. Soc.*, **26** : 732.

## PREHISTORIC FAUNA OF KAUSAMBI, NEAR ALLAHABAD, U. P., INDIA.

*By*

S. BANERJEE AND M. GHOSH

*Zoological Survey of India, Calcutta*

(With two Plates)

Kausambi is situated 32 miles south-west of the holy city of Prayaga (modern Allahabad) on the left bank of the river Yamuna. It is surrounded by the villages now known as Kosam-Khiraj, Garhwa, Kosam-Inam and Anwar-Kunwan, and to the south is the Vindhya range.

Cunningham was the first archaeologist to visit the ruins of Kausambi in 1861. Later, in 1949-50, the Archaeological Survey of India, in collaboration with the University of Allahabad, excavated this site.

Kausambi was the capital of Vatsas or the Vamsas, a branch of Indo-Aryan family. According to Fa-hein, who visited India in early fifth century A. D., Kausambi was situated 13 yojanas north-west of Saranath. He mentioned the monastery called the Garden of Gosira, where Lord Buddha once dwelt. Hiuen Tsang has left detailed and valuable account of Kausambi as he saw it during his travels in India in 630-646 A. D. From Prayaga the pilgrims went south-west through a forest infested with elephants and other fierce animals.

The animal remains excavated at Kausambi were sent to the Zoological Survey of India for study by the Archaeological Survey of India, New Delhi. They belong to four different phases as follows :—

KSB — I, c 1165 B. C. to c 885 B. C.; KSB —II, c 885 B. C. to c 605 B. C.; KSB — III, c 605 B. C. to c 45 B. C.; KSB — IV, c 45 B. C. to c 550 A. D. An account of these remains are given in this report. A number of remains are very fragmentary and some without any identifiable characters. The organic material has largely disappeared and they are impregnated with inorganic material, much as in the bone remains from Mohenjo-daro, Harappa, Maski, Nagda, Burzahom, etc.

573 fragments of bony remains including a few molluscan shells, have been identified. The remains of *Bos indicus* Linnaeus (Domestic humped cattle) is quite abundant (about 54%); *Sus scrofa* Linnaeus

(Domestic pig) forms about 10% of the total collection. Next to these are the remains of the domestic buffalo, *Bubalus bubalis* (Linnaeus); Indian elephant, *Elephas maximus* Linnaeus; the goat, *Capra hircus* Linnaeus; sheep, *Ovis orientalis vignei* Blyth, etc., with a good number of examples of each. Other species are represented by only a few fragments of bones.

The species and varieties represented are:

(a) INVERTEBRATES

Phylum MOLLUSCA

Class Order BIVALVIA EULAMELLIBRANCHIATA

*Lamellidens marginalis* (Lamarck) .. 3 ex.

Class Order GASTROPODA MESOGASTROPODA

*Viviparus crassus* (Hutton) .. 2 ex.

(b) VERTEBRATES

Phylum CHORDATA

Class PISCES

Teleostean fish (Undeterminable) .. 11 ex.

Class REPTILIA

Order CHELONIA

*Chitra indica* (Gray) .. 3 ex.

Class MAMMALIA

Order PRIMATES

*Homo sapiens* Linnaeus .. 2 ex.

*Macaca* sp. .. 2 ex.

Order CARNIVORA

*Canis lupus* Linnaeus .. 4 ex.

*Canis familiaris* Linnaeus .. 10 ex.

*Felis chaus* Guldenstaedt .. 3 ex.

Order PERISSODACTYLA

*Tapirus indicus* Desmarest .. 2 ex.

*Equus caballus* Linnaeus 5 ex.

Order PROBOSCIDAE

*Elephas maximus* Linnaeus 63 ex.

Order ARTIODACTYLA

*Bos indicus* Linnaeus 358 ex.

*Bos gaurus* H. Smith 14 ex.

*Boselaphus trogoamelus* Pallas .. 3 ex.

*Bubalus bubalis* (Linnaeus) .. 65 ex.

*Ovis orientalis vignei* Blyth .. 22 ex.

*Capra hircus* Linnaeus .. 25 ex.

<i>Sus scrofa cristatus</i> Wagner	..	67 ex.
<i>Axis axis</i> Erxleben	..	1 ex.
<i>Camelus bactrianus</i> Linnaeus	..	4 ex.
Order RODENTIA		
<i>Hystrix indica</i> Kerr		2 ex.
<i>Rattus</i> sp.	.	2 ex.

### SYSTEMATIC ACCOUNT

#### **Lamellidens marginalis** (Lamarck)

##### Freshwater Mussel

This species is represented by a few shells from site XIII. The mussel lives in freshwater ponds and is very common even now in that locality.

#### **Viviparus crassus** (Hutton)

##### Pond Snail

This snail is represented by two shells from site XIII. It also inhabits the freshwater ponds.

#### **Teleostean Fishes**

##### The carps (Pl. VII, Figs. 1 & 2)

Carp remains are found as a number of vertebrae from site XIII. This is a very common group of freshwater fishes in this locality.

#### **Chitra indica** (Gray)

##### River Turtle (Pl. VII, Fig. 3)

This turtle is represented by a few fragments of hypoplastron from site XIII. The habitat of this turtle is rivers like Ganga, Yamuna, etc.

#### **Homo sapiens** Linnaeus

##### Man

Human remains obtained were a fragment of skull and a portion of scapula, probably derived from damaged burial ground in the site XIII

#### **Macaca** sp.

##### Macaque

The macaque is represented by few teeth from site XIII. This animal is arboreal in habit, lives in the forests and orchards.

**Canis lupus Linnaeus****Wolf**

The wolf is represented by some teeth, mainly canine, and a portion of the maxilla from site XIII. It lives upon the flesh of small mammals and livestock. As such, it is occasionally found near the human habitations.

**Canis familiaris Linnaeus (Pl. VII, Fig. 6)****Domestic dog**

The dog, commonly called Indian pariah dog, is represented by fragments of mandibles, metatarsals and teeth from site XIII.

**Felis chaus (Guldenstaedt)****Jungle cat**

The jungle cat is represented by a few teeth from site XIII. It lives in tropical forests and feeds upon birds and small mammals. Occasionally, it comes in the vicinity of human dwellings in search of food and is killed by the people.

**Tapirus indicus Desmarest****Tapir**

Tapir is represented by a few skull fragments from site XIII. It is a very shy animal and lives in thick tropical forests with heavy rains.

**Equus caballus Linnaeus (Pl. VII, Fig. 7)****Horse**

The horse is represented by a number of teeth from sites IV, XIII and XIV. All the remains probably belong to the domestic stock.

**Elephas maximus Linnaeus (Pl. VIII, Fig. 5)****Indian Elephant**

The elephant is represented by 63 skeletal fragments from site XIII and from layers 1 and 2. All the remains are of domestic adult stock. The presence of so many remains indicates that the Kausambi rulers maintained a large herd of this animal.

**Bos indicus Linnaeus (Pl. VIII, Fig. 3)****Humped Cattle**

The domestic cattle is represented by 358 fragments of skeletal remains from sites IV, XIII and XIV. These remains show little difference, except

in a few, when compared with recent humped cattle skeletons. The majority of the bony remains belong to adult and fully developed animals. In a few limb bones, extremities like the condyles and the articulating facets are much broadened. This may probably be due to the selection in breeding by the people of those days.

***Bos gaurus* H. Smith**

Gaur

The gaur, a distant and wild relative of the cattle, is represented by 14 fragments of skeletons from site XIII. They were caught and kept in captivity probably for domestication. This animal now lives in the grassy plains and jungles in different parts of India.

***Boselaphus tragocamelus* Pallas**

Nilgai

The nilgai is represented by a few teeth and a jaw bone from site XIII. It is rarely met with in thick forest, though it may often be found on cultivated plains, where it does much damage to crops.

***Bubalus bubalis* (Linnaeus)**

Buffalo

Excepting a few very large bones, probably of the wild specimens, the majority of the remains belong to domestic stock. 65 fragments of skeletal remains were recovered from site XIII.

***Ovis orientalis vignei* Blyth (Pl. VIII, Fig. 4)**

Sheep

The domestic sheep is represented by 22 fragments of skeletal remains from site XIII. A number of bones belong to young animals. A few bones bear cut marks, which suggests that the flesh was consumed as food.

***Capra hircus* Linnaeus**

Goat

The domestic goat is represented by 25 skeletal fragments from Kausambi site XIII. No peculiarities were found when compared with the recent domestic goat bones in collection of the Zoological Survey of India.

***Axis axis* Erxleben**

Chital

Only one limb bone was found from site XIV. The chital or spotted deer is found almost everywhere in India.

***Sus scrofa cristatus* Wagner (Pl. VIII, Fig. 2)****Domestic Pig**

The pig is represented by 67 fragments of limb bones and skull from site IV and XIII. A number of bones are of young specimens and with chopping marks on them.

***Camelus bactrianus* Linnaeus (Pl. VIII, Fig. 1)****Asiatic Two-humped Camel**

The two-humped camel is represented by few fragments of limb bones and maxillary portion of the skull with three teeth from site XIII. It is not a common inhabitant of this region and was probably introduced there by the people of Kausambi (Ghosh 1976). Its original homeland is in Central Asia. It is also found in the desert region of Mongolia.

***Hystrix indica* Kerr (Pl. VII, Fig. 4)****Indian Porcupine**

The porcupine is represented by only few teeth from site XIII. The animal is very common in different parts of North India.

***Rattus* sp. (Pl. VII, Fig. 5)****Rat**

The rat is represented by two fragments from sites XIII and XIV. The size and other characters show that it was as large as the recent house rat, *Rattus rattus* Linnaeus, which is a pest of agricultural products.

**DISCUSSION**

All the remains were collected from the Kausambi settlement areas. Analysing the entire collection (list 1), we find that the cattle (*Bos indicus* Linnaeus) stands first among the species in frequency of occurrence. The majority of cattle belong to adult animals. There are some fragments of skull with well-developed horn cores. The remains of calf bones are few, about 6.5% , and with no cut or chopping marks, tends to prove that probably the people of Kausambi in general did not prefer beef. The presence of remains of wild buffalo associated with the ordinary domestic varieties of the same species tend to prove that for the development of livestock efforts were probably made to cross-breed the domestic varieties with the wild forms. Animal protein for the general consumption was mainly obtained from the goat, sheep and pigs. Remains of about 55% of goats, 30% of sheep, and 40% of pigs were of young animals and the cut marks and sign of mastication in some were also noticed. A number of fish remains (specially vertebrae) recovered from the

settlement areas, tentatively identified as carp remains indicate that the people of Kausambi used these as food fishes.

The presence of the remains of wolf, cat, monkey and porcupine suggests that the settlement was surrounded by light forest and bushes from where they used to come close to the vicinity of human habitat. A humid and tropical climate was prevalent in those days; this is suggested by the dominating number of elephant remains.

The two imported species, the tapir and the two-humped Camel were probably either purposefully brought or were received from foreign travellers or rulers as gifts.

#### SUMMARY

The ancient city of Kausambi was situated near Allahabad in U. P. About 3000 years ago it was surrounded by forests and had a humid and tropical climate. The ancient city was inhabited by civilized people and had many domesticated animals, which includes cattle and buffalo for milk; pig, sheep and goat for flesh; elephant and horse for transport. The presence of tapir and the bactrian camel indicates that the people had contact with the neighbouring countries like Mongolia, China and Malaya.

#### ACKNOWLEDGEMENTS

Thanks are due to Director, Zoological Survey of India for the facilities provided; to the Director-General, Archaeological Survey of India, Delhi, for giving the collection for study and Dr. B. Biswas, Deputy Director, Z.S.I., for critically going through the manuscript.

#### REFERENCES

- GHOSH, M. 1976. Record of the prehistoric remains of two-humped asiatic camel, (*Camelus bactrianus* L.) from Kausambi, U. P., India. *Sci. Cult.*, Calcutta, 42 : 161-162.



# ON SOME NEMATODES PARASITIC IN VERTEBRATE HOSTS FROM BIHAR, INDIA

By

T. D. SOOTA<sup>\*</sup> AND S. R. DEY SARKAR

*Zoological Survey of India, Calcutta*

(With one Text-figure)

## INTRODUCTION

During August, 1973, the authors undertook a faunistic survey of some areas in Patna district in the course of which some helminths parasitic in various vertebrates were collected. The nematode component of this collection with which the present paper deals comprises 13 species of 12 genera and 12 families of which one species is new.

All measurements are in millimeters.

Order ASCARIDIDA

Superfamily (1) SUBULUROIDEA

Family SUBULURIDAE (Travassos, 1914) Yorke and Maplestone, 1926

Genus *Subulura* Molin, 1860

*Subulura turdoideae* sp. n.

(Text-fig. 1a & b)

*Material*: Holotype ♂; Z.S.I. Reg. No. WN 252/1; host—Jungle Babbler (*Turdoides striatus*); location—intestine; locality—Monar, Dist. Patna; 18.ix.1973, coll. T. D. Soota.

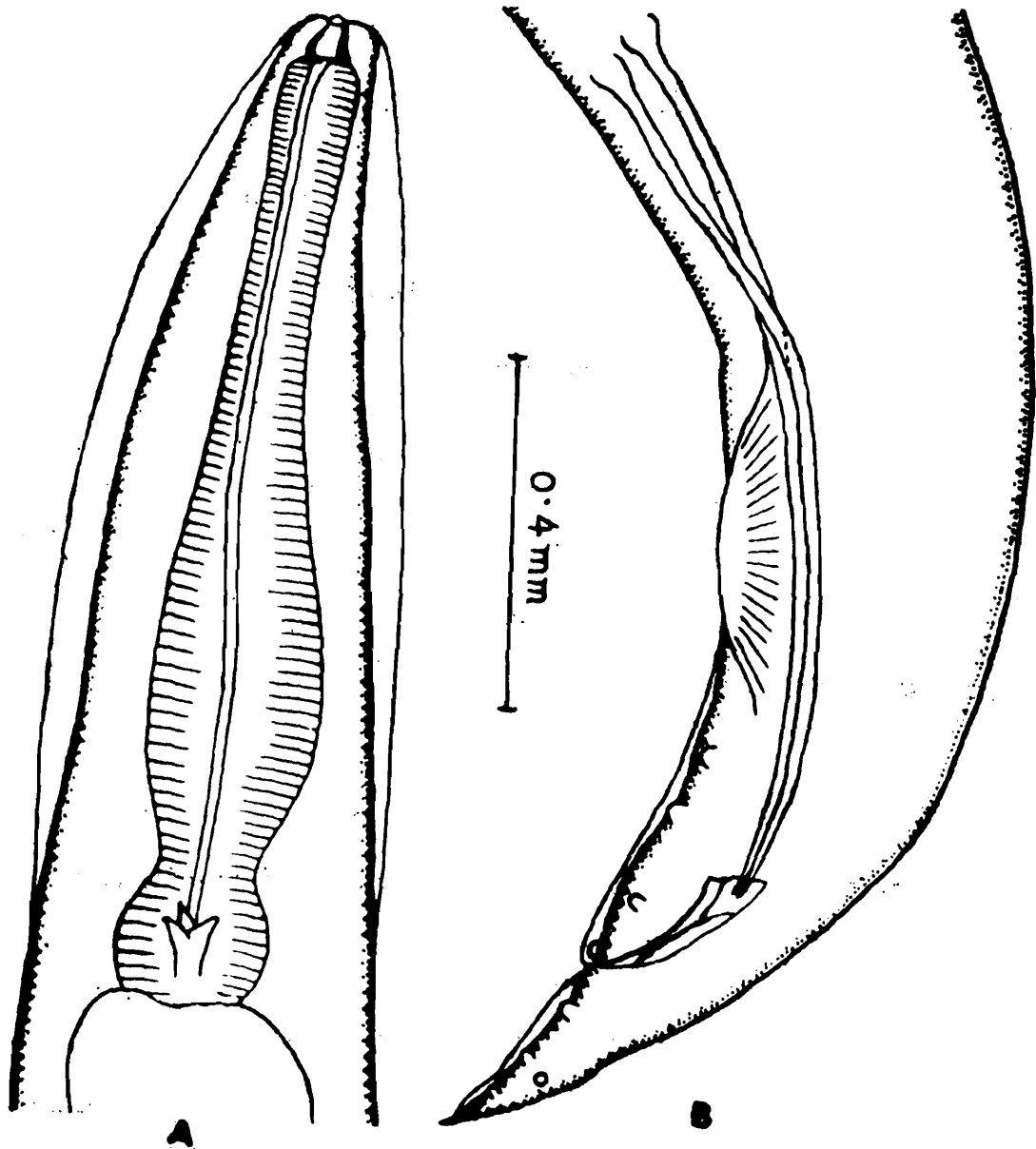
*Description*: Body 13.0 long, 0.44 wide; cervical alae 1.0 long; buccal capsule with chitinous walls and 0.055 long; oesophagus including bulb 1.1 long; bulb 0.16 long; tail 0.24 long; sucker fan-shaped and 0.38 from cloaca; caudal alae narrow; spicules equal, 0.9 long; gubernaculum 0.22 long; caudal papillae 9 pairs, 3 preanal, one adanal, and 5 postanal.

*Remarks* : Gupta and Kumar (1975), in abstract, described the

---

\* Present Address : Desert Regional station, Jodhpur

new species *Subulura sinensisi* from *Pseudibis papillosa* from Lucknow. Subsequently, Kumar and Gupta (1976) published the full description of this species designating it again as a new species without any reference at all to their earlier abstract publication and showing two avian host species instead of one.



Text-fig. 1. *Subulura turdoideae* sp. n. Holotype ♂. Body portions, A—Anterior B—Posterior.

The present species comes close to *Subulura sinensisi* Gupta and Kumar, 1975, *S. gracilis* (Linstow, 1899) Railliet and Henry, 1913, and *S. recurvata* (Linstow, 1901) Railliet and Henry, 1913, in the number of caudal papillae, but differs from them in size and shape of spicules, and in the arrangement of caudal papillae. It also differs from the second and third species in body size.

Superfamily (2) COSMOCERCOIDEA

Family COSMOCERCIDAE (Railliet, 1916, Subfam.) Travassos, 1925

Subfamily COSMOCERCINAE Railliet, 1916

Genus *Oxysomatium* Railliet and Henry, 1913

*Oxysomatium macintoshii* (Stewart, 1914) Karve, 1927

*Material*: 4 ♂♂ & several ♀♀; Z.S.I. Reg. No. 253/1; host—*Rana tigrina*; location—intestine; locality—Patna; 30.viii.1973, coll. T. D. Soota.

*Remarks*: Widely distributed in India.

Superfamily (3) HETERAKOIDEA

Family ASCARIDJIDAE Travassos, 1919

Genus *Ascaridia* Dujardin, 1845

*Ascaridia galli* (Schrank, 1788) Freeborn, 1923

*Material*: 1 ♂ & 4 ♀♀; Z.S.I. Reg. No. WN 254/1; host—domestic fowl; location—intestine; locality—Rajgirh; 6.ix.1973, coll. T. D. Soota.

*Remarks*: Widely distributed in India as common parasite of the domestic fowl.

Superfamily (4) ASCARIDOIDEA

Family ASCARIDIDAE Baird, 1853

Subfamily TOXOCARINAE (Hartwich, 1954, fam.) Osche, 1958

Genus *Porrocaecum* Railliet and Henry, 1912

*Porrocaecum reticulatum* (v. Linstow, 1899)

Baylis and Daubney, 1922

*Material*: 1 ♂ & 1 ♀; Z.S.I. Reg. No. WN 255/1; host—Pond Heron (*Ardeola grayii*); location—intestine; locality—Rajgirh; 7.ix.1973, coll. T. D. Soota.

*Description*: Male: Body 38.0 long, 1.1. wide; oesophagus including ventriculus 3.5 long; ventriculus 0.44 long; intestinal caecum 0.76 long; tail 0.44 long and with a finger—like terminal appendage; spicules 0.6 long; gubernaculum 0.25 long; caudal papillae eleven pairs, 7 preanal and 4 postanal, of which latter one after cloaca and 3 on the appendage.

Female: body 54.0 long, 1.1 wide; oesophagus including ventriculus 4.0 long; ventriculus 0.44 long; intestinal caecum 2.9 long; tail 0.99 long; vulva 18.7 from anterior end; eggs 0.044 × 0.044.

*Remarks*: The specimens show slight differences from the earlier descriptions of the species which, however, are considered here as intraspecific variations.

## Order ENOPLIDA

## Superfamily TRICHUROIDEA

Family TRICHURIDAE Railliet, 1915

Subfamily Trichurinae Ransom, 1911

Genus *Trichuris* Raederer, 1791*Trichuris globulosa* (v. Linstow, 1901) Ransom, 1911

*Material* : 2 ♂♂ & 4 ♀♀ ; Z.S.I. Reg. No. WN 256/1; host—domestic goat; location—intestine; locality—Patna; 14.ix.1973, coll. T. D. Soota.

*Remarks* : Widely distributed in India.

## Order STRONGYLIDA

## Superfamily (1) TRICHOSTRONGYLOIDEA

Family TRICHOSTRONGYLIDAE Leiper, 1912

Subfamily HAEMONCHINAE Skrjabin and Schulz, 1952

Genus *Haemonchus* Cobb, 1898*Haemonchus contortus* (Rud. 1803) Cobb, 1898

*Material* : 6 ♂♂ & 20 ♀♀ ; Z.S.I. Reg. No. WN 257/1; host—domestic goat; location—abomasum; locality — Patna; 14.ix.1973; coll. T. D. Soota.

*Remarks* : Widely distributed in India.

## Superfamily (2) DJAPHANOCEPHALOIDEA

Family DIAPHANOCEPHALIDAE Travassos, 1920

Genus *Kalicephalus* Molin, 1861*Kalicephalus costatus indicus* Ortlepp, 1923

*Material* : 4 ♂♂ & 1 ♀ ; Z.S.I. Reg. No. WN 258/1; host—rat snake (*Ptyas mucosus*); location—intestine; locality—Patna; 27. viii.1973, coll. T. D. Soota.

*Remarks* : Widely distributed in India as common parasite of snakes.

## Superfamily (3) STRONGYLOIDEA

Family STRONGYLIDAE Baird, 1853

Subfamily OESOPHAGOSTOMINAE Railliet, 1915

Genus *Oesophagostomum* Molin, 1861*Oesophagostomum brevicaudum* Schwartz and Alicata, 1930

*Material* : Several ♂♂ & ♀♀ ; Z.S.I. Reg. No. WN 259/1; host—pig; location—intestine; locality—Patna; 19.ix.1973, coll. T. D. Soota.

**Remarks :** Widely distributed in India as common parasite of pigs.

**Oesophagostomum columbianum** (Curtice, 1890) Stossich, 1899

**Material :** 3 ♂♂ & 4 ♀♀ ; Z.S.I. Reg. No. WN 260/1; host — domestic goat; location — intestine; locality — Patna; 14.ix.1973, coll. T. D. Soota.

**Remarks :** Widely distributed in India.

### Order SPIRURIDA

#### Suborder (I) CAMALLANINA

#### Superfamily CAMALLANOIDEA

#### Family CAMALLANIDAE Railliet and Henry, 1915

#### Genus *Camallanus* Railliet and Henry, 1915

#### *Camallanus anabantis* Pearse, 1933

**Material :** 3 ♂♂ & 4 ♀♀ ; Z.S.I. Reg. No. WN 261/1; host — *Anabas testudineus*; location — intestine; locality — Patna, 13.ix.1973, coll. T. D. Soota.

**Description :** Male: Body 3.4-3.6 long, 0.15-0.16 wide; tridents 0.044-0.055 long; cephalic papillae present; oesophagus 0.77 long; tail 0.088 — 0.099 long and with two spines; a short precaudal ala present; spicules two and unequal, smaller 0.22 and larger 0.5 long; caudal papillae 10 pairs, 4 preanal, one adanal, and 5 postanal.

Female: Body 13.5-20.0 long, 0.5-0.55 wide; tridents 0.022 long; cephalic papillae present; a pair of cervical papillae (hitherto unreported) also observed and 0.22 from anterior end; oesophagus 1.2 — 1.3 long; tail 0.2 - 0.24 long and bifid.

**Remarks :** Pearse (1933) described this species from the Climbing Perch (*Anabas testudineus*) from Bangkok, Thailand, and also reported a female of the species from *Clarias batrachus* from the same locality. Chakravarty (1939) redescribed the species from the type host from Calcutta. Kulasiri and Fernando (1956) added some data and new host records for the species from Sri Lanka. Yeh (1960), while reviewing the family Camallanidae, transferred the species to the genus *Zeylanema*, created by him which was accepted by subsequent workers. Thus, Fernando and Furtado (1963) redescribed this species from the type host from Sri Lanka, and Kalyankar (1971) from *Channa gachua* (= *Ophiocephalus gachua*) from Aurangabad (Maharashtra). However, in the recent classification of the family Camallanidae by Chabaud (1975) and upheld by Petter (1979) the genus has not been recognised due to the distinguishing character of the longitudinal bands in cephalic valves being shown to be variable. The present authors also agree both with Chabaud and Petter (*op. cit.*) and retain the original genus referring their specimens to it.

## Suborder (II) SPIRURINA

## Superfamily (1) GNATHOSTOMATOIDEA

Family GNATHOSTOMATIDAE Railliet, 1895

Genus *Tanqua* Blanchard, 1904*Tanqua anomala* (Linstow, 1904) Baylis, 1916

*Material* : 4 ♂♂ & 2 ♀♀ ; Z.S.I. Reg. No. WN 262/1; host — water snake (*Xenochrophis piscator*); location — intestine; locality — Rajgir; 10.ix.1973, coll. *T. D. Soota*.

*Remarks* : Widely distributed in India.

## Superfamily (2) SPIRUROIDEA

## Family SPIROCERCIDAE

(Chitwood &amp; Wehr, 1932, subfam. ) Chabaud, 1975

Subfamily ASCAROPSINAE Alicata and McIntosh, 1933

Genus *Physocephalus* Diesing, 1861*Physocephalus sexalatus* (Molin, 1860) Diesing, 1861

*Material* : 1 ♂ & 1 ♀ ; Z.S.I. Reg. No. 263/1; host — pig; location — intestine; locality — Patna; 14.ix.1973, coll. *T. D. Soota*.

*Remarks* : Widely distributed in India.

## Superfamily (3) DIPLOTRIAENOIDEA

## Family DIPLOTRJAENIDAE

(Skrjabin, 1916, subfam.) Anderson, 1958

Genus *Diplotriaena* Railliet and Henry, 1909*Diplotriaena tricuspis* (Fedchenko, 1874) Seurat, 1915

*Material* : 4 ♂♂ & 1 ♀ ; Z.S.I. Reg. No. WN 264 /1; host — common Mynah (*Acridotheres tristis*); location — body cavity; locality — Patna; 31.viii.1973, coll. *T. D. Soota*.

*Remarks* : Widely distributed in India as common parasite of the Common Mynah.

## SUMMARY

The paper deals with 13 species of nematodes of 12 genera and 12 families collected from Patna district of which one species is new.

## ACKNOWLEDGEMENTS

We are thankful to the Director, Zoological Survey of India, Calcutta, for his kind encouragement in the completion of this paper.

## REFERENCES

- BAYLIS H. A. 1936. *Fauna Br. India including Ceylon and Burma Nematoda*, I (Ascaroidea and Strongyloidea). Taylor & Francis, London : 408 pp.

- 1939. *Fauna Br. India including Ceylon and Burma Nematoda*, II (Filarioidea, Dioctophymoidea and Trichinelloidea). Taylor & Francis, London: 274 pp.
- CHABAUD, A. G. 1975. *CIH keys to the nematode parasites of vertebrates*. No. 3. Keys to genera of the order Spirurida. Part I. Camallanoidea, Dracunculoidea, Gnathostomatoidea, Physalopteroidea, Rictularioidea and Thelazoidea. Commonwealth Agricultural Bureaux, publ. : 1-27.
- CHABAUD, A. G. 1978. *CIH keys to the nematode parasites of vertebrates* No. 6. Keys to genera of the Superfamilies. Cosmocercoidea, Seuratoidea, Heterakoidea and Subuluroidea. Commonwealth Agricultural Bureaux, publ. : 1-71.
- CHAKRAVARTY, G. K. 1939. On the nematode *Camallanus anabantis* Pearse, 1933. *Sci. Cult.*, 5(5) : 317-318.
- FERNANDO, C. H. AND FURTADO, J. I. 1963. Study of some helminth parasites of freshwater fishes in Ceylon. *Z. ParasitenKde.*, 23(2) : 141-165.
- GUPTA, S. P. AND KUMAR, P. 1975. On four new avian nematode parasites from Lucknow. *Proc. 62nd Indian Sci. Congr.* (3), abstracts : 217-218.
- KALYANKAR, S. D. 1971. Studies on a known and some new nematode parasites of fishes from India. *Marath. Univ., J.*, 10 Sci. 3 : 89-107.
- KULASIRI, C. AND FERNANDO, C. H. 1956. Camallanidae parasitic in some Ceylon fish. *Parasitology*, 46 (3-4) : 420-424.
- KUMAR, P. AND GUPTA, S. P. 1976. On some species of the genus *Subulura* Molin, 1860 from avian hosts from Lucknow. *Riv. Parassit.*, 37(2-3) : 229-236.
- PEARSE, A. S. 1933. Parasites of Siamese fishes and crustaceans. *J. Siam. Soc. Supp.*, 2(2) : 179-191.
- PETTER, A. J. 1979. Essai de classification de la sous-famille des Camallaninae (Nematoda, Camallanidae). *Bull. Mus. natn. Hist. nat., Paris*, 4 th ser., 1 (4) : 991-1008.
- YAMAGUTI, S. 1961. *Systema Helminthum*, 3. The nematodes of vertebrates. Interscience Publishers Inc., New York, Pt. I, 679 pp., Part II, pp. 681-1261.
- YEH, L. S. 1960. On a reconstruction of the genus *Camallanus* Railliet et Henry, 1915. *J. Helminth.*, 34 (1/2) : 117-124.



ON LATERAL TESTES IN THE GENUS *GANEO*  
KLEIN, 1905 WITH REMARKS ON SYNONYMY OF  
*G. GASTRICUS* SRIVASTAVA, 1933 AND *G.*  
*SRINAGARENSIS* KAW, 1950 WITH *G. TIGRINUM*  
MEHRA & NEGI, 1928 (TREMATODA :  
LECITHODENDRIIDAE)

By

P. D. GUPTA\*

*Zoological Survey of India,*

*Calcutta*

(With one Text-figure)

The author (Gupta, 1970) published a review of the genus *Ganeo* Klein and regarded *G. gastricus* and *G. srinagarensis* as valid species. Subsequent study of additional 136 examples of *G. tigrinum* collected during 1973-1975 from frogs and toads in the vicinity of Poona, Maharashtra State indicates that *G. gastricus* and *G. srinagarensis* should be treated synonyms of *G. tigrinum* for reasons given below. The collection of *G. tigrinum* from Poona included one specimen with lateral testes as described below.

Body 0.936\*\* in length and 0.378 in width. Oral sucker  $0.068 \times 0.086$ . Ventral sucker  $0.082 \times 0.090$ , just post-equatorial in position. Pharynx  $0.047 \times 0.043$ . Oesophagus 0.125. Intestinal bifurcation at the junction of first and second quarters of body length. Intestinal caeca reaching  $\frac{4}{5}$ th of the body length. Testes almost equatorially placed in the body antero-lateral to the ventral sucker. Left testis  $0.109 \times 0.117$ , right testis  $0.097 \times 0.109$ . Ovary dextrally placed adjoining the ventral sucker. Genital pore sinistral, marginal, at the level of oesophageal bifurcation. Very few uterine coils which lack eggs due to early stage of maturity of the worm. Vitelline follicles post equatorial and amassed at caecal terminations.

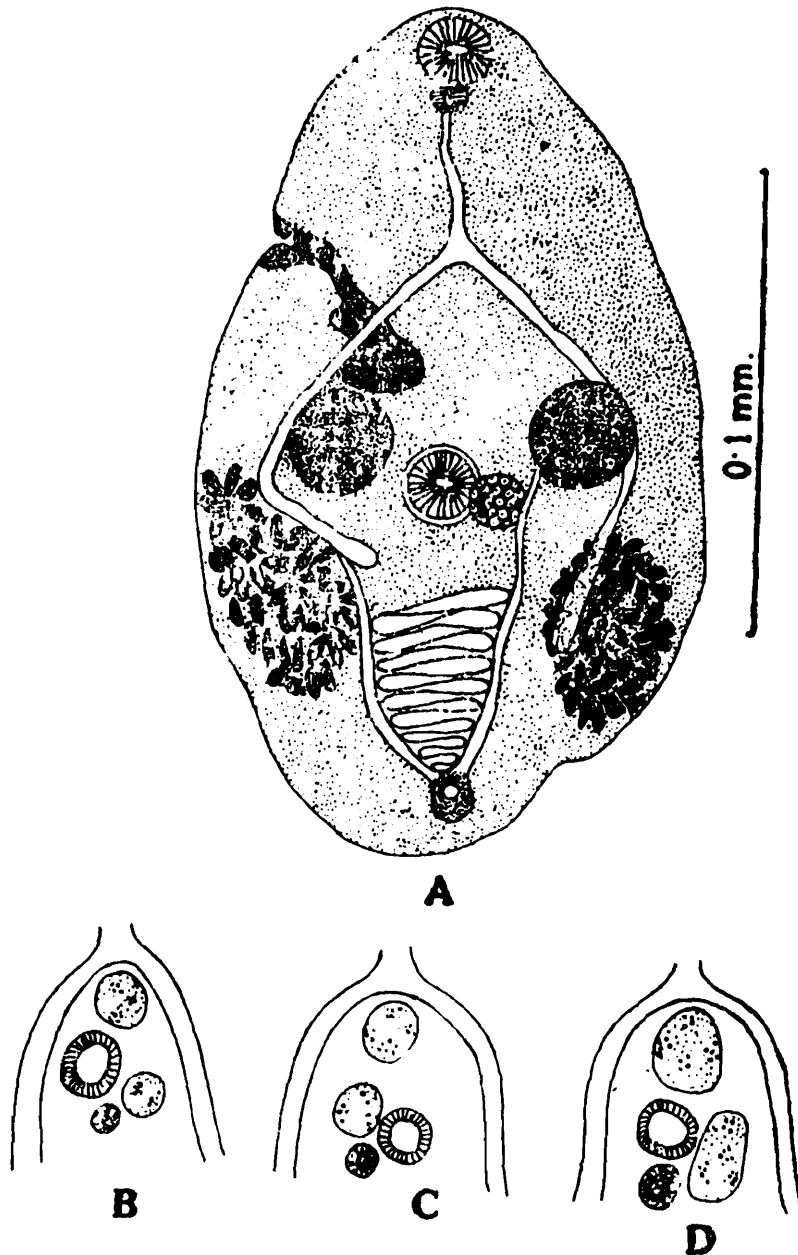
---

\*Present address: Gangatic Plains Regional Station, Zoological Survey of India, Patna, India.

\*\* All measurements in millimetres.

## DISCUSSION

In addition to the above specimen (Fig. 1) some other variations observed in relative position of gonads and acetabulum are diagrammatically shown in figure 2 which indicates a tendency of a gap between the two testes. *G. gastricus*, the specimen described above and *G. srinagarensis* form a series showing posterolateral migration of anterior testis to the left side of the body.



Text-fig. 1 (A—D) *Ganeo tigrinum* A—with lateral testes, (B—D) Variations in relative position of gonads and acetabulum in *G. tigrinum*.

Another trend regarding position of gonads in relation to body length is noticeable. In the specimen in early stage of maturity described above, the gonads are almost equatorial in position. In *G. srinagarensis*,

showing further stage of maturity and eggs filling up the uterus, the gonadial complex occupies comparatively anterior position. Finally in *G. gastricus* which appears to be gravid, the uterus is completely filled with eggs, the gonads occupy second quarter of the body length.

The anterior change in the position of gonads in the series formed by the present specimen, *G. srinagarensis* and *G. gastricus* can be explained by two alternatives. Either the whole gonadial complex is pushed forward by the growth of the uterus or the uterus and the posterior part of the body grow independently of the anterior part of the body and the gonads assume its position in second quarter of the body length in gravid specimens. The gonads and ventral sucker are situated in the second quarter of body length in normal specimens indicating the second possibility to be more probable. Hence the difference in the position of gonads in relation to body length shows only the developmental stages instead of characters of any taxonomic importance.

Mehra and Negi (1928) and Srivastava (1933) have rightly concluded that the oblique position of testes in the genus *Ganeo* is peculiar for the subfamily Pleurogenetinae. Specimens with lateral testes indicate a reversion to the primitive condition which is met with in the genus *Pleurogenes*. The lateral position of testes should be treated only as an aberration and in view of the close similarity of other characters like distribution of vitellaria in relation to body length and smaller ventral sucker *G. gastricus* Srivastava, 1933 and *G. srinagarensis* Kaw, 1950 should be treated synonyms of *G. tigrinum*.

#### REFERENCES

- GUPTA, P. D. 1970. Studies on the genus *Ganeo* Klein, 1905 (Trematoda : Lecithodendriidae) *Proc. 57th Indian Sci. Congr.*, (3) : 433. (Detailed paper in *Rec. Zool. Surv. India*), 72 (1—4) 1977 : 281-290)
- KAW, B. L. 1950. Studies in Helminthology : Helminth Parasites of Kashmir, Part 1. Trematoda *Indian J. Helminth.*, 2 (2) : 67-126.
- SRIVASTAVA, H. D. 1933. On new trematodes of frogs and fishes of United Provinces, India. *Bull. Acad. Sci. U. P.*, 3 (2) : 99-112. 1 pl.



**CERAMBYCIDAE (COLEOPTERA)  
OF  
ARUNACHAL PRADESH**

*By*

**CHANDAN KUMAR SENGUPTA AND TAPAN SENGUPTA**

*Zoological Survey of India, Calcutta*

(With 13 Text-figures)

**INTRODUCTION**

The representatives of the family Cerambycidae are commonly known as longhorn beetles and can be easily recognised from other families of Coleoptera by its elongated and somewhat parallel-sided body, with long antennae and pseudotetramerous tarsi. Fowler (1912) mentioned that around 1000 species belong under this family from India, of which Cerambycinae represents 400 species and Lamiinae represents 600 species. Beeson and Bhatia (1939) noted 1182 species of Cerambycidae from Indian subregion, of which 470 belong to Cerambycinae and 712 to Lamiinae. Around 350 species are known to attack various trees, shrubs, wood-climbers and vines, of which 37 species of Cerambycidae are recorded from *Shorea robusta* alone and the species *Stromatium barbatum* (Fabricius) bores 311 types of trees.

The present work based on the collection of Cerambycidae, collected by the various survey parties from Zoological Survey of India. So far, there was no record of Cerambycidae from Arunachal Pradesh (NEFA). In the present study sixteen species are recorded for the first time from Arunachal Pradesh, their distinguishable characters along with distributional record and illustrations (dorsal view) of each species are given below.

**LIST OF SPECIES**

**Family CERAMBYCIDAE**

**Subfamily CERAMBYCINAE**

**Tribe Cerambycini**

1. *Aeolesthes holosericea* (Fabricius)
2. *Aeolesthes sarta* (Solsky)

## Tribe Rosaliini

3. *Rosalia decempunctata* (Westwood)
4. *Rosalia lateritia* (Hope)

## Tribe Clytini

5. *Demonax leucoscutellatus* (Hope)
6. *Demonax albicinctus* (Hope)
7. *Caloclytus annularis* (Fabricius)

## Subfamily LAMINAE

## Tribe Lamiini

8. *Dihammus griseipennis* Thomson

## Tribe Pteropliini

9. *Sthenias grisator* Fabricius

## Tribe Batocerini

10. *Batocera (Semibatocera) parryi* Hope

## Tribe Gnomini

11. *Imantocera plumosa* Olivier

## Tribe Ceroplesini

12. *Diastocera wallichi* Hope

## Tribe Apomecynini

13. *Apomecyna neglecta* Pascoe

## Tribe Saperdini

14. *Oberea posticata* Gahan
15. *Nupserha fricator* Dalman

## Tribe Phytoeciini

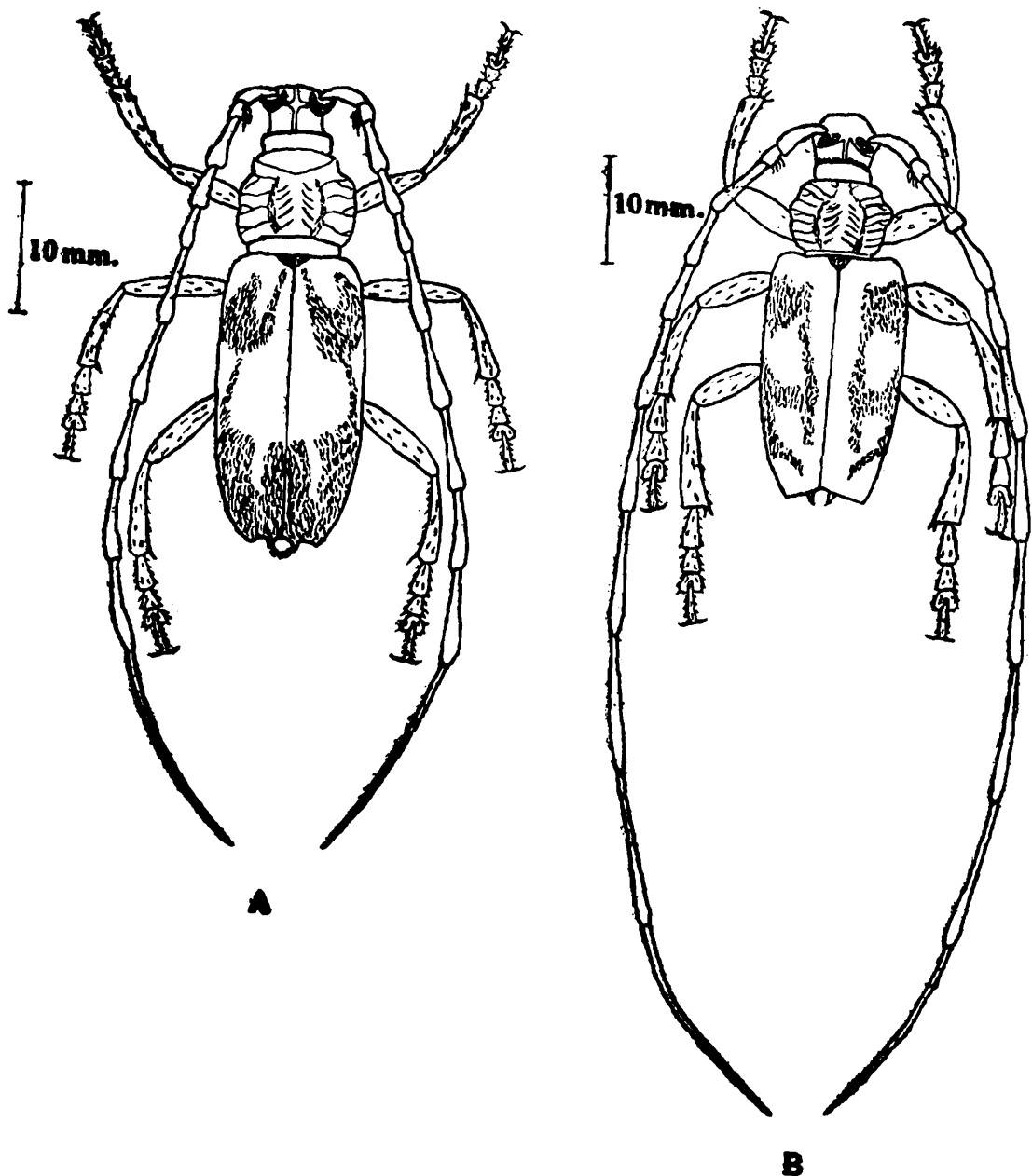
16. *Linda rubescens* Hope

1. *Aeolesthes holosericea* (Fabricius)

1787. *Cerambyx holosericea* Fabricius, *Mant. Ins.*, 1 : 135.
1906. *Aeolesthes holosericea* : Gahan, *Fauna British India, Cerambycidae*, 1 : 127.
1914. *Aeolesthes holosericea* : Stebbing, *Indian Forest Insects (Coleoptera)*: 301 — 305.
1939. *Aeolesthes holosericea* : Beeson and Bhatia, *Indian Forest Records (New Series) Entomology*, 5 (1) : 15—16.

General appearance (Text-fig-1A) moderately long, somewhat parallel-sided, dorsal surface blackish to reddish brown, covered with

greyish or golden brown silky pubescence. Head moderately long and narrow, eyes coarsely faceted and anterior part of head somewhat wrinkled. Antenna of ♂ markedly long, about 3 times as long as body, joints 1—5 slightly thickened, joints 5—11 progressively long and thin, and joint 11 twice as long as joint 10. Prothorax as broad as long, lateral margins slightly wavy, pronotum wrinkled and covered with very fine silky pubescence. Scutellum transverse, triangular and covered with whitish pubescence. Elytra almost parallel-sided, apex truncated, dorsal surface of elytra covered with fine silky pubescence in patches. Legs moderately long covered with very fine whitish pubescence. Length 20—35 mm. and breadth 5—10 mm.



Text-fig. 1. A- *Aeolesthes holosericea* (Fabricius) ♂; B- *Aeolesthes sarta* (Solsky) ♂;

**Material examined:** 50. ex. Arunachal Pradesh : Kameng, 10—21. iv. 1961, K. C. J. Coll. 5 ex; Kameng, 3. viii. 1961, S. Biswas, Coll. 1 ex., and Subansiri Division, 14. v. 1966, A. N. T. Joseph Coll. 1 ex.; and 43 ex. also studied from other states of India, and from Sri Lanka, Bhutan, Burma, Baluchistan and Indonesia.

**Distribution in India :** So far, this species was recorded from Assam, West Bengal, Bihar, Orissa, Uttar Pradesh, Punjab, Kashmir, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Tamil-Nadu, Andaman and Nicobar Island. In the present study this species is recorded for the first time from Arunachal Pradesh.

**Remarks :** This is a very common species of *Aeolesthes*, occur all over India. Chief distinguishable characters are : usually smaller than *Aeolesthes sarta* (Solsky), pubescence with golden lustre, and prothorax almost as broad as long. This species is recorded from *Acacia arabica*, *Aegle marmelos*, *Alnus nitida*, *Bauhinia acuminata*, *Bombax malabaricum*, *Chloroxylon swietenia*, *Duabanga sonneratioides*, *Eucalyptus robusta*, *Ficus bengalensis*, *Grewia oppositifolia*, *Hardwickia binata*, *Kydia calycina*, *Lannea grandis*, *Mangifera indica*, *Pinus longifolia*, *Shorea robusta*, *Tectona grandis*, *Terminalia tomentosa*. The larva bores heart wood and sap wood.

## 2. *Aeolesthes sarta* (Solsky)

1871. *Pachydissus sarta* Solsky, *Hor. Soc. Ent. Ross.*, 8 : 150.  
 1905. *Aeolesthes sarta* : Gahan, *Fauna British India, Cerambycidae*, 1 : 129.  
 1914. *Aeolesthes sarta* : Stebbing, *Indian Forest Insects* (Coleoptera) : 307-317.  
 1939. *Aeolesthes sarta* : Beeson and Bhatia, *Indian Forest Records (New Series) Entomology*, 5 (1) : 19-20.  
 1941. *Aeolesthes sarta* : Beeson, *Ecology and control of the Forest Insects*, Pt. 1 : 108-109.

**General appearance** (Text-fig. 1B) somewhat similar to *Aeolesthes holosericea*. Dorsal surface dark, reddish brown, covered with fine dense greyish silky pubescence. Head moderately large with coarsely faceted eyes. Antenna similar to *Aeolesthes holosericea*. Prothorax almost as long as broad, lateral margins undulated, slightly narrowed in front and behind, pronotum irregularly wrinkled. Scutellum triangular and less transverse than *Aeolesthes holosericea*. Elytra parallel-sided, dark, reddish brown, covered with fine silky greyish pubescence in patches, and inner apical angle armed with a spine.

Legs moderately long and covered with fine, dense, greyish pubescence. Length 33—44 mm. and breadth 9—13.

*Material examined* : 6 ex. Arunachal Pradesh : Kameng, 12. iv. 1961, K. C. Jayram Coll. 1 ex., and Subansiri Division, 10. v. 1966, A. N. T. Joseph Coll. 1 ex. and 4 ex. also studied from Baluchistan.

*Distribution in India* : So far, this species was recorded from Kashmir. In the present study this species is recorded for the first time from Arunachal Pradesh.

*Remarks* : This species is slightly larger than *Aeolesthes holosericea* and unlike other species of *Aeolesthes* elytral pubescence have silvery lustre. This species is recorded from *Acer cultratum*, *Aesculus indica*, *Corylus colurna*, *Juglans regia*, *Platanus orientalis*, *Populus alba*, *Prunus armeniaca*, *Pyrus malus*, *Salix alba*, *Ulmus wallichiana*. Larva bores heart wood and sap wood. Beeson (1941) reported that this species is injurious to avenue and shade trees along road, specially poplars and willows.

### 3. *Rosalia decempunctata* (Westwood)

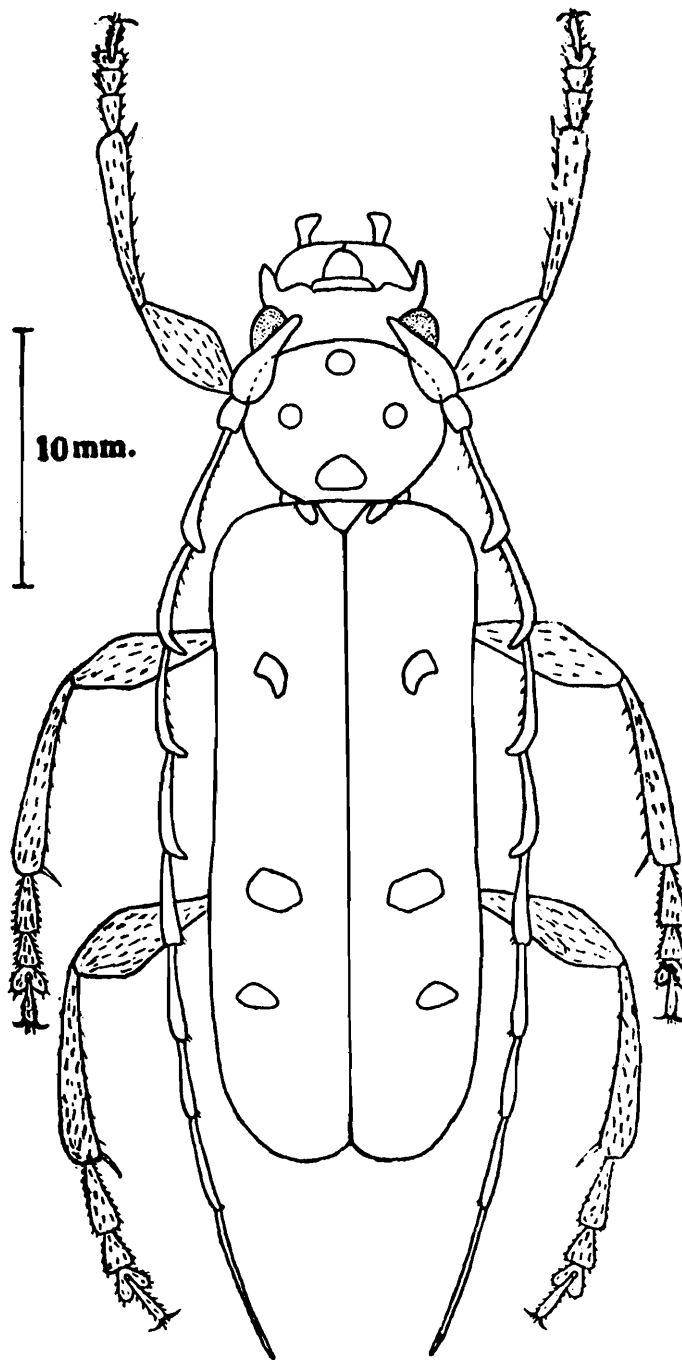
1848. *Purpuricenus decempunctata* Westwood, *Cab. Or. Ent* : 59.

1906. *Rosalia decempunctata* : Gahan, *Fauna British India (Cerambycidae)*, 1 : 179.

*General appearance* (Text-fig. 2) moderately large, depressed and parallel-sided. Pronotum and elytra reddish and head black. Head sub-vertical, expanded, genae long and can be seen from dorsal surface, eyes finely faceted. Antenna of ♂ markedly longer than body and in ♀ slightly so or shorter, joint 1 sparsely punctured, joint 3 slightly longer than joint 4, joints 3—5 with a apical blunt spine. Prothorax globose narrowed in front and behind, pronotum with four distinct black spots, two median and two lateral, the anterior median spot smaller than posterior median one. Scutellum black and elongated. Elytra long, parallel-sided, covered with very fine and minute whitish pubescence, each elytron with four longitudinally arranged black spots. Legs moderately long and black and its femora distinctly widened towards apex. Ventral surface of head, mesom etasterna and abdomen black and prosternum reddish. Length 30—35 mm. and breadth 5—9 mm.

*Material examined* : 11 ex. Arunachal Pradesh : Kameng, 22. vi. 1961, K. C. J. Coll. 1 ex.; and 10 ex. also studied from other states of India and from Burma.

*Distribution in India* : So far, this species was recorded from West Bengal, Sikkim and Assam. In the present study this species is recorded for the first time from Arunachal Pradesh.

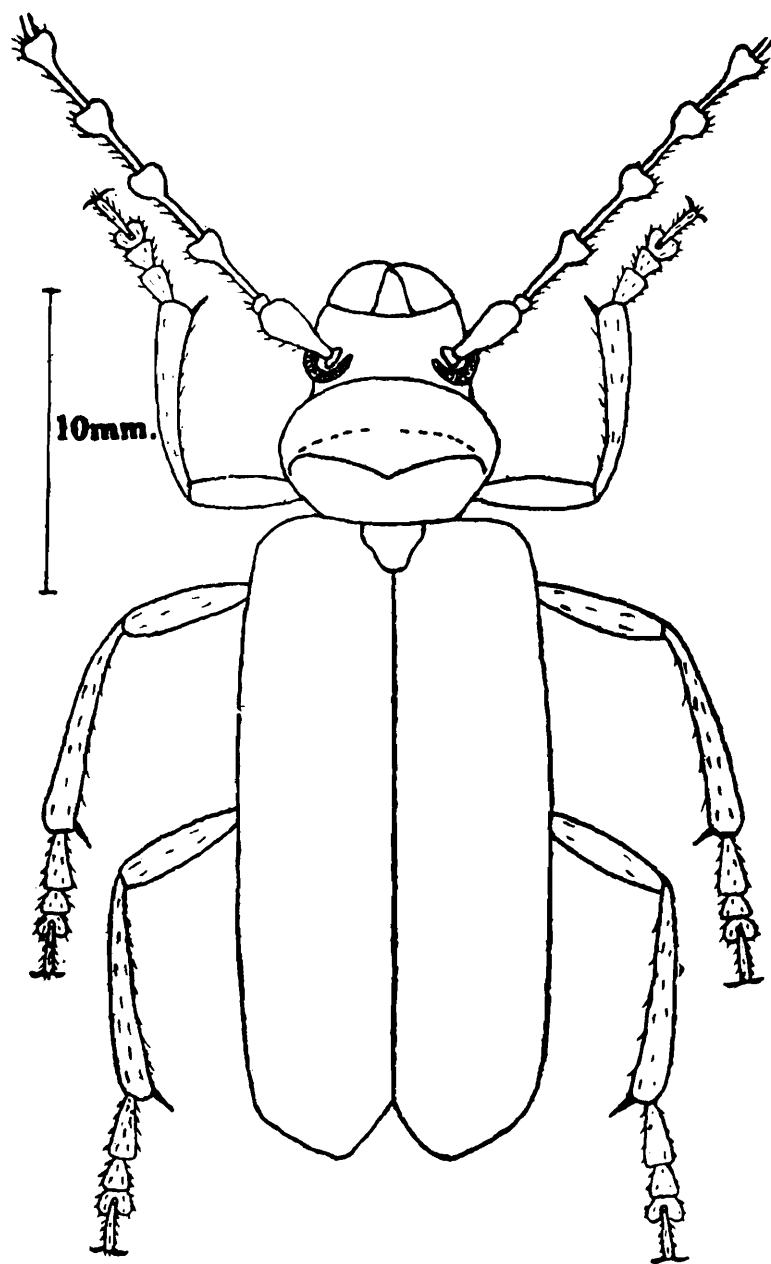


Text-fig. 2. *Rosalia decempunctata* (Westwood) ♂ ;

#### 4. *Rosalia lateritia* (Hope)

1831. *Lamia lateritia* Hope, *Gray's Zool. Misc.* : 27.  
 1906. *Rosalia lateritia* : Gahan, *Fauna British India (Cerambycidae)*, 1 : 177  
 1939. *Rosalia lateritia* : Beeson and Bhatia, *Indian Forest Records (New Series) Entomology*, 5 (1) : 172.

General appearance (Text-fig. 3) somewhat similar to *Rosalia decempunctata* but slightly smaller than the latter species, more parallel-sided, head blackish red, pronotum dark reddish brown, elytra slightly paler and red, and ventral surface black. Head with genae slightly developed, and eyes finely faceted. Apices of antennal joints 3—6 markedly enlarged and globular. Prothorax globose, a distinct transverse raised tubercle-like structure present across middle in ♀. Scutellum heart-shaped and dark blackish red. Unlike *Rosalia decempunctata* pronotum and elytra devoid of spot. Length 25—32 mm. and breadth 9—10 mm.



Text-fig. 3. *Rosalia lateritia* (Hope)♀;

*Material examined* : 2 ex. Arunachal Pradesh : Kameng, 26. iii. 1961, K. C. J. Coll. 1 ex., and 1 ex. also studied from Uttar Pradesh.

**Distribution in India :** So far, this species was recorded from Himalayas, West Bengal, Uttar Pradesh and Kerala. In the present study this species is recorded for the first time from Arunachal Pradesh.

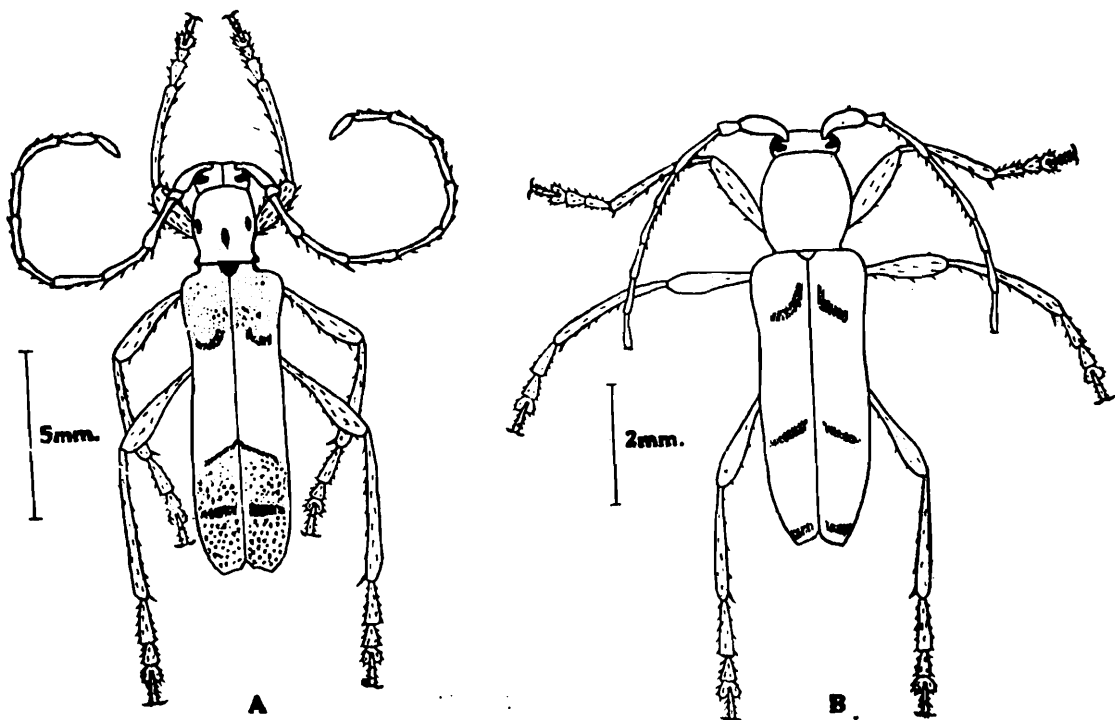
**Remarks :** This is a distinct species of *Rosalia* Serville, and can be easily separated from *Rosalia decempunctata* by its characteristic shape of prothorax, head, pronotum dark reddish brown and apical angles of antennal joints 3—5 markedly enlarged and globular. Beeson and Bhatia (1939) recorded this species from *Quercus dilatata* and *Quercus semicarpifolia*.

### 5. *Demonax leucoscutellatus* (Hope)

1831. *Clytus leucoscutellatus* Hope, *Gray's Zool. Misc.* : 28.

1906. *Demonax leucoscutellatus* : Gahan, *Fauna British India (Cerambycidae)*, 1 : 26.

**General appearance (Text-fig. 4A)** rather small, narrow, elongated and parallel-sided. Dorsal surface yellowish with characteristic marking on pronotum and elytra. Head with finely faceted eyes. Antenna moderately long, slender, joints 3—11 subequal, joints 3 and 4 armed with an apical spine. Prothorax elongated, slightly narrowed in front and behind, lateral margins smooth and slightly rounded, pronotum yellowish brown and with a median basal elongated blackish spot and a pair of lateral spots across middle. Scutellum moderately large, trian-



Text-fig. 4. A- *Demonax leucoscutellatus* (Hope) ♂ ; B- *Demonax albicinctus* (Hope) ♀

gular and its apical margin slightly rounded and covered with white pubescence. Elytra almost parallel-sided and slightly sinuated across middle, apical margin truncated, dorsal surface brownish testaceous and blackish near apex, and with three transverse rows of whitish fine silky pubescence. Length 10—12 mm. and breadth 2—2.5 mm.

*Material examined* : 4 ex. Arunachal Pradesh : Subansiri Division, 18.v.1966, A. N. T. Joseph Coll. 1 ex., and 3 ex. also studied from West Bengal.

*Distribution in India* : So far, this species was recorded from Sikkim, Assam, Nagaland, Manipur. In present study this species is recorded for the first time from Arunachal Pradesh.

*Remarks* : This species can be easily separated from *Demonax albicinctus* (Hope) by its antennal joints 3 and 4 armed with a apical spine, and prothorax more elongate and less convex.

#### 6. *Demonax albicinctus* (Hope)

1831. *Clytus albicinctus* Hope, *Gray's Zool. Misc.* : 28.

1906. *Demonax albicinctus* : Gahan, *Fauna British India (Cerambycidae)*, 1 : 296.

General appearance (Text-fig. 4B) small, narrow and somewhat cylindrical. Head and prothorax charcoal black, eyes finely faceted. Antenna moderately long, scape rather large and broad, joints 3—5 armed distinct apical spine. Prothorax elongated, cylindrical. broadest at posterior one-third, narrowed in front and slightly so posteriorly, lateral margin smooth, pronotum densely punctured and covered with fine whitish minute recumbent pubescence. Scutellum moderately large, triangular and covered with fine, minute dense greyish pubescence. Elytra parallel-sided, apical margin reddish brown and with three transverse rows of whitish pubescence. Legs long, slender, brownish and covered with greyish pubescence. Length 7—9 mm. and breadth 1.5—2 mm.

*Material examined* : 22 ex. Arunachal Pradesh : Kameng Division, 1 v 1966, A. N. T. Joseph Coll. 1 ex., Kameng, 3.vii.1961, S. Biswas Coll. 1 ex., and Kameng, 13. vi. 1961, K. C. J. Coll. 1 ex., and 19 ex. also studied from various localities of West Bengal.

*Distribution in India* : So far, this species was recorded from West Bengal. In the present study this species is recorded for the first time from Arunachal Pradesh.

*Remarks* : Unlike *Demonax leucoscutellatus* this species have prothorax and head charcoal black and antennal joint 2 longer than its width.

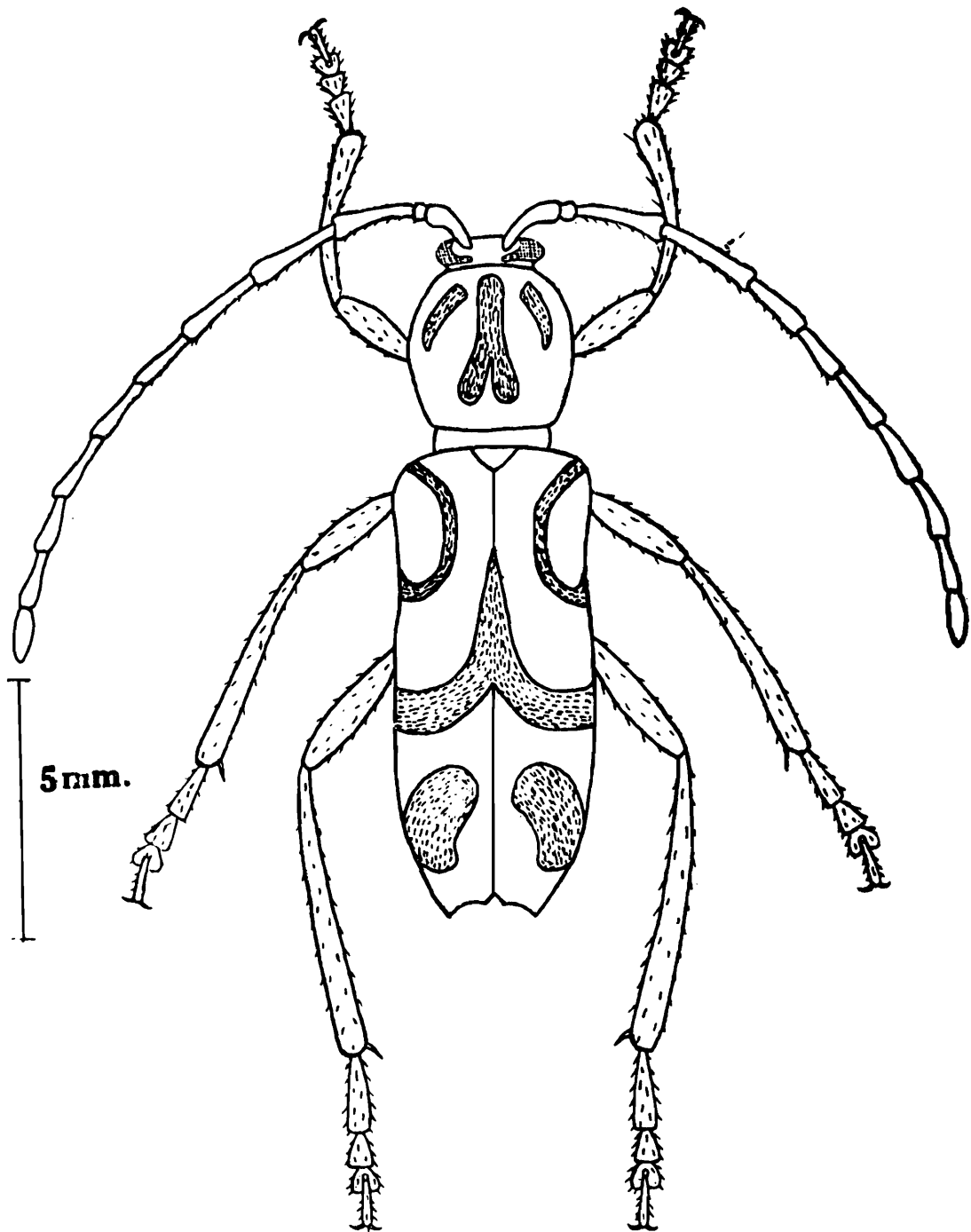
7. *Caloclytus annularis* (Fabricius)

1787. *Callidium annularis* Fabricius, *Mant. Ins.*, 1 : 156.

1906. *Caloclytus annularis* : Gahan, *Fauna British India (Cerambycidae)*, 1 : 261

1914. *Caloclytus annularis* : Stebbing, *Indian Forest Insects (Coleoptera)* : 354-355.

General appearance rather small, narrow and elongated, dorsal surface yellowish with characteristic dark brown marking on pronotum and elytra (Text-fig. 5). Head small with finely faceted eyes. Antenna usually slightly shorter than body length, joints 3—11 subequal. Prothorax subglobular, slightly longer than broad, lateral margin



Text-fig. 5. *Caloclytus annularis* (Fabricius) ♂ ;

smooth. Pronotum with a median and a pair of lateral brown markings. Elytra moderately long, somewhat parallel-sided and truncated at apex, each elytron with a pair of dark brown anterior bands and a rounded posterior band. Legs reddish brown. Length varies from 10—15 mm. and breadth 2.5 — 4 mm.

*Material examined* : 67 ex. Arunachal Pradesh : Kameng Division, 20.v.1961, K. C. J. Coll. 1 ex., Kameng, 10.vii. 1961, S. Biswas Coll. 1 ex., and Kameng, 6.v.1966, A. N. T Joseph Coll. 1 ex., and Subansiri Division, 18-20.v 1966, A. N. T Joseph Coll. 4 ex. and 60 ex. also studied from other states of India and from Bangladesh and Burma.

*Distribution in India* : So far, this species was recorded from North west and North east India. In the present study this species is recorded from Arunachal Pradesh and also from Kerela.

*Remarks* : This is one of the commonest species of *Caloclytus*, which can be easily recognised from other species of this genus by its antenna being slightly shorter than body length, prothorax subglobular and elytra moderately long and its characteristic colour pattern (Fig. 7). Stebbing (1914) recorded this species from *Bambusa* sp., larva bores into the tissue of the walls of Bamboo.

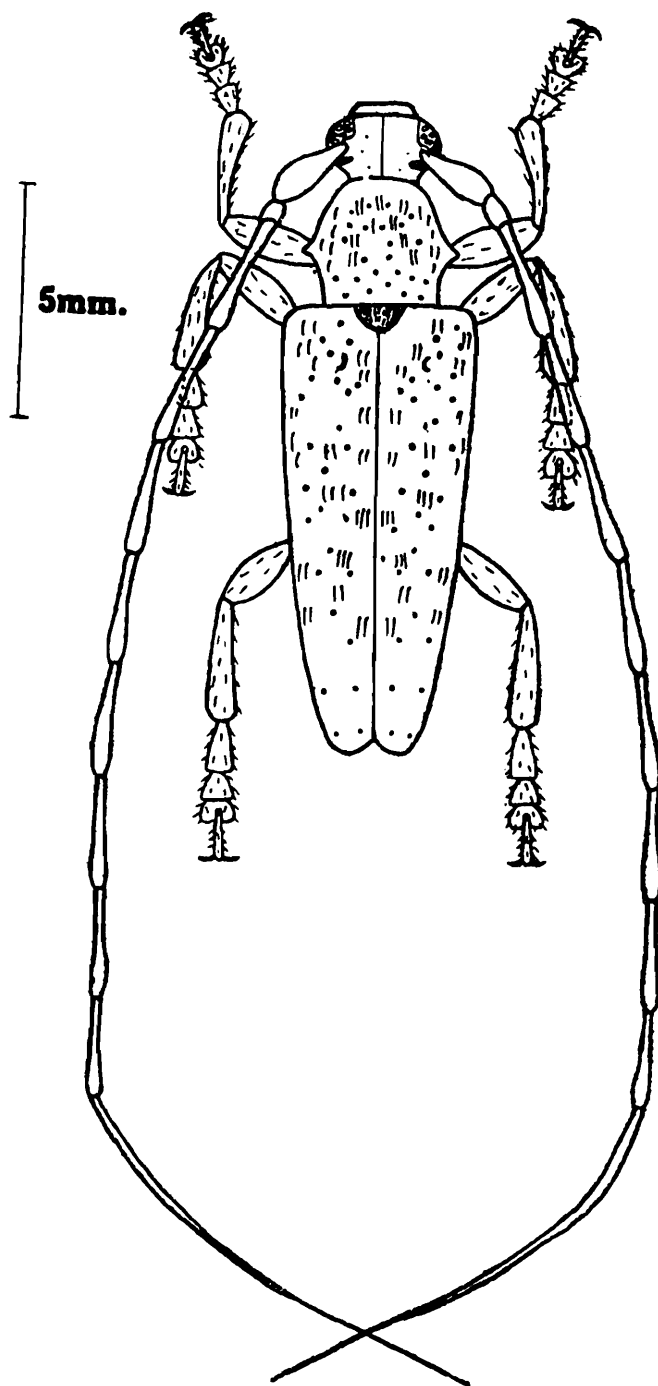
#### 8. *Dihammus griseipennis* Thomson

1857. *Dihammus griseipennis* Thomson, *Archiv. Entomol.*, 1 : 296.

1939. *Dihammus griseipennis* : Beeson and Bhatia. *Indian Forest Records (Nem series) Entomology*, 5 (1) : 67.

General appearance (Text-fig. 6) moderately large, rather narrow, broadest at base of elytra and narrowed in front and behind. Dorsal surface uniformly charcoal black and clothed with fine, short, dense whitish pubescence, puncturation irregular, small and deep. Head moderately large with coarsely faceted eyes. Antenna markedly long and slender, more than three times of total length of body and joint 11 markedly long. Prothorax as long as broad, narrowed in front and behind, lateral margin armed with a median prominent spine projecting outwardly. Scutellum moderately large, transversely triangular and covered with dense whitish pubescence. Elytra moderately long, narrowed posteriorly, puncturation sparse, deep and irregular. Legs rather short. Length 10—19 mm. and breadth 3—5 mm.

*Material examined* : 9 ex. Arunachal Pradesh : Subansiri Division, 17 v 1966, A. N. T Joseph Coll. 1 ex., and Kameng Division, 25.v 1961, K. C. J. Coll. 1 ex. and 7 ex. also studied from other states of India.



Text-fig. 6. *Dihammus griseipennis* Thomson;

*Distribution in India* : So far, this species was recorded from West Bengal. In the present study this species is recovered for the first time from Arunachal Pradesh and Sikkim.

*Remarks* : This is a distinct species of *Dihammus* Thomson and can be easily recognised from other species of this genus by its dorsal surface being charcoal black, antenna markedly long, elytral surface irregularly punctured. Beeson and Bhatia (1939) recorded this species from *Strobilanthes acrocephalus*. Aurivillius (1921-23) placed the genus *Dihammus* under the tribe Monochamini but Martins suggested

authors (personal communication) that the genus *Dihammus* has been transferred to the tribe Lamiini.

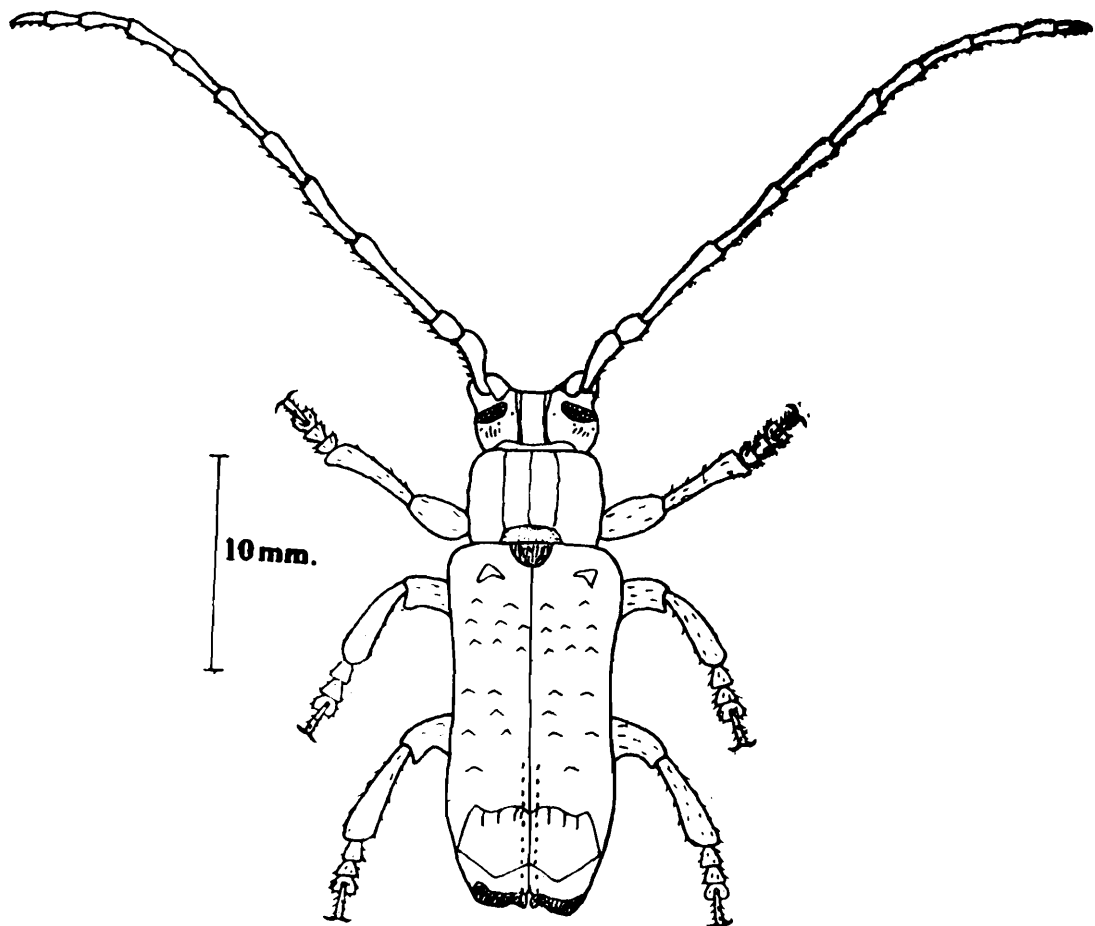
### 9. *Sthenias grisator* Fabricius

1787. *Sthenias grisator* Fabricius, *Mant, Ins.* 1 : 136.

1914. *Sthenias grisator* : Stebbing, *Indian Forest Insects* (Coleoptera) : 377—378.

1939. *Sthenias grisator* : Beeson and Bhatia, *Indian Forest Records (New Series Entomology, 5* (1) : 174.

General appearance (Text-fig. 7) moderately large, rather broad, short and somewhat parallel-sided. Dorsal surface greyish brown and dull with some darker irregular tubercles. Head broader than long, strongly prognathus and eyes coarsely faceted. Antenna rather short and its joints 3—11 progressively shorter. Prothorax slightly long, with two tubercles across the middle, lateral margins slightly undulated. Scutellum transverse and semicircular. Elytra slightly broader than prothorax, somewhat parallel-sided and lateral margins slightly undulated at middle, dorsal surface covered with many small, darker spinous tubercles, apical part of elytra depressed and demarketed with darker hairs. Legs rather short and thick. Length 15-25 mm. and breadth 5-8 mm.



Text-fig. 7. *Sthenias grisator* Fabricius;

**Material examined :** 5 ex. Arunachal Pradesh : Subansiri Division, 18.v 1966, A. N. T Joseph Coll. 1 ex., and 4 ex. also studied from other states of India.

**Distribution in India :** So far, this species was recorded from Uttar Pradesh, Rajasthan, Maharashtra, Karnataka and Tamil Nadu. In the present study this species is recorded for the first time from Arunachal Pradesh.

**Remarks :** Beeson and Bhatia (1939) noted this species as a pest of ornamental climbers, grape vines, flowering shrubs, mulberry plants and also recorded from *Beaumontia grandiflora*, *Chloroxylon swietenia*, *Erythrina indica*, *Manihot utilissima*, *Morus alba*, *Nerium odorum*, *Vitis vinifera*, *Wrightia tinctoria*. Aurivillius (1921-23) placed the genus *Sthenias* under the tribe Niphonini but Martins suggested authors (personal communication) that the genus *Sthenias* has been transferred to the tribe Pteropliini.

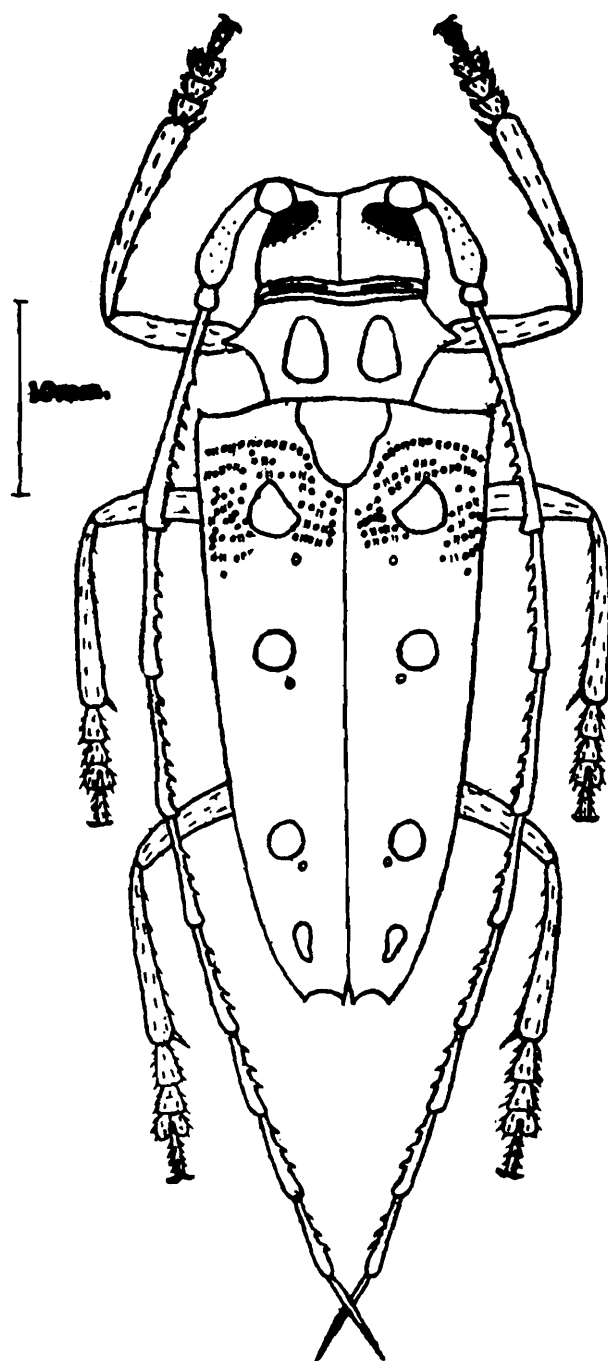
## 10. *Batocera* (*Semibatocera*) *parryi* Hope

1845. *Batocera parryi* Hope, *Trans. Ent. Soc. Lond.*, 4 : 77.

1921. *Batocera* (*Semibatocera*) *parryi* : Aurvillius, *Coleopt. Cat., Berl.*, 23 (73) : 124

**General appearance** (Text-fig. 8) large, rather broad at the base of elytra and narrowed posteriorly, and dorsal surface charcoal grey. Head large with coarsely faceted eyes. Antenna moderately long, scape large elongated, pedicel small, transverse, joints 3—11 subequal and joints 3—10 armed with distinct apical spine. Prothorax moderately transverse and its lateral margin armed with median spine, pronotum with a pair of median white spots. Scutellum heart shaped and covered with fine white hairs. Elytra moderately broad at base, progressively narrowed posteriorly, basal one-fourth of elytra granulated, humeral angle armed with small acute spine, each elytron with four distinct white spots arranged in longitudinal rows, apical margin truncated and armed with spine. Leg moderately long and charcoal grey. Length 34-44 mm. and breadth 12-20 mm.

**Material examined :** 14 ex. Arunachal Pradesh : Subansiri Division, 17 v 1966, A. N. T Joseph Coll. 1 ex., and Kameng Division, 16.v.1961, K. C. J. Coll. 1 ex., and 12 ex. also studied from other states of India.



Text-fig. 8. *Batocera (Semibatocera) parryi* Hope;

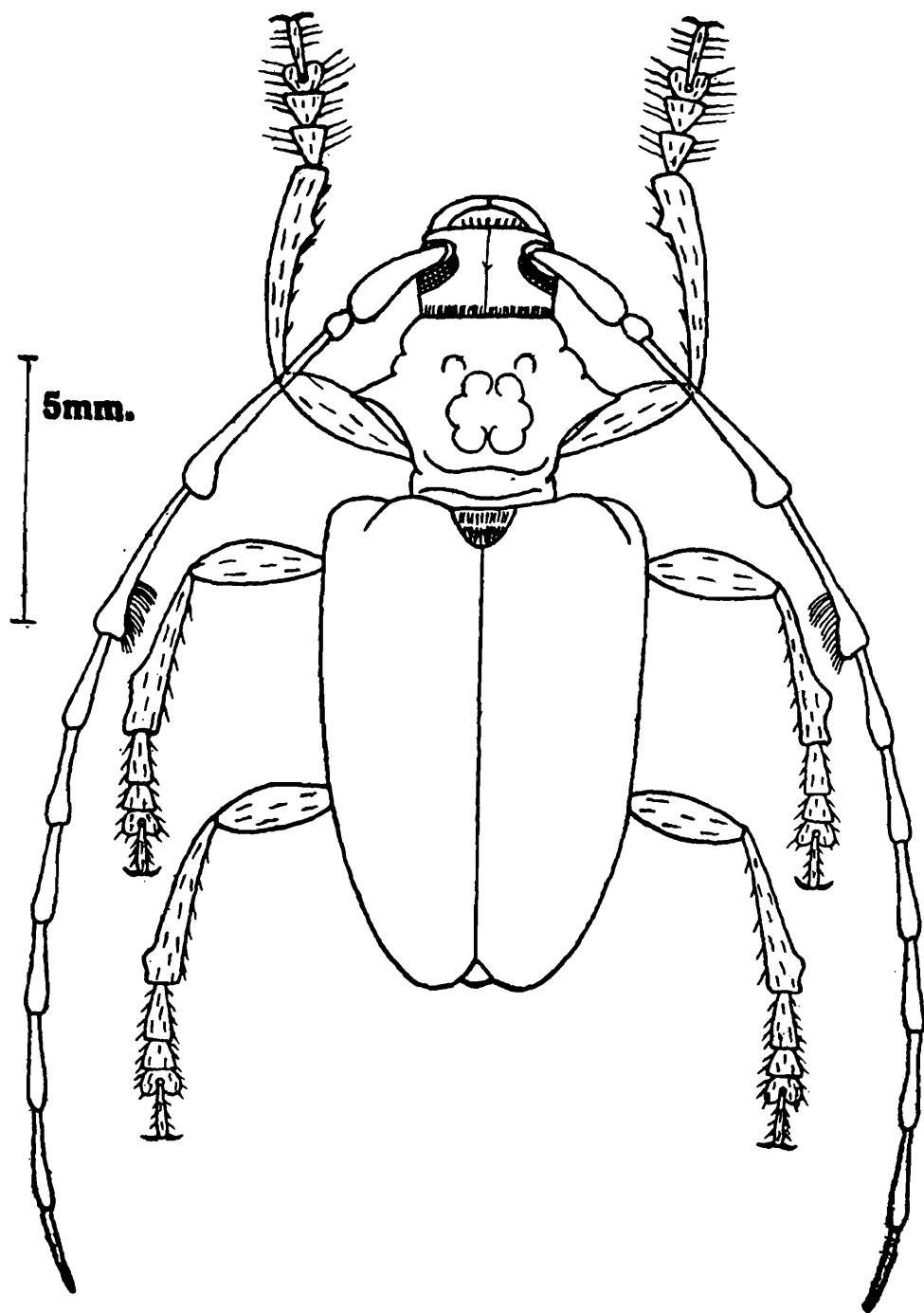
*Distribution in India* : Aurivillius (1921-23) listed this species from Assam and Sikkim. In the present study this species is recorded for the first time from Arunachal Pradesh and West Bengal.

#### 11. *Imantocera plumosa* Olivier

1792. *Imantocera plumosa* Olivier, *Encycl. meth. Ins.*, 7 : 463.

General appearance (Text-fig. 9) rather short, broad at base of elytra and narrowed in front and behind. Dorsal surface blackish brown, clothed with dense silvery greyish pubescence, with distinct

irregular and small tubercles. Head moderately long, narrow and eyes coarsely faceted. Antenna moderately long, joint 4 with tuft of apical hairs, joints 5—11 subequal and shorter than joint 4. Prothorax as broad as long, pronotum wrinkled, lateral margins armed with median spine. Scutellum semicircular and covered with dense white pubescence. Elytra slightly longer than broad, blackish, surface rough, covered with moderately dense and small tubercles, which are less prominent posteriorly. Legs rather short and front tarsi densely hairy. Length 16—20 mm. and breadth 6—7 mm.



Text-fig. 9. *Imantocera plumosa* Olivier

*Material examined* : 9 ex. Arunachal Pradesh : Subansiri Division, 17—19.v.1966, A. N. T. Joseph Coll. 3 ex., and 6 ex. also studied from other states of India and from Bangladesh.

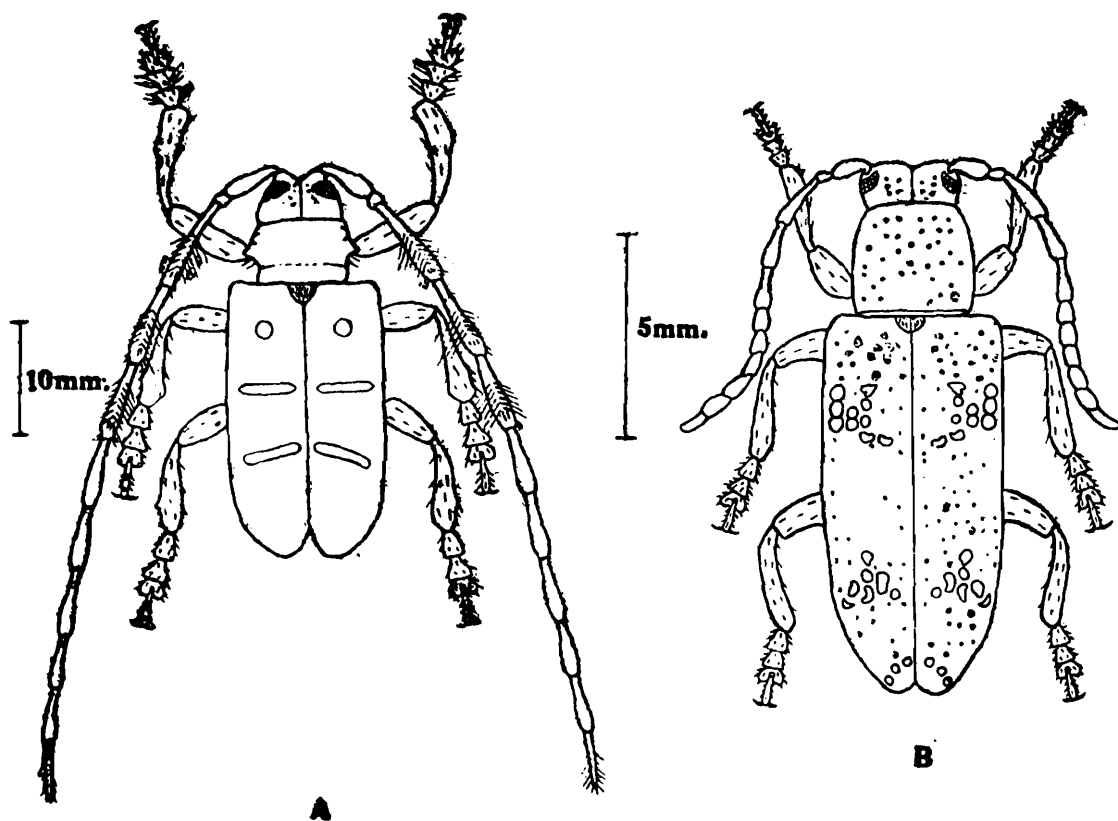
*Distribution in India* : Aurivillius (1921—23) listed this species from Java, Borneo, Flores. In the present study this species is for the first time recorded from India : Arunachal Pradesh, Assam and Sikkim.

## 12. *Diastocera wallichi* Hope

1831. *Diastocera wallichi* Hope, in *Gray Zool. Misc.*; 27.

1939. *Diastocera wallichi*: Beeson and Bhatia, *Indian Forest Records (New Series) Entomology*, 5 (1) : 58.

General appearance (Text-fig. 10A) large, somewhat parallel-sided, dorsal surface bronzy green purple and covered with minute, dense scale-like pubescence, colour varies at different angles of light. Head prognathus and brownish with green and purple lustre and eyes finely faceted. Antenna greenish, joints 3—5 with muff of long silky black hairs and joint 11 with fine and short hairs. Prothorax greenish, transverse, lateral margin of prothorax with a pair of small somewhat blunt median spines. Scutellum as broad as long, slightly narrowed posteriorly and brownish with purple lustre. Elytra moderately long, parallel-sided, light greenish with purple tinge, each elytron



Text-fig. 10. A- *Diastocera wallichi* Hope; B- *Apomecyna neglecta* Pascoe.

with two anterior rounded spots covered with long black erect hairs and posterior half with a pair of transverse band covered with velvety black hairs. Legs rather short, brownish with green lustre. Length 25—37 mm. and breadth 9—11 mm.

*Material examined* : 45 ex. Arunachal Pradesh : Kameng Division, 13—25.vi.1961, K. C. J. Coll. 3 ex., and 42 ex. also studied, from other states of India.

*Distribution in India* : So far, this species was recorded from Assam, West Bengal and Uttar Pradesh. In the present study this species is recorded for the first time from Arunachal Pradesh, Sikkim and Bihar.

*Remarks* : Beeson and Bhatia (1939) recorded this species from *Bombax malabaricum*.

### 13. *Apomecyna neglecta* Pascoe

1865. *Apomecyna neglecta* Pascoe, *Trans. Ent. Soc. Lond.*, 3 (3) : 152

General appearance (Text-fig. 10B) rather short and compact, dorsal surface dull reddish brown and covered with thick whitish pubescence, puncturation irregular, deep and darker. Antenna short, thick, joints 3—5 distinctly longer than joints 6—11, which are subequal. Head with black and coarsely faceted eyes. Prothorax slightly elongated and narrowed in front, front angle rounded, hind margin bordered puncturation deep, prominent and irregular. Scutellum slightly transverse, semicircular and whitish. Elytra parallel-sided with more or less, regular rows of deep and distinct punctures and each elytron with groups of white spots. Legs rather short and brownish. Length 11—14 mm. and breadth 4—5 mm.

*Material examined* : 16 ex. Arunachal Pradesh : Subansiri Division, 18.v.1966, A. N. T. Joseph Coll. 1 ex., and 15 ex. also studied from other states of India.

*Distribution in India* : Aurvillius (1921-23) listed this species from Bengal, Ceylon, Japan. In the present study this species is recorded for the first time from Arunachal Pradesh, Tamil Nadu and Andaman Island.

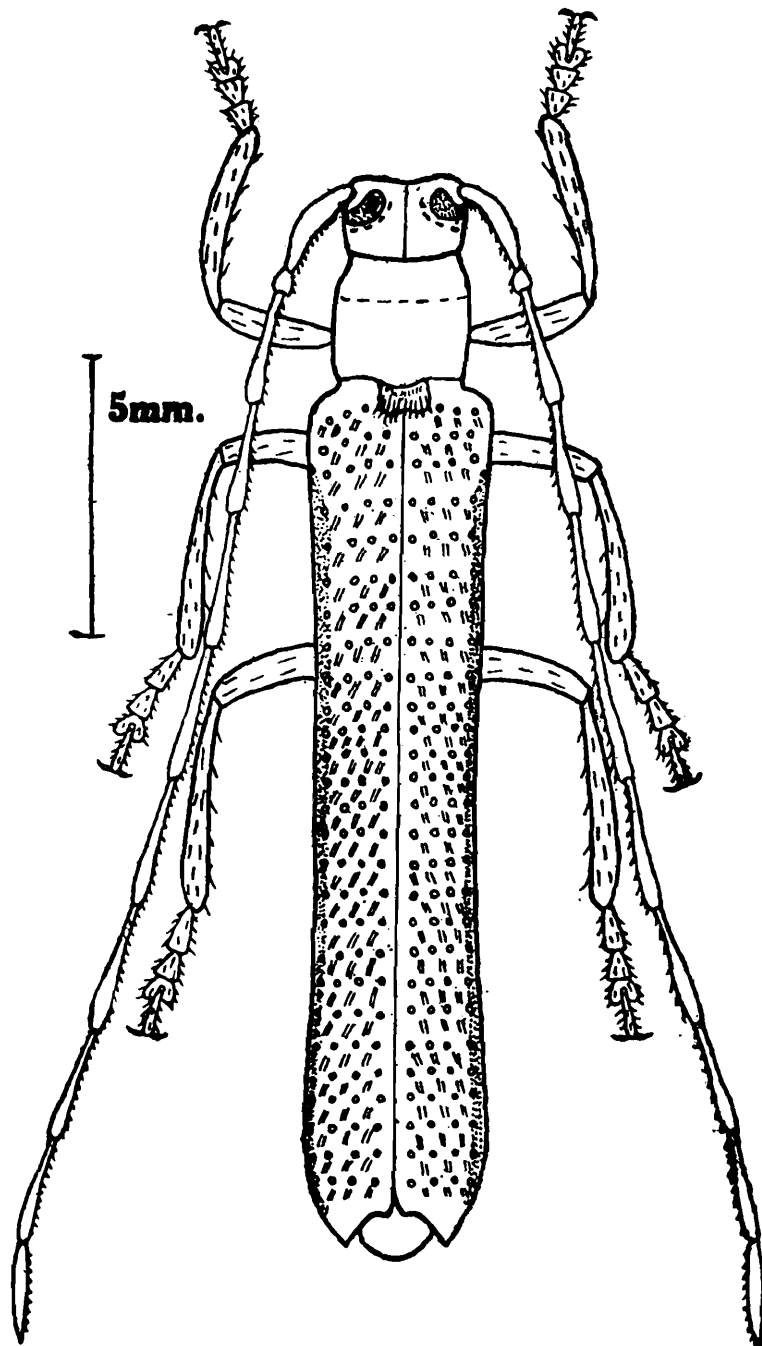
### 14. *Oberca posticata* Gahan

1895. *Oberca posticata* Gahan, *Ann. Mus. Civ. Genova*, 34 : 94.

General appearance (Text-fig. 11) narrow, slender, long and parallel-sided. Dorsal surface yellowish brown, elytra with rows of

small, deep, regular and darker punctures. Head moderately long and brown, and eyes finely faceted. Antenna long, narrow and blackish brown, pedicel markedly small. Prothorax elongated, cylindrical and parallel-sided, pronotum yellowish brown, impunctate and glabrous. Scutellum transverse and slightly bilobed posteriorly and covered with short hairs. Elytra markedly long and slender, parallel-sided, lateral margin darker covered with white dense and short pubescence, and apex of elytra truncated. Legs rather short and dark brown. Length 10—22 mm. and breadth 2—3.5 mm.

*Material examined* : 33 ex. Arunachal Pradesh : Kameng



Text-fig. 11. *Oberea posticata* Gahan;

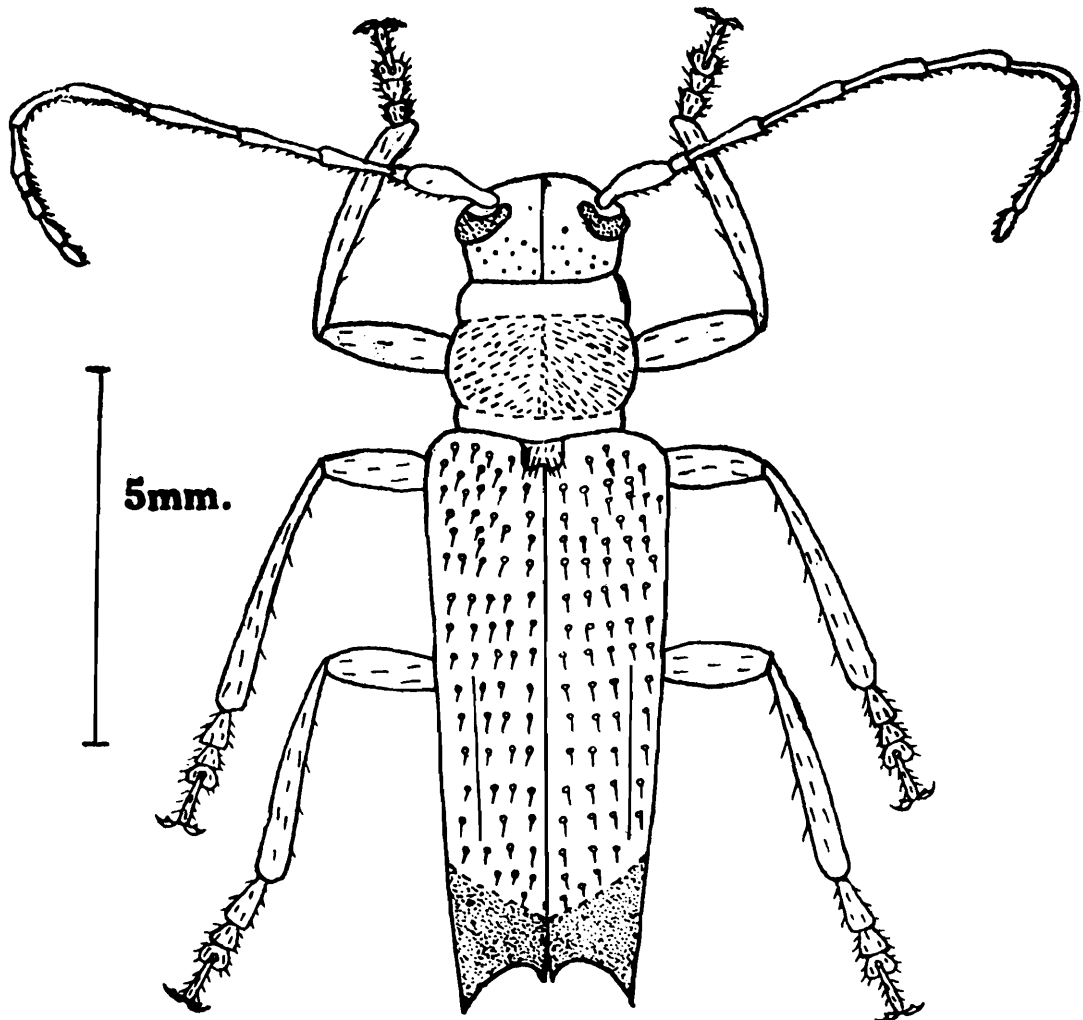
Division, 25—29. vi. 1961, K. C. J. Coll. 2 ex., and Kameng, 6. v. 1966 A. N. T. Joseph Coll. 1 ex., and 30 ex., also studied from other states of India.

*Distribution in India* : Aurivillius (1921-23) listed this species from Burma. In the present study this species is for the first time recorded from India : Arunachal Pradesh, West Bengal, Sikkim and Andaman Island.

### 15. *Nupserha fricator* Dalman

1817. *Nupserha fricator* Dalman, in *Schönh. Syn. Ins.*, 1, 3, Append, 183.

General appearance (Text-fig. 12) moderately large and somewhat parallel-sided. Dorsal surface yellowish brown, elytra slightly narrowed posteriorly, clothed with erect long yellowish hairs and fine dense minute pubescence, elytral puncturation large, deep and arranged in rows. Head black, transverse, vertex distinctly punctured, and eyes large, slightly projected and finely faceted. Antenna black, rather short and slender, joints 6—10 progressively shorter. Prothorax as



Text-fig. 12. *Nupserha fricator* Dalman;

long as broad, reddish brown, lateral margin of prothorax devoid of spines, broadest at middle and constricted in front and behind, pronotum impunctate and finely pubescent. Scutellum moderately large, slightly long and its apical margin bilobed and pubescent. Elytra moderately long, yellowish brown and its apical one-fifth black, lateral margins of elytra straight, narrowed posteriorly and apical margin truncated. Legs moderately long and dark yellowish brown, and claws slightly hooked. Length 7–14 mm. and breadth 2.5–4 mm.

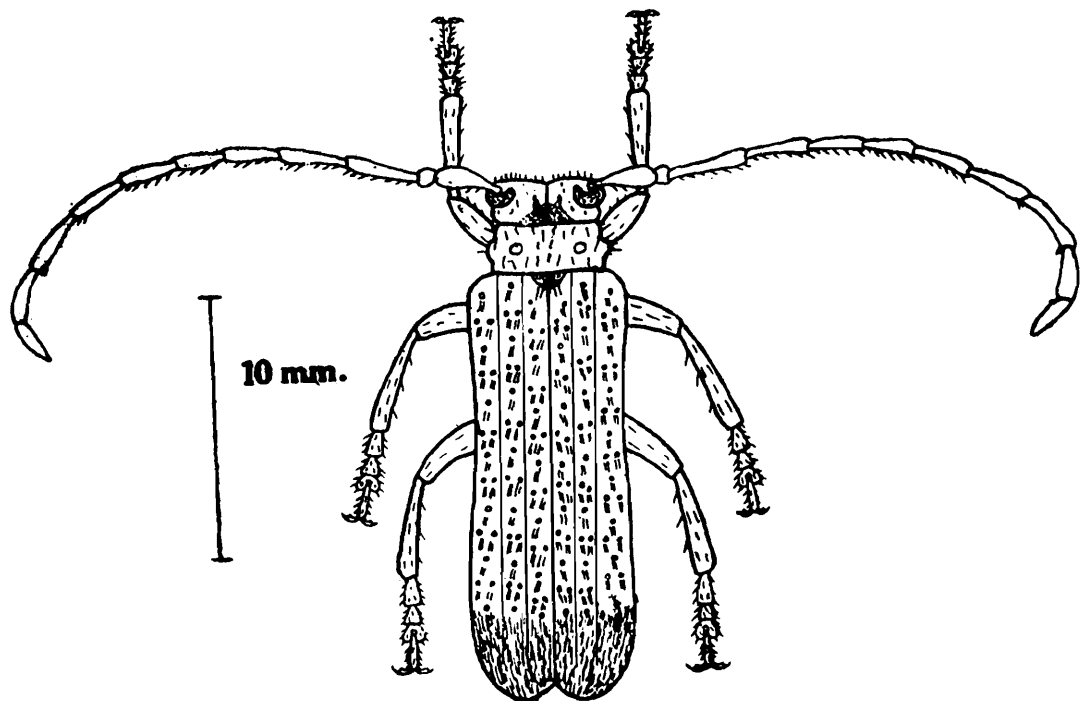
*Material examined* : 5 ex. Arunachal Pradesh : Kameng Division, 20. vi. 1966, A. N. T Joseph Coll. 1 ex., and 4 ex. also studied from other states of India.

*Distribution in India* : Aurivillius (1921-23)) listed this species from Burma, Malacca, Java and Borneo. In the present study this species is for the first time recorded from India : Arunachal Pradesh, West Bengal, Sikkim and Himachal Pradesh.

#### 16. *Linda rubescens* Hope

1831. *Linda rubescens* Hope, in Gray. *Zool. Misc.* : 28.

General appearance (Text-fig. 13) moderately large and parallel-sided. Dorsal surface yellowish and covered with fine yellowish erect pubescence. Head slightly transverse, yellowish with a median blackish patch, and covered with fine erect moderately long setae, eyes large and finely faceted. Antenna black, scape large and broadened towards apex,



Text-fig. 13. *Linda rubescens* Hope.

joints 3—1.1 subequal. Prothorax markedly short and transverse, pronotum broadest at middle and constricted in front and behind, and with two black spots at either side of middle line. Scutellum transversely semicircular and its apical margin slightly bilobed and covered with brownish long pubescence. Elytra yellowish, long, somewhat parallel-sided, each elytron with two slightly distinct ribs, puncturation irregular and deep, pubescence erect and moderately long. Legs black and rather short, and claws slightly hooked. Length 17—21 mm. and breadth 4—5 mm.

*Material examined* : 3 ex. Arunachal Pradesh : Subansiri Division, 14.v.1966, A. N. T Joseph Coll. 1 ex. and 2 ex. also studied from West Bengal.

*Distribution in India* : Aurivillius (1921-23) listed this species from Nepal. In the present study this species is recorded for the first time from India ; Arunachal Pradesh and West Bengal.

#### SUMMARY

The paper deals with sixteen species of Cerambycidae, their diagnostic characters, distribution in India and illustrations of dorsal view are given. All the sixteen species are being recorded for the first time from Arunachal Pradesh (NEFA).

#### ACKNOWLEDGEMENTS

The authors are grateful to the Director, Zoological Survey of India for Laboratory facilities and to Dr. U. R. Martins, Museu de Zoologia, Universidade de São Paulo, Brazil, for helpful suggestion.

#### REFERENCES

- AURIVILLIUS, C. 1921-23. *Cerambycidae : Lamiinae* in Junk and Schenckling, *Coleopterorum Catalogus*. 23 (Pars 73—74.) : 1—704. Berlin.
- BEESON, C. F. C. AND BHATIA, B. M. 1939. On the biology of the Cerambycidae (Coleopt). *Indian For. Rec.*, (N. S.) 5 (1) : 1—235.
- BEESON, C. F. C. 1941. *The Ecology and Control of the Forest Insects of India and Neighbouring Countries*. Part 1. : 767 pp. Government of India.
- STEBBING, E. P. 1914. *Indian Forest Insects of Economic Importance*. Coleoptera. xvi + 648. London. Eyre and Spottiswoode.
- GAHAN, C. J. 1906. *The Fauna of British India, including Ceylon and Burma*. Coleoptera, Cerambycidae. 1 : xviii + 329. (Taylor and Francis) London.
- FOWLER, W. W. 1912. *The Fauna of British India, including Ceylon and Burma*. Coleoptera. General Introduction and Cicindelidae and Pausidae : xx + 529. (Taylor and Francis) London.

ON A COLLECTION OF SCARABAEIDAE  
(INSECTA : COLEOPTERA) FROM ARUNACHAL  
PRADESH WITH THE DESCRIPTION OF A  
NEW SPECIES

By

S. K. CHATTERJEE AND G. N. SAHA

Zoological Survey of India  
Calcutta

INTRODUCTION

There is very little published information on the Scarabaeidae of Arunachal Pradesh (N. E. F. A.). The present paper would be the first account of the family from the area. It is based on 206 specimens of Scarabaeidae belonging to the subfamilies Cetoniinae, Dynastinae and Rutelinae, collected by various survey parties from the Zoological Survey of India in the Arunachal Pradesh. These surveys were conducted by Dr. K. C. Jayaramakrishna, Shri S. Biswas, Dr. A. N. T. Joseph, Dr. S. K. Tandon and Dr. J. M. Julka. This collection comprises 20 species of which one species is new to science and described below. All the species which have been dealt with in the present paper, are recorded for the first time from Arunachal Pradesh. It has been observed that these species are abundantly distributed in the north eastern part of India. Further these species so far have not been found from south India.

LIST OF SPECIES

Subfamily CETONIINAE

1. *Macronota quadrilineata* Hope
2. *Macronota virgata* (Janson)
3. *Torynorrhina distincta* (Hope)
4. *Torynorrhina opalina* (Hope)
5. *Rhomborrhina mearesi* (Hope)
6. *Trigonophorus nepalensis* Hope
7. *Protaetia neglecta* (Hope)
8. *Protaetia cariana* (Gestro)
9. *Oxycetonia albopunctata*  
(Fabricius)
10. *Clinteria arunachala* sp. n.

Subfamily DYNASTINAE

11. *Eophileurus planatus*  
(Wiedemann)

Subfamily RUTELINAE

12. *Popillia cyanea* Hope
13. *Popillia cupricollis* Hope
14. *Popillia pilicollis* Kraatz
15. *Mimela passerinii* Hope
16. *Mimela horsfieldi* Hope
17. *Mimela heterochropus*

Blanchard

18. *Mimela bicolor* Hope
19. *Anomala signaticollis*  
Nonfried

20. *Anomala perplexa* (Hope)

## SYSTEMATIC ACCOUNT

Order COLEOPTERA

Family SCARABAEIDAE

Subfamily CETONIINAE

1. *Macronota quadrilineata* Hope1831. *Macronota quadrilineata* Hope, Gray's Zool. Misc., p. 24.1910. *Macronota quadrilineata* : Arrow, Fauna British India, Coleoptera : Lamellicornia, 1 : 61.

Material examined : 1 ex., N. E. F. A., Kameng Div., Ka'aktang, Bairabkunda, alt. 275 m., 20. x. 1967, (S. Biswas).

*Distinctive characters* : Elongate and narrowed posteriorly, antennal club three-jointed and long; elytra reddish with three black spots on base, apex and near middle; blackish head and pronotum with two and four longitudinal lines respectively; scutellum and pygidium each with one longitudinal median line; length 15.5 mm, breadth 8 mm

*Remarks* : This species was previously recorded from different parts of northeast India.

2. *Macronota virgata* (Janson)1892. *Taeniodera virgata* Janson, Notes Leyd. Mus., 14 : 59.1892. *Taeniodera quadristrigata* Kraatz, Deutsche Ent. Zeitsch p. 316.1910. *Macronota virgata* : Arrow, Fauna British India, Coleoptera Lamellicornia, 1 : 62.

Material examined : 1 ex., N. E. F. A., Subansiri Div., Chakra, 22.v.1966, alt. 1128 m., (A. N. T Joseph).

*Distinctive characters* : Elongate and gradually narrowed posteriorly pronotum and head black with longitudinal lines, two on the head and four on the pronotum; elytra brick red and decorated with black patches and two yellow spots at the apical side, finely serrated at apex and gently sinuated behind the shoulders; abdomen finely punctured; length 16 mm.; breadth 7.5 mm.

*Remarks* : So far, this species was recorded from Assam, Manipur, Bangladesh : Silhet, Burma : Taung-ngu.

### 3. *Torynorrhina distincta* (Hope)

1841. *Rhomborrhina distincta* Hope, *Trans. Ent. Soc. Lond.*, 3 : 63.

1842. *Rhomborrhina mellyi* Burmeister, *Handb. Ent.*, 3 : 198.

1910. *Torynorrhina distincta* : Arrow, *Fauna British India, Coleoptera : Lamellicornia*, 1 : 82.

*Material examined* : 1 ex., N. E. F. A., Subansiri Expedition, Scium, alt. 500 M. 25. xi. 1974, (J. M. Julka).

*Distinctive characters* : Bright metallic green, antennae, lower surface, tarsi and legs black; posterior margin of the elytra and pygidium dark black and hairy; antennae small; clypeus densely rugose and punctured; pronotum strongly punctured at the sides; elytra irregularly punctate and coarsely rugose at the apex; metasternum closely punctured at the sides and abdomen fairly smooth; 33.5 mm; breadth 16 mm.

*Remarks* : Previously this species was recorded from Assam Manipur, Burma, Karen-ni, Kochin Hills.

### 4. *Torynorrhina opalina* (Hope)

1831. *Cetonia opalina* Hope, *Gray's Zool. Misc.*, p. 24.

1910. *Torynorrhina opalina* : Arrow, *Fauna British India, Coleoptera : Lamellicornia*, 1 : 84.

*Material examined* : 1 ex., N. E. F. A., Sonai, Rupai Forest, 28 v 1966., (A. N. T. Joseph); 1 ex., Daporijo, Subansiri bridge, alt. 150 m., 28. xi 966, (S. K. Tandon); 1 ex., alt. 500 m., 25. xi 1974, (J. M. Julka).

*Distinctive characters* : Elongate, pale pinkish olivaceous and faintly greenish above and leafy green beneath; clypeus green and deeply punctate at the sides; antennae brownish; pronotum shiny, deeply punctate at sides and nearly impunctate at the middle; scutellum dark green; elytra coarsely punctured at the apex; tarsi black; pygidium with brownish hairs; length 30—31 mm.; breadth 13.5—15 mm.

*Remarks* : This species widely distributed in the different parts of Northern India and Pakistan.

### 5. *Rhomborrhina mearesi* (Hope)

1843. *Diphillomorpha mearesi* Hope, *Trans. linn. Soc.*, 19 (2) : 107.  
 1842. *Anomalocera parryi* Westwood, *Arcana. Ent.*, 1 : 120. (Syn.)  
 1910. *Rhomborrhina mearesi* : Arrow, *Fauna British India*, Coleoptera : Lamellicornia, 1 : 88.

*Material examined* : 1 ex., N. E. F. A., Kameng Div., Nephra. alt. 1678 m., 4 vii.. 1961, (S. Biswas).

*Distinctive characters* : Elongate, bright green with pinkish reflections above; antennae and tarsi brown; prothorax strongly punctate laterally and finely at the middle; apical part of the elytral margins and pygidium rugose; metasternal process slender, slightly pointed and strongly curved at the apex; metasternum smooth, finely punctate and hairy at the sides, with a median line in the middle; length 20.5 mm. ; breadth 9.5 mm.

*Remarks* : This is rare species, previously recorded from Sikkim and Darjeeling.

### 6. *Trigonophorus nepalensis* Hope

1831. *Trigonophorus nepalensis* Hope, *Gray's Zool. Miscell.*, p. 24.  
 1842. *Trigonophorus nepalensis* Westwood, *Arcana Ent.*, 1 : 121.  
 1841. *Rhomborrhina cantori* Hope, *Trans. Ent. Soc. Lond.*, 3 : 62.  
 1910. *Trigonophorus nepalensis* : Arrow, *Fauna British India*, Coleoptera : Lamellicornia, 1 : 103.

*Material examined* : 1 ex. N. E. F. A., Likhabali round camp, 7.x. 1966. (S. K. Tandon).

*Distinctive characters* : Elongate and convex, green and moderately shining, lower surface including femora blackish brown, tibiae orange red and tarsi black; head long, clypeus upwardly directed and closely granulated; prothorax with a few fine punctures at the sides; elytra finely punctate striate; metasternum indistinctly punctured; metasternal process narrow, long, curved and directed slightly downwards; length 31.5 mm., breadth 16 mm.

*Remarks* : It is recorded earlier from the different parts of North East India.

### 7. *Protaetia neglecta* (Hope)

1831. *Cetonia neglecta* Hope, *Gray's Zool. Miscellany*, p. 24.  
 1833. *Cetonia dalman* Gory & Percheron, *Monogr. Cet.*, p. 195.

1842. *Protaetia puncticollis* Burmeister, *Handb. Ent.*, 3 : 470.

1910. *Protaetia neglecta* : Arrow, *Fauna British India*, Coleoptera: Lamellicornia, 1 : 160.

*Material examined* : 1 ex., N. E. F. A., Kameng Div., Dirong Dzong, alt. 5250 m., 10.iv 1961., (K. C. Jayaramkrishna).

*Distinctive characters* : Moderately elongate and convex; upper surface bronzy, legs and lower surface sometimes metallic greenish; head entirely deeply punctate, front margin reflexed and minutely emarginate in the middle; pronotum coarsely and closely punctured with a very minute depression on each side; elytra strongly and rugosely punctured except near the scutellum; sternal process very short and broad; metasternum smooth in the middle and rugose at the sides; legs short and each front tibia armed with three sharp teeth; abdomen smooth except the last segment which strongly punctured; length 19 mm.; breadth 11 mm.

*Remarks* : Though only a single specimen had been collected from Arunachal Pradesh but this species was previously recorded from different parts of northeast and northwest India.

#### 8. *Protaetia cariana* (Gestro)

1891. *Cetonia cariana* Gestro, *Ann. Mus. Genova*, (2) 10 : 850.

1910. *Protaetia cariana* : Arrow, *Fauna British India*, Coleoptera : Lamellicornia, 1 : 161.

*Material examined* : 3 ex., N. E. F. A., Kameng Div., Dirong Dzong, alt. 5250 m., 11 iv. 1961, (K. C. J.)

*Distinctive characters* : More or less compact and convex; upper surface bronzy, legs and lower surface coppery reddish or greenish; prothorax decorated with irregularly scattered yellowish spots at the sides; scutellum long, narrow and impunctate, elytra finely punctate; sternal process short, broad and flat; pygidium with two depressions apically; length 21 mm., breadth 12.3 mm.

*Remarks* : Previously recorded from Sikkim, Darjeeling, Mungphu, Burma.

#### 9. *Oxycetonia albopunctata* (Fabricius)

1798. *Cetonia albopunctata* F., *Ent. Syst., Suppl.*, p. 129.

1789. *Cetonia histrio* Oliver, *Ent.*, 1 : 45.

1842. *Gametis histrio* Burmeister, *Handb. Ent.*, 3 : 364.

1910. *Oxycetonia albopunctata* : Arrow, *Fauna British India*, Coleoptera : Lamellicornia, 1 : 166.

*Material examined* : 1 ex., N. E. F. A., Kameng Div., Salari, 22.vi. 1961, (K. C. J.).

*Distinctive characters* : Moderately elongate; pronotum with a lateral line on each side and two black spots near base; elytra black with two longitudinal brick red line, each side decorated with four yellow spots; head deeply punctate; four transverse spots on the pygidium; abdomen sparsely punctate; length 15 mm., breadth 8 mm.

*Remarks* : This species is widely distributed in India and Burma.

#### 10. *Clinteria arunachala* sp. n.

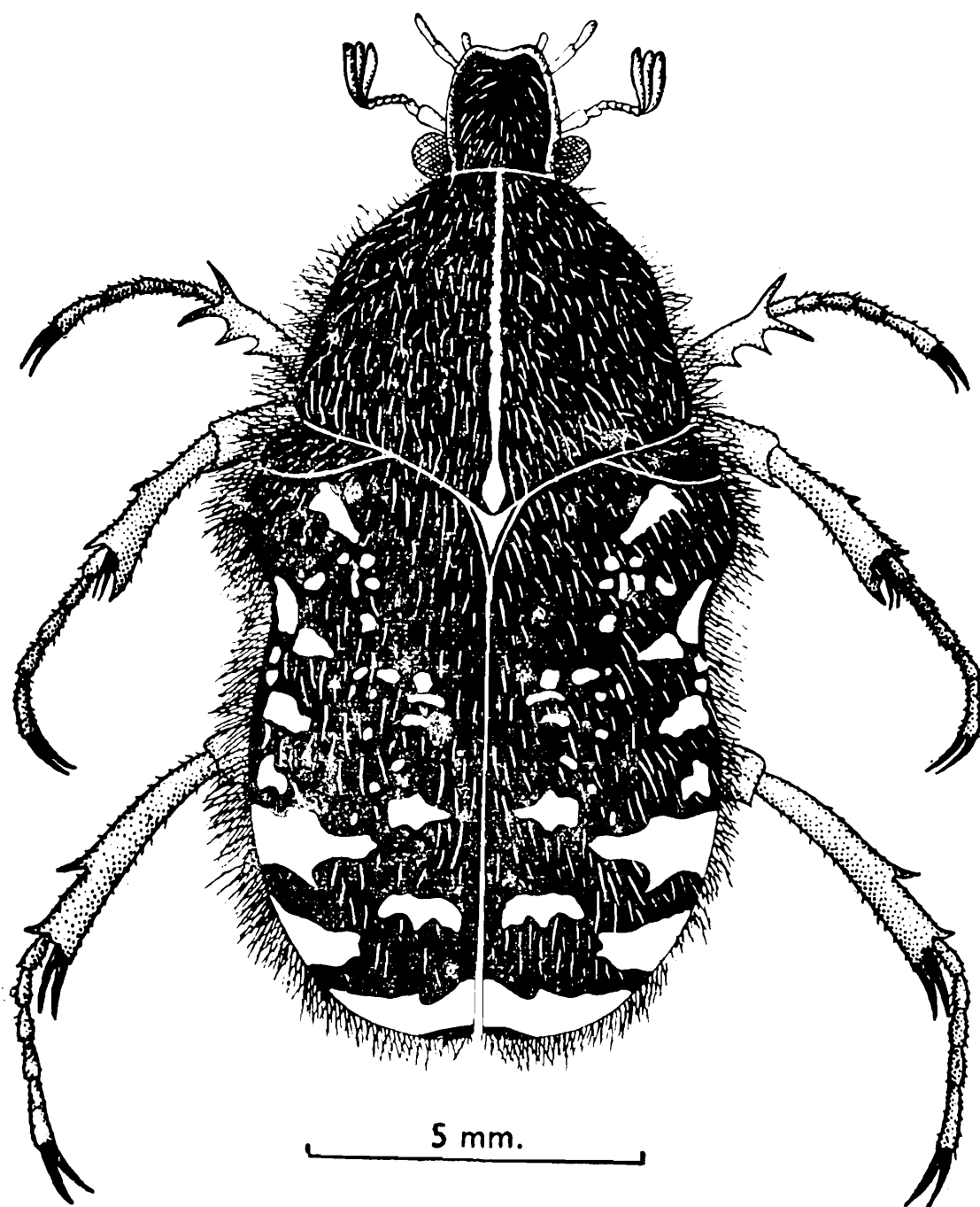
(Text-fig. 1)

Broad, robust and convex, coppery or greenish with whitish hairs except middle of the metasternum and abdomen, upper surface opaque with partial metallic lustre : head feebly rugose in front and densely punctate with long hairs and a fine median ridge posteriorly; abrum semirounded laterally and feebly notched in front, labrum and clypeua reflexed along margins; eyes moderately large with small hairs over and around it; antenna ten segmented, segment I three times longer than globular segment II, segments III-VII smaller than II, VIII-X forming club; pronotum narrow in front, wider posteriorly, moderately lobed behind, slightly curved and rugose at the sides; elytron generally coppery or greenish with 5-6 pale yellow patches and a few spots, sometimes patches and spots confluent and their number variable, humerus elevated in the middle, feebly punctate-striate with fine long hairs, strongly sinuated behind humerus, apical angles slightly rounded; pygidium finely rugose with long hairs, two lateral and one median spots which sometimes confluent; ventral side more hairy and shiny, mentum bilobed with hairs; maxillary palpi four segmented and labial palpi three segmented, apical segment of each palpus fairly long and narrow; prosternum short; mesosternal process extremely short, stout and blunt; metasternum impunctate in the middle and rugose at the sides; front tibia tridentate; each of meso and meta tibia with two pointed spurs at apex; sternites sparsely punctate in the middle, densely punctate and hairy laterally; length 10-14 mm.; breadth 6-8 mm.

In male abdomen broadly channeled at the middle and larger than the female.

*Holotype* : INDIA : N.E.F.A.; Kameng Div., Dunnbridge, alt. 1524 m., 21. iv 1966, (A. N. T. Joseph).

*Paratypes* : 16 ex., INDIA : N.E.F.A. : Kameng Div., Dunnbridge, alt. 1524 m., 21 iv 1966, (A. N. T. Joseph); 46 ex., Kameng Div., Dirong Dzong, alt. 5250 m., 7 iv 1961, (K. C. J.).



Text-fig. 1. Dorsal view of *Clinteria arunachala* sp. n.

*Remarks* : This new species is closely allied to *clinteria hoffmeisteri* White, but can be readily distinguished by its smaller size, absence of pale yellow markings on the lateral side of the pronotum, moderately lobed pronotum and impunctate metasternum in the middle.

## SUBFAMILY—DYNASTINAE

11. *Eophileurus planatus* (Wiedemann)

1823. *Geotrupes planatus* Wiedemann, *Zool. Mag.*, 2 (1) 5.

1910. *Eophileurus planatus* : Arrow, *Fauna British India*, Coleoptera : Lamellicornia, 1 : 238.

*Material examined* : 1 ex., N.E.F.A., Pading Village, alt. 300 m., 11 × 1966, (S. K. Tandon & Party).

*Distinctive characters* : Body slender, more or less parallel sided, black head, pronotum and elytra coarsely punctured; metasternum finely punctate in middle and strongly punctured and pubescent along sides; antennae small; pygidium convex and closely punctured; length 24.5 mm.; breadth 10.5 mm.

*Remarks* : The present study is based on a single specimen collected from Arunachal Pradesh, but it was previously recorded from Naga Hills, Manipur, Uttar Pradesh, Andaman and Nicobar Island, Burma and Bangladesh.

## SUBFAMILY RUTELINAE

12. *Popillia cyanea* Hope

1831 *Popillia cyanea* Hope, Gray's *Zool. Miscell.*, p. 23.

1917. *Popillia cyanea* : Arrow, *Fauna British India*, Coleoptera : Lamellicornia, p.62.

*Material examined* : 7 ex., N. E. F. A., Kameng Div., Dirong Dzong, Nykmadong, 3.VIII.1961; 1 ex., Kalaktang, Rupa, alt. 2135 m., 26.viii.1961.; 1 ex., Khelong, 29.IX.1961., (S. Biswas).

*Distinctive characters* : Short, robust and convex, very smooth and bright; indigo-blue or deep steel blue; clypeus and front finely and closely rugose, vertex closely punctured; antennae light brownish; pronotum closely punctate laterally, smooth and shiny in the middle; each elytron with a deep transverse impression near the sutural margin before the middle; meso-sternal process well produced, broad and apex bluntly rounded; pygidium coarsely punctured; length 10—12mm.; breadth 5.5—7 mm.

*Remarks* : This species is abundantly found in the North India.

13. *Topillia cupricollis* Hope

1831. *Popillia cupricollis* Hope, Gray's Zool. Miscell., p. 23.  
 1848. *Popillia caschmirensis* Redtenbacher, *Hiiugel's Kaschmir*, 4 : (2) 528.  
 1844. *Popillia nitidicollis* Gory, *Guerin's Iconographie*.  
 1855. *Popillia hilaris* Burmeister *Handb. Ent.*, 4 : (2) : 510.  
 1917. *Popillia cupricollis* : Arrow, *Fauna British India*, Coleoptera : Lamellicornia, 2 : 73.

*Material examined* : 12 ex., N. E. F. A., Kameng Div., Nephra, Salarai, alt. 1220 m., 3. VII. and 10. VII. 1961; 2 ex., Dirang Drong, Road side camp, 24. VII. and 2. VIII. 1961; 1 ex., Junga Camp, 21. VII. 1961 : 4 ex., Kameng Div., Nephra, alt. 1678 m., 4. VII. 1961.; 1 ex., Kalantang Siggaron, alt. 2010 M., 27 VIII. 1961. (S. Biswas).

*Distinctive characters* : Broad, very smooth and shiny, brilliant metallic with orange red; pronotum closely punctured; scutellum with a few fine punctures; pygidium strongly punctured, with long, dense yellow hairs on each side; lower surface and femora with yellow hairs; mesosternal process short; legs very stout and slightly long; length 12—13 mm.; breadth 6—7 mm.

*Remarks* : This species is widely distributed in North East and North West India.

14. *Popillia pilicollis* Kraatz

1892. *Popillia pilicollis* Kraatz, *Deutsche Ent. Zeits.*, p. 278.  
 1917. *Popillia pilicollis* : Arrow, *Fauna British India*, Coleoptera : Lamellicornia, 2, : 91.

*Material examined* : 3 ex., N. E. F. A., Kameng, Nephra, Salarai, alt. 1220 m., 3. VII and 10. VII 1961., (S. Biswas); 1 ex., Nephra, 25. VI. 1961., (K. C. J).

*Distinctive characters* : Long, narrow and slightly convex above; head, pronotum very brightly green and elytra coppery red; front densely rugose with greyish hairs; pronotum rugose with setiferous punctures and a very slightly median carina near the base; antennae small, coppery brownish; scutellum with a few punctures; each elytron with six to seven regular dorsal rows of deeply punctured lines; pygidium flat and coarsely punctured with two patches of yellow hairs at the base; mesosternal process very short and blunt; length 9.5—10 mm. ; breadth 4.5—5 mm.

*Remarks* : It is previously recorded from Gopaldhara, Kur-seong, Mangphu, Assam and Nepal.

### 15. *Mimela passerinii* Hope

1842. *Mimela passerinii* Hope, *Proc. Linn. Soc.*, 1 : 128.

1855. *Mimela limbata* Burmeister, *Handb. Ent.*, 4 : (2) : 508.

1890. *Mimela pomacea* Bates, *The Entomologist*, 23 : 245.

1917. *Mimela passerinii*: Arrow, *Fauna British India*, Coleoptera: Lamellicornia, 2 : 105.

*Material examined* : 2 ex., N. E. F. A., Kameng, Bomdila, alt. 2620 m., 14.VII.1961; ex., Kalaktang, Sangloom, 13-14. IX.1961.; (S. Biswas); 2 ex., Bomdila town, 16.VI., (K. C. J.).

*Distinctive characters* : Elongate oval and moderately broad, slightly convex and shining; deep grass green, sides of pronotum and lateral margin of elytra brownish red, lower surface coppery except tarsi and legs orange red; pronotum short with strongly scattered punctures, sides generally rounded; elytra deeply and densely punctured; mesosternal process moderately long, narrow and acute; pygidium metallic green and densely granulated; front tibia bidentate; length 18—20.5 mm.; breadth 9—10.5 mm.

*Remarks* : It is previously recorded from North East India and West China.

### 16. *Mimela horsfieldi* Hope

1836. *Mimela horsfieldi* Hope, *Trans. Ent. Soc. Lond.*, 1 : 114.

1848. *Mimela vittata* Redtenbacher, *Hügel's Kaschmir*, 4 (2) : 525.

1917. *Mimela horsfieldi* : Arrow, *Fauna British India*, Coleoptera : Lamellicornia, 2 : 110.

*Material examined* : 1 ex., N. E. F. A., Daporijo, Subansiri-bridge, alt. 150 m., 28.X.1966., (S. K. Tandon); 1 ex., Scium, alt 500 m., 25.XI.1974., (J. M. Julka).

*Distinctive characters* : Elongate oval, bright and smooth, body and legs deep metallic green; clypeus broad, little elevated in the middle and slightly rugose, front densely punctured; pronotum sub-rounded punctured in front rugose at the sides with red markings upon each side of middle; scutellum broad and finely punctate, each elytron with median vitta and with distinct rows of punctures on outer half; pygidium with fine scattered punctures; mesosternum impunctate in the middle with distinct setiferous puncture at the sides, mesosternal process

short and acute; abdomen rugosely punctate at the sides and impunctate at the middle; length 16.5—18 mm., breadth 9.5—10 mm.

*Remarks* : It is abundantly found from North West to North East India.

### 17. *Mimela heterochropus* Blanchard

1836. *Mimela splendens* Hope, *Trans. Ent. Soc. Lond.*, 1 : 114.

1851. *Mimela heterochropus* Blanchard, *Cat. Coll. Ent. Mus. Paris*, p. 196.

1855. *Mimela hopei* Burmeister, *Handb. Ent.*, 4 (2) 507.

1917. *Mimela heterochropus* : Arrow, *Fauna British India, Coleoptera : Lamellicornia*, 2 : 117.

*Material examined* : 3 ex., N. E. F. A., Kameng Div., Ankaling, alt. 2000 M., 25—26.V 1961; 1 ex., Bokhar, alt. 2800 m. 27 V 1961 3 ex., Salari, 22.VI.1961; 3 ex., Nephra, alt. 1220-1678 m., 3-4. VII. 1961. 2 ex., Subansiri Div., Dejco, alt. 183 m., 10.V 1966, (K. C. J.); 5 ex. Subansiri Div., Pamir, alt. 564 m., 17.V.1966 : 1 ex., Tamen, alt. 157 m., 20.V 1966; 1 ex., Northlakhimpur, 26.V 1966, (A. N. T Joseph).

*Distinctive characters* : Elongate ovate, very smooth and bright metallic green except femora and tarsi, head finely and irregularly punctured, eyes moderately prominent, antennae orange red pronotum with fine scattered punctures; elytra with fine punctate-striate; scutellum broad and impunctate; metasternum smooth and deeply schanneled; tibiae orange red, hind tibiae short and stout with long apical spur, tarsi blackish; length 16—18 mm.; breadth 9—10 mm.

*Remarks* : This species abundantly distributed in North East India and Burma, so it is not surprising of the occurrence from Arunachal Pradesh.

### 18. *Mimela bicolor* Hope

1836. *Mimela bicolor* Hope, *Trans. Ent. Soc. Lond.*, 1 : 116.

1917. *Mimela bicolor* : Arrow, *Fauna British India, Coleoptera : Lamellicornia*, 2 : 125.

*Material examined* : 1 ex., N. E. F. A., Kameng Div., Kalaktang, 30.V 1961, (K. C. J).

*Distinctive characters* : Small, ovate, smooth and shiny; upper surface and pygidium pinkish yellow; head and pronotum slightly reddish pink, pronotum finely punctate along sides and nearly impun-

ctate in the middle; elytra with longitudinal rows of fine punctures; pygidium smooth, very finely and sparsely punctate; length 12.5 mm.; breadth 8 mm.

*Remarks* : This species was earlier recorded from Sikkim, Kurseong, Assam, Pedong and Nepal.

### 19. *Anomala signaticollis* Nonfried

1893. *Anomala signaticollis* Nonfried, *Berl. Ent. Zeitschr.*, p. 334.

1917. *Anomala signaticollis* : Arrow, *Fauna British India* Coleoptera : Lamellicornia, 2 : 198.

*Material examined* : 1 ex., N. E. F. A., Kameng Div., Pobrangehu, 22.IV.1961., (K. C. J.).

*Distinctive characters* : Elongate and small, parallel-sided and slightly depressed posteriorly; bright yellow with pale metallic green lustre on head and middle of pronotum, head densely rugose; elytra strongly and coarsely punctate-strigate; scutellum short and smooth; legs long and bright yellow with blackish brown apices of hind tibia and tarsi, fore tibiae broad, flat and bidentate; length 7 mm. ; breadth 4 mm.

*Remarks* : This species was previously recorded from Assam, Shillong and Manipur.

### 20. *Anomala perplexa* (Hope)

1839. *Euchlora perplexa* Hope, *Proc. Zool. Soc.*, 2 : 70.

1917. *Anomala perplexa* : Arrow, *Fauna British India*, Coleoptera : Lamellicornia, 2 : 228.

*Material examined* : 2 ex., N. E. F. A., North Lakhimpur, Koliari Tea State, 3.X.1966., (S. K. Tandon).

*Distinctive characters* : Elongate-oval, convex and moderately shiny and greenish, lower surface greenish brown, femora and lateral margins of the pronotum and posterior part of the pygidium orange; nearly semicircular and very finely rugose, front deeply punctured, pronotum sub-rounded and with deep round punctures; scutellum finely punctured; each elytron with a row of unequal punctures; metasternum densely punctured at the sides; length 19 mm., breadth 9.5 mm.

*Remarks* : It has already been recorded from different parts of North East India and Nepal.

#### SUMMARY

All the specimens studied in the present paper is based on a collection of Cetoniinae, Dynastinae and Rutelinae (Scarabaeidae) made during the faunistic survey of Arunachal Pradesh by the Zoological Survey of India, between 1961—1966. It deals with 20 species, one is described as new viz. *Clinteria arunachala* and 19 species are being described and recorded for the first time from Arunachal Pradesh.

#### ACKNOWLEDGEMENTS

We are thankful to the Director, Zoological Survey of India, Calcutta, for the facilities provided during this work.

#### REFERENCES

- ARROW, G. J. 1910. The Fauna of British India, including Ceylon and Burma Coleoptera : Lamellicornia (Cetoniinae and Dynastinae), 1 : 1—322.
- ARROW, G. J. 1917. The Fauna of British India, including Ceylon and Burma. Coleoptera : Lamellicornia (Rutelinae), 2 : 1—387.



INTRASPECIFIC VARIATIONS IN  
*PLEUROGENOIDES SITAPURII* (SRIVASTAVA, 1934)  
(TREMATODA : LECITHODENDRIIDAE)

By

P. D. GUPTA\*

Zoological Survey of India,  
Calcutta

(With one Text-figure)

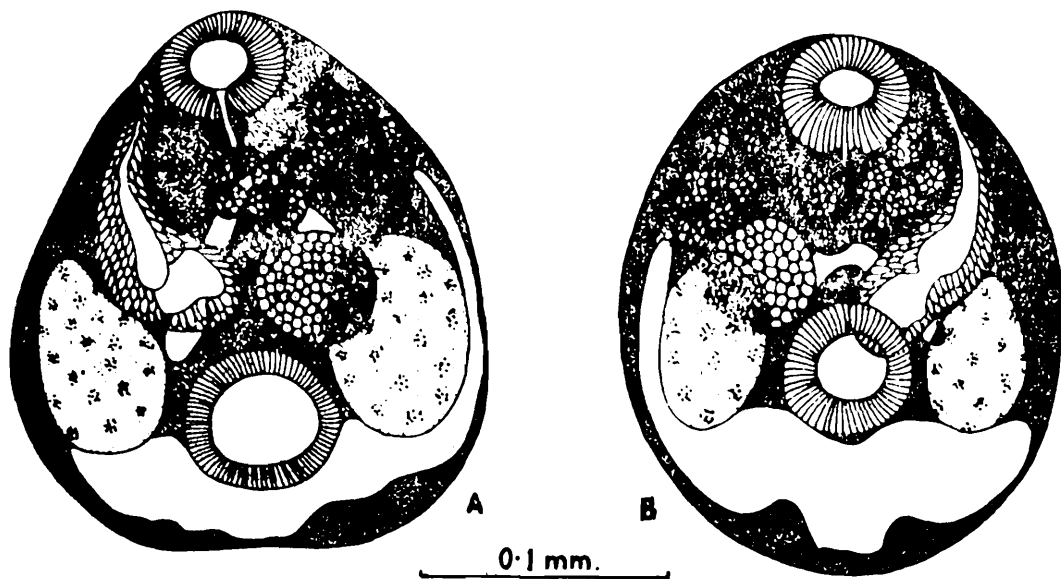
The author collected six specimens of *Pleurogenoides sitapurii* from *Rana cyanophlyctis* in Chittorgarh (= Chittor) Rajasthan and about 150 specimens from the same host in Poona (Maharashtra State). Only one out of 14 host specimens examined in Chittorgarh was found parasitized, while 5 out of 43 (11.6%) were found infected in Poona. The intensity of infection in Poona was two over 100 specimens. Here in the case when they were found in maximum number, there was a concomitant infection with numerous immature specimens of *Tremorchis ranarum* Mehra and Negi, 1926. Present material though fairly agrees with the account given by Srivastava (1934), it shows some important variations due to their developmental stages and state of body at the time of preservation. These variations are described in this paper. *Pleurogenoides sitapurii* is reported for the first time Western Ghats of India.

Body in mounted specimens measures 0.187—0.740\*\* in length and 0.148—0.507 in maximum breadth in acetabular zone. Suckers may be equal in size or the acetabulum may be slightly larger. Oral sucker circular or transversely elongated and measures 0.043—0.109 X 0.051—0.113. Acetabulum measures 0.051—0.139 X 0.051—0.144, situated from preequatorial region to very near the posterior end of the body. In one specimen it is approaching paramphistomid condition (Text-fig. 1), situated 0.023 from posterior end of body. Srivastava (1934) described the acetabulum as being post-equatorial<sup>1</sup> only.

The left testis 0.062—0.152 X 0.039—0.129, is circular, oval or elongated antero-posteriorly, situated postero-lateral to the cirrus

\* Present Address : Gangetic Plains Regional Station, zoological Survey of India, Patna, India.

\*\* All measurements in millimetres.



Text-fig.-1. (A-B) *Pteuregenordes ritapurii* (Srivastava, 1934)

sac. The right testis,  $0.062-0.195 \times 0.047-0.148$ , situated on the side of ovary, is rounded in shape and usually larger than the left one, some times the two testes are equal in size. The testes frequently extend behind the centrum of the ventral sucker. In some cases the left testis has been observed reaching posterior margin of the acetabulum (Text-fig. 1B). Srivastava (1934) has described their position in front of the centrum of the acetabulum. In the present material they occupy a position far behind. In gravid specimens the testes assume the anterior position as described by Srivastava. The cirrus such is clubshaped with various degree of curvature of its stem to appear somewhat 's' shaped, and measures  $0.101-0.312 \times 0.035-0.078$ .

Ovary, subglobular;  $0.043-0.101 \times 0.039-0.097$ , its position varying from immediately behind the intestinal bifurcation to very close to or sometimes partly overlapping the acetabulum. It is almost rounded in shape but irregular or somewhat lobed condition was also met with as a result of pressure of the coverslip at the time of preservation.

The uterine space behind the gonads increases with the attainment of gravid condition, resulting in the variation of relative position of gonads, suckers and compactness of different organs. In one case the uterine loop between the right testis and the body wall has been observed extending in front of the posterior margin of the oral sucker.

Genital pore usually located near the anterior margin of oral sucker. Only in well-extended specimens, it is situated at the level of pharynx as stated by Srivastava (1934).

Vitelline follicles are usually distributed in two groups. The left group occupying median position and the right marginal group may or may not be cephalad to the left one. The space between these two groups is wanting in many cases so that they appear coalescing with each other.

REFERENCE

- SRIVASTAVA, H. D. 1934. On new trematodes of frogs and fishes of the United Provinces, India. Part III. On a new genus *Mehraorchis* (Pleurogenetinae) with a systematic discussion and revision of the family Leiothodendriidae *Bull. Acad. Sci. U. P.*, 3 (4) : 239—256.