

RECORDS OF THE ZOOLOGICAL SURVEY OF INDIA

Vol. 88 (3&4).

1990

Pages 241 - 366

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ON SOME ASILIDAE (DIPTERA) PRESENT IN THE B.P.
BISHOP MUSEUM, HONOLULU III

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INTRODUCTION

It is the third and last lot of asilids from India and Nepal received on loan for study through the courtesy of Dr. Neal L. Evenhuis, Associate Entomologist, B.P. Bishop Museum, Honolulu, Hawaii, 96819. A new species, *Philodicus indicus*, described is based also on the material from the Zoological Survey of India, Calcutta. The arrangement of genera followed in this paper is after "A Review of the Asilidae (Diptera) from the Oriental Region" by Joseph and Parui (1984).

Types are deposited in the B.P. Bishop Museum, Honolulu, and in the Zoological Survey of India, Calcutta.

Leptogaster Meigen

1803. *Leptogaster* Meigen, *Magazin insektkde*, 2 : 269.

1. **Leptogaster albimana** Walker

1859. *Leptogaster albimana* Walker, *J. Linn. Soc. London*, 3 : 89.

Material examined: 1 Male, India, Kerala, Trivandrum District, Poonmudi Range, 900 m., iv-v. 1971, Coll. P.S. Nathan.

Remarks: The species was originally described from "India" (Walker, 1859).

Lobus Martin

1972. *Lobus* Martin, *J. Kansas ent. Soc.*, 45(1) : 8.

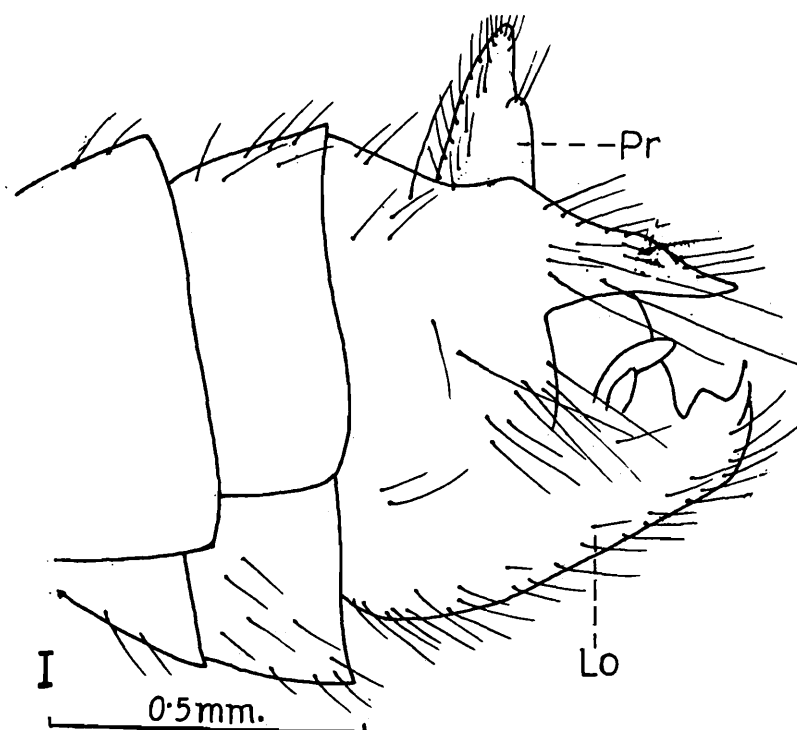
2. **Lobus evenhuisi** sp. nov.

(Fig. 1)

A slender black species with dark brown and yellowish-brown legs, brown wings and black with grey tomentose abdomen. Male: length 11 mm, wing 7 mm.

Male: Head black with grey and greyish-yellow tomentum; gibbosity indistinct, mystax white and arranged in transverse row on mouth border, frontal vitta slightly raised and golden yellow, postcranium black with greyish-white tomentum posterolaterally, hairs black above and white below. Antennae broken with flagellum and style absent, scape and pedicel dark brown, scape with 1 and pedicel with few black bristles, pedicel slightly longer than scape. Palpi and proboscis black, former black haired, latter bare.

Thorax black, greyish-white tomentose; pronotum rather densely greyish-white tomentose, bare; scutum shining black, vestiture black leaving mediolongitudinal bare stripe; 2 supra-alar bristles present; scutellum black, grey tomentose, scutellar disc with few black hairs, hind border with rather dense black hairs, without bristles; pleura grey tomentose, mesopleuron and sternopleuron anteriorly bearing dense white hairs. Halteres pale yellow.



1. *Lobus evenhuisi* sp. nov., lateral view of male genitalia.

Legs dark brown and yellowish-brown, fore and mid femora dark brown with basal and apical yellowish-brown marks, yellowish-brown more in mid femur, hind femur yellowish-brown nearly half length; fore and mid tibiae dark brown and yellowish-brown particoloured to varying extent, hind tibia yellowish-brown with apical third dark brown, tarsus dark brown, but basitarsus to varying extent yellowish-brown, vestiture predominantly white, bristles black.

Wings uniformly brown.

Abdomen black with grey tomentum, tergite 2 medially and distally, tergites 3 and 4 both anteriorly and posteriorly, and tergite 5 posteriorly with transverse band of grey tomentum, tergites 1 and 2 laterally with black and pale yellow hairs. Male genitalia (Fig. 1) black with pale yellow hairs predominant.

According to the key to *Lobus* Martin by Joseph and Parui (1984) it runs to *L. martini* Joseph and Parui, from which it differs in larger size, predominantly dark brown legs, uniformly brown wings, and in details of male genitalia, especially epandrium.

Holotype Male, S. India, Madras (Tamil Nadu), Anamalai Hills, Cinchona, 1067 m, v. 1956, Coll. P.S. Nathan.

Laphria Meigen

1803. *Laphria* Meigen, *Magazin insektkde*, 2 : 270.

3. *Laphria nathani* Joseph and Parui

1981. *Laphria nathani* Joseph and Parui, *Ent. Scand.*, 12 : 217.

Material examined: 1 Male, Kerala, Calicut District, Chembra Peak Area, 1067 m., v. 1970, Coll. T.R.S. Nathan.

Remarks: This species is so far recorded from Kerala and Karnataka.

Cyrtopogon Loew

1847. *Cyrtopogon* Loew, *Linn. Ent.*, 2 : 516.

4. *Cyrtopogon laphrides* Walker

1851. *Cyrtopogon laphrides* Walker, *Insecta Saundersiana*, 1:99.

Material examined: 1 Male, 3 Females, Nepal, Langtong Valley, 60 km. N. of Katmandu, 2700 m., 13-25. x. 1965, Coll. L.V. Gupta.

Remarks: This is reported for the second time from Nepal.

Microstylum Macquart

1838. *Microstylum* Macquart, *Dipt. exot.* 1(2) : 26.

5. *Microstylum ananthakrishnani* Joseph and Parui

1984. *Microstylum ananthakrishnani* Joseph and Parui, *Ent. Scand.*, 15 : 449.

Material examined: 1 Male, India, Kerala, Trivandrum District, Poonmudi Range, 900 m., iv - v. 1971, Coll. P.S. Nathan.

Remarks: So far the species is recorded only from Kerala.

6. *Microstylum apicale* (Wiedemann)

1821. *Dasypogon apicale* Wiedemann, *Dipt. exot.*, 216.

1975. *Microstylum apicale* (Wiedemann): Oldroyd, *A catalog of Diptera of the Oriental Region*, 2 : 119.

Material examined: 2 Females, India, West Bengal, Sukna, 55 km. S. of Darjeeling, V. 1966, Coll. J & M. Sedlacek.

Remarks: It is originally described from 'Bengal'.

Neolaparus Williston

1889. *Neolaparus* Williston, *Psyche*, 5 : 525.

7. *Neolaparus volcatus* (Walker)

1849. *Dasypogon volcatus* Walker, *List Dipt. Colln. Br. Mus.*, 2 : 346.

1975. *Neolaparus volcatus* (Walker): Oldroyd, *A Catalog of Diptera of the Oriental Region*, 2 : 122; details of synonymy given by Oldroyd, 1975.

Material examined: 1 Male, India, Kerala, Trivandrum District, Poonmudi Range, 900 m., iv - v. 1971, Coll. P.S. Nathan.

Remarks: This is the first record of the species from Kerala.

Saropogon Loew

1847. *Saropogon* Loew, *Linn. Ent.*, 2 : 439.

8. *Saropogon hulli* Joseph and Parui

1981. *Saropogon hulli* Joseph and Parui, *Oriental Ins.*, 15 : 27.

Material examined: 1 Male, India, Kerala, Anaimalai Hills, Cinchona, 1067 m., v. 1959, Coll. P.S. Nathan.

Remarks: So far the species has been recorded only from Kerala.

Scylaticus Loew

1858. *Scylaticus* Loew, *Ofvers. K. svenska Vet. -Akad. Forh.*, 14 : 346.

9. *Scylaticus indicus* Bromley

1939. *Scylaticus indicus* Bromley, *Indian J. Agric. Sic.*, 8 (6):864.

Material examined: 2 Males, India, Kerala, Calicut District, Chembra Peak Area, 1067 m., v.1970, Coll. T.R.S. Nathan.

Remarks: The species was described from Tamil Nadu. Here it is recorded for the first time from Kerala.

***Stenopogon* Loew**

1847. *Stenopogon* Loew, *Linn. Ent.*, 2 : 453.

10. *Stenopogon kherai* Joseph and Parui

1976. *Stenopogon kherai* Joseph and Parui, *Ent., Scand.*, 7 :105.

Material examined: i Male, India, Kerala, Anaimalai Hills, Cinchona, 1067 m., v.1959, Coll. P.S. Nathan. i Female, Nepal, Kathmandu, 1300 - 1400 m., 7-12.v. 1966, Coll. J & M. Sedlacek.

Remarks: It is recorded for the first time from outside India.

***Trigonomima* Enderlein**

1914. *Trigonomima* Enderlein, *Wien. ent. Ztg.*, 33 : 164.

11. *Trigonomima anamaliensis* Joseph and Parui

1980. *Trigonomima anamaliensis* Joseph and Parui, *Bull. zool. Surv. India*, 2 (2 & 3) : 197.

Material examined: 1 Male, India, Kerala, Anaimalai Hills, Cinchona, 1067 m., v. 1959, Coll. P.S. Nathan.

Remarks: So far the species is reported only from South India.

***Damalis* Fabricius**

1805. *Damalis* Fabricius, *systema antliatorum*, : 147.

12. *Demalis cederholmi* (Joseph and Parui) new combination

1984. *Xenomyza cederholmi* Joseph and Parui, *Ent. Scand.*, 15:448.

Material examined: 1 Female, India, Kerala, Trivandrum District, Poonmudi Range, 900m., iv -v. 1971, Coll. P.S.Nathan.

Remarks: So far the species has been recorded only from Kerala.

13. *Damalis dravidica* (Joseph and Parui) new combination

1984. *Xenomyza dravidica* Joseph and Parui, *Ent. Scand.* **15** : 441.

Material examined: 1 Female, India, Kerala, Calicut district, Chembra Peak Area, 1067 m., v. 1970, Coll. T.R.S. Nathan.

Remarks: So far the species has been recorded only from Kerala.

14. *Damalis fusca* Walker

1849. *Damalis fusca* Walker, *List. Dipt. Colln. Br. Mus.*, **2** : 481.

1975. *Damalis fusca* : Joseph and Parui, *Insecta : Asilidae (Diptera) Fauna of West Bengal State Series* (in press)

Material examined: 1 Male, 1 Female, India, Pondichery, Karaikal, viii.1970, Coll. P.S. Nathan; 2 Males, 1 Female, Kerala, Trivandrum District, Poonmudi Range, 900 m., iv - v. 1971, Coll. P.S. Nathan.

Remarks: The species was described from N. Bengal, it is the first record from Kerala.

Michotamia Macquart

1838. *Michotamia* Macquart, *Dipt. exot.* **1** (2) : 72.

15. *Michotamia aurata* (Fabricius)

1794. *Asilus aurata* Fabricius, *Ent. Syst.* **4** : 387.

1975. *Michotamia aurata* (Fabricius) : Oldroyd, *A catalog of Diptera of the Oriental Region*, **2** : 130.

Material examined: 1 Female, India, Pondichery, Karaikal, xi.1961, Coll. P.S. Nathan; 1 Female, Kerala, Calicut District, Chembra Peak Area, v. 1970, Coll. T.R.S. Nathan.

Remarks: It is widely distributed in India.

Ommatius Wiedemann

1821. *Ommatius* Wiedemann, *Dipt. exot.*, 213.

5. *Ommatius minor* Doleschall

1857. *Ommatius minor* Doleschall, *Natuurk. Tijdschr. ned.-Indie*, **14** : 395.

Material examined: 1 Male, India, Kerala, Calicut District, Chembra Peak Area, 1067 m., v. 1970, Coll. T.R.S. Nathan.

Remarks: For distributional records, please refer Joseph and Pauri (in press).

17. *Ommatius tuberculatus* Joseph and Parui

1983. *Ommatius tuberculatus* Joseph and Parui, *Ent. Scand.* **14** : 87.

Material examined: 2 Females, India, Kerala, Anailamai Hills, Cinchona, 1067 m., v. 1956, Coll. P.S. Nathan; 1 Male, 11 Females, v. 1959, and 9 Females, v. 1970, other details as in preceding.

Remarks: It is a common species in Kerala.

***Astochia* Becker**

1913. *Astochia* Becker, *Ann. Mus. Zool. Acad. St. Petersbourg*, **17** : 538.

18. *Astochia philus* (Walker)

1849. *Asilus philus* Walker, *List. Dipt. Colln. Br. Mus.* **2** : 393.

1975. *Astochia philus* (Walker): Oldroyd, *A Catalogue of Diptera of Oriental Region*, **2** : 139.

Material examined: 1 Female, Nepal, Kathmandu, 1300-1400 m., 7-12.v. 1966, Coll. J & M. Sedlacek.

Remarks: This is the first record of the species from Nepal.

***Clephyroneura* Becker**

1925. *Clephyroneura* Becker, *Ent. Mitt.*, **14** : 68.

19. *Clephyroneura mudigorensis* Joseph and Parui

1984. *Clephyroneura mudigorensis* Joseph and Parui, *Rec. zool. Surv. India*, Occ. paper No.66: 14.

Material examined: 2 Males, India, Pondichery, Karikal, ii-iv. 1971, Coll. P.S. Nathan.

Remarks: So far the species has been recorded only from South India.

20. Clephydroneura pulla Oldroyd

1938. *Clephydroneura pulla* Oldroyd, *Ann. Mag. nat. Hist.*, (11)1 : 467.

Material examined: 1 Male, India, Tamil Nadu, Coimbatore, 420 m, x. 69, Coll. T.R.S. Nathan.

Remarks: Hitherto recorded only from South India.

21. Clephydroneura wilcoxi Joseph and Parui

1979. *Clephydroneura wilcoxi* Joseph and Parui, 1979, *Ent. Scand.*, 10 : 35.

Material examined: 1 Male, India, Tamil Nadu, Coimbatore, 420m., xi. 1967, Coll. P.S. Nathan.

Remarks: This species has so far been reported from South India.

Machimus Loew

1849. *Machimus* Loew, *Linn. Ent.*, 4 : 1.

22. Machimus hirtipes Ricardo

1919. *Machimus hirtipes* Ricardo, *Ann. Mag. nat. Hist.*, (9) 3 : 49.

Material examined: 1 Male, India, Kerala, Calicut district, Chembra Peak Area, 1067 m., v. 1970, Coll. T.R.S. Nathan.

Remarks: This is the first record of the species from Kerala. It has already been recorded from Tamil Nadu and West Bengal, other than its type locality Assam (Joseph and Parui, in press).

Philodicus Loew

1848. *Philodicus* Loew, *Linn. Ent.*, 3 : 991.

23. Philodicus indicus sp. nov.

(Fig. 2)

A medium black species with sparse grey tomentum, white mystax, black legs, and light brown and grey wings. Male: length 19-22 mm, wing 13-14 mm; female: length 22-24 mm, wing 14-15 mm.

Males: *Head* narrower than thorax, black, grey or greyish-yellow tomentose; mystax white; fronto-orbital plate with black and white bristles, ocellar bristles black, postocular bristles black and confined to above, postcranium white haired, postgena with dense white hairs. Antennae black with brown arista, scape and pedicel with black bristles, scape about 1 to 2 times length of pedicel, first flagellomere slightly shorter than scape. Palpi and proboscis black, both white haired.

Thorax black, grey or greyish-yellow tomentose; pronotum with transverse row of black bristles, laterally with dense white hairs; scutum with mediolongitudinal black stripe divided by narrow grey or greyish-yellow stripe, stripe extends from anterior border to more than four-fifths distance, laterally with 3 black spots in longitudinal row; chaetotaxy: 2 - 3 dorsocentral anterior to scutoscutellar suture, 1 intra-alar, 1 supra-alar, 2 notopleural, 2 postalar; vestiture and bristles black; scutellar disc black or white haired or mixed with both, hind border with 4 black bristles and 2 thin, long, median, bristly black hairs, metapleuron with yellow or white bristly hairs, often also with some black ones, hypopleuron with white or mixed white and black bristly hairs. Halteres brown with occasional dark brown marking on head.

Legs black, mid and hind femora with anteroventral row of black bristles, vestiture white, bristles black, fore tibia and tarsus anteriorly with mat of golden yellow hairs, in hind tibia and tarsus similar hairs present posteriorly.

Wings light brown but basally nearly hyaline, submarginal cell mostly, and marginal and first posterior cells partly grey.

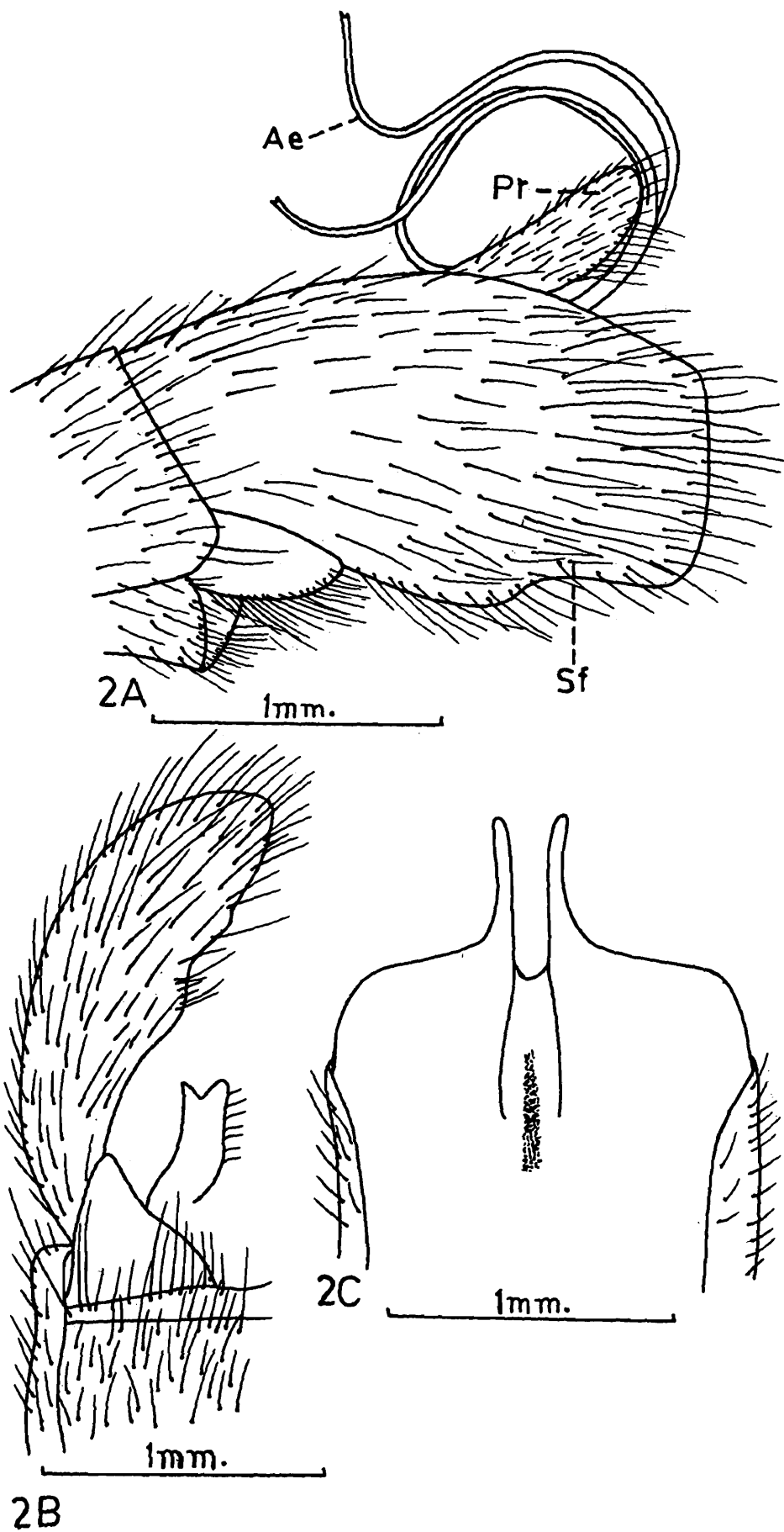
Abdomen black, grey tomentose, tergite 1 mostly grey tomentose, tergites 2-5 laterally and posterior border grey tomentose while rest black, tergite 6 laterally grey tomentose and remaining black, tergites 7 and 8 completely black, tergite 1 laterally with dense white hairs amidst which few black bristles, tergite 2 with few lateral black bristles both anteriorly posteriorly, tergites 3 and 4 with 3 or more black bristles posterolaterally, vestiture white and black. Male genitalia (Fig. 2 A, B) black with black and white hairs.

Females: Similar but with the following differences in the paratype from Mahe: the central bristly hairs on hind margin of scutellum white; genitalia (Fig. 2 C) black, ninth tergite with 8 spines.

It is similar to *Philodicus chinensis* Schiner but different from this and all the other known Indian species of the genus by the distinctive eighth sternite of female.

Holotype Male, ZSI Reg. No. 7407/H6, Maharashtra: Ratnagiri Sea Shore, 10. vii. 1981, Coll. P. Parui.

Paratypes 4 Males, 1 Female, ZSI Reg. Nos. 7408/H6 to 7412/H6, details as in holotype except 1 male type which is collected by P. Parui and P. H. Roy; all of these and holotype



Philodicus indicus sp. nov., A, lateral view of male genitalia; B, ventral view of male genitalia; C, ventral view of eighth sternite of female.

in ZSI. 1 ♂ in the Bishop Mus. Colln. with the following details: South India: Mahe, x. 1973, Coll. T.R.S. Nathan.

24. *Philodicus londti* sp. nov.
(Fig. 3)

A medium black species with black legs and brown wings. Male: length 15 mm, wing 9 mm; female: length 17-21 mm, wing 9-14 mm.

Male: Head narrower than thorax, black with dense grey and greyish-yellow tomentum; mystax white; fronto-orbital plate with black hairs and bristles, ocellar bristles black, postocular bristles black, postcranium with few black hairs above and remaining white haired, postgena white haired. Antennae black, scape and pedicel with black bristles, pedicel long and only slightly shorter than scape, segment 3 about 1.5 times the length of scape. Palpi and proboscis black, both white haired.

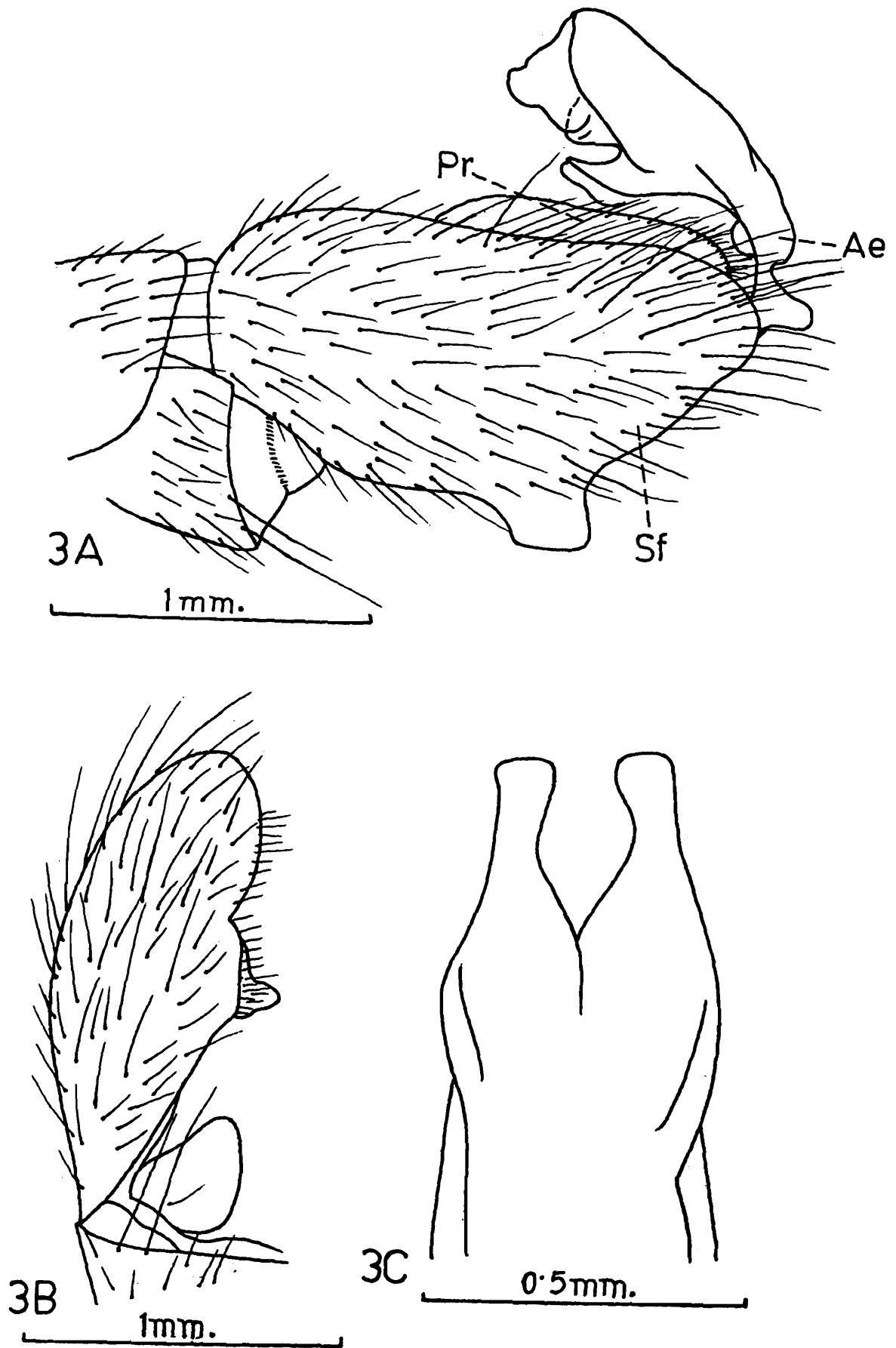
Thorax black with grey and greyish-yellow tomentum, pronotum with transverse row of black bristles, laterally with few short black hairs and some medium sized white hairs; scutum with mediolongitudinal black stripe extending from anterior border to near hind border, which is divided by greyish-yellow stripe, latter gradually narrows from front to behind, laterally with 3 black spots in longitudinal row; chaetotaxy: 2 dorso-central anterior to scutosutellar suture, 1 intra-alar, 1 supra-alar, 2 notopleural, 2 postalar; vestiture and bristles black; scutellar disc black haired, hind border with pair of black bristles; metapleuron with 2 black bristles. Halteres pale yellow with dark brown marking on head.

Legs black, mid and hind femora with anteroventral and postero-ventral rows of bristles which are poorly developed in former, vestiture white and bristles black, fore tibia and tarsus anteroventrally and hind tibia and tarsus posteriorly with mat of golden yellow hairs.

Wings brown, but medially and basally hyaline.

Abdomen black with sparse grey tomentum, tergites posteriorly light grey tomentose, tergite 1 posterolaterally white haired and mixed with few pale yellow bristles, tergite 2 with 1 black bristle laterally above middle, tergites 2-5 posterolaterally with 1 or 2 white bristles, vestiture black and white. Male genitalia (Fig. 3 A, B) black, greyish-yellow tomentose and predominantly black hairs.

Females: Similar but with the following differences: mystax white and black or wholly black, third antennal segment comparatively longer; chaetotaxy: 2-3 dorsocentral, metapleuron with 2 or more black bristles; mid femur with poorly developed anteroventral and posteroventral bristles; brown colour of wing more extensive, abdomen with grey tomentum distinct in some examples, bristles on abdomen black and white. Genitalia (Fig. 3 C) black, spines on ninth tergite very short, their number quite variable and in more than 1 row.



3. *Philodicus londti* sp. nov., A, lateral view of male genitalia; B, ventral view of male genitalia; C, ventral view of eighth sternite of female.

Philodicus londti sp. nov. is quite similar *P. univentris* (Walker) from which it differs in the shape of epandrium, especially ventrally, as well as in the shape of eighth sternite of female. It is named in honour of Dr. J.G.H. Londt, the distinguished student of Afrotropical Asilidae.

Holotype Male, S. India: Kerala State: Calicut District: Chembra Peak Area, 1067 m., v. 1970, Coll. T.R.S. Nathan.

Paratypes : 8 Female, data as in holotype.

25. *Philodicus raoi* Joseph and Parui

Philodicus raoi Joseph and Parui, *Rec. zool. Surv. India* (in press).

Material examined : 7 Males, 7 Females, India, Thar Desert, Banmuel, 1.vii. 1955, Coll. P.S. Nathan.

Remarks : It is also from the type locality.

SUMMARY

This paper reports 25 species of 16 genera of Asilidae from India and Nepal. Of these three species are new: *Lobus evenhuisi*, *Philodicus indicus* and *P. londti*.

ACKNOWLEDGEMENTS

Our heartfelt thanks are due to Dr. Neal L. Evenhuis, Associate Entomologist of B.P. Bishop Museum, Honolulu, Hawaii, for loaning the specimens dealt with in this paper. Our gratitude is also due to the Director, Zoological Survey of India, Calcutta, for laboratory facilities.

ABBREVIATIONS Ae, aedeagus; Lo, lobos; Pr, proctiger, Sf, superior forceps (epandrium).

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**STUDIES ON INDIAN CALANOIDS V. OCCURRENCE OF
TROPODIAPTOMUS AUSTRALIS KIEFER (COPEPODA : DIAPTOMIDAE)
IN THE ANDAMAN AND NICOBAR ISLANDS, INDIA.**

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INTRODUCTION

The genus *Tropodiaptomus* was created by Kiefer (1932) to accommodate *Diaptomus orientalis* Brady, 1886 originally collected from Ceylon. This genus now includes forty six species (Roy, 1984) out of which the following nine have been recorded from India. These are : *T. dorai* (Richard, 1894); *T. hebereri* Kiefer, 1930; *T. mutatus* Kiefer, 1930; *T. vicinus* Kiefer, 1930; *T. euchaetus* Kiefer, 1936; *T. informis* Kiefer, 1936; *T. nielsenii* Brehm, 1953; *T. lakhimpurensis* Reddiah, 1964 and *T. chauhani* Roy (lit. cit.). The present discovery increases the number of Indian species to ten.

The specimens described herein were collected by the author in the Andaman and Nicobar Islands on September 25, 1972 during the faunistic survey of the Islands by the Zoological Survey of India. The first collection of 6 females and 3 males was obtained by towing a plankton net in a small temporary pool, 94 sq. metres in area and 1 metre in depth. None of the females carried egg sacs or attached spermatophores. One of the males had a spermatophore attached to the tip of the left fifth leg.

***Tropodiaptomus australis* Kiefer**

(Figures : 1 a-d, adult female; e-h, adult male)

(?) *Diaptomus orientalis* Brady (nomen dubium), 1886, p. 296; De Guerne and Richard, 1889, pp. 81-83 (partim); Daday, 1898, p. 22; Tollinger, 1911, p. 50 (partim).

Diaptomus orientalis Sars, 1889, pp. 59-68; 1903, pp. 16-17; De Guerne and Richard, 1889, pp. 81-83 (partim), figs. 25-27; Tollinger, 1911 P. 50 (partim); Grochmalicki, 1915, p. 228; Henry, 1922, pp. 554-555; Bayly, 1961, p. 88.

Tropodiaptomus orientalis (Sars) Kiefer, 1932, pp. 466-467.

Tropodiaptomus australis Kiefer, nomen novum, 1936, pp. 79-81.

Diaptomus (*Tropodiaptomus*) *australis* (Kiefer). Bayly, 1966, pp. 127-131.

(Non) *Diaptomus orientalis* Brady. Cooper, 1906, p. 97; Tollinger, 1911, p. 50 (partim).

(Non) *Diaptomus orientalis* Brady. Kiefer, 1930, pp. 120-122.

(*Tropodiaptomus mutatus* Kiefer, nomen novum, 1936, p. 81).

Material : 4 exs., Z.S.I. Regd. No. C3235/2 (3 Females, 1 Male), T. Roy, 26.9.1972, Small pool on the road side of Malacca village (Car Nicobar) about 2 furlongs away from the Govt. Rest House, Andaman & Nicobar Islands, INDIA.

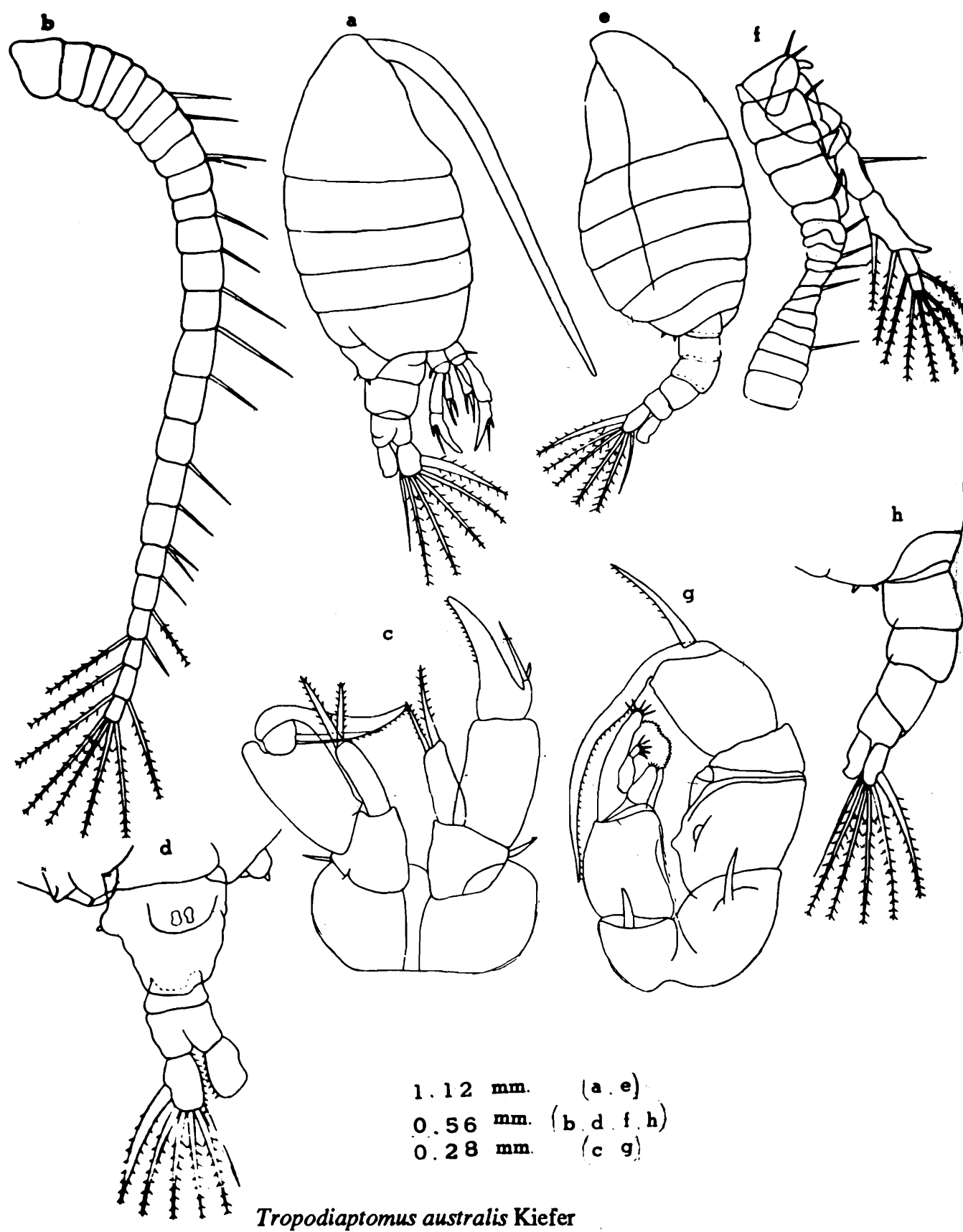


Fig. 1. (a -h), a -d, adult female; e - h, adult male a. dorsal view; b. antennule; c. fifth pair of legs; d. urosome with last thoracic segment e. dorso-lateral view; f. right antennule; g. fifth pair of legs; h. urosome with last thoracic segment'

Description of the adult female :

Total length excluding caudal setae is 1.63 mm. The wings of the last thoracic segment (fig. a) are symmetrical, with a larger distal lobe on either side. The prosome is nearly 4 times longer than the urosome. The urosome (fig. d) is three-segmented. The genital segment is the largest and has a swelling on the left side which carries a small lamella and a small sensilla on the right side. The second segment is the smallest. Each caudal ramus bears six setae. The setae are equal in size and plumose except the inner most which is shorter and thinner than the rest and naked. This seta has a weakly sclerotised knee a short distance from the base. The inner margin of the caudal rami is hairy. The proportional lengths of the urosomal esgments are as follows :

Segments	-1	-2	-3	caudal rami		
	48	9	20	23	=	100

The antennule :

The first antennule (fig.b) consisting of 25 segments. The proportionate lengths of the segments are as follows :

Segments	1	:	2	:	3	:	4	:	5	:	6	:
	66	:	41	:	24	:	24	:	24	:	29	:
	7	:	8	:	9	:	10	:	11	:	12	:
	29	:	35	:	41	:	35	:	29	:	47	:
	13	:	14	:	15	:	16	:	17	:	18	:
	47	:	47	:	59	:	59	:	53	:	48	:
	19	:	20	:	21	:	22	:	23	:	24	:
	47	:	35	:	41	:	35	:	35	:	41	:
	$\frac{25}{29} = 1000$											

Fifth leg :

The fifth legs (fig. e) are symmetrical with two segmented protopod, two segmented exopod and one segmented endopod on their right and left legs.

The right fifth leg :

It (fig. c) consists of two segmented protopod, two segmented expod and one segmented endopod. The proximal segment is nearly circular and larger than the other segment of the protopod. The proximal part of the claw is wider and possesses two unequal spines on its outer edge. The inner spine is nearly four times longer than the outer spine. The half of the margin of the claw is finely serrated. The endopod is nearly 2/3rd length of the first expod which is cylindrical and its tip with two unequal setae with serrations.

The left fifth leg :

The left fifth leg (fig. c) is almost identical in shape and structure of the right fifth leg. It also bears equal number of segment as in the right leg.

Description of the adult male

Total length of the male (fig. e) excluding the caudal setae is 1.59mm. The wings of the metasomal segment are symmetrical without prominent lobes. The left lobe bears two small spines laterally. The urosome (fig. h) is five segmented. The proportionate lengths of the segments are as follows :

Segments	-1	-2	-3	-4	-5	caudal rami	= 100
	14	20	18	21	11	16	

The caudal rami are symmetrical. Each ramus bears six setae, excepting the inner most, all other setae have a feather like arrangement with thickened setules. The inner most naked seta is shorter and thinner with a sclerotised knee a short distance from the base.

The antennule :

The antennule (fig. f) consists of 23 segments. The proportionate lengths of the segments are as follows :

Segments	1	:	2	:	3	:	4	:	5	:	6	:
	44	:	37	:	29	:	22	:	22	:	22	:
	7	:	8	:	9	:	10	:	11	:	12	:
	22	:	29	:	15	:	22	:	22	:	22	:
	13	:	14	:	15	:	16	:	17	:	18	:
	29	:	60	:	51	:	58	:	44	:	66	:
	19	:	20	:	21	:	22	:	23	:		
	104	:	111	:	96	:	44	:	29	:	=	1000

A strongest, stoutest and highly chitinated spine present on the 13th segment. Segments 14 and 17 bear a small spine. The antepenultimate segment bears a small spine terminally which is straight and slightly recurved distally. The setae of the ultimate and penultimate segments are feather like arrangement with fine setules.

Fifth leg :

The fifth leg (fig. g) is asymmetrical. The left leg is shorter than the right and the tip of its reaching the middle of the second exopod segment. The size and shape of the segments of the fifth leg are as shown in the figure.

The right fifth leg :

The first protopod segment is nearly circular and smaller than the second protopod segment. It bears a strong spine on the upper portion of the dorsal margin. The second protopod segment bears a small hyaline tubercle in the middle of the inner margin and a short strong spine appears very close of it. The first exopod segment is short. The second exopod segment is larger than the first and a long strong spine arising from it which is very close to the base of the third exopod segment (claw). The inner margin of the spine is ornamented with fine hairs. The third exopod segment which forms claw is strong and tappers distally and originates from the distal portion of the second exopod segment. About 2/3rd of the inner margin of the third exopod segment is ornamented with fine hairs. The endopod is so short and strong that it is usually difficult to separate it by pressing the cover slip. The endopod originated from the dorso-lateral portion of the inner margin of the second protopod segment.

The left fifth leg :

It consists of two protopod segments, one exopod segment and one endopod segment. The first protopod segment is nearly circular and shorter than the counterpart of the right leg. The second protopod segment is as long as but little thinner than the second protopod of the right leg. The tip of the exopod segment reaching 2/3rd distal edge of the second exopod segment of the right leg. Posterior surface along the inner distal of the exopod segment produced curved serrated lamella. A lobe from the outer margin of the exopod segment projecting inwards and bearing a row of fine setae along proximal edge of it. A cluster of setae projecting little beyond the serrated lamella. The endopod is single segmented and extending about the middle of the exopod segment.

DISCUSSION OF SYNONYMY

There is some confusion regarding the nomenclature of this species. Brady first described this species in brief under the name of *Diaptomus orientalis* from Ceylon in 1886. Sars (1889) while studying the fresh water copepod fauna of Australia, redescribed it as Brady's (lit. cit.) original description was too inadequate. Subsequently, De Guerne and

Richard (1889) from Ceylon; Sars (1903) from Sumatra; Tollinger (1911) from Australia and Sumatra; Grochmalicki (1915) from Java; Henry (1922) from Casino of New South Wales recorded this species under the same name. But in 1932, Kiefer recognised that this species is in reality a member of the genus *Tropodiaptomus* Kiefer. In the meantime Bayly had in 1961 described briefly under the name *Diaptomus orientalis* a species widely distributed in the northern parts of Australia. Again, Bayly (1966) described in brief this species under the name *Diaptomus (Tropodiaptomus) australis* from Western Australia. Kiefer (1936) pointed out after studying Brady's female specimens of *Diaptomus (Tropodiaptomus)* that all female specimens were almost similar and asserted that specific identification of *Diaptomus (Tropodiaptomus)* spp. could better be made on the male characters. Kiefer (lit. cit.) therefore, stressed that the shape and structure of the distal protopodite segment of the male right fifth leg bears considerable importance in the taxonomy of *Diaptomus (Tropodiaptomus)*. However, as the male specimens of Brady's (lit. cit.) collection were never described, it was better to accept Kiefer's (lit. cit.) designation of *D. orientalis* as "Species incarta" (nomen dubium) and the new name *Tropodiaptomus australis* must be valid.

SUMMARY

Based on material collected in the Andaman and Nicobar Islands, *Tropodiaptomus australis* Kiefer is redescribed. The present record increases the number of species of *Tropodiaptomus* known from India to ten.

ACKNOWLEDGEMENT

I wish to acknowledge my gratitude to the Director, Zoological Survey of India, Calcutta, for providing me all facilities to carry out this work. I also wish to place on record my sincerest appreciation of the assistance extended to me by Shri Sumil Kumar Ghosh of the Crustacea Division, Zoological Survey of India, Calcutta.

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**MAMMALS OF THE MEHAO WILDLIFE SANCTUARY (DIBANG
VALLEY DISTRICT, ARUNACHAL PRADESH) WITH REMARKS
ON THEIR STATUS**

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INTRODUCTION

A composite party from the Zoological Survey of India, Botanical Survey of India and the Wildlife Division of Arunachal Pradesh conducted a faunal and floral survey of the Mehao Wildlife Sanctuary, Dibang Valley District, Arunachal Pradesh, under the leadership of the present authors. The survey was conducted during January-February, 1988 for the purpose of making an inventory of the mammalian fauna of the sanctuary with special reference to the Snow Leopard, *Panthera uncia* (Schreber). No detail account of the mammalian fauna of the sanctuary is known except for the reports of Sinha (1984) and Mehata (1987). In the present paper an attempt has been made to give an account of the mammalian fauna of the sanctuary, with remarks on their present status.

This account is based mainly on observations, collection, and information gathered from the local people. Skins and skulls of different species that are available with the local villagers have been examined for this purpose. However, this account is in no way considered to be complete, as many of the areas, particularly the northeastern hills, could not be surveyed due to inaccessibility and bad weather. Some of the smaller and nocturnal species, a number of Chiropteran species, which were observed in flying or moving condition either could not be collected or identified in the field. Thus these species also could not be included in the present account.

Attempts have been made to collect the local names of the species. It was noticed that different tribes called the same species by different names, whereas, at times different species were known by the same name. Many of the species have no local names. Only the names used by the 'Adi' tribe of Arunachal Pradesh have been included, wherever, available.

Mehao Wildlife Sanctuary is very thinly populated and most of the areas have not yet been named. There is only one fair weather jeepable road passing through the sanctuary from Roing to Hunli (Plate Ia). Base camps were set at three points, viz., Sally lake, Tewarigaon and Mayudia Pass on this road. From the base camps, sorties were made on the hills. As the names of some of the collection or observation stations are not available, the approximate distance from Roing or from some specific point of Roing-Hunli road have been given in the text.

In the systematic account, arrangement of Ellerman and Morrison-Scott (1951) has been followed. The type-locality of the species has been mentioned in parenthesis in the first reference.

Following abbreviations have been used in the text.

Apf. Anterior palatal foramen ; Bul. Bullae ; Cb. Condylbasal ; C¹-C¹. Canine width ; Cr. Cranial-rostrum ; Crn. Cranial ; Cw. Cranial width ; Dia. Diastema ; E. Ear ; Eng. English ; Ext. External ; Hb. Head and Body ; Hf. Hindfoot ; Fa. Forearm ; F & Cl. Foot and claw ; Iow. Interorbital width ; Km. Kilometre ; m. Metre ; Ml. Mandibular length ; M¹-M¹. Molar width ; Nas. Nasal length ; Onl. Occipitonasal ; P. Pollex ; Pal. Palate ; Pow. Post orbital width ; Tl. Tail ; tl. Total length of skull ; Tr. Tragus ; Utr. Upper tooth row ; Zw. Zygomatic width.

GAZETTEER

Roing (c 406 m.) is a small town and subdivisional head quarter of Dibang Valley District, situated on the southern bank of Deopani river at about 20 Km. northeast of Assam-Dibang Valley border of Santipur. It lies just outside the boundary of the sanctuary.

Sally Lake (c 450 m.) is a small natural lake within the sanctuary, about 5 km. from Roing.

Tewarigaon (c 1400 m.) is a deserted military village on the Roing-Hunli road and 28 Km. from Roing.

Mayudia Pass (c 2656 m.) is the highest point of Roing-Hunli road, 56 Km. from Roing.

PHYSIOGRAPHY AND ECOLOGICAL FEATURES OF THE SANCTUARY

(Text-fig. I)

Mehao Wildlife Sanctuary lies between 95°45' and 96°3' E. longitudes and 28°5' and 28°15' N. latitudes. The sanctuary covers an area of about 281 sq. km. Topographically the terrain is entirely hilly, varying in altitude from 400 m. to 3560 m. (Sinha 1984). There are a number of perennial streams draining the sanctuary, viz., Iphipani, Eje, Eme, Aba, Difu, etc. Between the perennial streams, which are 5-6 Km. apart on an average, a large number of streamlets spring during rainy season but dry up after the Monsoon and the major blocks are almost bounded by perennial streams.

The southern and western boundaries of the sanctuary follow the foot hills and are continuous with the Korunu township in the east and Roing in the West. This also delineates the boundary between the sanctuary and the habitation area. From the southern and western boundaries, hills rise with moderately steep to precipitous slopes except for flat to gently undulating terrain in the narrow river valleys. The skyline is marked by a number of peaks from 3003 m. to 3650 m. heights. The peaks above 2000 m. usually experience snowfall up to 2 m. in thickness at places during winter months. With the onset of summer, the process of thawing begins and by the end of April, the snow cap melts down.

The important perennial rivers viz. Ihipani, Eje, Eme, Jawe and Difu are tributaries to the mighty Brahmaputra of Assam while the sanctuary itself forms a part of the catchment of the Brahmaputra Valley. The streams draining the sanctuary are characterised by a number of rapids and falls. Gorges are a common sight. The sanctuary is also dotted with landslips and landslides.

No natural salt lick has yet been known. Wild animals generally quench their thirst from the perennial streams. There are, however, some wallows which are used by the pigs and bears.

Geographically, the sanctuary falls in the subtropics. Its effect is however, masked by altitudes which rises up to 3560 m. Though no temperature data are available, it may be concluded that the subtropical zone is marked by a short, but distinct winter from November to January when humidity in the air is minimum. In the higher altitudes, snow fall lasts for 3-4 months and January is the coldest month.

Sanctuary is situated on the windward side of the Eastern Himalayas so it experiences heavy rainfall from south-west and north-east monsoons and here it rains nearly half the year.

The forests are of two types, subtropical wet and subtemperate wet. The subtropical type is represented by a large number of species with local variations depending on edaphic conditions. In this type, no single species is dominant or gregarious. The typical species are *Cedrela toona*, *Schima wallichii*, *Sapindus baecatum*, *Duabanga grandiflora*, *Michelia* sp., *Ficus* sp., *Chukrasia valutin*, *Castanopsis* sp., *Magnolia* sp., *Lannea grandis*, *Albizia* sp., etc. Areas of earlier jhooming are covered with bamboos and other trees representing secondary succession. Palms and cycads dot the landscape. *Musa* occurs in sheltered situations while screpine is found in hill slopes. Canes are common in humid areas. Forest floor is covered up of *Phrynium imbricatum*, *Musa* sp., *Clerodendron* sp., various aroids ferns, ground orchids, etc. Tree trunks are often covered with moss and lichen. *Lycopodium* is common in hill slopes. The subtemperate forest is represented by *Quercus* sp., *Castanopsis* sp., *Betula* sp., *Juniperus recurva*, *Taxus baccata*, *Cephalotaxa griffithii*, etc. Bamboo and canes are common. The forest floor consists of *Rasas* sp., *Rubus* sp., *Hydrangia* sp., etc. Ferns and orchids are of common occurrence.

SYSTEMATIC ACCOUNT

Order SCANDENTIA
Family TUPAIIDAE

Tupaia glis assamensis Wroughton

1921. *Tupaia belangeri assamensis* Wroughton, *J. Bombay nat. Hist. Soc.*, 27 : 599. (Mocokchung, 1525 m., Nagaland).

Common name : Eng. Common Tree Shrew ; Adi. Tei.

Material examined : 1 Male; c 700 m. downhill from Mayudia Pass.

Measurements : Ext. — Hb. 195*, Tl. 170, Hf. 50, E. 10. Crn.-tl. 50.1, Cb. 46.6, Zw. 26.6, Iow. 14.6, Pow. 17.5, Cw. 20.1.

Remarks : Very common in the forested areas up to c 2000 m. Though arboreal, often moves in the forest floor in search of food.

Population from Mishmi Hills was regarded as a distinct subspecies *T. g. versurae* by Thomas (1922) and the same was maintained by Ellerman and Morrison-Scott (1951). However, Agrawal (1975) synonymised *versurae* with *T. g. assamensis*.

Order INSECTIVORA

Family TALPIDAE

***Talpa micrura micrura* Hodgson**

1841. *Talpa micrurus* Hodgson, *Calcutta J. nat. Hist.*, 2 : 221. (Nepal).

Common Name : Eng. Eastern Mole ; Adi. Kurt, Pinchi.

Material examined : 1 Female; c 400 m. up hill from Tewarigaon.

Measurements : Ext. - Hb. 100, Tl. 11, Hf. 8. Crn. - tl. 27, Cb. 26, Cw. 11.5

Remarks : Fur slight spiny. Except the extremity of facial region, entire dorsum glossy black but tips of hairs pale. A brownish tinge can be marked on the undersurface particularly when noticed from a distance.

Common throughout the sanctuary particularly in the undisturbed forest floor. Burrows were located below decomposed leaf litter.

Family SORICIDAE

***Soriculus nigrescens radulus* Thomas**

1922. *Soriculus radulus* Thomas, *J. Bombay nat. Hist. Soc.*, 28 : 429. (Dreyi, 1567 m., Mishmi Hills, Arunachal Pradesh).

Common name : Eng. Sikkim Large-clawed Shrew.

Remarks : Common in the cultivated areas within the sanctuary.

***Suncus murinus* (Linnaeus)**

1766. *Sorex murinus* Linnaeus, *Syst. Nat.*, 12th ed., 1 : 74 (Java).

Common name : Eng. House Shrew ; Adi. Pea.

Remarks : Very common in villages within the sanctuary. It is interesting to note that specimens observed within the sanctuary appeared to be much smaller than those observed in the adjacent towns like Roing or Korunu.

* Unless otherwise stated all measurements are in milimetre.

***Crocidura attenuata rubricosa* Anderson**

1877. *Crocidura rubricosa* Anderson, *J. Asiat. Soc. Beng.*, **46** : 280. (Sibsagar, Assam).

Common name : Eng. Grey Shrew ; Adi. Pea.

Material examined : 1 Male, c 560 m. down hill from Tewarigaon.

Measurements : Ext. - Hb. 90, Tl. 70, Hf. 9, E. 6. Crn.- tl. 21.5, Cb. 21.1, Iow. 4.7, Cw. 9.5.

Remarks : Fur short and soft ; dorsum blakish from close view but greyish from distance ; reddish on sides ; tail poorly bicolor, dorsally black, ventrally paler ; venter grey.

According to Hinton and Thomas (1926), Ellerman and Morrison-Scott (1951), this species is so far recorded from Punjab, Jammu and Kashmir, Uttar Pradesh, Sikkim, West Bengal and Assam in India. The present specimen from the sanctuary constitutes its first record from Arunachal Pradesh.

Common throughout the sanctuary.

***Anourosorex squamipes* Milne-Edwards**

1872. *Anourosorex squamipes* Milne-Edwards, *Rech. Hist. Nat. Mamm.*, 264 pl. 38. (probably Moupin, Szechuan, China).

Common name : Eng. Szechuan Burrowing Shrew.

Remarks : Very common throughout the sanctuary up to 1800 m. and often enters the kitchen of our camp in search of food.

Order CHIROPTERA
Family PTEROPODIDAE

***Rousettus leschenaulti* (Desmarest)**

1820. *Pteropus leschenaulti* Desmarest, *Encyclo. Méth. Mamm.*, **1** : 110. (Pondecherry, India).

Material examined : 1 Male, ; Near Sally Lake, c 5 Km. from Roing.

Measurements : Ext. - Fa. 70, P. 26.7, E. 14, F & Cl. 18.2. Crn-tl. 33.6, Cr. 11.7, Iow. 7, Pow. 8.9, Cw. 15, C¹-C¹. 7.5, M¹-M¹. 10.6, Ml. 25.7.

Remark s: As compared to other fruit-eating bat, *Cynopterus brachyotis* (Muller), this species is not so common in the sanctuary.

Rookmaaker and Bergmans (1981) were the first to record this species from Kameng of Arunachal Pradesh. Present specimen indicates its distribution in the Dibang Valley District of the State.

Cynopterus brachyotis (Miiller)

1838. *Pachysoma brachyotis* Muller, *Tijdschr. Natuur. Gesch.*, 5, 1 : 146. (Borneo).

Material examined : 1 Male ; Tewarigaon. 4 Males ; near Sally Lake. 4 Males; Roing.

Measurements : Ext. - 9 Males. Fa. 61.3-73 (65.5) ; E. 14.5-19.2 (17.2). Crn. - 1 Male. tl. 29.8, Cr. 8, Iow. 5.4, Pow. 7.9, Cw. 13.5, Zw. 18.8, C¹-C¹. 6.5, M¹-M¹. 9, Ml. 24.5.

Remarks : This is one of the most common species of bats found throughout the sanctuary at different ecological zones up to 1800 m.

Family RHINOPOMATIDAE

Rhinopoma ? hardwickei Gray

1831. *Rhinopoma hardwickii* Gray, *Zool. Misc.*, 37. (India).

Common name : Eng. Lesser Rat-tailed Bat.

Remarks: Common in the sanctuary but were not seen above 1700 m. No specimen was collected. So the specific identification was not made. They were noticed just before dusk and were common near water sources.

Family MEGADERMATIDAE

Megaderma lyra Geoffroy

1810. *Megaderma lyra* Geoffroy, *Annu. Mus. natn. Hist. Nat.*, 15 : 190. (India).

Common name : Eng. Indian False Vampire.

Remark: Common in the sanctuary.

Family RHINOLOPHIDAE

Hipposideros ? larvatus (Horsfield)

1823. *Rhinolophus larvatus* Horsfield, *Zool. Res. Java*, No. 6 pl. 9. (Java).

Remark : Common in the sanctuary.

Family VESPERTILIONIDAE

Pipistrellus sp.

Remark : The species of bats of this genus were observed up to the height of 2200 m.

Scotophilus heathi (Horsfield)

1831. *Nycticejus heathi* Horsfield, *Proc. zool. Soc. Lond.*, 113. (Madras, India).

Common name : Eng. Greater Yellow Bat.

Material examined : 1 Male; 37 Km. from Roing.

Measurements : Ext. - Fa. 58, F & Cl 9.8, E. 13.2, Tr. 7.3, Cm.-tl. 22, Cr. 5.8, C¹-C¹. 7.6, Cw. 10.3, Ml. 16.4.

Remark : Common in the lower elevation and in open areas of the sanctuary.

Order PRIMATES

Family LORISIDAE

Nycticebus coucang (Boddaert)

1758. *Tardigradus coucang* Boddaert, *Elench Anim.*, 67. (Type locality unknown).

Common name : Eng. Slow Loris ; Adi. Senni.

Material examined : An old and badly preserved skin in possession of a local hunter ; down hill near 42 km. point from Roing.

Remark : According to the local people it is rare in the sanctuary.

Family CERCOPITHECIDAE

Macaca mulatta (Zimmermann)

1780. *Cercopithecus mulatta* Zimmermann, *Geogr. Gesch. Mensch.*, 2 : 195. (India)

Common name : Eng. Rhesus Macaque ; Adi. Sibe.

Remarks : Common in the sanctuary. A troop of about 28 animals was observed on the Roing-Hunli road near 48 Km. point.

Macaca assamensis M'Clelland

1839. *Macacus assamensis* M'Clelland, *Proc. zool. Soc. Lond.*, 148. (Assam, India).

Common name : Eng. Assamese Macaque ; Adi. Sibe Berao.

Material examined : 1 subad. Male; Sally Lake.

Measurements : Ext.-Hb. 470, Tl. 195, E. 40.

Remarks : Fairly common throughout the sanctuary, at least up to 2500 m. The specimen examined was hunted by a tribal for food from a troop of 16 animals near Sally Lake on 24 January (Plate 1b). On the next day the same troop was located on the same area. It indicates that the animals are not shy.

Presbytis pileatus pileatus (Blyth)

1843. *Semnopithecus pileatus* Blyth, *J. Asiat. Soc. Beng.*, 12 : 174. (Type locality unknown).

Common name : Eng. Capped Langur.

Material examined : 4 skins, 1 skull in possession of local hunters ; Mehao Wildlife Sanctuary.

Remarks : Vulnerable. No Capped Langur was observed in the sanctuary. All the skins examined were from the collection of local people who regard them as auspicious. They informed that Capped Langur is restricted in their distribution to higher altitudes of the sanctuary, and comes down up to 500 m. during winter months.

Family PONGIDAE**Hylobates hoolock (Harlan)**

1834. *Simia hoolock* Harlan, *Trans. Am. Phil. Soc.*, 4 : 52. (Garo Hills, Meghalaya).

Common name : Eng. Hoolock Gibbon ; Adi. Ulu Bandar.

Remarks : Common in the lower hills of the sanctuary. Its presence in the sanctuary can be detected by the loud calls made by this ape during the morning hours between 08.00 to 10.00, and in the afternoon between 15.00 to 17.00 hours. During the survey they were always observed in pairs. A total of 12 pairs were observed as follows : 1 Roing, 2 Sally Lake areas, 5 down hill regions of Tewarigaon, 2 down hill areas near 41 Km. point, and 2 down hill regions near 48 Km. point.

Order PHOLIDOTA**Family MANIDAE****Manis pentadactyla aurita Hodgson**

1836. *Manis auritus* Hodgson, *J. Asiat. Soc. Beng.*, 5 : 234. (Lower and Central Nepal).

Common name : Eng. Chinese Pangolin ; Adi. Hochik.

Material examined : A badly preserved skin ; 52 Km. point from Roing.

Remark : The presence of the burrows indicates that it is common in the sanctuary (Plate 2a).

Order CARNIVORA
Family CANIDAE

***Canis aureus indicus* Hodgson**

1833. *Canis aureus indicus* Hodgson, *Asiatic Res.*, 18 (2) : 237.(Nepal).

Common name : Eng. Asiatic Jackal ; Adi. Manru.

Remarks: Common. This animal was commonly observed during night as well as in day time in the lower region near human habitation and in the open areas.

***Cuon alpinus* (Pallas)**

1811. *Canis alpinus* Pallas, *Zoogr. Ross. Asiat.*, 1 : 34. (Near Udskoi Ostrog, Amurland).

Common name : Eng. Indian Wild Dog of Dhole ; Adi. Sipyang.

Remark : Though local people reported its presence in the sanctuary but no proof of its occurrence could be established in the sanctuary.

Family URSIDAE

***Selenarctos thibetanus thibetanus* (Cuvier)**

1823. *Ursus thibetanus* Cuvier, *Ossements Foss.*, 4 : 325. (Sylhet, Bangladesh).

Local name : Eng. Asiatic Black Bear ; Adi. Situm.

Material examined : 4 skins in possession of local people ; Mehao Wildlife Sanctuary.

Remarks : Vulnerable. Found throughout the sanctuary. Many local villagers posses damaged skins.

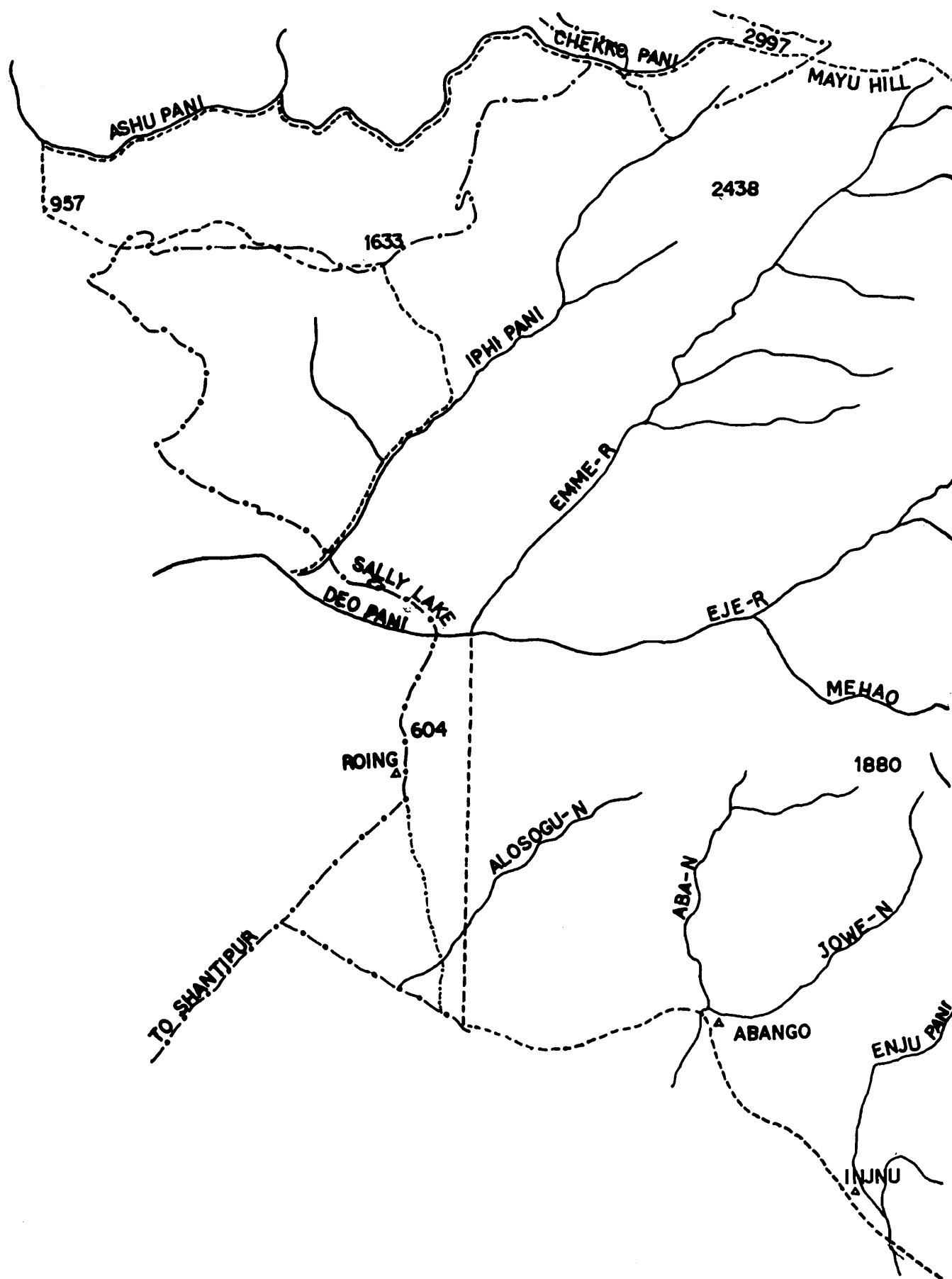
Family PROCYONIDAE

***Ailurus fulgens* Cuvier**

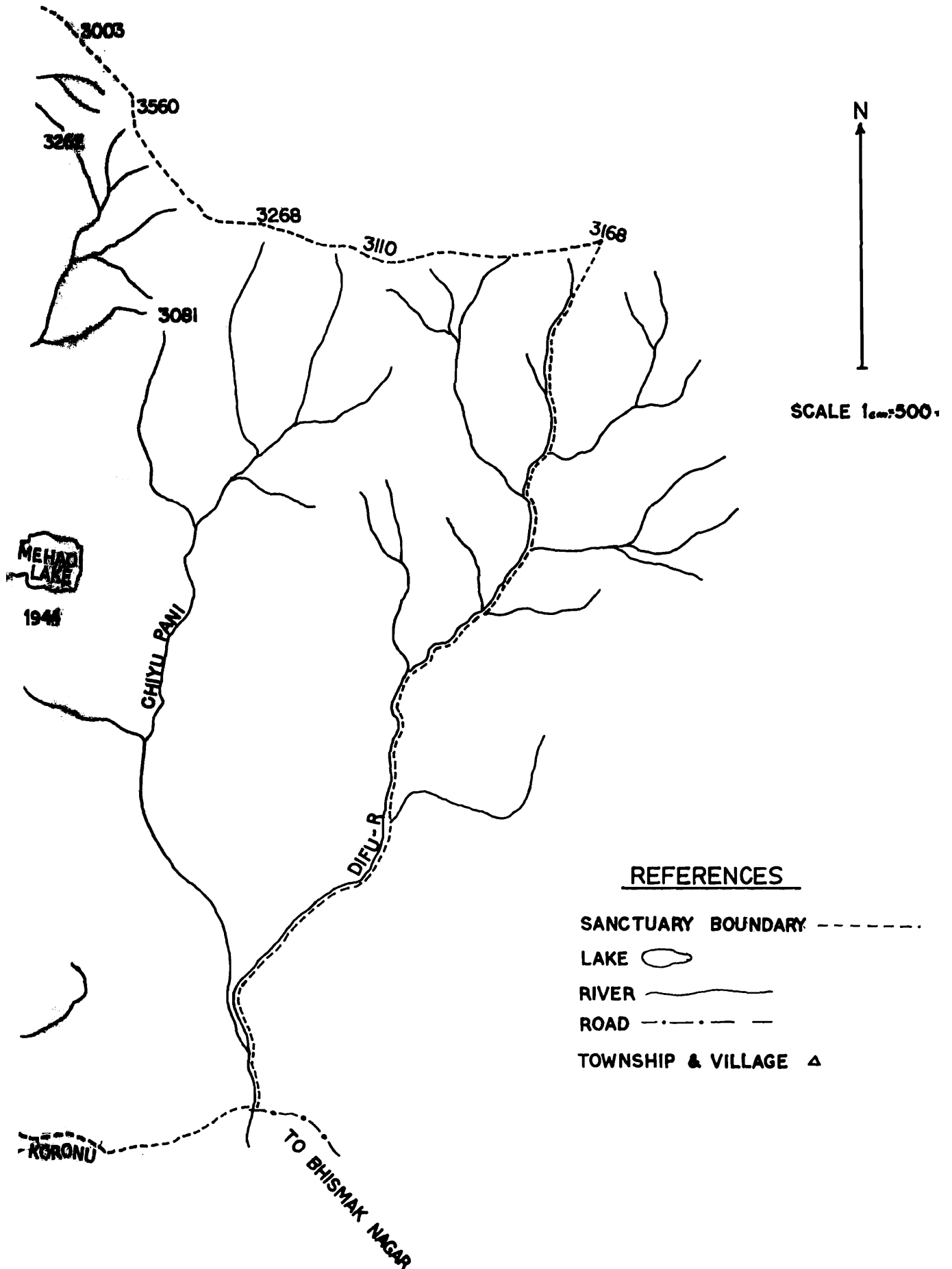
1825. *Ailurus fulgens* Cuvier, in Geoffroy and Cuvier, *Hist. Nat. Mamm.*, 3(50) : Panda, 3. (Type locality not known).

Common name : Eng. Red Panda.

Text fig.1. A MAP OF MEHAO WILDLIFE SANCTUARY



AREA — 281.5 Sq. Km.



Remarks : Rare, found at higher elevations only. A pair was observed on the Roing-Hunli Road Just before dusk near Mayudia, c 2560 m.

Family MUSTELIDAE

Melogale personata Geoffroy

1831. *Melogale personata* Geoffroy, in Belanger, *Voy. Zool. Indes Orient.*, 137 pl. 5. (Near Rangoon, Burma).

Common name : Eng. Burmese Ferret-Badger.

Material examined : 1 skin in possession of a local hunter ; Bank of Deopani river, near Roing.

Remarks : No specimen could be noticed during the survey. Status could not be ascertained.

Arctonyx collaris collaris Cuvier

1825. *Arctonyx collaris* Cuvier, *Hist. Nat. Mamm.*, 3 pl. 51. (Bhutan Duars, Eastern Himalayas).

Common name : Eng. The Hog-badger.

Remark s: A single specimen was observed on the stones of the bank of river Ihipani about 4 Km. north of Sally Lake. Appears not to be common.

Lutra lutra monticola Hodgson

1839. *Lutra monticolus* Hodgson, *J. Asiat. Soc. Beng.*, 8 : 320. (Nepal).

Common name : Eng. Common Otter ; Adi. Horam.

Remark : Parties of 2-10 commonly observed during the day time along the banks of all the rivers in the sanctuary.

Lutrogale perspicillata perspicillata (Geoffroy)

1826. *Lutra perspicillata perspicillata* Geoffroy *Dict. Class Hist. Nat.*, 9 : 519. (Sumatra).

Common name : Eng. Smooth-coated Indian Otter.

Remark : A party of 4 adult and two young animals were regular visitor to Sally Lake.

Aonyx cinerea concolor (Rafinesque)

1832. *Amblonyx concolor* Rafinesque, *Atlant. J.*, 1 : 62. (Garo Hills, Meghalaya).

Common name : Eng. Oriental Small-clawed Otter.

Remarks : Not common. None was observed during the survey. Local people confirmed its occurrence in the sanctuary when photograph was shown to them.

Family VIVERRIDAE**Viverra zibetha zibetha Linnaeus**

1758. *Viverra zibetha* Linnaeus, *Syst. Nat.* 10th ed., 1 : 44. (Bengal).

Common name : Eng. Large Indian Civet.

Remark : Common in occurrence and lives in the forest but often comes out to human habitation for food.

Viverricula indica (Desmarest)

1817. *Viverra indica* Desmarest, *Nouv. Dict. Nat. Hist.*, 7 : 170. (India).

Common name : Eng. Small Indian Civet.

Remark : Common in the sanctuary as well as to Roing town.

Prionodon pardicolor Hodgson

1842. *Prionodon pardicator* (Sic) Hodgson, *Calcutta J. Nat. Hist.*, 2 : 57. (Nepal).

Common name : Eng. Spotted Linsang.

Remark : Altogether two specimens were observed, one at the down hill near 37 Km. point, other at the up hill near 48 Km. point from Roing.

Paradoxurus hermaphroditus pallasi Gray

1832. *Paradoxurus pallasi* Gray, 1832. *Proc. zool. Soc. Lond.*, 67. (India).

Common name : Eng. Toddy Cat or Common Palm Civet ; Adi. Siran.

Remarks : None was observed in the sanctuary proper during survey. However, a specimen was noticed at Roing while it was passing from the roof of one house to another through an overhead electric wire. People of Roing reported it to be common in the town living particularly in the false ceiling of the houses.

Arctictis binturong (Raffles)

1821. *Viverra ? binturong* Raffles, *Trans. Linn. Soc. Lond.*, **13** : 253. (Malacca).

Common name : Eng. Binturong.

Material examined : 1 skin in possession of a local hunter ; down hill near 32 Km. point from Roing.

Remarks: Not common. Neither any specimen was seen nor any call was heard during the survey.

Herpestes edwardsi (Geoffroy)

1818. *Ichneumon edwardsi* Geoffroy, *Descr. Egypte*, **2** : 139. (Madras, Tamil Nadu).

Common name : Eng. Indian Grey Mongoose.

Remarks: Quite common. Found in bushes bordering the open areas near human habitation. Packs of 2 to 11 animals were observed in different areas of the sanctuary up to 1950 m.

Family FELIDAE**Felis chaus affinis Gray**

1830. *Felis affinis* Gray, *Ind. zool.*, **1**, pl. 3. (Gangootri, Tehri Garhwal, Uttar Pradesh).

Common name : Eng. Jungle Cat ; Adi. Tasse.

Remarks : Not common. None was seen during the survey. However, it is reported to be present in the reed jungles on the southern bank of Deopani river.

Felis marmota charltoni Gray

1846. *Felis charltonii* Gray, *Ann. Mag. nat. Hist.*, **18** : 211. (Darjeeling, West Bengal).

Common name : Eng. Marbled Cat ; Adi. Simnyo-Nyeling.

Material examined : 1 damaged skin in possession of a local hunter ; Mehao Wildlife Sanctuary.

Remarks : None could be observed. Reported to be very very rare in the sanctuary.

***Felis bengalensis horsfieldi* (Gray)**

1842. *Leopardus horsfieldi* Gray, *Ann. Mag. nat. Hist.*, 10 : 260. (Bhutan).

Common name : Eng. Leopard Cat ; Adi. Hole.

Remark : Quite common in the sanctuary, particularly in the forested areas.

***Neofelis nebulosa* (Griffith)**

1821. *Felis nebulosa* Griffith, *Descr. Anim. (Carn.)*, 37. (Canton, Southern China).

Common name : Eng. Clouded Leopard.

Remarks: Sinha (1984) reported its occurrence in the sanctuary, however, no specimen could be seen during the survey. Local people could not authenticate its occurrence in the sanctuary.

***Panthera pardus* (Linnaeus)**

1758. *Felis pardus* Linnaeus, *Syst. Nat.* 10th ed., 1 : 41. (Egypt).

Common name : Eng. Leopard ; Adi. Thakkar.

Remarks: Endangered. Pug marks were observed near a streamlet about 370 m. down the 42 Km. point from Roing. In this region, leopards are being hunted for meat and most of the local people possess pieces of skin. According to them this species was fairly common a decade ago, but now its number is greatly reduced.

***Panthera tigris* (Linnaeus)**

1758. *Felis tigris* Linnaeus, *Syst. Nat.* 10th ed., 1 : 41. (Bengal).

Common name : Eng. Tiger ; Adi. Simyo.

Remarks : Endangered. Pug marks were observed along the banks of Eme and Iphipani rivers. An adult male was noticed near “Dangori Baba” temple at Mayudia. It is said to be a permanent resident of the neighbouring forest and never attacks human beings.

***Panthera unica* (Schreber)**

1776. *Felis uncia* Schreber, *Saugeth*, 3 pl. 100 (1776) and text 386, 586 (1777). (Type locality not known).

Common name : Eng. Ounce or Snow Leopard ; Adi. Yuodi Simyo.

Remarks: Pug marks were noticed in the snow at Mayu hills at an elevation of 2560-2880 m. (plate 2b). No specimen was observed during the survey. Local people, hunters and officials opined that Snow Leopard is not a permanent resident of this sanctuary but only a visitor during winter. However, two hunters claimed that Snow Leopard is a permanent resident of the northeastern high hills of the sanctuary.

Order PROBOSCIDEA
Family ELEPHANTIDAE

Elephas maximus Linnaeus

1758. *Elephas maximus* Linnaeus, *Syst. Nat.* 10th ed., 1 : 33. (Sri Lanka).

Common name : Eng. Indian Elephant ; Adi. Sot.

Remark : Elephant is not a permanent inhabitant of the sanctuary but is only a casual visitor.

Order ARTIODACTYLA
Family SUIDAE

Sus scrofa cristatus Wagner

1839. *Sus cristatus* Wagner, *Munch. Gelehrt. Anz.*, 9 : 435. (Probably Malabar Coast, India).

Common name : Eng. Indian Wild boar ; Adi. Shira.

Remarks: Found almost through out the sanctuary at different elevations. This animal is hunted for meat and this makes it vulnerable.

Family CERVIDAE

Moschus moschiferus Linnaeus

1758. *Moschus moschiferus* Linnaeus, *Syst. Nat.* 10th ed., 1 : 66. (Tartary, approaching China).

Common name : Eng. Musk Deer, Kastura ; Adi. Hodung, Sibuei.

Material examined : 2 skins in possession of local hunters : Mehao Wild Life Sanctuary.

Remarks: No animals was seen during the survey. It is a permanent resident of northeastern hills. Skins and musk glands were found in the possession of local people. Local people are specially interested for meat and musk gland of this animal. Previously, they used the musk gland for medicinal and aesthetical purposes but now they realised its commercial value through illegal trade. So this species is threatened in the sanctuary.

Muntiacus muntjak vaginalis (Boddaert)

1785. *Cervus vaginalis* Boddaert, *Elench. Anim.*, 1 : 136. (Bengal).

Common name : Eng. Barking Deer; Adi. Sidumg.

Remarks: Endangered. Found throughout the sanctuary. It is killed for meat and skin.

Axis porcinus (Zimmermann)

1777. *Cervus porcinus* Zimmermann, *Spec. zool. Geogr.*, 532 (Bengal).

Common name : Eng. Hog Deer ; Adi. Dumsang.

Remarks : No animal could be seen. Local people reported its occurrence in the lower regions of the sanctuary.

Cervus unicolor Kerr

1792. *Cervus axis unicolor* Kerr, *Anim. Kingd.*, 300. (Sri Lanka).

Common name : Eng. Sambar; Adi. Shiben.

Material examined : 3 skins in possession of local hunters ; Mehao Wild Life Sanctuary.

Remarks: Endangered. Its call was heard in different parts of the sanctuary, but only a single specimen could be seen at about 670 m. down hill from 49 Km. point from Roing. The three skins examined were different from each other in respect of dorsal coloration. One grey, the other grey with brown and the third uniform dark. They are hunted for meat.

Family BOVIDAE**Budorcas taxicolor taxicolor Hodgson**

1850. *Budorcas taxicolor* Hodgson, *J. Asiat. Soc. Beng.*, 19 : 65. (Mishmi Hills, Arunachal Pradesh).

Common name : Eng. Mishmi Takin ; Adi. Takin.

Remarks : Reported to be once common in the northeastern high hills of the sanctuary in the past, but now it is hardly seen. A number of skulls available with the local people were examined.

Capricornis sumatraensis thar (Hodgson)

1831. *Antilope thar* Hodgson, *Glean. Sci.*, 3 : 324. (Nepal).

Common name : Eng. Serow ; Adi. Bibe.

Material examined : 1 Male; 100 m. down from Mayudia Pass.

Measurements : Ext. - Height at Shoulder 1100, Hb. 1340, Tl. 132, E. 236.

Remarks: The specimen was found dead on the snow (Plate 2C). Entire dorsum blackish; no separate black dorsal stripe could be seen. Hairs on the sides long and shaggy.

Common. Observed singly as well as in pairs particularly above 1400 m. Much wary of human beings.

Order LAGOMORPHA

Family LEPORIDAE

Lepus nigricollis Cuvier

1823. *Lepus nigricollis* Cuvier, *Dict. Sci. Nat.*, 26 : 207. (Madras, Tamil Nadu).

Common name : Eng. Indian Hare, Black-napped hare.

Remarks: In spite of hunting pressure, it is common throughout the sanctuary. Harvested fields and grassy areas are its favourite foraging ground.

Family OCHOTONIDAE

Ochotona roylei (Ogilby)

1829. *Lagomys roylei* Ogilby, *Royle's Jll. Botany Himalaya*, 69 pl. 4. (Choor Mountain, Himachal Pradesh).

Common name : Eng. Royle's Pika.

Remarks: Common at higher altitudes, but during the period of survey specimens were seen at the height of 1890 m.

Order RODENTIA

Family SCIURIDAE

Petaurista petaurista (Pallas)

1766. *Sciurus petaurista* Pallas, *Misc. Zool.*, 54. (Western Java).

Common name : Eng. Common Giant Flying Squirrel; Adi. Hojo.

Material examined : 4 damaged skins in possession of local people; Mehao Wildlife Sanctuary.

Remarks : Very common throughout the sanctuary. At night its call can frequently be heard.

Sinha (1984) mentioned the occurrence of Hodgson's Flying Squirrel, *Petaurista magnificus* (Hodgson) in the sanctuary. The skins examined during the survey belong to *P. petaurista*.

***Callosciurus erythraeus erythrogaster* (Blyth)**

1842. *Sciurus erythrogaster* Blyth, *J. Asiat. Soc. Beng.*, **11** : 970. (Manipur).

Common name : Eng. Pallas's Squirrel.

Remark : Common in the sanctuary and lives in groups on the trees of relatively open areas.

***Callosciurus pygerythrus* (Geoffroy)**

1831. *Sciurus pygerythrus* Geoffroy, in Belanger, *Voy. Indes Orient.*, **1** : 145. (Pegu, Burma).

Common name : Eng. Irrawaddy Squirrel.

Remarks : Common in distribution and occurs singly or in group at an altitudes of 400 to 1700 m. Often comes to the ground in search of food.

***Tamias maclellandi maclellandi* (Horsfield)**

1839. *Sciurus maclellandi* Horsfield, *Proc. zool. Soc. Lond.*, 152. (Assam).

Common name : Eng. Himalayan Striped Squirrel.

Remark : Reported to be common, but only a pair could be observed on a "Rudrakha" tree near 25 Km. point from Roing.

***Dremomys lokriah lokriah* (Hodgson)**

1836. *Sciurus lokriah* Hodgson, *J. Asiat. Soc. Beng.*, **5** : 232 (Nepal).

Common name : Eng. Orange-bellied Himalayan Squirrel.

Remarks : Common in occurrence and arboreal, but moves in the forest floor in search of food. Observed in groups of 4-7.

Ratufa bicolor gigantea (M'Clelland)

1839. *Sciurus giganteus* M'Clelland, *Proc. zool. Soc. Lond.*, 150 (Assam).

Common name : Eng. Malayan Giant Squirrel ; Adi. Chikkat, Lippo.

Remarks: Common throughout the sanctuary up to an altitude of 2400 m. Lives in high trees and never comes down below 10 m. It can easily be located in the forest by its frequent call and dropping of their rejected fruits, leaves, twigs, etc., during feeding.

Family HYSTRICIDAE**Hystrix hodgsonii (Gray)**

1847. *Acanthion hodgsoni* Gray, *Proc. zool. Soc. Lond.*, 101. (Nepal).

Common name : Eng. Crestless Himalayan Porcupine ; Adi. Bobbi.

Remarks : Common. No animal could be seen due to its nocturnal habit, but its quills were found at several places of the sanctuary up to an altitude of 1950 m. Local people kill them for meat.

Family RHIZOMYIDAE**Cannomys badius (Hodgson)**

1842. *Rhizomys badius* Hodgson, *Calcutta J. Nat. Hist.*, 2 : 60. (Nepal).

Common name : Eng. Bay Bamboo Rat.

Remarks : No specimen or burrow could be observed. However, when the photo of the specimen was shown to the local people, they confirmed its occurrence in the sanctuary, particularly in the bamboo forests and grassy areas.

Family MURIDAE**Rattus rattus rufescens (Gray)**

1837. *Mus rufescens* Gray, *Ann. Mag. nat. Hist.*, 1 : 585. (Dharwar, Karnataka).

Common name : Eng. Dark-bellied House Rat ; Adi. Kobu.

Remark : Observed in the shops of Roing and in the Sally Lake bungalow.

Rattus rattus ? brunneusculus

Remarks : A white bellied specimen of *Rattus rattus* was observed in a Peach tree near Tewarigaon. Local people reported that similar type of rats are common in the forest and they make nest in the tree.

***Rattus nitidus nitidus* (Hodgson)**

1845. *Mus nitidus* Hodgson, *Ann. Mag. nat. Hist.*, **15** : 267. (Nepal).

Common name : Eng. Himalayan Rat ; Adi. Kobu.

Material examined : 1 Male; 1 Km. from Sally Lake towards Roing. 1 Female ; 36 Km. point on Roing-Hunli Road.

Measurements : Ext. - 1 Male, 1 Female; Hb. 152, 147, Tl. 164, 180, Hf. 32, 32. E. 21, 22. Crn : 1 Male, 1 Female; Onl. 42, 42.8, Pal. 23, 23.3, Nas. 18.2, 18.6, Apf. 7.9, 8.2 Bul. 6.3, 6.4, Utr. 6.6, 6.7.

Remark : Commonly found in the forest as well as in the open areas.

***Rattus bowersi bowersi* (Anderson)**

1879. *Musbowersii* Anderson, *Zool. Res. Yunnan*, 304. (Hotha, Kakhyen Hills, Western Yunnan, 1372 m. China).

Common name : Eng. Bower's Rat ; Adi. Kobu.

Material examined : 1 Male; c 200 m. up hill from Tewarigaon.

Measurements : Ext. - Hb. 264, Tl. -, Hf. -, E. 24. Crn. - Onl. 54.2, Pal. 28, Nas. 21.5, Apf. 10, Utr. 8.1, Dia. 16.6, Zw 16.6.

Remark : Though the species is mainly restricted to the Jungle, but it visits to the Jhoom areas after the harvesting is over.

Honacki et al. (1982) treated *bowersi* under the genus *Berylmys*.

***Rattus niviventer* (Hodgson)**

1836. *Mus (Rattus) niviventer* Hodgson, *J. Asiat. Soc. Beng.*, **5** : 234. (Katmandu, Nepal).

Common name : Eng. White-bellied Rat ; Adi. Kobu.

Remark : Common in the forest.

Honacki et al. (1982) treated this species as *Niviventer niviventer*.

***Rattus fulvescens brahma* (Thomas)**

1914. *Epimys brahma* Thomas, *J. Bombay nat. Hist. Soc.*, **23** : 232. (Anzong Valley, Mishmi Hills, 1829 m, Arunachal Pradesh).

Common name : Eng. Chestnut Rat.

Remarks: Common in the bamboo forests of the sanctuary. Nests are made at the base of bamboo thickets. These are round in shape and made up of dry bamboo leaves. These animals, though small in size, can easily be seen in the forest by their bright reddish dorsal coloration.

Honacki et al. (1982) kept *brahma* as distinct species under the genus *Niviventer*.

Mus musculus Linnaeus

1758. *Mus musculus* Linnaeus, *Syst. Nat.* 10th ed., 1 : 62. (Upsala, Sweden).

Common name : Eng. House Mouse.

Remark : Common in the huts and jhoom fields within the sanctuary.

RECOMMENDATION

Mehao Reserve Forest was declared as 'Sanctuary' in the year 1980. However, from time immemorial people living in and around the sanctuary are mainly dependant on the forest produce. They hunt the animals for skins, meat and other products. In recent years they came in close contact with the people of the plains and realised the commercial value of the forest products. This further encouraged them to the killing of animals. During the survey, we met people with the guns in the sanctuary. It appears from their talk that they have no idea about 'Sanctuary' or Wild life Acts. This makes the task difficult for the forest staff to guard the entire sanctuary and enforce the Wild life Act strictly. So it is suggested that the local people should be educated about the need of the protection of the fauna and flora and they should be involved in the scheme of ecological management of the sanctuary.

SUMMARY

An account of the mammalian fauna of the Mehao Wild Life Sanctuary was given along with their status. Altogether, 66 Mammalian species have been reported from the sanctuary, of which *Crocidura attenuata rubricosa* is recorded for the first time from Arunachal Pradesh.

ACKNOWLEDGEMENT

Authors are thankful to the Director, Zoological Survey of India, and the Chief Wildlife Warden, Arunachal Pradesh for providing all facilities and permission of the survey work. We are grateful to Shri J. L. Singh, D.F.O., Forest Department (Roing) for providing transport facilities and for many valuable suggestions. Thanks are due to Dr. V.C. Agarwal, Scientist 'SE', and Dr. R.P. Mukherjee, scientist 'SE', for critically going through the manuscript and for their valuable suggestions. We express our sincere gratitude to Shri P. K. Das, Scientist 'SE', Shri T. K. Chakraborty, Asstt. Zoologist and Shri M. K. Ghosh,

Jr. Zool. Asstt. for their comments. We are grateful to other party members who helped in the survey work. We are indebted to the local people of the Dibang Valley district who provided us many important information about the Wildlife of Mehao Wildlife Sanctuary.

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CHAKRABORTY & SEN

PLATE 1



a



b

- a. Snow-clad Roing-Hunli Road passing through the Mehao Wildlife Sanctuary**
- b. Freshly killed specimen of *Macaca assamensis*.**

a



b



c



- a. Burrow made by *Manis pentadactyla aurlta* in search of insects.
- b. Pug marks of *Panthera uncia*.
- c. Specimen of *Capricornis Sumatraensis thar* which was found dead on the snow.

NEMATODES OF KHAGARIA DISTRICT, BIHAR

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INTRODUCTION

Khagaria is a recently created district of Bihar. The part of old Munger district north of the river Ganga was carved out as Khagaria district. Present studies are part of a project on nematodes of Bihar.

The present communication deals with twentyfive species of nematodes mainly from the vegetable fields. Many of them are highly pathogenic. Besides the species dealt here, a number of other genera like *Dorylaimus*, *Leptonchus*, *Panagrolaimus*, *Diplogaster* etc. were also found. As very little is known about the nematodes of this state most of the species dealt in this paper constitute the first record from Bihar. Many hosts also are new. The locality and host records were checked from those given by Sitaramaiah (1984). Some of the specimens showed interesting variations. classification followed is mainly after Goodey (1963).

SYSTEMATIC ACCOUNT

Family TYLENCHIDAE Oreley, 1880

1. *Malenchus nobilis* Andrassy

Females (4) : L = 0.40 - 0.57mm, a = 29-38, b = 4.7-6.5, c = 4.2-6.3, c' = 9.3-11.6, V = ²⁸⁻⁴⁰ 61-67, stylet = 8-12 μ m.

Males (2) : L = 0.53 - 0.60mm, a = 33-36, b = 5.8-6.7, c = 5.9-6.4, c' = 6.9-8.3, stylet = 10-12 μ m, spicula = 15-18, μ m, gubernaculum = 3-6 μ m.

Remarks : The present specimens show some variations in deManian values mainly of a, c, V and size of gubernaculum. However, these difference are considered here as intraspecific variations between two widely seperated populations (original specimens from Bombay-Andrassy, 1981).

The species is recorded from Bihar for the first time and hosts are also new (type host -grass).

Host *Brassica oleracea* var. *capitata*, *lycopersicum esculentum*, *Solanum tuberosum* *Allium cepa*.

Locality Bhadas, Mehsauri.

2. *Ditylenchus myceliophagus* Goodey

Females (2) : L = 0.50-0.82 mm, a= 39-41, b=5.3-6.8, c=11.2-11.7, c'=4.5-3.3, V= ²⁶⁻³⁰ 77-79, stylet =7-8 μ m.

Remarks : This is the first record of the species from Bihar and host is also new.

Host : *Brassica oleracea* var. *capitata*.

Locality : Bhadas.

3. *Pseudhalenchus anchilisposomus* Tarjan

Females (8) : L=0.53-0.80mm, a=33-45, b=4.2-6.2, c=10.0-14.8, c'=3.3-4.6, V= ²⁸⁻⁴⁹ 76-85, stylet = 8 - 12 μ m.

Males (3) : L=0.50-0.65 mm, a=29-34, b=4.2-5.2, c=11.2-16.8, c'=2.8-3.0, stylet = 7-8 μ m, spicula=17- 23 μ m, gubernaculum =7.0-10. μ m.

Remarks : The species has been repoted in India from guava (Siddiqi, 1964), jute (Chaturvedi & Khera, 1979 and pigeon pea Chaturvedi & Kansal, 1979). The present hosts are new record for the species.

Host : *Solanum melongena*, *S. tuberosum*, *Brassica oleracea* var. *capitata*, *B. oleracea* var. *botrytis*, *Lycopersicum esculentum*, *Capsicum annuum*, *Coriandrum sativum*, *Allium cepa*, and *Ricinus communis*.

Locality : Kuttupur, Bhadas, Bachhota, Mehsauri, Sansarpur and Permanpur.

Family TYLENCHORHYNCHIDAE Eliava, 1964

4. *Tylenchorhynchus mashhoodi* Siddiqi & Basir

Females (5) : L =0. 54 - 0.66mm, a = 28-33, b = 4.4 - 5.0, c =14-17, c'= 2.8 - 3.6, V =²¹⁻²⁶ 54-61 ²¹⁻²⁵, stylet =17-19, μ m.

Males (4) : L = 0.54 - 0.65mm, a = 24 - 30, b = 4.7-5.3, c=16 -18, c'=2.3 - 3.3, stylet =15-17 μ m, spicula = 17-20 μ m, gubernaculum=8-12 μ m.

Remarks : A large number of species were examined including juveniles . The specimens showed morphological variations as described by Baqri & Jairajpuri (1970). The species was recorded from several vegetable hosts from Patna district by the present authors (1984) and appears to be of wide occurrence in Khagaria district too.Except eggplant all hosts mentioned here are new.

Host: Solanum melongena, S. tuberosum, Brassica oleracea var. capitata, B. oleracea var. botryis, Capsicum annuum, Coriandrum sativum, Allium cepa and Lycopersicon esculentum.

Locality : Bhadas , Bachhota, Mehsauri, Sansarpur and Permanpur.

5. *Tylenchorhynchus divittatus* Siddiqi

Female (1juv.) : L =0.47mm , a=27, b=3.7, c=13.3, c'=2.7, V=? stylet =17 µm.

Male (1) :L =0.61mm, a=30, b=4.7, c=18, c'=2.3, stylet =16µm, spicula=17µm, gubernaculum =8µm.

Remarks : The present specimens constitute the new host and new locality record of the species.

Host : Solanum melongena.

Locality : Kuttupur.

Family PRATYLENCHIDAE (Thorne, 1949) Siddiqi, 1963

6. *Pratylenchus coffeae* (Zimmermann, 1898) Goodey

Females (2) : L = 0.50-0.58mm, a=28-32, b=5.6-6.7, b'=4.3-4.8, c=19.8-21.5, c'=2.0-2.1, V=²³⁻³⁵ 80-82, stylet= 17-18 µm.

Male (1) :L =0.59 mm, a=39, b=7.2, b'=5.2, c=21, c'=2.2, stylet = 15 µm, spicula = 17µm, gubernaculum = 7 µm.

Remarks : The species is being recorded for the first time from Bihar.

Host : Musa sp.

Locality : Bachhota.

7. *Pratylenchus penetrans* (Cobb, 1917) Chitwood & Oteifa

Females (4) : L =0.43-0.54mm, a=20-27, b=5.3-6.4, b'=4.0-4.3, c=16.6-21.0, c'=1.7-2.3, V=²⁹⁻³⁹ 75-79, stylet =16-17µm.

Remarks : While going through the literature authors came across P. capitatus Das & Sultana, 1979 which happens to be preoccupied (Ivanova, 1968) Moreover, figure shows oesophageal gland overlapping dorsally (excretory pore side being ventral) and vulva and anus situated on opposite sides. This necessitates re-examination of type material of P. capitatus Das & Sultana, 1979.

All the hosts mentioned here as well as the localities are new record.

Host : Solanum tuberosum, S. melongena, Capsicum annuum, and Ricinus communis.

Locality Mehauri , Sansarpur and Permanpur.

Family HOPLOLAIMIDAE (Filipjev, 1934) Wieser, 1953

8. *Hoplolaimus dubius* Chaturvedi *et al.*

Females (9) : L=0.92-1.32mm, a=23-33, b=7.4-9.5, b'=6.4-8.8, c=35-47, c'=0.59-0.83, V=¹⁶⁻²⁹ 54-62 ¹⁷⁻²⁷, stylet=36-40 µm, anterior phasmid =28-37%, posterior phasmid=80-86%.

Males (7) : L =0.97-1.47mm, a=30-32, b=8-12, b'=5.2-7.8, c=35-47, c'=1.3-1.6, stylet=33-38µm, spicula = 31.5-42.0 µm, gubernaculum =17-22 µm, bursa=45-65 µm, anterior phasmid = 31-38%, posterior phasmid=77-87%.

Remarks : The position of excretory pore was found to be very much variable as mentioned in the original description of the species.

The species is being recorded from vegetable hosts for the first time.

Host : Lycopersicum esculentum, Brassica oleracea var. capitata, Solanum melongena, Musa sp., Coriandrum sativum, Capsicum annuum, and Allium cepa.

Locality : Kuttupur, Bhadas, Bachhota, Mehauri, Sansarpur, and Permanpur.

9. *Helicotylenchus erythrinae* (Zimmermann, 1904) Golden

Females (8) : L =0.56-0.72mm, a=19-26, b=5.5-6.5, b'=3.5-5.3, c=24-44, c'=0.74-2.0, V=¹⁹⁻²⁸ 54-63 ¹⁵⁻²³, stylet =24-27 µm, O=23-25.

Remarks : Rashid et al. (1973) recorded it from unspecified vegetable hosts. The present hosts except eggplant and banana are new.

This is the first record of the species from Bihar.

Host : Lycopersicum esculentum, Capsicum annuum, Solanum tuberosum, S. melongena, Brassica oleracea var. capitata, Ricinus communis and Musa sp.

Locality : Kuttupur, Bachhota, Mehauri

Family NACOBIDAE (Chitwood & Chitwood , 1950) Golden, 1971

10. *Rotylenchulus reniformis* Linford & Oliveira

Females (4 immature) : L=0.33-0.41 mm, a=23-27, b=3.6-4.0, b'=2.3-2.9, c=12-26, c'=1.8-2.7, V=¹³⁻¹⁵ 71-76¹²⁻¹⁴, stylet =16-20 µm.

Males (3) : L = 0.38-0.42mm, a=26-28, b=3.6-4.0, c=17.0-19.7, c'=1.9-2.3, stylet =13-14 μ m, spicula = 15-20 μ m, gubernaculum = 6-7 μ m.

Remarks : Mature females were not found although several roots were examined. Several larvae also found.

Host : *Solanum melongena*, *Lycopersicum esculentum*, *Capsicum annuum*.

Locality : Bhadas, Bachhota, Kuttupur.

Family APHELENCHIDAE (Fuchs, 1937) Steiner, 1949

11. *Aphelenchus avenae* Bastian

Females (4) : L = 0.55-0.62mm, a=28-38, b=6.6-8.1, b'=3.4-3.9, c=24.8-27.5, c'=1.6-2.2, V=³¹⁻⁴⁵ 75-78, stylet = 15-20 μ m

Males (2) L= 0.57-0.65mm, a=37-38, b=7.5-7.6, b'=3.5-3.9, c=24.8-28.7, c'=2.0, stylet = 15-18 μ m, spicula = 20-25 μ m, gubernaculum = 5-10 μ m.

Remarks : Some variations in the shape of the median bulb as reported by Khera & Chaturvedi (1977) were observed. The species is recorded from eggplant, chilli, and coriander for the first time.

Host : *Brassica oleracea* var. *botrytis*, *Solanum melongena*, *Lycopersicum esculentum*, *Coriandrum sativum*, *Allium cepa*, *Capsicum annuum*.

Locality : Bhadas, Bachhota, Mehsauri, Kuttupur, Sansarpur, Parmanpur.

Family APHELENCHOIDIDAE (Skarbilovich, 1947) Paramonov, 1953

12. *Aphelenchoides asterocaudatus* Däs

Female (1) : L = 0.57mm, a=29, b=8., b'=3.8, c=19, c'=2.5, V=³⁵ 69, stylet =12 μ m.

Remarks : Khera & Chaturvedi (1975) and Chaturvedi & Khera (1979) recorded the species from Orissa and West Bengal, respectively. Tail seems to be smaller (c=13-16 in W. Bengal, 15-17 in Orissa populations). The species is being recorded from Bihar for the first time.

Host *Capsicum annuum*.

Locality Bachhota.

13. *Aphelenchoides bicaudatus* (Imamura, 1931) Filipjev & Sch. Stekhoven, 1941

Females (2) : L = 0.36-0.50mm, a=33, b=7.2-9.0, b'=4.0-4.4, c=14.2-16.4, c'=2.8-3.8, V=²⁸ 61-69, stylet = 9-12 μ m.

Remarks : The present specimens fit well in the description of the species by Imamura (1931) and Siddiqui and Taylor (1968). However, tail in present specimens is slightly smaller (c=9.4-12.6—Imamura; c=9.8-13.7-Siddiqui & Taylor). This is the first record of the species from Bihar.

All the hosts and localities are new for the species.

Host : *Coriandrum sativum*, *Lycopersicum esculentum*.

Locality : Bachhota, Mehsauri.

14. *Aphelenchoides sanwali* Chaturvedi *et al.*

Females (6) : L = 0.45-0.50mm, a=22-29, b=8.4-9.3, b'=4.1-4.7, c=15.2-23.8, c'=1.6-3.2, V=⁴⁶⁻⁵³ 71-72 ⁵⁻¹⁰, stylet = 10-15 μ m.

Remarks : The species was described from the rhizosphere of jute hence the vegetable hosts are new and distributional range is extended to Bihar.

Host : *Brassica oleracea* var. *capitata*, *Capsicum annum*, *Solanum tuberosum*, *Lycopersicum esculentum*.

Locality : Bachhota, Bhadas, Mehsauri, and Permanpur.

15. *Seinura hecherae* Chaturvedi *et al.*

Female (1) : L = 0.46mm, a=26, b=8.4, b'=4, c=6.6, c'=7, V=³¹ 63, stylet -12 μ m.

Remarks : The specimen fits in the original description.

Hosts and Locality are new records.

Host : *capsicum annum*.

Locality : Mehsauri.

Order RHABDITIDA (Orley, 1880) Chitwood, 1933

Family CEPHALOBIDAE (Filipjev, 1934) Chitwood & Chitwood, 1934

16. *Chiloplacus* sp.

Females (2) : L = 0.46-0.51mm, a=25-29, b=3.0-3.4, c=16.4-18.4, c'=2.7-2.8, V=67-70.

Remarks : The genus is recorded for the first time from Bihar.

Host : *Capsicum annum*, *Solanum melongena*.

Locality : Kuttupur, Mehsauri.

17. *Acrobeles bustschlii* (de Man, 1884) Steiner & Buherer

Male (1) : L = 0.39mm, a=14, b=3.6, c=19.5, c'=1.3, V=66.

Remarks : The specimen fits well in the description of the species by Goodey (1963) and Khera & Chaturvedi (1977) Genus is recorded for the first time from Bihar.

Host : *Solanum melongena*.

Locality : Sansarpur.

18. *Acrobeles timmi* Chaturvedi & Khera

Females (4) : L = 0.64-0.69mm, a=14-20, b=4.2-4.4, c=10.7-11.6, c' = 2.3-2.7, V=59-60.

Males (2) : L = 0.47-0.54mm, a=20-21, b= 3.5-4.4, c=11.8-13.3, c'=1.7, spicula =25-32 μ m, gubernaculum =10-18 μ m.

Remarks : The specimens closely fit in the original description of the species except slight variation in deManian indices. The hosts are new and this is first record from Bihar.

Host : *Lycopersicum esculentum* , *Allium cepa*, *Coriandrum sativum*.

Locality : Bhadas, Bachhota, Mehsauri, and Sansarpur.

Order MONHYSTERIDA (Orley, 1880) Sch Stekhoven & De conink, 1933
Family MONHYSTERIDAE , 1880

19. *Prismatolaimus andrassyi* Khera & Chaturvedi

Female (1) : L = =0.52mm, a=52, b=3.7, c=3.2, c'=17.7, V=55.

Remarks : The specimen agrees in all respect with the original description (Khera & Chaturvedi, 1977) except slight difference in body length and the value of 'a' The genus is reported for the first time from Bihar and host is also new.

Host Solanum tuberosum.

Locality : Permanpur.

Order CHROMADORIDA (Filipjev, 1971) Chitwood, 1933

Family CYATHOLAIMIDAE (Micoletzky, 192) deConink & Sch. Stekhoven, 1933

20. Achromadora ruricola (deMan, 1880) Micoletzky

Female (1juv.) : L = 0.55mm, a=36, b=4, c=6.8, c'=6.6, V=?

Remarks Species is recorded for the first time from Bihar.

Host : *Brassica oleracea* var. *capitata*.

Locality : Mehsauri.

Order ENOPLIDA (Baird, 1853) Chitwood, 1933

Family IRONIDAE deMan, 1876

21. Ironus longicaudatus deMan

Females (3) L = 1.49-1.54mm, a=47-48, b=5.1-6.2, c=4.4-5.5, c'= 14.3-15.2, V=42-45.

Remarks : The specimens closely fit in the description of the species by andrassy (1968) and Khera (1976) The genus is recorded for the first time from Bihar

Host : *capsicum annuum*, *Musa* sp., *Lycopersicum esculentum*

Locality Bhadas, Bachhota, Sansarpur.

Order DORYLAIMIDA Pearse, 1942

Family DORYLAIMIDAE deMan, 1876

22. Thornenema mauritiana (Williams, 1959) Baqri & Jairajpuri

Females (3) : L=1.43-1.57mm, a= 38-42, b=5.0-6.2, c=5.6-7.0, c'= 10-13, V=32-49^{6'}, stylet = 12-14 µm, stylet extension = 16-18 µm.

Remarks : The specimens tally with the description by Baqri & jairajpuri (1967) except some variations in the valu of 'V' and length of stylet. This is the first record from Bihar.

Host : *Lycopersicum esculentum*, *Ricinus communis*.

Locality Kuttupur, Bachhota.

Family DORYLAIMELLIDAE (Jairajpuri, 1964) Thorne , 1964

23. *Dorylaimellus parvulus* Thorne

Females (2) : L = 0.45-0.71mm, a=30-32, b=2.6-2.9, c=20-30, c'=1.3-2.3, V=53-59, odontostyle = 8-12 μ m, odontophore = 10 -12 μ m.

Remarks : The specimens show some variations in deManian values This is the first record from Bihar.

Host : *Solanum melongena* *Musa* sp.

Locality : Bachhota.

Family ALAIMIDAE Micoletzky, 1922

Amphidelus candidus Siddiqi & Basir

Female (1) : L = 0.88mm, a=59, b=4.7, c=4.5, c'=21.4, V=40.

Remarks : The specimen fits well in the description of the species by siddiqi & Basir (1965) this is the first record of the genus from bihar.

Host : *Brassica oleracea* var. *botrytis*.

Locality Bhadas.

Order MONONCHIDA Jairajpuri, 1969
Family MYLONCHULIDAE Jairajpuri, 196925. *Mylonchulus lacustris* (N.A. Cobb in M.V Cobb, 1915) Andrassy

Females (3) L= 0.92-1.21mm, a=23-30, b=3.0-3.9, c=26.2-32.4, c' =1.3-1.7, V=62-65.

Remarks Jairajpuri & Khan (1982) recorded the species from many places in U.P. earlier Chaturvedi & Khera (1979) has recorded it from West Bengal The present record from Bihar shows that the species is widely distributed in the Gangetic plains.

Host : *Lycopersicum esculentum*, *Musa* sp., *Brassica oleracea* var. *botrytis*

Locality : Kuttupur, Bhadas, Bachhota.

SUMMARY

Twentyfive species of plant parasitic and soil nematodes have been recorded mainly from the vegetable fields in Khagaria district, Bihar. Most of the species reported constitute new locality records. Some new hosts and interesting variations are also reported.

ACKNOWLEDGEMENTS

Thanks are due to the Director, Zoological Survey of India, Calcutta and the Officer-incharge, Gangetic Plains Regional Station, Patna for providing the facilities for the present work.

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ON LITTLE-KNOWN MOTHS OF TRIPURA, INDIA

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INTRODUCTION

The paucity of knowledge existing till date on the fauna of Lepidoptera from the state of Tripura in North-East India gives the authors an opportunity to attempt on the present problem. Quite a series of surveys were earlier conducted by different explorers in almost all other states and territories of the North-Eastern Himalayas. But the published account of Lepidoptera is far from complete from the hills and plains of Tripura or "Tipperah", as earlier known under the "Province of Bengal". This is obviously due to the disadvantage of survey works caused by the prevalence of long range-*cum*-valley type of topography in the state concerned.

The present work highlights the systematic account of 47 species of moths together with their infra-specific variations, as and when observed, under 43 genera in 15 families, being preceded by brief notes on other items of interest as mentioned in the text. Besides, two tables, one dealing with the data of local collections and the other, with those of their global distribution as per literature review, are also incorporated. The measurement of wing expanse, i.e., the tip-to-tip distance between fore wings of bilaterally spread specimens, is given in millimeters (mm). The classification is mainly followed *sensu* Hampson (1892, 1894, 1895, 1896), but with subsequent modifications for the families as cited in the text. All the material, which constitute new locality records for Tripura, have recently been collected by different parties from the Zoological Survey of India chiefly during the pre-winter and winter seasons and, repositied at Z. S. I. Of these, only a few species could not, however, be determined, but their affinities have been provided. The paper is concluded by summary and references.

GENERAL CLIMATOLOGY

ABIOTIC FACTORS

1. *Physiography*

Chatterjee (1965) stated that the elevated lands of North-East India are divisible into three major physiographical areas, of which the "Purvachal", i.e., the eastern zone, is traversed by both mountain ranges of varying altitudes and plains. It is further split up into as many as six subareas. One such subarea is represented by Tripura, where the temperate forest-hills rise abruptly to about 800 metres above the Great River Brahmaputra. These hills are oriented as long ranges alternating with valleys. The edaphic pattern is mostly clayey in origin and thus seems to signify the recency of descendency of the land mass in question.

The major undulated division of Tripura belongs to the Indian jurisdiction, whereas the greater portion of the plains is spread over the neighbouring country of Bangladesh. The Indian portion of the state is the smallest of all its counterparts in the North-Eastern Himalayas. It is situated at 23°-24°50' N latitudes and 91°21'- 92°50' E longitudes with an approximate area of 10,450 sq. kms. It is almost entirely surrounded by Bangladesh except the Mizo Hills on the east and the Cachar Hills on the north.

The state of Tripura includes the North, Central/Sadar and South districts. It is bathed by the north-flowing rivers like Zuri, Manu, Dhalai and Khowai and also the largest south-flowing river Gumti. The River Gumti receives a number of streams and cuts right across the ranges amidst deep valley from east to west before its emergence near Radhakishorepur. Also, there are several cascades along its course particularly through the Dumbura Hill.

2. Climate

This is made of a varying number of weatherological parameters, of which very important are temperature, humidity and photoperiodicity. In fact, the overall climatic pattern is subject to a fair degree of modifications which are principally brought about by the subtropical or temperate features of the state itself.

The meteorological data, *sensu* Basu (1965) and also the reports of recent faunistic surveys on behalf of Z.S.I. reveal that the maximum temperature is about 40°C in valleys and plains during the summer and the minimum, about 5°C in the hills during winter. The annual rainfall is about 2517.7 mm. The durational difference between the diurnal and nocturnal periods in the natural condition varies rather negligibly as in other areas in the outer line of the North-Eastern Himalayas.

BIOTIC FACTORS

1. Flora

In view of the comparatively higher moisture contents than those of colder niches of the Indian subregion, the state of Tripura elicits certain differences of floral distribution from that of the North-Western Himalayas and also Northern and Western Peninsulas.

The growth of plantations is luxuriant enough particularly over the hill-tops and also down the valleys at places. These are covered in succession with tall grasses of the Savannah-type and dense forests of the evergreen and broad-leaved types. Elsewhere, majority of these forests are denuded mainly due to the practice of shifting cultivation of crops like jhuming.

The evergreen forests are made of *Pinus* spp. and sporadically distributed hygrophilous trees of *Tectona* together with *Dipterocarpus alatus*, *D. pilosus* and *D. turbinatus*. These are also represented by other plantations including *Anacardium occidentale*, *Bombax malabaricum*, *Castilloea elastica*, *Eugenia jambolana*, *Ficus bengalensis*, *F. esculentus*, *F.*

religiosa, *Shorea robusta*, etc., together with the species of *Bambusa*, *Calamus*, *Hevea* and *Plectoconnia*.

The broad-leaved type is mainly composed of *Acer saccharum*, *Betula alnoides*, *Machilus odoratissima* and also other species of *Castanopsis*, *Magnolia*, *Michaelia*, *Quercus*, etc.

It is quite interesting to note that the plantations on the hill-tops at Tripura are closely allied to those of the well explored Nilgiri Hills in South India, where the impact of maximum similarity of the present fauna is equally marked. Amongst the cultivated crops, *Camelia sinensis*, *Oryza sativa* and the species of *Corchorus* and *Gossypium* are important. Further, the work of afforestation, particularly with *Shorea robusta*, *Tectona grandis* and species of *Hevea*, etc., is in progress amidst certain deforested areas of the state.

2. Fauna

Presently, the moths, amidst other animals collected at Tripura, constitute the focal theme. At the initial stage of moth-exploration in the state, the material are represented by a rather poor number of species as compared to those of the well-surveyed adjoining areas of the North-Eastern Himalayas. Nevertheless, they help cast limelight on the distributional pattern of the moths in the state which remains hitherto unexplored in respect of the fauna concerned.

Customarily, the moths differ appreciably from the butterflies in all the four stages of life-cycle by both morphological and behavioural aspects in harmony with their general possession of cryptic *cum* crepusculo-nocturnal habits. Very often, they become seriously nuisible to various plant products of economic importance to mankind.

A total of 96 specimens under study apparently show an approximate sex-ratio of female: male :: 1 : 1.75. About two dozen of the material have been tagged with "at light" labels including 15 for male and 8 for female specimens. All these show that the females are more sluggish in habit and less observed in their ecotones than the comparatively fast-flying males.

BIOTIC ZONATIONS

In relation to the aforesaid account of climatology, the state may be conveniently classified into four distinctly delimited valleys and one plain, called the biotic zones. These, on an overall profile surveillance, alternate, in turn, with six hill ranges extending from western and southern to the eastern and northern directions. Of these, a couple of ranges in the west is also associated with the upland plains.

Only a single macroclimatic biotic zone, i.e., the Dharmanagar Valley, which is situated in the extreme north of Tripura between the Jamraitlang and Sakhantlang ranges and bathed by the rivers Zuri and Deo, could not be successfully explored for the moths.

The localities of the remaining four such zones, actually surveyed from north to south of the state (*vide* Table I) , are as hereunder.

I. KAILASHAHAR VALLEY : This zone is situated between the Sakhlantlang and Langtharai ranges of the North Tripura district and bathed by the rivers Manu and Deo. It includes the following collecting localities :-

1. *Kanchanpur* : A fairly big town situated on the bank of the river Deo at a distance of about 40 kms. south of Kumarghat.

2. *Kumarghat* : The District Headquarter situated on the Dharmanagar-Agartala Highway at a distance of about 60 kms. south-west of Dharmanagar.

3. *Manu* : A town situated on the bank of the river Manu at a distance of about 10 kms. north of a large village, Chailtinga. The adjoining spot is Jarulcheria.

4. *Kailashahar* : The large forested area of the valley.

II. KAMALPUR VALLEY : This zone is situated between the Langtharai and Atharamura ranges also of the North Tripura district and bathed by the rivers Khowai and Dhalai. It includes the following collecting localities:-

1. *Ganganagar* : A small village situated on the bank of the river Khowai at a distance of about 28 kms. south of Ambassa.

2. *Ambassa*: A small town situated on the Dharmanagar- Agartala Highway at a distance of about 87 kms. east of Agartala; with dense forests in the outskirts. The adjoining spot is Garo Basti.

III. AGARTALA PLAIN : So named after the capital and also the Headquarter of the Central / Sadar district of Tripura, this zone is situated between the low Deotamura-Baramura ranges and the Indo-Bangladesh border on the west of the state. It is bathed by a system of tributaries of the Great River Brahmaputra, of which the largest Gumti flows over here from east to west. It includes a single collecting locality, as follows:-

Agartala : The biggest town of Tripura, with Peratheia, Chandmari, Peratina and Bishalgarh as the adjoining collecting spots.

IV. KHOWAI VALLEY: This zone is situated between the Baramura and Atharamura ranges in the South Tripura district, being bathed mainly by the river Khowai. It includes the following collecting localities:-

1. *Charilam* : Located on the Agartala-Udaipur Road at a distance of about 25 kms. south of Agartala.

2. *Udaipur* : The District Headquarter, in the vicinity of which are situated Garjee and Banpath, both on the Udaipur-Belonvia Road at a distance of about 65 kms. south of Agartala.

3. *Abhoya* : A small village of which the adjoining spot is Barpathari.

4. *Ampi* : Also a small village on the Amarpur-Teliamura Road at a distance of about 25 kms. south of Teliamura. The adjoining collecting spot is Khowaipur.

5. *Teliamura* : The second biggest town in the state of Tripura, being located at a distance of about 42 kms. east of Agartala. The adjoining spots are Kunjlina, Bramochara, Gomar Tilla, Kali Tilla and the Sripur Village.

6. *Belonia* : Situated at a distance of about 8 kms. south-east of Abhoya.

BIOGEOGRAPHY

The interesting pattern of distribution of the Heteroceran fauna in question may be viewed from two different angles, viz., intra-state (*vide* Table I, pages 330-332) and global (*vide* Table II, pages 333-334).

Within the state of Tripura, the maximum of a dozen of species are presently explored from Udaipur, being followed in diminutive sequence by 11 from Teliamura, 8 from Kumarghat, 6 from Ambassa, 4 from Agartala, 3 from Ampa, 2 each from Manu, Gangaganagar, Charilam and Abhoya and one each from Kanchanpur, Kailashahar and Belonia. Of these, *Amata cyssea* (Cramer), *Euchera nigralbata superstigmata* (Prout), *Spilarctia casigneta* (Kollar) and *Cretonotus transiens* (Walker) overlap at one or other niches between the first seven but fifth and the penultimate couple amongst the aforesaid localities. According to the data presently assessed, about 64% of the material under study are found in winter, 22% in the pre-winter and 14% in the summer. This apparently suggests that the conceivably low temperature is preferable for the overall thriving of the elements in their habitats. However, for a better conception of their detailed seasonal cycle, further explorations are needed in the state concerned.

As to the pattern of global distribution of the fauna, majority of the species are continental in origin, though over 50% are known from the insular belts of Australasia. These are principally oriental hill-dwellers, showing affinities more with the Palaearctic than with other fauna of the world, though the state of Tripura itself is bereft of alpine zone unlike the one elsewhere in the Himalayan inner line range. Analysing from the viewpoint of resemblance amongst the intra-oriental members, a little over 40% from the Chinese and about 50% from the Malayan subregions are mutually common. About 20% are confined in the Indian subregion, where in its different sectors the pattern of distribution of the elements may be broken up into gradations from maximum to the minimum number as given in parentheses in common with the Tripuran fauna. The sequence starts from the Southern Peninsula (33 spp.) onwards to the Eastern Peninsula (28 spp.), Sri Lanka (25 spp.), North-Western Himalayas (23 spp.), Western (22 spp.) and Northern Peninsulas (15 spp.), Andaman and Nicobar Islands (12 spp.) and Central Himalayas (7 spp.). Of these, quite a many, of course, overlap with one another depending on the similarity of their respective niches. Amongst the moths all recorded new for Tripura, no species is endemic nor, strictly speaking, cosmopolitan in India, though *Ceryx imaon sargania* (Butler) and *Eressa confinis catoria* Swinhoe are known to be confined in the North-Eastern Himalayas. With the present discovery, one more subspecies, i.e., *Leucoma submarginata hipparia* (Swinhoe), which was hitherto known from Singapore, also constitutes new locality record for the Indian subregion. Besides, at least one morph, i.e., *Eupterote fabia*, f. *discordans* Butler, is also new for the North-Eastern Himalayas. No material, however, is known to be common with the Laccadive Islands in the South-West Indian Ocean. It is further interesting to note that only a little over 20% of the material under study is represented in the nearest international border of Bangladesh.

Apart from the highest number of 14 species showing Palaearctic affinities, as observed

from the present data of distribution, 11 occur exotically in the Australian, 10 in the Ethiopian, 4 in the Papuan, 3 each in the Malagassic and Hawaiian, 2 in the Neotropical and only one in the Nearctic region.

SYSTEMATIC ACCOUNT

(For the details of material examined, vide code No. in Table I, Pages 330-332)

Order LEPIDOPTERA Suborder HETEROCERA

I. Family EUPTEROTIDAE

1. *Eupterote fabia* (Cramer).

1779. *Phalaena fabia* Cramer, *Pap. Exot.*, 3 :pl. 250, fig. B.

1816. *Eupterote fabia*, Hübner, *Verz. bek. Schmett.*, p. 187.

Material examined.-(IV 5h).

Wing expanse.- 88 mm.

Distribution.- Nepal. India : Assam; Tripura; Sikkim; West Bengal (Darjeeling; Calcutta); Andhra Pradesh (Coromandel); Karnataka (Belgaum); Tamil Nadu; Kerala (Malabar). Sri Lanka.

Remarks.- The species was originally referred to as "*Bombyx fabia* Olive." by Cotes & Swinhoe (1887), who, however, did not mention the year of publication of the same. The specimen, which was not earlier known from Tripura, fits well in the species. Hampson (1892) and Seitz (1933) mentioned sexual dimorphism as well as about half a dozen of morphs (ff.) of the species from India. The moth is referable to one such morph (f.), as hereunder.

f. *discordans* Butler: This is recognised by the wings brown in female which is nearly identical in facies with that sex of *E. undata*, f. *invalida* Butler from India and Burma. Hitherto known from Calcutta, it is recorded new for the North-Eastern Himalayas.

II. Family SPHINGIDAE

Division Semanophorae Subfamily PHILAMPELINAE Tribe Nephelini

2. *Sphingonaepiopsis pumilio* (Boisduval)

1875. *Lophura pumilio* Boisduval, *Spec. Gén. Lép. Hét.*, 1 : 311.

1903. *Sphingonaepiopsis pumilio*, Rothschild & Jordan, *Revision of Sphingidae*, p. 592.

Material examined.-(II 2c).

Wing expanse.- 31mm.

Distribution.- China. India : Assam (Cachar); Meghalaya (Khasi Hills, c 1525 m); Tripura . Bangladesh. Western Malaysia.

Remarks.- The species, in which the specimen fits well, is known to exhibit crypsis as a dried-up leaf in the natural surrounding. Mimicry with other life-forms is, however, unknown. The moth under study is a little larger in wing expanse than that in male, as mentioned by Bell & Scott (1937). Rare in India, it is recorded new for Tripura.

3. *Macroglossum insipida insipida* Butler

1875. *Macroglossa insipida* Butler, *Proc. zool. Soc. Lond.*, p.242.

1903. *Macroglossum insipida insipida*, Rothschild & Jordan, *Revision of Sphingidae*, p. 642, pl. 3, fig. 10.

Material examined. - (IV 5e).

Wing expanse.- 42 mm.

Distribution.- India : Sikkim; Tripura; Southern Peninsula; Andaman & Nicobar Islands (the Andamans). Bhutan. Sri Lanka. Malaya.

Remarks.- The specimen, a new record for Tripura, fits well in the nominate subspecies of *insipida* Butler. The moth is not known to be attracted to light. Bell & Scott (1937) stated to "have bred the subspecies in S. India, where it is very plentiful towards the end of the rainy season, in forests with very heavy rainfall up to 1000 feet elevation" The subspecies is the only known Indian representative of the species in question.

III. Family SYNTOMIDAE

4. *Ceryx imaon sargania* (Butler)

1879. *Syntomis sargania* Butler, *Trans. ent. Soc. Lond.*, p. 4.

1933. *Ceryx imaon sargania*, Seitz, *Macrolep. World*, 10 : 65

Material examined. - (I 2e).

Wing expanse.- 28-32 mm.

Distribution.- India : Assam (Cachar); Tripura.

Remarks.- This is one of the three known Indian subspecies of *Ceryx imaon* (Cramer). It is distinguished from ssp. *artina* (Butler) and *mota* (Swinhoe) by the fore wings with a long streak between M1 and M2. Seitz (1933) figured a female specimen from Sri Lanka, in which the wings are without hyaline spots. Diurnal and flower-frequenting in

habit, the moth reposes with wings spread out in its niches and when disturbed, takes a darting flight. It mimicks the non-Lepidopteran insects showing a dancing flight aided by the appendage-like hind wings. The specimens are locally common but endemic in the Assam Himalayas. These fit well in the subspecies recorded new for Tripura. Certain schools of thought have, however, introduced the names of the family as "Amatidae" and "Ctenuchidae", but the authors retain here the name "Syntomidae" as such.

5. *Amata sperbius* (Fabricius)

1787. *Zygaena sperbius* Fabricius, *Mant. Ins.*, 2 : 103.

1933. *Amata sperbius*, Seitz, *Macrolep. World*, 10 : 68, pl. 10, figs. g, h.

Material examined.- (IV 2f).

Wing expanse.- 30-33 mm.

Distribution.- South China. Vietnam. India : Sikkim; Assam (Cachar); Tripura. South Burma.

Remarks.- A new record for Tripura, the species is found in the North-Eastern Himalayas and elsewhere. According to Seitz (1933), the female is very robust and black, with the anal segment clothed with yellow-grey hairs. He (*loc. cit.*) further observed that the specimens particularly from Sikkim and Hainan have hind wings of variable colourations of geographical interest, though no subspecies based on this character has ever been mentioned. The present material fit well in the species with little variation of the hind wing colour.

6. *Amata cyssea* (Cramer)

1782. *Sphinx cysseus* Cramer, *Pap. Exot.*, 4 : 124, pl. 355, fig. B.

1933. *Amata cyssea*, Seitz, *Macrolep. World*, 10 : 68

Material examined.- (I 3), (II 2e), (IV 2e).

Wing expanse.- 25-32 mm.

Distribution.- The Palaearctic region. Pakistan. Nepal. India : Jammu & Kashmir (Kashmir); Himachal Pradesh (Kangra); Sikkim; Tripura; Nagaland; Madhya Pradesh (Mhow); Maharashtra (Bombay); West Bengal (Calcutta); Andhra Pradesh (the Coromandel Coast). Sri Lanka.

Remarks.- The specimens, previously unknown from Tripura, fit well in the species. Seitz (1933) mentioned two aberrants, viz., ab. *cysseoides* (Butler) and ab. *georgina* (Butler), showing respectively "larger" and "reduced" hyaline spots on wings, but no material under study is referable to these aberrants. Earlier, Hampson (1892) considered

the latter aberrant as a distinct species, and the former as its synonym under the genus *Syntomis* Ochsenheimer which has lately been considered as subgenus of *Amata* Fabricius by Obraztsov (1966).

7. *Eressa confinis catoria* Swinhoe

1900. *Eressa catoria* Swinhoe, *Ann. Mag. nat. Hist.*, (7) 6 : 305.

1933. *Eressa confinis catoria*, Seitz, *Macrolep. World*, 10 : 83.

Material examined.- (I 2c).

Wing expanse.- 24-27mm.

Distribution.- India : Assam; Tripura. Bhutan.

Remarks.- This is one of the three known Indian subspecies of *E. confinis* (Walker). It differs from ssp. *musa* (Swinhoe) and ssp. *intensa* (Rothschild) by the hind wings being dark and unspotted. All the specimens, recorded new for Tripura, fit well in ssp. *catoria* which is confined in the North-Eastern Himalayas, being rather common in the state under review.

IV. Family ZYGAENIDAE

Subfamily CHALCOSIINAE

8. *Trypanophora semihyalina* Kollar

1848. *Trypanophora semihyalina* Kollar, *Hugel's Kaschmir*, 4 : 457, pl. 19, figs. 1-4.

Material examined.- (I 3).

Wing expanse.- 47 mm.

Distribution.- South China. India : Jammu & Kashmir; Himachal Pradesh (Kangra); Sikkim; West Bengal (Darjeeling; Calcutta); Assam (Cachar); Tripura; Southern Peninsula. Burma.

Remarks.- The specimen, a new record for Tripura, fits well in the species and may be referred to one of the three Indian forms, *sensu* Hampson (1892) and Jordan (1933).

f. semihyalina Kollar : This differs from *f. argyrospila* Walker and *humeralis* (Walker) by the discal hyaline patches of fore wings large, tegulae orange and abdomen with complete bands. Apparently, it is not common at Tripura, though Jordan (1933) mentioned the form as "widely distributed in North India"

V. Family DREPANIDAE
Subfamily EUCHERINAE

9. *Euchera nigralbata superstigmata* (Prout)

1918. *Cyclidia substigmata superstigmata* Prout, *Ann. Mag. nat. Hist.*, (9) 2 : 416.

1934. *Euchera nigralbata superstigmata*, Gaede, *Macrolep. World*, Suppl. 2 : 167.

Material examined.- (II 2f, g), (IV 2g), (IV 5c), (IV 5f).

Wing expanse.- Males, Female 65 - 75 mm.

Distribution.- Nepal. India : Jammu & Kashmir; Himachal Pradesh (Solan; Kulu; Dharmasala); Uttar Pradesh (Mussourie); Sikkim; West Bengal (Darjeeling; Malda); Assam (Dangsiri; Silchar; Sibsagar); Meghalaya (Khasi Hills; Shillong); Tripura. Bhutan. Burma. Bangladesh.

Remarks.- This is the only Indian subspecies of *E. nigralbata* (Warren). These specimens, new for Tripura, fit well in the subspecies and are common in status. Only in one male, the apex of fore wings is more acute than falcate and 1A of hind wings extends up to a little beyond the middle of anal margin. All the specimens are quite smaller in wing expanse than that given by Hampson (1892) for the species.

VI. Family LIMACODIDAE

Subfamily LIMACODINAE

10. *Susica pallida* Walker

1855. *Susica pallida* Walker, *Cat. Lep. Het. Brit. Mus.*, 5 : 1114.

Material examined.- (IV 2g).

Wing expanse.- 33mm.

Distribution.- Nepal. India : Sikkim; Tripura. Burma. Japan.

Remarks.- The species, in which the specimen fits well, is a new record for Tripura. The nearest ally, *Tadema sinensis* Walker from China, which was synonymised with *S. pallida* Walker by Hampson (1892) and Seitz (1913), has been revalidated to the specific status under *Susica* Wasker by Hering (1933, 1934). The specimen is larger in wing expanse than that reported earlier.

11. *Phocoderma velutinum* (Kollar)

1848. *Gastropacha velutina* Kollar, *Hügel's Kaschmir*, 4 : 473.

1933. *Phocoderma velutinum*, Hering, *Macrolep. World*, 10 : 720, pl. 90, fig. a.

Material examined.- (IV 5c).

Wing expanse.- 51 mm.

Distribution.- Pakistan. India : Jammu & Kashmir; Uttar Pradesh (Mussourie); Sikkim; Assam (Cachar); Tripura; West Bengal (Malda); Maharashtra (Pune). Burma. Borneo.

Remarks.- The species is well represented by the specimen not earlier known from Tripura. Seitz (1913) mentioned it as "the largest Limacodid", with wing expanse reaching to 78 mm. in female. He (*loc. cit.*) also stated about the distribution of the moth as "throughout the Himalayas and North India, one of the commonest Limacodids; in the spring until May and again in August and September, from 1000 to 5000 ft." But hunting of other literature reveals no locality at least in the Northern Peninsula, from where the species has ever been recorded. The species, earlier placed under *Natada* Walker by Seitz (*loc.cit.*) and also Hampson (1892), has been retransferred to *Phocoderma* Butler by Hering (1933,1934).

12. *Altha nivea* Walker

1862. *Altha nivea* Walker, *J. Linn. Soc. Lond.* , 6 : 173.

Material examined.- (III 1c).

Wing expanse.- 32 mm.

Distribution.- India : Jammu & Kashmir; Himachal Pradesh (Simla; Solan; Kulu); Sikkim; Assam (Sibsagar); Tripura; Punjab; Madhya Pradesh (Mhow); Maharashtra (Pune); Bihar (Ranchi); Orissa (Ganjam); Southern Peninsula Sri Lanka.

Remarks.- This is the only Indian species of the genus *Altha* Walker, which, *sensu* Seitz (1913), reaches the Palaearctic territory in Kashmir. A new record for Tripura, the specimen fits well in the species. It resembles the form from Sikkim with olive markings in fore wings in which R_2 is stalked with $R_{3.5}$. Hampson (1892) synonymised *Candyba punctata* Moore with the species under study, though he (*loc. cit.*) noted, "*Candyba punctata* , Walk., is from Brazil, and the genus is distinct from *Altha*" But this statement was against the view of Cotes & Swinhoe (1887), who already catalogued *C. punctata* from the Indian subregion.

VII. Family LASIOCAMPIDAE

13. *Arguda* sp.

Material examined.- (I 2b).

Wing expanse.- 45 mm.

Remarks.- The specimen fits well in the genus *Arguda* Moore excepting for the eyes being "densely" hairy, as mentioned by Grünberg (1913, 1933). The moth, which could not be identified up to the species, is apparently close to *A. vitta* Moore from the Sundaland, but differs from it by the colouration of the body being paler, fore wings dorsally without discal spot, with postdiscal band and subterminal line indistinct and ventrally with the subterminal band represented by a row of vermilion dots and also the distal area of hind wings paler. The species, of which the male is not known, appears to be rare at Tripura.

VIII. Family LYMANTRIIDAE

Subfamily LYMANTRIINAE

(i) Group Areolatae

14. *Dasychira lineata* (Walker)

1855. *Lymantria lineata* Walker (pt.). *Cat. Lep. Het. Brit. Mus.*, 4: 875

1933. *Dasychira lineata*, Strand, *Macrolep. World*, 10 : 294, pl. 47, fig. a.

Material examined.- (IV 5g).

Wing expanse.- 68 mm.

Distribution.- India : Sikkim; Assam (Dansiri); Meghalaya (Khasi Hills); Nagaland; Tripura. Bhutan. Bangladesh. Burma.

Remarks.- A new record for Tripura, the specimen fits well in the species, excepting for the postdiscal and subterminal lines which are much obsolete. Also, the wing expanse is considerably smaller than that mentioned by both Hampson (1892) and Strand (1933).

15. *Leucoma submarginata hipparia* (Swinhoe)

1893. *Redoa hipparia* Swinhoe, *Ann. Mag. nat. Hist.*, (6) 12 : 213.

1933. *Leucoma submarginata hipparia*, Strand, *Macrolep. World*, 10 : 310.

Material examined.- (IV 2b).

Wing expanse.- 38 mm.

Distribution.- India : Tripura. Singapore.

Remarks.- The specimen fits well in the Indian subregion. It differs from subspecies which was not previously known from ssp. *sikkima* Strand at Sikkim and Darjeeling by the fore wings with a very small black discal spot and also, like the hind wings, being transparent white, with minute silvery striae and cilia flesh-coloured. It has the wing

expanse larger than that mentioned by Strand (1933). While Hampson (1892) treated *Redoa* Walker as subgenus of *Leucoma* Stephens, Hering (1930) revalidated it to the generic status including the African species. Hering (*loc. cit.*) cross-referred to *Leucoma* in the Palaearctic Fauna of *Macrolep. World* (Vol. II : 1913) at "p. 123", but the genus could not be traced therein, though strand (*loc. cit.*) did mention the Palaearctic distribution of sp. *submarginata* Walker.

16. *Pendria* sp.

Material examined.- (IV 4b)

Wing expanse.- 45 mm.

Remarks.- The specimen fits well in the genus *Pendria* Swinhoe. The moth, which could not be identified up to species, seems to be allied to *P. rinaria* (Moore) from India (Khasi Hills), Sumatra and Java, but differs from it by the body and fore wings ochreous, latter with distal bands untraceable, subapical spot single, hind wings whitish and cilia in both wings brown throughout. Also, the wing expanse is much reduced, as compared to that of sp. *rinaria* (*vide* Hampson, 1892; Strand, 1933). The species, of which the male is unknown, appears to be rare at Tripura.

(ii) Group *Inareolatae*

17. *Lymantria* sp.

Material examined.- (IV 5e).

Wing expanse.- 59mm.

Remarks.- The specimen, which fits well in the genus *Lymantria* Hübner, is very much allied to *L. subrosea* (Swinhoe) [= *rosea* Hampson, nom. praecocc.] from India (Assam) and Sri Lanka, but differs from it by the antennal shaft and fore wings not pure white, head, thorax and legs tinged crimson and also by the larger wing expanse (*cf. subrosea* in Hampson, 1892 and Strand, 1933). It is apparently rare at Tripura.

18. *Euproctis* sp.

Material examined.- (I 2g).

Wing expanse.- 49mm.

Remarks.- The specimen, belonging to the genus *Euproctis* Hubner, has close alliance with *E. tonkinensis* Strand from Tonkin, but differs from it by the presence of discal spot on the ventral side of both fore- and hind wings. Strand (1933) stated to have described *tonkinensis* "hesitatingly" by a male which "resembles *E. plana* Wlk., *E. catala* Swh., etc.",

but none of these species, all known from India, has ever been reported to have ventro-discal spots on wings. The present specimen, which is larger in expanse, could not, however, be described new to science due to paucity of material. Apparently, it may be a case of rare geographical variation of *E. tonkinensis* at Tripura.

19. *Perina pura* Walker

1869. *Perina pura* Walker, *char. undecr. Het.*, p. 17.

Material examined.- (III 1b)

Wing expanse.- 43mm.

Distribution.- India : Assam (Cachar) ; Tripura ; West Bengal (Calcutta).

Remarks.- This is one of a couple of very similar species of *Perina* Walker. It differs from *sp. nuda* (Fabricius) of the Indo-Sino-plaeartic areas by head, thorax and abdomen whitish. Hampson (1892) and Strand (1933) mentioned *sp. pura* from "North India", but its occurrence in the Northern Peninsula is doubtful. A new record for Tripura, the moth is known to frequent the fig trees shading the streets of tropical towns.

IX. Family HYPSIIDAE

20. *Asota caricae caricae* (Fabricius)

1794. *Noctua caricae* Fabricius, *Ent. Syst.*, 3 (2) : 27.

1933. *Asota caricae caricae*, Seitz, *Macrolep. World*, 10 : 227, pl. 27, fig. d.

Material examined.- (IV 5h).

Wing expanse.- 55 mm.

Distribution.- South China. Vietnam. India : Himachal Pradesh (Kulu); Sikkim; West Bengal (Darjeeling); Assam (Cachar; Sibsagar); Tripura; Maharashtra (Bombay) ; the Andamans. Burma. Sri Lanka. Sundaland. The Philippines.

Remarks.- The specimen, which is a new record for Tripura, fits in the only known Indian subspecies of *Asota caricae*, though it shows certain variations, viz., antennal cilia long-bristled, fore wings with M_1 from below upper angle, hindwings with subterminal row of spots incomplete and abdomen with a prominent dorsal black spot on segment IV. Also, it has a smaller wing expanse than that mentioned by Hampson (1892). The moth appears to be rare at Tripura, though Seitz (1933) stated, "..... imago is extremely common and may be beaten out from the bushes, in which it rests on the underside of leaves". The element was treated by Hampson (*loc. cit.*) under the name of *Hypsa alciphron* (Cramer), with *H. plaginota* Butler as synonym, under Hypsiidae; later, it was transferred to *Asota* Hubner (=

Hypsa Hubner) under Hypsinae of Arctiidae by Seitz (*loc. cit.*), who revalidated *plaginota* to the specific status under that genus. Presently, however, the species in question is retained under the family Hypsiidae. Further, Seitz's (*loc. cit.*) citation as, "*A caricae* Bsd.", "*caricae* Don. nec F., ...", is under the comment reserved by the authors.

X. Family ARCTIIDAE

(A) Subfamily SPILOSOMINAE

21. *Spilarctia casigneta* (Kollar)

1844. *Euprepia casigneta* Kollar, *Hugel's Kaschmir*, 4 (2) : 469.

1913. *Spilarctia casigneta*, Seitz, *Macrolep. World*, 2 : 85, pl. 15, fig. b.

Material examined. - (I 2d), (II 2b).

Wing expanse.- 2 Females 36 – 40, 2 Males 48 – 52 mm.

Distribution.- Eastern Siberia. China. India : Jammu & Kashmir; Himachal Pradesh (Kangra; Dharmasala; Dalhausi; Kasauli); Uttar Pradesh (Dehra Dun; Mussourie); Sikkim; Assam (Sibsagar); Nagaland; Manipur; Tripura; Arunachal Pradesh; West Bengal (Calcutta); Maharashtra (Bombay); Tamil Nadu (Nilgiris). Bhutan. Burma. Korea. Japan.

Remarks.- The specimens, fitting in the species, are new record for Tripura. These show certain variations, viz., antennae in female tipped with long blackish bristles, antemedial speck on 1A of fore wings in male single or absent, Sc+R1 arising from well before the middle of cell of hind wings and abdomen in female with small blunt and buff anal tufts. Also, the wing expanse in both sexes is much reduced as compared to that given by Hampson (1901), who, however, considered the species in the subfamily Arctiinae. Amongst the material examined, which appear to be common at Tripura, none is referable to the aberrations mentioned by Hampson (*loc. cit.*) and Seitz (1913).

(B) Subfamily ARCTIINAE

22. *Cretonotus gangis* (Linnaeus)

1764. *Phalaena gangis* Linnaeus, *Amoen. Acad.*, 6 : 410.

1901. *Cretonotus gangis*, Hampson, *Cat. Lep. Phal. Brit. Mus.*, 3 : 333.

Material examined.- (II 2d).

Wing expanse.- 39 mm.

Distribution.- China. Pakistan. Nepal. India : Assam (Cachar; Sibsagar); Meghalaya (Cherrapunji); Tripura; Arunachal Pradesh; Madhya Pradesh (Mhow); West Bengal (Cal-

cutta); Gujarat (Ahmedabad); Maharashtra (Bombay); Andhra Pradesh (Hyderabad); Tamil Nadu (Nilgiris) ; Kerala (Coromandel). Burma. Sri Lanka. Western Malaysia. Java. Australia.

Remarks.- The specimen, fitting in the species, is a new record for Tripura. It shows certain variations, viz., tegulae not broadly black-striped, fore wings with R2 from cell and not stalked with R3-5 (*cf.* Hampson, 1901), black dot at upper and lower angles of cell absent and hind wings with an additional black marking near outer angle and the dark subterminal spot on M2 very minute. Certain aberrations were mentioned earlier by Hampson (*loc. cit.*) and Rothschild (1933), and one more is presently observed in that the stalk of M3 and Cula of the right hind wing is much longer than that of the left. The moth is known to be common, though it is apparently not so at Tripura. The species, of which the generic name was spelt as "*Cretonotos*" by Strand (1919) and followed by Daniel (1943), was, however, placed in the subfamily Spilosominae by the latter. The material may be referred to one of the two morphs (*ff.*), *sensu* Seitz (1913), as hereunder.

f. gangis (Linnaeus) : This differs from *f. continuatus* Moore by the median stripe of fore wings not connected with the cell.

23. *Cretonotos transiens* (Walker)

1855. *Spilosoma transiens* Walker, *Cat. Lep. Het. Brit. Mus.*, 3 : 675.

1901. *Cretonotos transiens*, Hampson, *Cat. Lep. Phal. Brit. Mus.*, 3 : 334, fig. 150.

Material examined.- (I 1), (I 2f), (IV 3), (IV 4a), (IV 5a).

Wing expanse.- 2 Females 35 - 45, 2 Males 45 - 50 mm.

Distribution.- China. India : Jammu & Kashmir; Himachal Pradesh (Simla; Kulu); Uttar Pradesh (Kumaon); Skkim; Assam (Sibsagar); Tripura ; Arunachal Pradesh; Punjab (Sultanpur) ; West Bengal (Calcutta); Karnataka (Belgaum); Tamil Nadu (Nilgiris). Bhutan. Bangladesh. Burma. Java. Borneo. Sulawesi. The Philippines. Moluccas.

Remarks.- The species, in which the material fit well, is a new record for Tripura and was also treated, like the preceding one, in the subfamily Spilosominae by Daniel (1943). It was considered under the genus *Phissama* Moore by Hampson (1894), Seitz (1913) and also Daniel (*loc. cit.*). It shows sexual dimorphism in which the female differs from the male by the creamy-white fore wings and subhyaline hind wings with three black subterminal dots. Certain additional characters and variations are presently observed, viz., fore wings with 2 spots each in and just beyond the cell in both sexes and one small black tornal spot in a single female, hind wings with Cula and M3 shortly stalked in males and one subterminal black spot above M2 and two in the anal area in females. Also, the wing expanse in both sexes is smaller than that as mentioned by Hampson (1901). Apparently common at Tripura, the moth dwells in bushes, shows diurnal flight and also becomes attracted to light. The specimens may be referred to two morphs (*ff.*), *sensu* Hampson (1894), as hereunder.

(a) *f. transiens* (Walker) : Almost white, to which belong four specimens.

(b) *f. vacillans* (Walker) : Dark fuscous and hind wings with white cilia, to which belong eight specimens.

XI. Family AGARISTIDAE

24. *Episteme adulatrix* (Kollar)

1848. *Eusemia adulatrix* Kollar, *Hugel's Kaschmir*, 4 : 464, pl. 20, fig. 1.

1914. *Episteme adulatrix*, Jordan, *Macrolep. World*, 3 : 6, pl. 1, fig. a.

Material examined.- (III 1d).

Wing expanse.- 74 mm.

Distribution.- China. Vietnam. Nepal. India : Jammu & Kashmir ; Himachal Pradesh (Simla) ; Uttar Pradesh (Mussourie) ; Sikkim ; Assam (Cachar ; Sibsagar) ; Meghalaya (Cherrapunji) ; Nagaland ; Tripura ; Madhya Pradesh (Mhow) ; Maharashtra (Ratnagiri ; Bombay ; Pune) ; Bihar ; Karnataka (Belgaum ; Kanara) ; Kerala (Calicut) ; Tamil Nadu (Nilgiris) . Bhutan. Burma. Sri Lanka.

Remarks.- This is the only Indian species of the genus *Episteme* Hübner, in which the specimen fits well. A new record for Tripura, this diurnal element has the wing expanse smaller than that cited by Hampson (1894). Jordan (1914) mentioned the species as "common in north India, rarer in Kashmir and West China" The specimen may be referred to one of the four forms, "occurring irrespective of locality", *sensu* Hampson (*loc. cit.*).

f. afflicta (Butler) : It differs from *sectinotis* (Butler), *contracta* (Butler) and *simplex* (Butler) by the postdiscal spots of fore wings reduced in size.

XII. Family NOCTUIDAE

(A) Subfamily HADENINAE

25. *Pseudaletia separata* (Walker)

1865. *Leucania separata* Walker, *Cat. Lep. Het. Brit. Mus.*, 32 : 626.

1965. *Pseudaletia separata*, Ramani & Rao, *Indian J. Ent.*, 27 (3) : 363.

Material examined.- (IV 3).

Wing expanse.- 40 mm.

Distribution.- Europe. U. S. S. R. The Ethiopian region. China. Pakistan. India : Jammu & Kashmir ; Himachal Pradesh (Simla ; Kasauli ; Kulu ; Solan ; Dharmasala ; Narkunda) ; Sikkim ; West Bengal (Darjeeling ; Calcutta) ; Assam (Sibsagar) ; Meghalaya (Shillong ; Khasis) ; Manipur ; Tripura ; Punjab (Sultanpur ; Murree ; Cambellpur) ; Madhya Pradesh

(Mhow; Jabbalpur); Maharashtra (Bombay; Pune); Tamil Nadu (Nilgiris). Java. Australia. Papua. Neotropical and Nearctic regions. Korea. Japan.

Remarks.- The species was earlier considered as synonym of *Cirphis unipuncta* (Haworth) by Hampson (1905) and later of *Sideridis unipuncta* (Haworth) by Warren (1914). The moth, a new record of Tripura, fits well in the species. It may be referred to one of a couple of aberrations, *sensu* Hampson (*loc. cit.*), as hereunder.

ab. punctulata (Blanchard): This differs from **ab. saccharivora** (Bulter) by body grey-brown and fore wings with striae and stigmata quite distinct.

26. *Cirphis yu* (Guenee)

1852. *Leucania yu* Guenee, *Hist. nat. Ins. Lep. Noct.*, 1 : 78.

1905. *Cirphis yu*, Hampson, *Cat. Lep. Phal. Brit. Mus.*, 5 : 550.

Material examined.- (II 1b).

Wing expanse.- 35 mm.

Distribution.- India : Sikkim ; Tripura ; Maharashtra (Bombay) ; Karnataka (Kanara); Kerala (Malabar) ; the Andaman & Nicobar Islands. Burma. Sri Lanka. Singapore. Borneo. The Philippines. Loochoo Islands.

Remarks.- The species, in which the specimen fits well, was formerly called *Leucania exempta* Walker. It is a new record for Tripura.

(B) Subfamily ACRONYCTINAE

27. *Prodenia litura* (Fabricius)

1775. *Noctua litura* Fabricius, *Syst. Ent.*, p. 601.

1909. *Prodenia litura*, Hampson, *Cat. Lep. Phal. Brit. Mus.*, 8 : 245.

Material examined.-(IV 5h).

Wing expanse.- 35 mm.

Distribution .- Africa. Western Asia. China. Nepal. India : Himachal Pradesh (Kulu ; Kasauli ; Dharmasala) ; Uttar Pradesh (Allahabad) ; Punjab (Sultanpur) ; Sikkim ; Manipur; Tripura ; Maharashtra (Bombay ; Bandra ; Ratnagiri) ; Karnataka (Kanara); Kerala (Travancore ; Permad) ; Tamil Nadu (Nilgiris ; Coimbatore). Burma. Sri Lanka. Singapore. Borneo. Java. Papua. Australia. The Hawaiian region.

Remarks.- The species, in which the specimen fits well, is a new record for Tripura. It was, however, placed in the subfamily Amphipyridae by Warren (1914).

28. *Laphygma exigua* (Hubner)

1808. *Noctua exigua* Hubner, *Eur. Schmett. Noct.*, p.362.

1909. *Laphygma exigua*, Hampson, *Cat. Lep. Phal. Brit. Mus.*, 8 : 265, fig. 68.

Material examined.- (IV 6).

Wing expanse.- 27 mm.

Distribution.- Europe. Africa. U.S.S.R. Western Asia. China. Vietnam. India : Himachal Pradesh (Simla ; Dharmasala) ; Sikkim ; Manipur ; Tripura ; Punjab (Campbellpur) ; Uttar Pradesh (Allahabad) ; Tamil Nadu (Gooty ; Nilgiris). Burma. Sri Lanka. Australia. Hawaii. Japan.

Remarks.- The species was also placed in the subfamily Amphipyridae by Warren (1914). It is known to be a pest on Lucerne and Cotton. The specimen, a new record for Tripura, fits well in the species and may be referable to one of the two aberrations, *sensu* Hampson (1909).

ab. *pygmaea* (Rambur) : Recognised by the fore wings being almost uniformly pale brown and size very small.

(C) Subfamily CATOCALINAE**29. *Parallelia fulvotaenia* (Guenee)**

1852. *Ophiura fulvotaenia* Guenee, *Hist. nat. Ins. Noct.*, 3 : 272.

1913a. *Parallelia fulvotaenia*, Hampson, *Cat. Lep. Phal. Brit. Mus.*, 12 : 585.

Material examined.- (IV 2d).

Wings expanse.- 64 mm.

Distribution.- Natal. Central and South China. India : Assam (Dibrugarh); Tripura. Bangladesh. Burma. Sri Lanka. Western Malaysia. Sumatra. Borneo. Java. Japan.

Remarks.- The moth , a new record for Tripura, fits well in the species which is widely distributed from the Ethiopian region to the Far East. It has wing expanse much smaller than that mentioned by Hampson (1913 a). Warren (1914), who treated the species in the genus *Ophiura* Ochsenheimer, however, noted, “ two or three appreciably different forms “ including two of his subspecies from the Austro-Malayan belts, but none of these holds good for the present material.

30. *Chalciope hyppasia* (Cramer)

1779. *Noctua hyppasia* Cramer, *Pap. Exot.*, 3 : 99, pl. 250, fig.E.

1913 b. *Chalciope hyppasia*, Hampson, *Cat. Lep. Phal. Brit. Mus.*, 13 : 27.

Material examined.- (I 2e).

Wing expanse .- 42-43 mm.

Distribution .- The Ethiopian and Malagassic regions. Western Asia. China. Pakistan. India : Himachal Pradesh (Kulu; Kangra); Uttar Pradesh (Mussourie; Allahabad; Kanpur); Punjab (Sultanpur); Assam; Meghalaya (Shillong); Manipur; Tripura; West Bengal (Calcutta); Maharashtra (Bombay; Pune; Ratangiri); Tamil Nadu (Nilgiris; Coimbatore); the Andaman & Nicobar Islands (Camorta; Nancowry). Burma. Sri Lanka. Sundaland. The Philippines. The Australo-papuan regions.

Remarks.- The moth , a new record for Tripura, fits well in the species formerly known under the genus *Trigonodes* Guenée. Reportedly, it shows sexual dimorphism in which the hind wings of female is much browner than in male. The specimen under study may be referable to one of the three aberrations, *sensu* Hampson (1913 b).

ab. *inacuta* (Guenee) : Recognised by the fore wings with the postdiscal triangular patch shorter.

31. *Mocis undata* (Fabricious)

1775. *Noctua undata* Fabricious, *Syst. Ent.*, p. 600.

1913b. *Mocis undata*, Hampson, *Cat. Lep. Phal. Brit. Mus.*, 13 : 91, fig.25.

Material examined.- (I 2a).

Wing expanse.- 40 mm.

Distribution.- The Ethiopio-Malagassic regions. China. India : Himachal Pradesh (Dharmasala) ; Assam (Dibrugarh) ; Meghalaya (Shillong) ; Manipur ; Tripura ; Uttar Pradesh (Allahabad) ; Punjab; Madhya Pradesh (Jabalpur); Bihar (Darbhanga); West Bengal (Calcutta); Maharashtra(Bombay; Ratnagiri; Thane;Wangni); Kerala (Travancore); Tamil Nadu (Nilgiris); the Andaman and Nicobar Islands (Nancowry). Bangladesh. Burma. Sri Lanka. Western Malaysia Sumatra. Java. The Philippines. Korea . Japan.

Remarks.- The moth, which fits well in the species, is a new record for Tripura. The species was formerly known as *archesia* (Stoll in Cramer) under the genus *Remigia* Guenee, Which was , on one hand, synonymised with *Mocis* Hübner by Hampson (1913 b) and segregated, on the other , as a valid genus by Warren (1914). Warren (*loc. cit.*), however, placed the species in question under *Cauninda* Moore. *M. undata* is known to exhibit sexual dimorphism in which the female has hind wings ventrally deep yellow. The specimen under study is closely allied to one of the five forms, i.e., *gregalis* (Guenee) from Taiwan and Java, being dull grey and without black spot in the area of dorsum, but it differs by the prominent distal markings of fore wings.

32. *Pericyma umbrina* (Guenee)

1852. *Alamis umbrina* Guenee, *Hist. nat. Ins. Noct.*, 3:4.

1913 b. *Pericyma umbrina*, Hampson, *Cat. Lep. Phal. Brit. Mus.*, 13 : 301, fig. 75.

Material examined.- (IV 2a).

Wing expanse.- 35 mm.

Distribution.- India : Jammu & Kashmir (kashmir) ; Himachal Pradesh (Kulu; Dharmasala; Simla); Uttar Pradesh (Dehra Dun; Almorah ; Mughal Sarai); Sikkim; Assam; Manipur; Tripura; Punjab (Sultanpur ; Cambellpur) ; Madhya Pradesh (Jabbalpur; Mhow); Maharashtra (Bombay). Bangladesh.

Remarks.- The moth , new for Tripura, fits well in the species. The species, earlier known under the genus *Homoptera* Boisduval, was subsequently treated under *Alamis* Guenée by Warren (1914) , though he (*loc cit.*) maintained the status of *Pericyma* Herring- Schaffer but for other species. Presently , the species is retained after the system of Hampson (1913 b) . It also exhibits sexual dimorphism , in which the female has both wings ventrally with indistinct waved brown lines beyond cell. The specimen may be referred to one of the four aberrations, *sensu* Hampson (*loc. cit.*) and Warren (*loc cit.*). *ab. perfusa* (Warren): Recognised by both wings being dark brown almost throughout

33. *Fodina oriolus* Guenée

1852. *Fodina oriolus* Guenée , *Hist. nat. Ins. Lep . Noct.*, 3 : 274.

Material examined.- (IV 5b).

Wing expanse .- 38 mm.

Distribution .- India : Sikkim ; Tripura. Bhutan Bangladesh

Remarks .- A new record for Tripura , the moth fits well in the species . It is very much allied to *F. pallula* Guenée from the North-Western Himalayas , Assam, Calcutta and also Sri Lanka, but can be distinguished from it by the hind wings without fuscous black at base. Besides, the specimen is quite smaller in wing expanse than that mentioned by Hampson (1894) . Also, the moth seems to be a good mimic of *Zalissa transiens* (Walker) that belongs to the family Agaristidae

(D) Subfamily NOCTUINAE

34. *Hypocala moorei* Butler

1892. *Hypocala moorei* Butler, *Ann. Mag. nat. Hist.*, (6) 10 : 21.

Material examined.- (I 4).

Wing expanse .- 44 mm.

Distribution .- Western Africa. India : North-Western Himalayas ; Sikkim; Tripura ; Karnataka (Kanara) Sri Lanka.

Remarks .- The species, in which the specimen fits well, is a new record for Tripura. It is very much allied to the generic type-species, *H. deflorata* (Fabricius) from Africa and also India, but differs from it by the hind wings with terminal band inwardly even and a small linear orange spot, the subterminal one being absent. Hampson (1894), however, mentioned, “ W. Africa “ as one of the habitats of the species and not “Western China”, which was only indicated by Warren (1914) Warren (*loc. cit.*) did not mention any Indian or African locality for the species concerned.

35. *Ophideres hypermnestra* (Cramer)

1780. *Phalaena* (*Noctua*) *hypermnestra* Cramer, *Pap. Exot.* , 4 : pl. 323, figs. A, B.

1894. *Ophideres hypermnestra*, Hampson, *Fauna Brit. India*, Moths, 2 : 562.

Material examined.- (IV 1b).

Wing expanse .- 86 mm.

Distribution .- India : Sikkim; Meghalaya (Khasi Hills); Tripura; Maharashtra (Pune); Karnataka (Kanara; Belgaum); Kerala (Malabar); Tamil Nadu (Nilgiri Hills); the Andaman & Nicobar Islands (Andamans). Burma. Bangladesh. Sri Lanka.

Remarks.- The species, in which the moth fits well, is a new record for Tripura. It shows sexual dimorphism in which the female is provided with large and small white rufous-striated patches and spots on fore wings below and beyond cell, at outer angle and below apex. This, along with the preceding one and the following two species, has been placed in the subfamily Noctuinae by Warren (1914).

36. *Adris tyrannus* (Guenée)

1852. *Ophideres tyrannus* Guenee, *Hist. nat. Ins. Noct.*, 3 : 110.

1914. *Adris tyrannus*, Warren, *Macrolep. World*, 3 : 362, pl. 66c.

Material examined.- (I V 2d).

Wing expanse .- 101 mm.

Distribution .- China. India : Himachal Pradesh (Simla; Kulu); Sikkim; Meghalaya

(Khasi Hills); Tripura; West Bengal (Calcutta); Maharashtra (Bombay). Malaya. Java. Japan.

Remarks.- A new record for Tripura, the species is already known to exhibit varying patterns of colouration particularly in fore wings, as mentioned by Warren (1914) from its different habitats. The specimen under study matches well with description of the taxon from India by both Hampson (1894) and Warren (*loc. cit.*), though it is fairly shorter in wing expanse than that hitherto known.

37. *Raparna* sp.

Material examined.- (IV 5h).

Wing expanse.- 25 mm.

Remarks.- This indetermined species, found for the first time at Tripura, is very much allied to the widely distributed member, *R. imparata* (Walker) from West Africa, South Yemen, Pakistan, India (including Punjab, Tamil Nadu, West Bengal, Assam and Manipur), Sri Lanka and also Japan. But the specimen examined differs from it by the absence of dark costal and terminal series of black specks of fore wings and of cell-spot of hind wings. The genus, in which the moth fits well, was earlier placed in the subfamily Focillinae by Hampson (1895) and later transferred to Noctuinae by Warren (1914).

XIII. Family URANIIDAE

Subfamily MICRONIINAE

38. *Micronia aculeata* Guenée

1857. *Micronia aculeata* Guenée, *Hist. nat. Ins. Lep. Phal.*, 2 : 26, pl. 13, fig. 8.

Material examined.- (IV 5d).

Wing expanse.- 43 mm.

Distribution.- South China. India : Himachal Pradesh (Kulu); Sikkim; Assam (Cachar; Sibsagar); Tripura; Uttar Pradesh (Mirzapore); West Bengal (Calcutta); Maharashtra (Pune); Tamil Nadu (Nilgiri Hills); the Andaman & Nicobar Islands (Andamans). Bhutan. Burma. Sri Lanka. The Sundaland. The Philippines.

Remarks.- Typical of the Indian forest districts, the species, in which the moth fits well, is a new record for Tripura. It was reported by Seitz (1913) as "very common" in most of its habitats. The moth is known to repose on the underside of leaves, with the wings spread

out like the Geometers. Seitz (*loc. cit.*) stated that the Indian examples have the wings longer and more pointed than the Chinese ones, which Gaede (1933) observed these as only a little less yellowish than *f.sondaicata* Guenée from Sundaland.

XIV. Family GEOMETRIDAE

(A) Subfamily GEOMETRINAE

39. *Zamarada translucida* Moore

1887. *Zamarada translucida* Moore, *Lep. Ceyl.*, 3 : 432, pl. 197, fig. 2.

Material examined.- (II 2a).

Wing expanse.- 35 mm.

Distribution.- India : Meghalaya (Khasis) ; Nagaland; Tripura; Orissa (Ganjam); Tamil Nadu (Nilgiris). Sri Lanka. Western Malaysia. Borneo.

Remarks.- The Specimen, not previously recorded from Tripura, agrees well with the known description of the species. The species, like the following one, is presently placed under the subfamily Geometrinae with which Boarmiinae has been synonymised by Prout (1912) Later, Fletcher (1974) has contributed an exhaustive revision of the concerned genus from the Old World.

40. *Hyposidra talaca* (Walker)

1860. *Lagyra talaca* Walker, *Cat. Lep. Het. Brit. Mus.*, 20 : 59.

1895 . *Hyposidra talaca*, Hampson, *Fauna Brit. India*, Moths, 3 : 213, fig. 117.

Material examined.- (III 1a).

Wing expanse.- 45 mm.

Distribution.- India : Sikkim; Assam (Cachar; Sibsagar); Meghalaya (Khasis); Tripura; Maharashtra (Pune); Karnataka (Kanara); the Andaman & Nicobar Islands (Andamans). Bhutan. Burma. Sri Lanka. Java. Borneo. Sulawesi. The Philippines.

Remarks.- This is one of the eight species, of which all but *H. albifera* (Moore) are known from the Eastern Himalayas, sp. *albifera* occurring in the Western Himalayas. The specimen, new for Tripura, fits well in the species. The moth was mentioned by Hampson

(1895) to occur “ throughout India “ It differs from the South Indian members, belonging to the morph, f. *rigusaria* (Walker), by being not much red in tinge.

(B) Subfamily ORTHOSTIXINAE

41. *Eumelia rosalia* (Cramer)

1782. *Phalaena* (*Geometra*) *rosalia* Cramer, *Pap. Exot.*, 4 : 152, pl. 368, fig. f.

1895 *Eumelia rosalia*, Hampson, *Fauna. Brit. India*, Moths, 3 : 320, fig. 155.

Material examined.- (II 1a).

Wing expanse.- 56 mm.

Distribution.- China. Bhutan. India : Sikkim; Assam (Sibsagar); Tripura; Tamil Nadu (Coromandel; Nilgiris); the Andaman and Nicobar Islands (Andaman, Nicobar and Great Nicobar). Bangladesh. Burma. Sri Lanka. Java. The Philippines. The Australian region.

Remarks.- The specimen, which fits well in the species, was hitherto unknown from Tripura, though Hampson (1895) cited the distribution of the species as “ throughout India “ but without giving the particular localities of the country. He (*loc.cit.*) considered the species in the subfamily Orthostixinae which is equivalent to Oenochrominae, as mentioned by Prout (1912) for the Palaearctic members. The material may be referred to one of the three morphs from India, as hereunder.

f. *ludovicata* Guenée : Recognised by the fore wings being much more orange and with diffused bands.

XV. Family PYRALIDAE

(A) Subfamily SCHOENOBIINAE

42. *Tryporyza incertulas* (Walker)

1863. *Catagela incertulas* Walker, *Cat. Lep. Het. Brit. Mus.*, 27 : 143.

1960. *Tryporyza incertulas*, Common, *Auster. J. Zool.*, 8 (2).

Material examined.- (IV2a).

Wing expanse.- 30 mm.

Distribution.- India ; Tripura; Nagaland; West Bengal (Calcutta); Maharashtra (Pune). Burma. Sri lanka. Java. Borneo.

Remarks.- The specimen, which fits well in the species, is a new record for Tripura. The

moth, earlier mentioned as *Schoenobious incertellus* by Hampson (1896), has been considered by common (1960) as *incertulas* under the genus *Tryporyza* Common. It is known to exhibit sexual dimorphism in which the female differs from male by the fore wings fuscous brown, hind wings pale fuscous and also by the larger wing expanse.

(B) Subfamily PYRAUSTINAE

43. *Pycnarmon cribrata* (Fabricius)

1794. *Phalaena cribrata* Fabricius, *Ent. Syst.*, 3 (2) : 215.

1939 a. *Pycnarmon cribrata*, Klima, *Lep. Cat.*, 89 : 20.

Material examined.- (IV 2a).

Wing expanse.- 21 mm.

Distribution.- The Ethiopian region. China. Vietnam. India : Tripura; Maharashtra (Bombay; Khandala); Tamil Nadu (Nilgiri Hills). Burma. Sri Lanka. The Sundaland. The Lesser Sunda Islands. The Australo-Papuan regions. The Hawaiian region. Korea. Japan.

Remarks.- The species, in which the specimen fits well, is a new record for Tripura and possibly also for the entire North-Eastern Himalayas, though Hampson (1896) referred to its distribution as "throughout India", but without mentioning any specific locality. Cotes & Swinhoe (1889), as cross-referred to by Hampson (*loc.cit.*), also did not mention any locality of the species from the North-Eastern Himalayas. The species was earlier treated as *Pycnarmon caberalis* (Guenée) by Hampson (*loc.cit.*), then as *Entephria cribrata* (Fabricius) also by Hampson (1898) and later transferred to the genus *Pycnarmon* lederer by Klima (1939 a). The material differs from both the morphs, viz., f.*caberalis* (Guenée) and f.*abdicalis* (Walker), *sensu* Hampson (1896), by the fore wings with the two conjoined apical black spots defined by a distinct terminal black line which tapers towards tornus and is interrupted by the subterminal black spots.

44. *Diaphania laticostalis* (Guenée)

1854. *Margarodes laticostalis* Guenée, *Hist. nat. Ins. Lep. Delt. & Pyral.*, p. 303.

1963. *Diaphania laticostalis*, Mathur & Singh, *Indian Forest Rec. Ent.*, (NS) 10 (6).

Material examined.- (IV 2c).

Wing expanse.- 38-40 mm.

Distribution.- Pakistan. India: sikkim; Assam (Sib-sagar; Dansiri); Tripura; the Andaman & Nicobar Islands (Andamans). Bhutan. Bangladesh. Burma. Sri Lanka. The Malayan subregion and the Australian region.

Remarks.-The species, in which the specimen fits well, is a new a record for Tripura. This, along with the following couple of species, was earlier treated under the Genus *Glyphodes* guenee by Hampson (1896, 1898), but later considered under *Diaphania* Hübner by Klima (1939 b) and also Mathur & Singh (1963).

45. *Diaphania unionalis* Hübner

1824. *Diaphania unionalis* Hübner, *Samml. eur. Schmett. pyr.*, fig. 132.

Material examined.- (IV 1a).

Wing expanse.- 36 mm.

Distribution.- South Europe. The Ethiopian region. Malagasy. " Throughout India " including Tripura. Sri Lanka. Australia.

Remarks.- The specimen fits well in the species which is recorded new for Tripura, though Hampson (1896) referred to its habitat as "throughout india" and elsewhere, as cited above. Hampson (*loc. cit.*) mentioned only a single form, i.e., *f. quinquepunctalis* (Boisduval), from which the present example differs by the brown specks of fore wings being present in traces.

46. *Diaphania indica* (Saunders)

1851. *Eudiotpes indica* saunders, *Trans ent. Soc. Lond.*, (2) 1 : 163, pl. 12, figs. 5-7.

1963. *Diaphania indica*, Mathur & Singh, *Indian Forest Rec.Ent.*, (NS) 10 (6).

Material examined.- (IV 4a).

Wing expanse.- 26 mm.

Distribution. The Ethiopian region. China. Pakistan. India : Uttar Pradesh (Dehra Dun); Sikkim; Tripura; Haryana (Ambala) : Madhya Pradesh (Mhow) ; Maharashtra (Bombay; Pune) ; West Bengal (Calcutta) ; Bihar (Pusa ; Ranchi) ; Tamil Nadu (Nilgiri Hills) ; Andaman & Nicobar Islands (Great Nicobar). Burma. Sri Lanka. Java. Sulawesi. Australia.

Remarks.- This widely distributed species, which was already reported for the first time from the Great Nicobar Island by Mondal & Bhattacharya (1980), constitutes new locality record for Tripura, too. The specimen fits well in the species, the larvae of which are known to feed on the Cucurbitaceous and Corchorous species.

47. *Psara phaeopteralis* (Guenée)

1854. *Botys phaeopteralis* Guenée, *Hist. nat. Ins. Lep. Delt. & Pyral.*, p. 349.

1939b. *Psara phaeopteralis*, Klima, *Lep. Cat.*, 94.

Material examined .- (IV 2a).

Wing expanse.- 24 mm.

Distribution.- The Ethiopian region. Southern Yemen. Pakistan. India : Himachal Pradesh (Solan); Uttar Pradesh (DehraDun; Mirzapur); Sikkim; Tripura; Madhya Pradesh (Mhow); Maharashtra (Mahabaleshwar; Bombay; Pune); West Bengal (Calcutta); Bihar (Pusa); Tamil Nadu (Nilgiri Hills); the Andaman & Nicobar Islands (Andamans). Burma. Sri Lanka. Java. The Australian region. The Neotropical region.

Remarks.- A new record for Tripura, the specimen fits well in the species, of which one male "at light" was also reported from the South Andamans by Mandal & Bhattacharya (1980). The Species is known as a serious pest of *Anisomeles ovata*. It was earlier considered under the genus *Pachyzancla* Meyrick by Hampson (1896, 1899).

SUMMARY

The paper deals with the systematic account of 47 species distributed over 43 genera and 15 families of moths— all recorded new for the state of Tripura in North-East India. Local and geographical variations for certain species are also annotated, wherever possible. Besides, the account is preceded by the general highlights on physiography and climate amidst the abiotic factors on one hand and flora and fauna, particularly the moths, amongst the biotic components of the state, on the other. Over and above, an overall review of macroclimatic biotic zonations with specific mention of their collecting stations in the state visited by different parties from Zoological Survey of India mainly during the winter and pre— winter seasons between 1969 and 1978 and also that of global distribution of the fauna are made, being accompanied by their respective tables. While the scope of the present work is briefly introduced at the beginning, references mostly consulted in relation to the concerned problem are cited at the end of the paper.

ACKNOWLEDGEMENTS

The authors are grateful to the Director, Zoological Survey of India, for kindly providing the laboratory facilities. They are also thankful to Dr. B. Dutta, Superintending Zoologist , Entomology Division, of the same Institute, for numerous courtesies.

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TABLE I. COLLECTING DATA OF MATERIAL FROM THE STATE OF TRIPURA

District	Biotic zones	Collecting stations	Date of collection	Ordinal no. of species††	Cardinal No. of exs.		Parties leg.
					Male	Female	
I	II	III	IV	V	VI	VII	VIII
NORTH	KAILASHAHAR VALLEY	Kanchanpur	17. ii. 1971 (I I)	23	2*		V. C. Agrawal
		Kumarghat	26. xi. 1972 (I 2a)	31		1*	"
		"	22. xii. 1972 (I 2b)	13		1	"
		"	25, 27, 29. xii. 1972 (I 2c)	7	9	2	"
		"	26, 27. xii. 1972 (I 2d)	21	2*		"
		"	27, 29. xii. 1972 (I 2e)	4	5		"
		" : Near Forest R. Office	" "	30	4*		"
		"	29. xii. 1972 (I 2f)	23	5		"
		"	30. xii. 1972 (I 2g)	18	1*		"
		Manu : Jarulcherra	26. xi. 1972 (I 3)	6	1		M. S. Shihsodia
		" "	" "	8		1	"
		Kailashahar : In & arround F. R. H.	28. v. 1978 (I 4)	34		1*	J. K. Jonathon
	KAMALPUR VALLEY	Ganganagar	12. xii. 1972 (II 1a)	41		1	V. C. Agrawal
		"	14. xii. 1972 (II 1b)	26		1	"
		Ambassa	1. i. 1973 (II 2a)	39		1	"
		"	2, 3. i. 1973 (II 2b)	21	1*	8	"
		"	3. i. 1973 (II 2c)	2	1		"
		"	16. xi. 1974 (II 2d)	22	1		M. S. Shihsodia
		" : Garo Basti (c 200-250 m)	21. xi. 1974 (II 2e)	6	1		"
		" : 1 km. eastward	26. x. 1977 (II 2f)	9	1		N. Muraleedharan
		"	24. v. 1978 (II 2g)	9	2	1	J. K. Jonathon

TABLE I (contd.)

I	II	III	IV	V	VI	VII	VIII
SADAR CENTRAL	AGARTALA PLAIN	Agartala : Perathea	3. xi. 1969 (III 1a)	40	1		V. C. Agrawal
		" : Chandmari	10. xi. 1969 (III 1b)	19		1	"
		" : Peratina	30. xi. 1969 (III 1c)	12	1		"
		" : Bishalgarh	20. xi. 1979 (III 1d)	24	1		"
SOUTH	KAILASHAHAR VALLEY	Charilam	15. xi. 1969 (IV 1a)	45	1		"
		"	21. xi. 1969 (IV 1b)	35		1	"
		Udaipur : Banpath	17. xi. 1969 (IV 2a)	32		1	"
		" : "	" "	42		1	"
		" : "	" "	43	1		"
		" : "	" "	47		1	"
		" : Garjee	24. xi. 1969 (IV 2b)	15		1	"
		" : "	25. xi. 1969 (IV 2c)	44	3		"
		" : "	1. xii. 1969 (IV 2d)	36		1	"
		" : "	" "	29		1	"
	KAMALPUR VALLEY	" : "	7. xi. 1974 (IV 2e)	6	1		M. S. Shihsodia
		" : "	8. xi. 1974 (IV 2f)	5	2		"
		" : "	14. v. 1978 (IV 2g)	9	1*		J. K. Jonathon
		" : "	" "	10	1		"
		Abhoya : Barpathari	4. xii. 1969 (IV 3)	23	1		V. C. Agrawal
		" : "	" "	25		1*	"
		Ampi : In & around F. R. H.	17. i. 1971 (IV 4a)	23		3*	"
		" : "	" "	46	1*		"
		" : Khowaipur	9. xii. 1972 (IV 4b)	16			

TABLE I (contd.)

I	II	III	IV	V	VI	VII	VIII
SOUTH	KHOWAL VALLEY	Teliamura :	29. i. 1971 (IV 5a)	23	1		V. C. Agrawal
		" : Kunjlina	14. x. 1974 (IV 5b)	33		1	M. S. Shihsodia
		" : Bramochara	10. x. 1974 (IV 5c)	9	1		"
		" : "	" "	11			"
		" : Gomar Tilla	14. x. 1977 (IV 5d)	38	1		N. Muraleedharan
		" : "	19. x. 1977 (IV 5e)	3	1		"
		" : "	" "	17	1		"
		" : Kali Tilla	20. x. 1977 (IV 5f)	9	1		"
		" : Sripur Village	26. x. 1977 (IV 5g)	14		1	"
		" : in & around F. R. H.	20. v. 1978 (IV 5h)	1		1*	J. K. Jonathon
SOUTH	KAMALPUR VALLEY	" : "	" "	20	1*		"
		" : "	" "	27	1*		"
		" : "	" "	37		1*	"
		" : "	" "	10	1		"
		Belonia : In & around F. R. H.	27. ix. 1977 (IV 6)	28	1*		N. Muraleedharan

N. B. : †, Cross-referred to the 'Material examined' of the relevant species under 'SYSTEMATIC ACCOUNT' ;
 ††, Corresponding to the serial number of species as in the text; *, specimens collected "at light"

TABLE II. GLOBAL DISTRIBUTION OF THE MOTHS RECORDED NEW FOR THE STATE OF TRIPURA

Sl. no. of species as per Systematic Account	P A L A E A R C T I C	E T H I O I A N	M A L A G A S S I C	O R I E N T A L												P A P U A N	A U S T R A L I A N	H A W A I I A N	N E O T R O P I C A L	N E A R C T I C	Remarks, if any
				C H I N E S E	I N D I A N										M A L A Y A N						
					Himalayan			Peninsular				Insular									
					N. W E S T E R N	C E N T R A L	N. E A S T E R N	W E S T E R N	N O R T H E R N	E A S T E R N	S O U T H E R N	S. W E S T E R N	S O U T H E R N	S. E A S T E R N							
					VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV							
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	IX	XX	XXI	XXII
1						+	+			+	+		+		+						
2				+			+			+					+						
3							+				+		+		+						
4							+														
5				+			+				+										
6	+				+	+	+	+	+	+	+		+								
7							+														
8				+	+		+			+	+		+								
9					+	+	+			+	+		+								
10	+					+	+				+										
11					+		+	+	+		+			+							
12					+		+	+	+	+	+		+	+							

TABLE II (contd.)

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	IX	XX	XXI	XXII
13							+														Sp. indet.
14							+			+	+										
15							+								+						
16							+														
17							+														"
18							+														"
19							+			+											"
20				+	+		+	+			+		+	+	+						
21	+			+	+		+	+		+	+										
22				+	+	+	+	+	+	+	+		+		+		+				
23				+	+		+		+	+	+				+		+				
24				+	+	+	+	+	+	+	+		+								
25	+	+		+	+		+	+	+	+	+				+	+	+		+	+	
26	+						+	+			+		+	+	+						
27	+	+		+	+	+	+	+	+		+		+		+	+	+	+			
28	+	+		+	+		+		+		+		+		+	+	+	+			
29	+	+		+			+			+	+		+		+						
30	+	+	+	+	+		+	+	+	+	+		+	+	+	+	+				
31	+	+	+	+	+		+	+	+	+	+		+	+	+						
32							+	+	+	+											
33							+			+											
34		+		+	+		+	+			+		+	+							
35							+	+		+	+		+								
36	+			+	+		+	+		+				+	+						
37							+														"
38				+	+		+	+		+	+		+	+	+						
39							+		+	+	+		+	+	+						
40							+	+			+		+	+	+						
41				+			+			+	+		+	+	+						
42							+	+		+	+		+		+						
43	+			+			+	+			+		+		+	+	+	+			
44					+		+			+			+	+	+		+				
45	+	+	+		+		+	+	+	+	+		+	+	+		+				
46		+	+	+	+		+	+	+	+	+		+	+	+		+				
47	+	+			+		+	+	+	+	+		+	+	+		+		+		

**HYDROLOGICAL PARAMETERS AND A REPORT ON
PLANKTONIC AND BENTHIC FAUNA OF SAGAR ISLAND,
SUNDARBANS, WEST BENGAL**

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INTRODUCTION

Studies on hydrobiological features of Hooghly -Matla estuarine system is limited to a few reports. Works of Bose (1956), Dutta *et al.* (1954), Roy (1955), Shetty *et al.* (1961) and Gopalakrishnan (1971) provided some information for the upper stretch of the system. Recently, some hydrobiological findings were made by Bhunia and Choudhury (1981a, 1981b, 1982a, 1982b), Choudhury *et al.* (1980) from Sagar Island at the confluence of river Hooghly with Bay of Bengal. The present observation is on the changes in the hydrological parameters like, temperature, salinity, dissolved oxygen and pH of the waters around Sagar Island during November 1975 to June 1978. In addition, a qualitative survey of the zooplankton and benthic macrofauna was also undertaken in the creeks and the mudflats of the island.

Sagar Island, the largest block in the western sector of the Gangetic Sundarbans, is situated nearly 100 Km south of Calcutta, in the deltaic West Bengal, between lat. 20.56° to 21.88° N and long. 88.08° to 88.16° E. It is surrounded by large water bodies, river Hooghly in the northwestern side and the river Mooriganga in the eastern side. The southern part of the islands opens into the Bay of Bengal (Fig. 1). Three seasons are recognised in the area. The premonsoon period (March to June) is the dry season with considerably higher temperature. The south-west monsoon season (July to October) is accompanied by heavy rainfall and postmonsoon (November to February) comprises partly the winter season with comparatively lower temperature and less precipitation.

MATERIALS AND METHODS

The hydrological data were collected from two stations (A and B) as shown in Fig. 1. The water samples were taken at fortnightly interval in the forenoon hours from the surface during November 1975 to June 1978. Mean value for each month is presented in Fig. 2.

The temperature was recorded in degree centigrade in the field. The salinity of the sample was estimated by 'Mohr- Knudsen' method. Winkler's method was followed to estimate the dissolved oxygen content of the sample. for pH colour comparator disc was

used in the field. Monthly sampling of zooplankton was done for two years to note the occurrence of the different groups of zooplankton in this brackish water zone. The hand plankton net used for the sampling was made of bolting silk No.10 (mesh : 0.15mm). The qualitative study of benthos was based on monthly observation for a period of one year. Mud sample from a depth of 25cm were taken and the benthos inhabiting the mud were sorted out and preserved in 4% formaldehyde in sea water.

RESULTS AND DISCUSSION

Temperature : The variation in temperature was between 22°C and 32° C. The lowest temperature was recorded in the month of January 1978. During the entire period of study the rise of temperature was noticed higher in the premonsoon months and lower during the post monsoon months. A bimodal temperature oscillation in every year was a distinct feature. Two maxima, one in the premonsoon season and the other in the monsoon were recorded (Fig. 2). Similar type of observation was reported by Sewell(1929) in the waters of Bay of Bengal and by Annigeri (1968) from Karwar Bay.

Salinity : Every year the salinity gradient increased to a maximum during the premonsoon months paralleling the temperature rise and decreased during the monsoon season due to heavy precipitation and surface drainage. The maximum and minimum salinity recorded were 24.9‰ in May 1976 and 1.3‰ in September 1977 (Fig. 2)

The change in salinity was maximum during March to June which accounts for no rain but with higher evaporation and was minimum during July to October when the South-West monsoon winds was accompanied by heavy rains. The period , from November to February may be considered a fluctuating period because the water is somewhat diluted with the just over monsoonal rain and followed by the winter months with minimum records of temperature and rain . During this period the salinity gradient kept a rising trend and attained maximum concentration in the premonsoon months.

Dissolved Oxygen and pH : The dissolved oxygen did not show any long range of fluctuation during the period of observations. The variation was limited within the range between 2.1ml/ and 3.8ml/l. pH remained almost constant throughout the year with a little fluctuation in the monsoon months (Fig.2).

Zooplankton : The occurrence of different components of zooplankton is discussed under two categories, Holoplankters and Meroplankters.

Holoplankters : Hydromedusae : *Bongainvillia* spp. were more or less common during the late premonsoon collections and very few in postmonsoon months.

Chaetognaths : The fair representation of *Sagitta bedoti* and *S. enflata* were observed during the premonsoon period. The paucity of the population during the South-West monsoon was noticed due to reduced salinity.

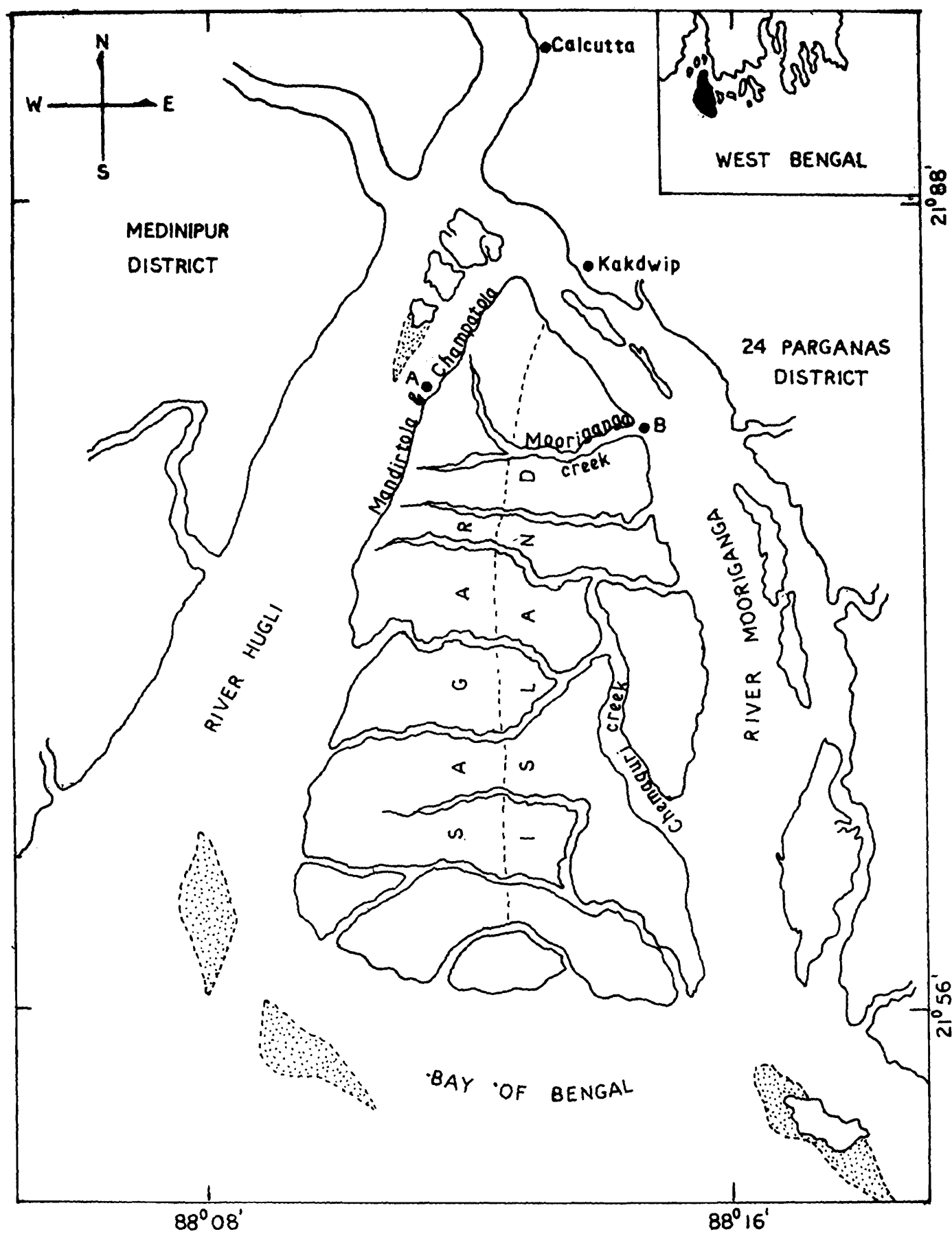


FIG.1 THE STUDY AREA WITH THE STATION POSITIONS (A & B).

Records of the Zoological Survey of India

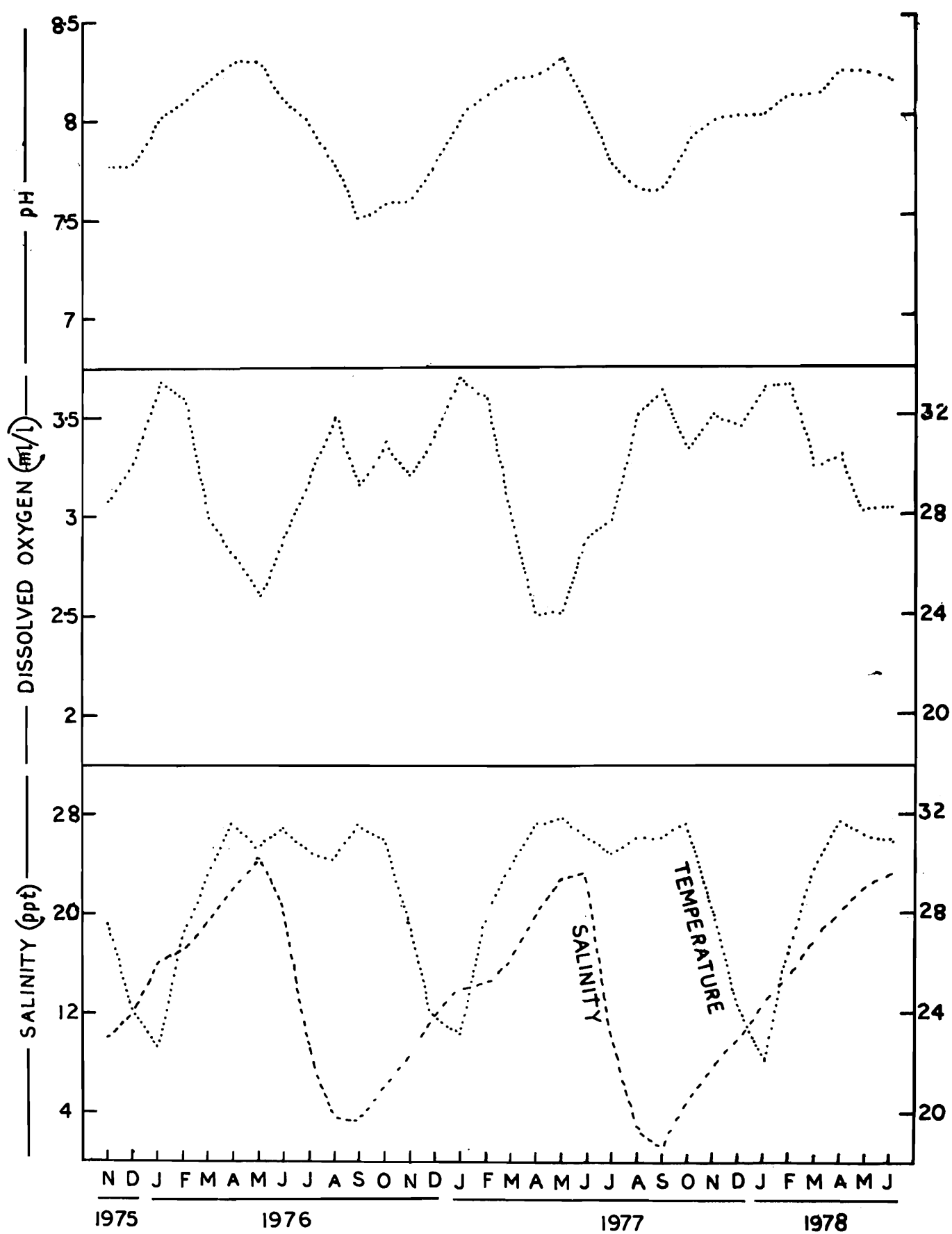


FIG. 2. MONTHLY MEAN VALUES OF DIFFERENT HYDROLOGICAL PARAMETERS DURING NOVEMBER, 1975 TO JUNE, 1978.

Copepods : Copepods constituting the dominant group of zooplankton were noticed in abundance during November to June, when the salinity of the ambient medium was fairly high. During July to October their occurrence of the large portion of the marine component was hindered due to monsoonal rain causing the dilution of the environment.

The following Copepod species were identified :

Calanoid Copepods :

Acartia spinicauda (Giesbrecht); *A. erythraea* (Giesbrecht); *A. centrura* (Giesbrecht); *Acartia* sp.; *Acrocalanus gracilis* (Giesbrecht); *A. similis* (Sewell); *Paracalanus aculeatus* (Giesbrecht); *Labidocera acuta* (Dana); *L. minuta* (Giesbrecht); *L. pavo* (Giesbrecht); *Echaeta marina* (Prestandrea); *Eucalanus monachus* (Prestandrea); *E. elongatus* (Dana); *Pontellopsis herdmanni* (Thompson & Scott); *Pontella* sp.; *Pseudodiaptomus tollingarae*; *P. aurivilli* (Cleve); *P. annandalei* (Sewell); *Centropages* spp.

Cyclopoid Copepods :

Oithona spp.; *Corycaeus* sp.

Harpacticoid Copepods :

Macrosetella gracilis (Dana); *Euterpina* sp.

Cladocerans : *Evadne* sp. was encountered in the premonsoon months and very rarely noticed in the postmonsoon months.

Mysids : This group was observed more or less throughout the year. They were recorded in abundance during pre-and postmonsoon collections.

Amphipods : Very few gammarid amphipods were collected from the creeks during pre-and postmonsoon periods.

Adult decapods : *Lucifer* sp. comprised the group and found more or less in the sample throughout the year.

Meroplankters

Crustacean larvae :

1) The larvae of *Penaeus monodon* and *P. indicus*, *Metapenaeus monoceros*, *M. dobsoni* were collected during November to June.

2) Cirrepede larvae : Larvae of barnacles were recorded throughout the period except in the monsoon months.

3) Zoea and Megalopa : The occurrence of these two groups were common in pre- and postmonsoon collections.

Fish larvae : In the present study, the larvae of the commercially important fishes such as *Liza parsia*, *L. tade*, *M.cephalus*, *Lata calcarifer* were recorded more in the late premonsoon and less during the postmonsoon months. In Cochin backwaters, George (1985), and Menon *et al.* (1972) recorded the maximum fish eggs and larvae during the postmonsoon period. Sialas and Pillai (1975) recorded fish eggs during early premonsoon and postmonsoon period and fish larvae only during postmonsoon months from the same water.

Benthic macrofauna :

The qualitative analyses of benthic macrofauna of the lower littoral zone of Sagar Island were based on monthly collection. Species comprising the faunal community structure in the mudflat were encountered more during January to May and less during June to December.

List of Benthic macrofauna ;

Actinarians :

Pelocoetes exul (Annandale); *Pelocoetes* sp.; *Edwardsia jonesii* (Seshaiya & Cutress) ; *Andwakia* sp.; *Paracondylactis* sp.

Polychaetes :

Dioptera neopolitana (Dellechiaje); *Lepidonotus cristatus* (Grube); *Lumbrinereis notocirrata* (Fauvel); *L. polydesma* (Southern); *Talehsapia annandalei* (Fauvel); *Glycera alba* (Müller); *Nereis* spp.

Decapods ;

Uca dussumieri (Edw.); *U. annulipes* (Latreille); *U. marionis* var *nitidus* (Dana); *U. acutus* (Stripson); *U. triangularis* (de Man); *Carcinus meanus*; *Sesarma* spp.; *Scylla serrata* (Forsk.); *Dotilla brevitarsis* (de Man); *D. blanfordi* (Alcock); *Metaplax intermedia* (de Man); *M. distincta* (de Man); *Macrophthalmus pectinipes* (Gurin); *Alpheus* sp.; *A. crassimanus* (Heller); *Stomatopods* ; *Cloridopsis bengalensis* (Tiwari & Biswas); *C. immaculata* (Kemp).

Isopods :

Cirolana parva (Hansen); *Sphaeroma terebrans*.

Amphipods :

Photis geniculata; *Podocercus* sp.

Bivalves :

Glaucomya sculpta (Sowerby); *Crassostrea cucullata* (Born); *Neosolen aquae-dulcioris* (E.N. Ghosh); *Tanysiphon rivalis* (Benson); *Dosinea excisa* (Schroter); *Macoma birmanica*; *Teredo* spp.; *Modiolus striatulus* (Hanley).

Gastropods :

Nerita articulata (Gould); *N. lireata*; *Cerithidea* (Cerithidiopsis) *cingulata* (Gmelin); *C. obtusa* (Gmelin); *Littorina scabra scabra* (Linnaeus); *L. melanostoma* (Gray); *L. undulata* (Gray); *Natica tigrina* (Roding); *Onchidium tigrinum* (Stoliczka); *Assimineia brevicula* (Pfeiffer); *Neritina violacea* (Gmelin); *Telescopium telescopium*; *Nassarius foveolatus* (Dunker).

Bryozoa :

Electra sp.; *Nemertines* (Species unidentified).

Echiurids :

Anelassorhynchus branchiorhynchus (Annandale & Kemp); *A. dendrorhynchus* (Annandale & Kemp).

Fish :

Gobiopsis macrostomus (Steindachner); *Scartelaos histophorus* (Valenciennes); *Boleophthalmus boddarti* (Pallas); *B. viridis*; *Pisodonophis boro* (Ham.); *Anguilla bengalensis* (Gray & Hardwick); *Muraena* sp.

SUMMARY

The hydrological parameters, temperature, salinity, dissolved oxygen and pH in particular were studied in the water around Sagar Island during the period November 1975 to June 1978. In this estuarine habitat salinity showed pronounced fluctuation (1.3 - 24.9 %) as compared to temperature (22° to 32° C). The qualitative distribution of fauna was closely related to seasonal variation in salinity. The dissolved oxygen of the area varied from 2.1 ml/l to 3.8 ml/l and the range of pH read between 7.3 and 8.3.

The estuarine plankton was composed of a mixture of endemic species and a large portion of marine components which penetrates into the region during high saline premon-

soon period. Most common copepod species generally encountered were *Acartia* spp., *Labidocera* spp., *Eucalanus* sp., *Pseudodiaptomus* spp., and *Oithona* sp. Chaetognaths were represented by *Sagitta enflata* and *Sagitta bedoti*. The occurrence of groups like Cladocerans (*Evadne* sp.), *Lucifer* and Mysids were often recorded during the premonsoon months. A substantial representation of meroplankters were also recorded during pre- and postmonsoon seasons. The most common groups of Macrofauna represented were actiniarians, echiurids, decapods, polychaetes, bivalves, gastropods, nemertines and goboid fishes.

ACKNOWLEDGEMENT

The authors are greatly indebted to the Susama Devichoudhurani Marine Biological Research Institute, Sagar Island for the laboratory facilities. A. B. Bhunia is thankful to U. G. C. for the fellowship. Efforts made by the experts of Zoological Survey of India, Calcutta in identifying most of the benthic forms are appreciated and acknowledged.

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ON AN ACCOUNT OF INDIAN SPECIES OF GENUS *BAETIS*
LEACH (BAETIDAE : EPHEMEROPTERA) WITH KEY TO
THEIR IDENTIFICATION

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INTRODUCTION

The genus *Baetis* (Leach, 1815) is represented , within our limits , by 18 species. This well established, widely distributed genus belongs to Baetidae which is represented in India by 35 species under 6 genera. *Baetis* is widely distributed among all the Zoo -Geographical regions inhabiting lotic aquatic ecosystem at higher elevations. *Baetis* is single largest genus and constitutes a little more than half of Baetidae (18 :35) and one fifth of (18 :90) of all Indian mayflies species taken together - Srivastava (1984). All *Baetis* species are endemic to India and 7/9 of them (14 : 18) are high altitude inhabitants ranging between 2438-3618 meters above mean sea level. Of the 18 species male of 15, female of 11 and larvae of only three known. A key has been formulated to distinguish all Indian species of genus *Baetis*.

SYSTEMATICS

Baetis Leach(1815) was established under the subfamily Baetinae. This was given family status subsequently. Its type species -genotype was subsequently designated as *Ephemerafuscatus* Linnaeus. Part of *Cloe* (Pictet, 1843). *Brachyphlebia* Westwood (1840) and part of *Acentralla* Bengtsson (1912) was also placed under *Baetis*. Our knowledge of Indian species of *Baetis* is due to Dubey (1971), Gillies(1949), Kapur and Kripalani (1963), Kaul & Dubey (1970), Srivastava (1979, 1983) has discussed the high altitude components among Indian mayflies and also our endemic components. It has been pointed out that all Indian *Baetis* species are endemic within our limits and out of these 7/9 of them (14 :18) are high altitude inhabitants ranging between 2438-3618 meters above mean sea level. This represent bulk of our high altitude mayflies (14 : 37). Accompanying table (Table I, page 356) indicates qualitative composition of Indian *Baetis*, their male, female and larval status known, endemic distribution and altitudinal records. Hubbard and Peters (1978) pointed that in the Indian subregion (i.e. India, Sri Lanka, Pakistan, Nepal, Sikkim, Bhutan, Bangladesh, Burma) a total of 23 species of *Baetis* are recorded, 18 among these are endemic to India, 3 species viz. *B. consuetus* (Hagen), *B. feminalis* Eaton and *B. solidus* (Hagen) are restricted to Sri Lanka, while another two species viz. *B. macamis* Ali and *B. meeheanis* Ali are known only from Pakistan. These have not been recorded from other countries of subregion. There are strong possibilities of genus being represented in more wider zone by more species on further detailed investigation of our water bodies, specially lotic ones of high altitude.

Salient Features of *Baetis* with special reference to Indian species

Imago : Size and colour :

Members of this genus are small to medium in size. A few ranging between 3-5 mm. like *B. palmyrae*, *B. solitarius* and *B. fluitans*, while certain others like *B. chandra*, *B. longistylis*, *B. lahulensis*, *B. serragruis* range between 10-12 mm. Others are mainly medium ranging species between 6-7 mm. like *B. acuticostalis*, *B. solangensis*, *B. septemmenes*, *B. simplex*, *B. thurbonis*, *B. tigroides*, *B. punjabensis*, *B. himalayana*, *B. bifurcatus*, *B. dipsicus*, *B. festivus*, female of these species are mostly a shade bigger are equal to male imagos.

Male are almost always more colorful than female, being always dull reddish or some shade of brown pigmented. Immature stage larvae of only three Indian species are known. Of these larvae of *B. simplex* is 6mm. while larvae of other two viz., *B. chandra* and *B. lahulensis* are almost double in body length measuring respectively 10 and 11 mm.

Eyes in male are turbinate mounted on stalk of variable size and two eyes meeting or closely approximated on middorsal zone of head. In contrast eyes in female are simple, unstalked and relatively well separated dorsally.

Wings : All members possess paired wings. Forewings of each side almost as long as body and little more than double of it in across wings of both sides. Hindwings are relatively very small almost 1/4 to 1/5 of former. This may be even to the extent of 1/8 in *B. septemmenes*, *B. himalayana* and *B. simplex*. Wings are generally hyaline, membranous with brownish or yellowish on veins.

Forewing : area around wing base and outer one third of costal and subcostal space in *B. punjabensis* slightly darker than rest which is hyaline. In *B. tigroides* above area is sooty brown but it is only one fourth rather than one third of costal and subcostal space. In *B. fluitans* wings are translucent instead of hyaline. There are variable number of simple, slanting slightly anastomosed cross veins. These widely ranges between 3-15 in different Indian species of genus *Baetis*. In *B. longistylis*, 3-6 in *B. thurbonis*, 4-7 in *B. palmyrae*, 5 in *B. acuticostalis*, 5-6 in *B. fluitans*, 6 in *B. solangensis*, 6-7 in *B. solitarius* 6-10 in *B. dipsicus*, 7-9 in *B. tigroides*, 8 in *B. simplex*, 8-9 in *B. chandra*, 9 in *B. himalayana*, 8 complete 1 incomplete in *B. septemmenes*, 10 in *B. lahulensis*, 10-12 in *B. bifurcatus*, 8 complete 6- incomplete in *B. serragruis* and 15 in *B. festivus*. Space corresponding to the stigmatic area in subcostal space generally devoid of any cross vein but in *B. festivus* there are 5 and 7 in *B. bifurcatus*.

There are paired intercalaries all along hind margin in between branches of longitudinal vein. Intercalary is not present in costal and sometimes subcostal space also. In *B. simplex* there is no intercalary in first space also, only one in the second space, but short paired intercalaries in the rest. Hinder margin of wing invariably fringed, in some these fringes are relatively more conspicuous.

Hindwing : These are always present but are relatively smaller. These may be even 1/8 of forewing. It shows more variations and as such presents characters of taxonomic

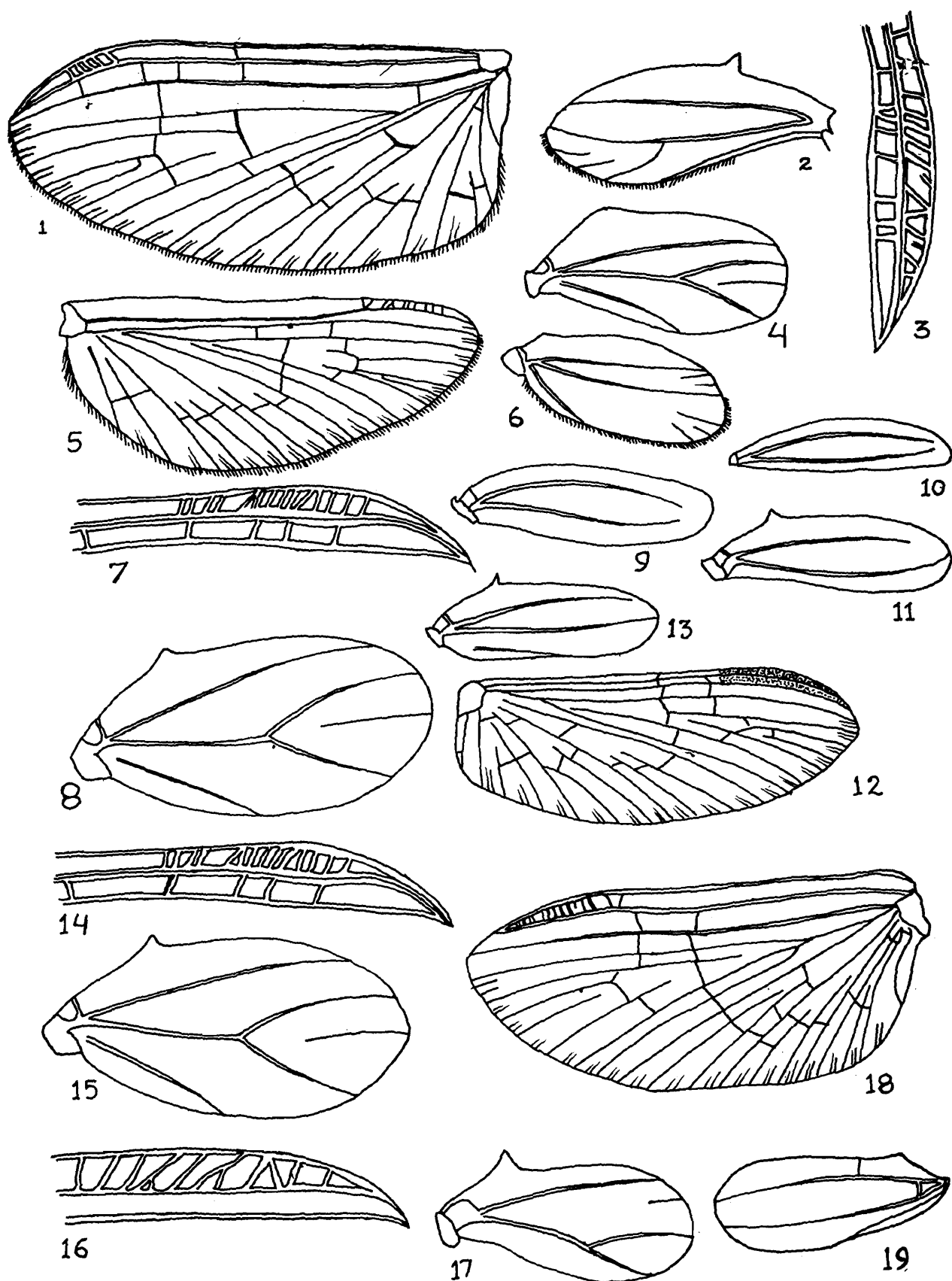
importance, specially at specific level. Among Indian representatives *B. palmyrae* have the smallest hindwing measuring 0.1mm, while that of *B. chandra* having largest measuring 3.5 mm. In between these ranges rest of our species *B. solitarius* (0.5mm), *B. fluitans* (0.6mm), *B. tigroides* (0.7mm), *B. dipsicus* (0.8mm.), *B. acuticostalis* (0.9mm.), *B. septemmenes*, *B. solangensis* and *B. thurbonis* (1mm.), *B. festivus* (1.2mm.), and *B. punjabensis* (1.1mm.), *B. himalayana*, *B. simplex*, *B. lahulensis* and *B. longistylis* (3mm.). These are hyaline or translucent, may be colourless or brownish on veins. In *B. chandra* these are translucent grey with violet tinge. Costa has in most cases a costal spur but lacks in *B. dipsicus* and *B. palmyrae*. This is in contrast to all other 16 species of genus which possess ill developed to well developed costal spur. In respect of presence of 2 longitudinal veins instead of 3 above two species are unique, however *B. solitarius* also has only 2 longitudinal veins. Two species mentioned above were previously placed in *Acentrella* group but were subsequently placed under *Baetis* by Gillies (1949). This point deserves further examination in greater detail, based on more material to justify their inclusion in genus, though at present these are treated as parts of genus. Costal spur is small and subacute in *B. longistylis* and *B. punjabensis*; that of *B. lahulensis* is also small but acute. It may be well developed, acute, pointed backwards in *B. acuticostalis* and *B. fluitans* or may be well developed but not pointed as in *B. festivus* or it may be only as obtuse projection as in *B. chandra* and *B. septemmenes*. Rest of the species have well developed costal process of moderate length.

Third longitudinal vein is always relatively smaller which is present in all species except three species mentioned earlier. Second longitudinal vein is either forked as only in 5 species viz., *B. acuticostalis*, *B. furcatus*, *B. festivus*, *B. himalayana* and *B. solangensis* but remains unforked in rest of species. There are no intercalaries between longitudinal veins and cross veins are absent in most of Indian representatives except 1 between fork of second longitudinal vein in *B. festivus*, 2 between fork of second longitudinal vein of *B. acuticostalis* but 4-5 same position in *B. chandra* and *B. himalayana*.

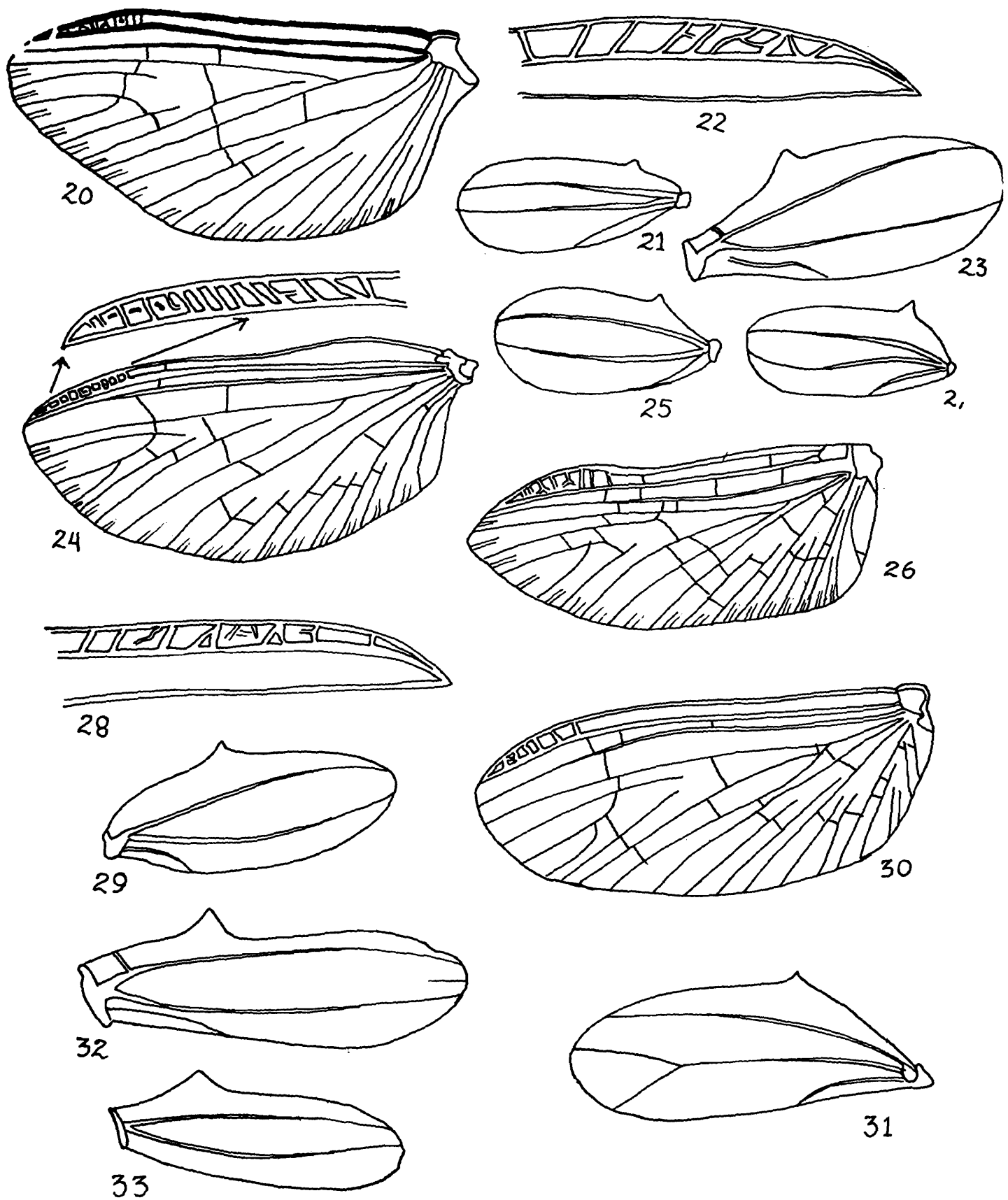
Abdomen : It is long, 0.5 to 0.7 times that of whole body length excluding cerci which are two in number. Cerci are long, slender, filamentous. These are 1.4 times body length in *B. acuticostalis*, double the body as in *B. dipsicus*. 2.5 times in *B. serragruis* and a little less than or thrice the body length as in *B. solitarius*, *B. thurbonis* and *B. tigroides*. Pigmentation on abdomen and or cerci are either white, yellow or some shade of brown.

Genital forcep : The genital forcep is invariably 4 segmented, of which 2 and 3 are more or less completely fused in all the Indian species of genus, though male of 3 species viz., *B. festivus*, *B. serragruis* and *B. simplex* are not recorded and described so far. Small basal tubercle to second segment in *B. dipsicus*; distinct but obtuse tubercle on inner basal side of second in *B. himalayana*; distinct tubercle on inner of basal segment of *B. fluitans* and basal, obtuse tubercle to the basal inner side of third segment in *B. longistylis*. Rest of the species have no tubercles on the genital forcep. Most of the species have more or less straight arms of forcep but a few, however, show departure from it. Third segment of *B. palmyrae* and *B. tigroides* show a sharp bent at basal one third.

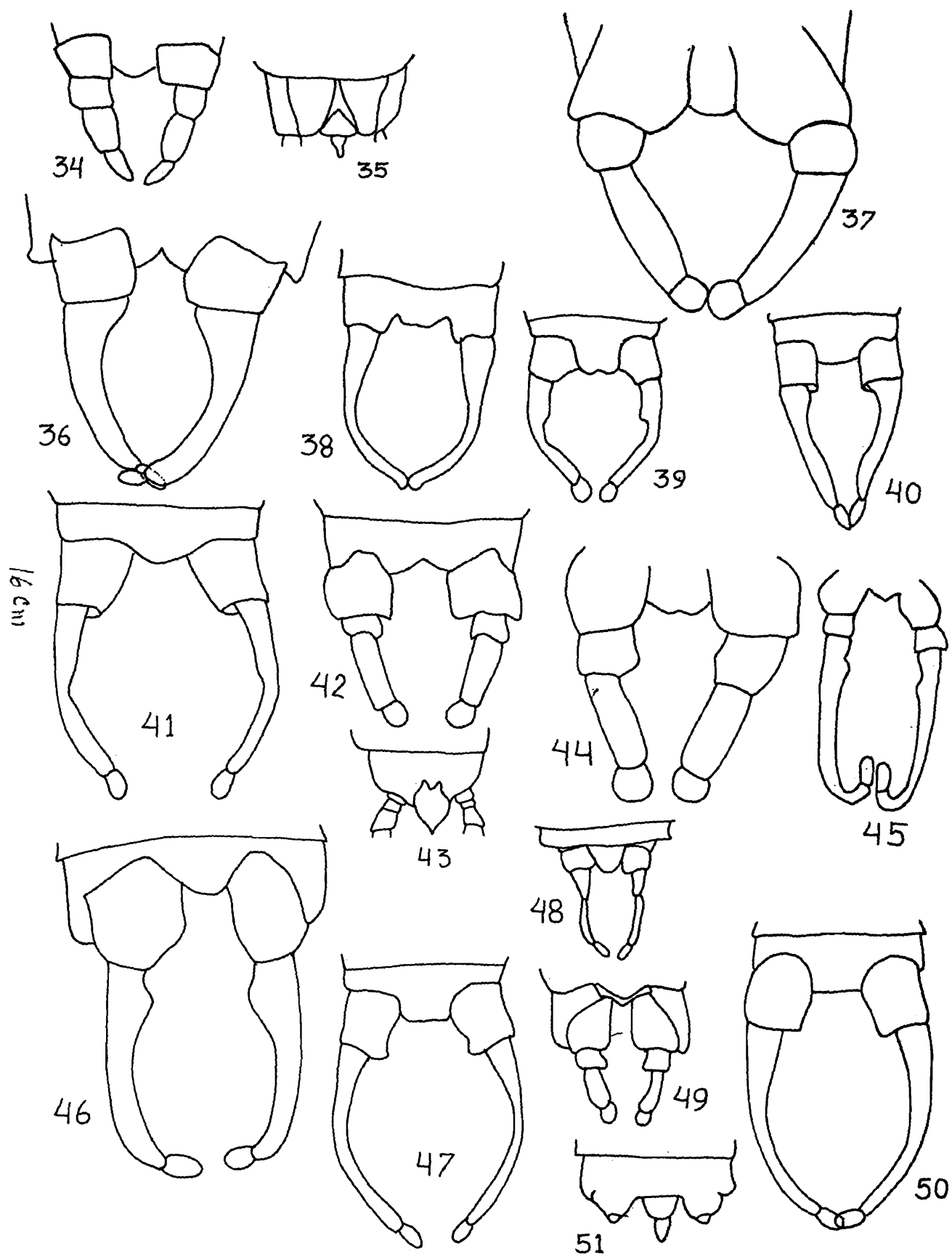
There are two main type of genitalia in this genus separated on the basis of genital



Text figures: 1-19 (Wing): 1, 2 Fore Wing (F.W.) and Hind Wing (H.W.) of *B. acuticostalis*; 3, 4 stigmatic are of forewing (S.F.W.) and whole of H. W. of *B. bifircatus*; 5, 6 F.W. and H.W. of *B. Chandra*; 7, 8 S.F.W and whole of H.W. of *B. festivus* ; 9, 10, 11 H.W. of *B. dipsicus*, *B. palmyrae* and *B. fluitans* respectively ; 12, 13 F.W. and H.W. of *B. tigroides*; 14, 15 S.F.W. and whole of H. Wing of *B. himalayana*; 18, 19 F. W. and H. W. of *B. lahulensis*.



Text figures : 20-23 (Wing-contd.) : 20, 21 F.W. and H.W. of *B. longistylis*; 22, 23 S.F.W. and whole of H.W. of *B. punjabensis*; 24, 25, 26, 27 F.W. and H.W. of *B. seragrui* and *B. septemmenes* respectively; 28, 29 S.F.W. and whole of H.W. of *B. simplex*; 30, 31 F.W. and H.W. of *B. solangensis* and 32, 33 H.W. of *B. thurbonis* and *B. solita* respectively.



Text figures : 34-51 (External genitalia) : 34, 35 Male (genital forcep) (G.F.) and female ovipositor (O.) *B. acuticostalis*; 36, 37, 38, 39, 40, 41 G.F. of *B. bifucatus*, *B. chandra*, *B. dipsicus*, *B. palmyrae*, *B. fiuitans* and *B. tigroides* respectively ; 42, 43 G.F. and O. of *B. lahulensis*, 44, 45, 46, 47, 48, 49, 50 G.F. of *B. himalayana*, *B. logistyles*, *B. punjabensis*, *B. thurbonis*, *B. solangenis*, *B. septemmenes* and *B. solitarius* and 51 O. of *B. seragruis*.

forcep. In the *Intercalaries* type basal forcep joint is beset with tubercle or projection on its inner apical margin which are not present in *Moffati* type. Second joint relatively long, slender, conical, tapering apically. Further it differs in third joint quite long, slender getting narrower at base in former type but in latter type this joint is rather less slender and not appreciably getting narrower at base.

Ovipositor : Female genitalia consists of ovipositor which is invariably 2 segmented in all the 4 species whose female is known and ovipositor described viz., *B. acuticostalis*, *B. lahulensis*, *B. longistylis* and *B. serraguris* and are yellowish to pale brown. In others either female is not yet recorded and described or ovipositor have not been studied.

Nymph : Larvae of only 3 Indian species are known in respect of genus, these are *B. chandra*, *B. lahulensis* and *B. simplex*, whereas larvae of other 15 species yet to be described. Perusal of literature reveals that there had been mention of occurrence etc, of larvae of genus *Baetis* within our limits. Hora (1930) has recorded nymphs of *Baetis* sp. inhabiting fast flowing lotic water body even at the point of fall, clinging to rocky substratum by help of claws. Traver (1939) also reported occurrence of nymphs of *Baetis* from Kashmir and Nepal. Kapur and Kriplani (1963) described *B. chandra* and *B. simplex*, including imago and larvae, from Lahul and Spiti valleys based on direct field and camp laboratory observations. Certain other specimens were recorded referable to this genus from the same area; but they were not linked to particular species. Kaul and Dubey (1970) described nymphs of *B. lahulensis* from Gramphu, Northern Slope of Pir Panjal Range, North West Himalaya inhabiting fast riverine ecosystem.

Larvae of *Baetis* are stream lined, slender forms, well adapted to negotiate as free swimming forms between inter-space of vegetation and rocks in the littoral zone of mostly lotic type of water body, streams, rivers etc. Head is smaller in width and length than thorax and directed downwards. This body form of larvae are also known as 'torpedoshaped' Body size of larvae are more or less that of their respective imagos. This proportion varies in larvae of different species. In *B. simplex* it is 6 mm; 7mm., in *B. chandra* 10mm.: 10mm. Male, 11mm. Female and *B. lahulensis* 10mm.: 10mm. Male, 11mm. Female. Cerci are 2 in the larvae of *B. simplex* and length wise ratio of these and body is 3 : 2 or 9 and 6mm. There is in addition to paired cerci a terminal caudal filament in larvae of *B. chandra* and *B. lahulensis* In former body length, cerci and caudal filament are in ration of 5 : 3 : 2 (or 10, 6 and 4mm.) while in latter ratio is 5:4:2.5 (or 10, 8 and 5mm.), Cerci are fringed on inner side and median caudal filament on both sides . These together help movement and provide rader effect to the larvae. Only two cerci are also present in larvae of *B. caudatus* and *B. propeisguis* group, both not occuring within our limits.

Corresponding to abdominal segments 1-7 there are 7 paris of simple, slightly ovoid, plate like gill lamellae. Of these first smallest, increasingly bigger posteriorly, last again relatively small. In some members gill lamellae may be pinnately branched but not is any Indian respresentatives.

Endemism and High Altitude Representation

An overview of the faunal component of Indian mayflies reveal that the genus *Baetis*

Leach is represented by 1/5 of all species taken together (18 : 90). Genus itself is single largest represented within our limits and constitutes a little more than half of Baetidae (18 : 35) to which it belongs. Srivastava (1979, 1983) has dealt with the analysis of the faunal component of Indian Ephemeroptera including endemism, relative preponderance and high altitude representation. It is shown that a large proportion of 74 species or 5 : 1 is endemic within our limits. Among these Baetidae with 29 endemic component, all 18 species of genus are endemic to India, though genus has its species distributed amongst wider Zoo-geographical range even beyond oriental into Holarctic, Palearctic, Nearctic, Ethiopan.

Of 18 *Baetis* species 15 have been found to inhabit riverine (= lotic) ecosystems of Himalayan Mountain range ranging between 2438-3618 meters above mean sea level. Remaining 3 species are recorded, not within consideration of high altitude dwellers, at altitude of 569 m. Species of this genus alongwith other genera viz., *Baetiella* Ueno, *Cloeon* Leach and *Pseudocloeon* Klapalek having 1, 2 and 1 high altitude forms respectively constitutes almost half of our high altitude forms (19 : 37) of our 15 high altitude *Baetis* a little more than half (8 : 7) range above 3000 meters. Incidentally there is a single record of *Ororotsia hutchinsoni* Traver above 4000 at an altitude of 5927 meters while most of high altitude Indian mayflies have been reported occurring between 3000-4000 meters.

Key to the Indian species of genus *Baetis* Leach

1. Hind wing with 2 longitudinal veins.....2
Hind wing with 3 longitudinal veins, third may be smaller and weakly developed ...5
2. Costal spur of hind wing absent.....3
Costal spur of hind wing present.....4
3. Body length 6-6.5mm abdominal tergites 2-6 white semi-opaque 7-10 opaque brownish cream, gonostyle with small vasal tubercle to second segment, 6-10 cross vein to stigmatic area.....*dipsicus* Gillies
Body length 3 1/2 - 4 1/2 mm. Abdominal tergite 2-6 translucent white, 7-10 opaque Genostyle with no tubercle third segment with sharp bent 4-7 cross vein to stigmatic area.....*palmarae* Gillies
4. Body length 3 - 3.5 mm costal and subcostal area not milky. Abdominal tergite 2-6 white, 7-10 opaque sandy brown. Distinct tubercle in inner side basal segment of gonostyle.....*fluitans* Gillies
Body length 4.5 mm. Costal and subcostal area of fore wing milky, abdominal tergite 2-6, white 7-10 yellowish cream. Tubercle to gonostyle absent, 6-7 branched, horizontal veins to stigmatic area.....*solitarius* Gillies
5. Second longitudinal vein of hindwing not forked 6
Second longitudinal vein of hindwing forked 14
6. Fore wing 10-12mm. long.....7
Fore wing 6-8.5 mm. long.....10

7. 4-5 intercalaries present in the hindwing , 8-9 simple slanting, sometimes forked cross vein to stigmatic area.....*Chandra* Kapur & Kripalani
Intercalary in the hind wing absent 8
8. Cross vein 2 or none in hind wing. Forewing 11mm., 10 complete and 2 incomplete cross veins to stigmatic area*lahulensis* Kaul & Dubey
Cross vein in hind wing absent 9
9. Costal process small , subacute in hindwing, forewing 10 mm., 3 complete, 9 more or less complete anastomosed veins in stigmatic area*longitotylus* Kaul & Dubey
Costal process small , acute in hindwing, forewing 12 mm., 8 complete, 6 incomplete simple , slanting veins in stigmatic area *seragrui*s Dubey
10. 3-6 irregular slanting cross veins to stigmatic area of forewing. Forewing 6mm., Translucent colourless except dark brown at the wing base and faintly milky stigmatic area.....*thurbonis* Gillies
7-9 cross veins to stigmatic area of forewing 11
11. Costal margin of forewing marked inwards, forewing 8 mm. Cross vein 8 complete, 1 incomplete in stigmatic area*septemmenus* Dubey
Costal margin of forewing not marked inwards.....12
12. Abdominal tergites red and yellow, bimaculate pigment in wings, second segment of Genostyle with few distinct hairs at its inner side*tigroides* Gillies
Abdominal tergites and pigment in wings not as above.....13
13. 8 complete veins in stigmatic area, costal process of hind wing acute, veins 1 and 2 in hindwing converging apically abdominal tergite 2-8 Brown or pale brown, 10 dark brown.....*simplex* Kapur & Kripalani
7 complete veins in stigmatic area, costal of hind wing not acute, veins 1 and 2 in hindwing converging abdominal tergite 2-6 dull brown , 8- 10 dark brown.....
.....*punjabensis* Kapur & Kripalani
14. Forewing 8 mm., stigmatic area with 9 veins, area below this in subcostal space without cross veins.....*himalayana* Kapur & Kripalani
Forewing 6-6.5 mm., stigmatic area with 10-15 cross veins.....15
Forewing 7 mm., stigmatic area with 5-6 cross veins.....16
15. Stigmatic area with 10-12 slanting , anastomosed cross veins, space below has 7 cross veins, 2 intercalaries between fork of second longitudinal vein in hind wing, abdominal dull brown*bifurcatus* Kapur & Kripalani
Stigmatic area with 15 slanting , anastomosed cross vein, space below has 5 cross veins, 1 intercalary between fork of second longitudinal vein in hind wing , abdominal golden brown*festivus* Kapur & Kripalani
16. 5 complete cross vein to stigmatic area, 2 intercalaries between fork of second vein of hindwing, wings hyaline - grey, hind margin fringed*acuticostalis* Dubey
6 complete cross vein to stigmatic area, intercalary absent, wings hyaline - veins pale brown, hind wing margin not fringed.....*solangensis* Dubey

SUMMARY

A detailed taxonomic status of the genus *Baetis* Leach (Baetidae) and its salient features have been presented with reference to 18 Indian species of the genus. A key to species has also been provided. Members of the genus represents half of Indian Baetidae and one -fifth of all our mayflies. All our *Baetis* species are endemic within our limits and 7/9 of them are high altitude inhabitants ranging between 2438-3618 meters.

ACKNOWLEDGEMENT

Author is highly thankful to the Director, Zoological Survey of India, Calcutta for constant encouragement and facilities to bring out this work.

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Table I. Qualitative composition on Indian *Baetis* Leach

	Species	M	F	L	Endemic	Distribution	Remarks
1.	<i>B. acuticostalis</i> Dubey	+	+	—	Himachal Pradesh	(P. Solong)	2800 M.
2.	<i>B. bifurcautus</i> Kapur & Kripalani	+	—	—	-do-	(Ralha, Kulu)	3048 - 3358 M.
3.	<i>B. chandra</i> Kapur & Kripalani	+	+	+	-do-	(Chhatoru, Lahul Sipti Valley)	2743 - 3618 M.
4.	<i>B. dipsicus</i> Gillies	+	+	—	Maharastra	(R. Mutha, Poona)	569 M.
5.	<i>B. festivus</i> Kapur and Kripalani—	+	—	—	Himachal Pradesh	(Ralha - Kulu Valley)	3048 - 3358 M.
6.	<i>B. fluitans</i> Gillies	+	+	—	Maharastra	(R. Mutha, Poona)	569 M.
7.	<i>B. himalayana</i> Kapur & Kripalani	+	+	—	H. P.	(Sissu, Lahul Valley)	3200 M.
8.	<i>B. lahulensis</i> Kaul & Dubey	+	+	+	H. P.	(Gramphu)	3507 M.
9.	<i>B. longistylus</i> Kaul & Dubey	+	+	—	-do-	-do-	569 M.
10.	<i>B. palmyrae</i> Gillies	+	—	—	Maharastra	(R. Mutha, Poona)	3048 - 3358 M.
11.	<i>B. punjabensis</i> Kapur & Kripalani	+	—	—	H. P.	(Ralha - Kulu Valley)	2800 M.
12.	<i>B. septemmenes</i> Dubey	+	—	—	H. P.	(R. Solong)	3600 M.
13.	<i>B. seragruis</i> Dubey	—	+	—	H. P.	(Seragru Icefall, Kuninal)	2438 M.
14.	<i>B. simplex</i> Kapur & Kripalani	—	+	+	H. P.	(Kothi, Kulu Valley)	2800 M.
15.	<i>B. alauyensis</i> Dubey	+	—	—	H. P.	(E. Solong)	2615 M.
16.	<i>B. solitarius</i> Gillies	+	—	—	West Bengal	(Mirik)	2615 M.
17.	<i>B. thurbonis</i> Gillies	+	—	—	West Bengal	(Mirik)	2615 M.
18.	<i>B. tigroides</i> Gillies	+	—	—	West Bengal	(Mirik)	2615 M.
	18 species	15	11	3	Himachal Pradesh, Maharashtra, West Bengal		2438 - 3618 M.

SHORT COMMUNICATIONS

**RECORD OF THE INDIAN ROOFED TURTLE
KACHUGA TECTA (GRAY) FROM ESTUARINE ENVIRONMENT**

INTRODUCTION

Only a few highly specialised forms of reptiles can live for protracted period in regions of high salinity (Dunson 1979). Turtles of family Emydidae regularly reported from estuarine environments of Asia are the painted tetrapi *Callagur borneoensis*, river terrapin *Batagur baska* and Burmese roofed turtle *Kachuga trivittata* (Pritchard 1979). A few typically freshwater species under this family have also been recorded periodically from such regions, throughout the world, permanent residents in saline areas being comparatively rare.

A single specimen of the Indian roofed turtle *Kachuga tecta* was captured by fishermen at Arbesi, in the Sunderbans Tiger Reserve, and deposited at the Sajnekhali turtle hatchery. This is an addition to the chelonian fauna of the area and constitutes the first record of the species from estuarine environment.

Order CHELONIA

Suborder CRYPTODIRA

Family EMYDIDAE

Subfamily BATAGURINAE

Genus & Species *Kachuga tecta*

Material : 1 EX., 0, Dhajekhali, Arbesi Compartment 3, Sunderbans Tiger Reserve, South 24 Parganas District, West Bengal, India. 14 November, 1985.

Measurement and Weight : Carapace length 151 mm., carapace breadth 105 mm., plastron length 133 mm., shell height 72 mm., weigh 510 gms.

Diagnosis : Carapace elevated with a prominent vertebral keel which is produced into a spike at the posterior-end of the third vertebral scute. and continuing as a ridge on the fourth and fifth. Second vertebral scute longer than third, fourth is bottle-neck in contact with third. Posterior margin of carapace feebly serrated.

Colouration : Carapace chocolate brown with scattered small black patches. First three vertebral scutes with a horny brown keel, edged with black, becoming black on the fourth and fifth vertebral scutes. Pale yellow margin of carapace. Yellow-pink below, with upto

three black blotches on each scute. Posterior rim of the anal scutes a reddish-orange. Each inframarginal, axillary and inguinal scutes with a single black blotch.

Forehead with a black arrow-head shaped mark ; dark crescent markings on the red temples behind the eyes. Lower jaw orange-yellow. Pupils black, other parts of eye olive-green. Dark grey neck with numerous fine yellow stripes. Fore and hind limbs dark greenish, the former with bright yellow scales.

DISCUSSION

The Indian roofed turtle *Kachuga tecta* is a freshwater species, known from the Brahmaputra, Ganga and Indus drainage, occurring more commonly in ponds and other lentic habitats, rather than in lotic ones. Its occurrence in the salt-water tracts of the Sunderbans may be explained as either due to the devastating cyclone which hit lower Bengal on 15 October, 1985 or the decreasing salinity of Arbesi river water after summer (electric conductivity 14.21 millimoles/cm in November, after what appears to be the salinity peak 29.14, in the month of March). According to Goldman and Horne (1983), heads of estuaries become highly saline during summer due to the penetration of almost full strength sea water, and less so in winter because of floods of freshwater. Freshwater inflow is significantly less in the western part of the Sunderbans, which falls under the jurisdiction of West Bengal, India, unlike in the eastern Sundarbans of Bangladesh.

In the Indian Subcontinent, records of emydid turtles except for the river terrapin *Batagur basaka* from estuarine environment are practically non-existent. Only the crowned river turtle *Hardella thurjii* has been reported from mangrove regions of Pakistan by Minton (1966) and Minton and Anderson (1962). An experiment performed by Deraniyagala (1939) in Sri Lanka indicates that the Sri Lanka black turtle *Melanochelys trijuga thermalis* avoids brackish water. When specimens were thrown into a brackish lagoon, they were observed orienting towards the mouth of a drain, 20 metres away. Another experiment with the comparatively salt-tolerant emydid of the Malay Peninsula, the painted terrapin *Callagur borneoensis* in captivity suggests that it too prefers freshwater (Dunson and Moll 1980).

In conclusion, it may be remarked that except for very few estuarine specialists, like *Batagur*, emydid turtles are incapable of living in regions of high salinity for long. The present record of *Kachuga tecta* from estuarine environment of the Sundarbans apparently is either the result of a cyclone which affected the area several days prior to its capture or due to the low salinity of the river water caused by continued winter flooding.

ACKNOWLEDGEMENTS

Support for the field work on turtles in the Sunderbans came from the World Wildlife Fund-India. The author wishes to express his gratitude to Ms. Bonani Kakkar, Project/Education Officer, WWF-I (Eastern Region) and Dr. Edward O. Moll, IUCN/SSC Fresh-

water Chelonian Specialist Group for the help and encouragement, and to the West Bengal Forest Department for providing the logistic support. Data on the salinity of Arbesi river water was kindly provided by Dr. A. R. Bal, Central Soil Salinity Research Institute, Canning.

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INDRANEIL DAS

SHORT COMMUNICATIONS

OCCURRENCE OF *CALLOSOBRUCHUS CHINENSIS* AND *ALPHITOBIUS LAEVIGATUS* (COLEOPTERA) AS PESTS ON THE SEEDS OF *MAUGHANIA MACROPHYLLA*, A LAC-HOST PLANT

Maughania macrophylla * (Willd.) O. Ktze. (syn. *Flemingia congesta* Roxb.) (Leguminosae, Papilionatae) is a very suitable bush for the culture of lac insects. It takes both *rangeeni* and *kusumi* forms of *Kerria lacca* (Kerr) (Hemiptera : Tachardiidae) successfully. Although a native of Assam, the plant has been extensively used for experiments and widely recommended for lac culture by the Indian Lac Research Institute (I.C.A.R.), Ranchi (Bihar). Two coleopterous pests attacked the seeds of this plant, of which this is the first report.

MATERIAL

One Kg. seeds of *M. macrophylla* were collected from the plantation of the Indian Lac Research Institute at Namkum, Ranchi (Bihar) and carried to Calcutta by the senior author in 1978, with the intention of sowing and raising the bushes. However, the attempt could not succeed, because all the seeds were found to be heavily infested with insects.

OBSERVATIONS

The following two species of coleopterous insects emerged from the seed lot:

(1). *Callosobruchus chinensis* (Linn.) (syn. *Bruchus chinensis* Linn.) (Family Bruchidae) ; and

(2). *Alphitobius laevigatus* (Fabr.) (syn. *A. piceus* Oliv.) (Family Tenebrionidae).

These both beetles are well known stored grain pests. However, these are recorded here for the first time on *M. macrophylla*. Mathur & Singh (1959) have not reported any of them on this plant.

Callosobruchus chinensis is a destructive common pest of gram, unmilled pulses and seeds of some leguminous plants in storage. Its infestation may start on maturing seeds inside pods in the field. This insect has been recorded from many places in North India (Arora, 1977), but not from Bihar, from where the present report is first.

The black fungus beetle, *Alphitobius laevigatus* is mainly a pest of damp and mouldy

* This plant has so far been cited as *Moghania* erroneously - RKV.

stored cereals, pulses, oilseeds, cake, meal and milled products. It is particularly abundant under moist dunnage, piles of old sacks and in the recesses, ship holds and bilges. Thus, it seems that this insect secondarily infested the mouldy seeds, which were primarily damaged by *C. chinensis* (Linn.).

During emergence, it was observed that whereas adults of the former insect emerged in large numbers during February-March, the adults of latter insect appeared in late April and May months. Both the pests were in relatively 50% ratio and they, thus, destroyed the entire seed lot, leaving behind the powdery black hard seed coats. The adults of *C. chinensis* even penetrated through the cellophane bags and took to flight on emergence. On the other hand, the adults of *A. laevigatus* were found to avoid light and flight, but moved vigorously when disturbed.

ACKNOWLEDGEMENTS

The authors are thankful to the Director, Indian Lac Research Institute, Ranchi, for the seeds; to the Director, Zoological Survey of India, Calcutta, for laboratory facilities; and to Mr. A.R.K. Sastry, Dy. Director, Botanical Survey of India, Calcutta, for checking the plant name.

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SHORT COMMUNICATIONS

MESONYCHILESTES A NEW NAME PROPOSED FOR *LESTES* YAN DEFA AND TANG YINGJUN (CONDYLARTHRA : MAMMALIA) NEC *LESTES* LEACH (ODONATA)

Yan Defa & Tang Yingjun (1976) described a new fossil genus *Lestes* with type species *Lestes conexus* sp.nov., for a mesonychid (Condylarthra) from the Palaeocene of Anhui (Chaia). Wang Banyue (1976) in the same journal added another species, *L. datangensis* sp.nov., from Late Palaeocene of Guangdong. These authors apparently were not aware that *Lestes* is a name pre-occupied by Lestes Leach (1815) with type species *Lestes sponsa* Hans, a damselfly (Zygoptera : Odonata : Insecta). Since then several damsel-flies were accommodated in this genus. Further, the insect genus is placed in a separate family Lestidae Jacobson and Bianchi, and Fraser (1933) through erected a new subfamily, but according to the *International Rules of Zoological Nomenclature* the authorship of the subfamily Lestinae belongs to Jacobson & Bianchi.

Under articles 53 & 56 of the *Rules*, *Lestes* Yan Defa & Tang Yingjun (Mammalia) is a junior homonym of *Lestes* Leach (Insecta), and hence not available for scientific use. Since no other synonym for the new genus *Lestes* Yan Defa & Tang Yingjun is available, a new name *Mesonychilestes* nom. nov. pro *Lestes* Yan Defa & Tang Yingjun nec *Lestes* Leach, 1815, is proposed now.

ACKNOWLEDGEMENTS

The author expresses his sincere thanks to Dr. R. S. Pilli, Joint Director, (Retd.). Southern Regional Station, Zoological Survey of India, Madras, and the Director of Zoological Survey of India, Calcutta, for facilities.

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K.V LAKSHMINARAYANA

SHORT COMMUNICATIONS

OBSERVATION ON THE BIFID TAIL IN A SPECIMEN OF *HEMIDACTYLUS BROOKI* GRAY

It is a well known fact that the tail of geckoes breaks off very easily but they have the power of reproducing a new one. The new tail is not a complete organ, the vertebrae are not reproduced but in their place, a non-segmented rod grows; new muscles are developed according to Smith (1935).

Hora (1926) reported a specimen of *Hemidactylus brooki* Gray with a triradiate tail. There was a normal median limb and two symmetrical short limbs. N Krishna Pillai (1955) recorded a bifurcated tail of *Hemidactylus brooki* Gray. The left limb of that tail was longer than the right abnormal one.

I have come across one specimen of *Hemidactylus brooki* Gray with a forked tail from Himachal Pradesh. The tail is normal. But one third of its anterior part is verticillate only and the rest are smooth. Only the distal end is forked. The forks are not symmetrical. The left limb is very small and is about one fifth of the length of right one. Dorsal scutes and ventral scales which are salient characters of the species, are present on the right limb. The left limb does not possess ventral plates. The external character of the right limb thus proves that the right limb is the original normal tail and the smaller left limb is the original normal tail and the smaller left is an abnormal one.

ACKNOWLEDGEMENT

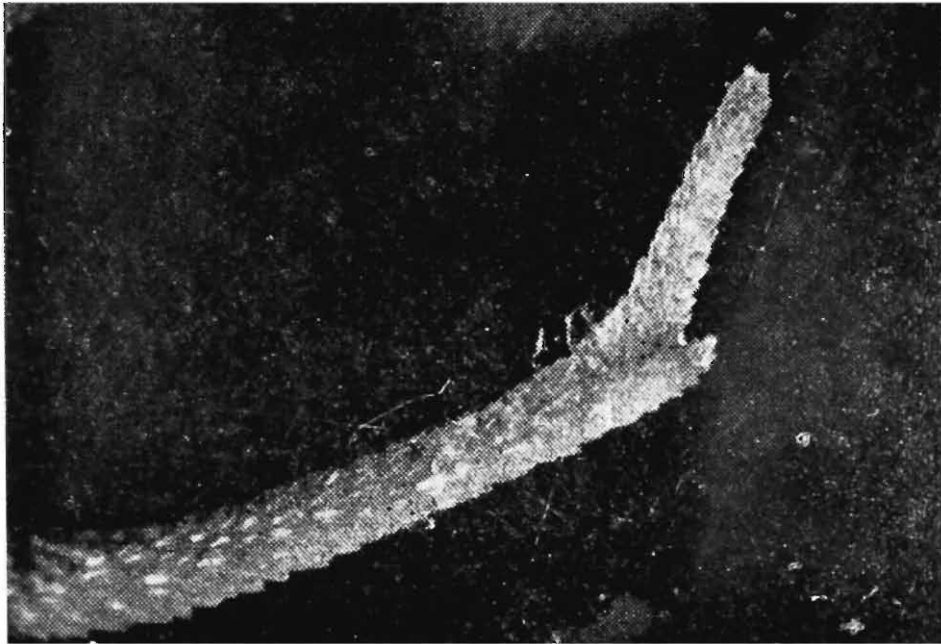
The author is grateful to the Director, Zoological Survey of India, Calcutta for providing necessary facilities and to Dr. Q. H. Baqri, Superintending Zoologist, Herpetology Division for offering valuable suggestions.

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AHAMED

PLATE I



Tip of tail (dorsal view).