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Dr. A. K. Ghosh
Director
Zoological Survey of India

RECORDS

OF THE

ZOOLOGICAL SURVEY OF INDIA

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CONTENTS

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RECORDS OF MOSQUITOES (DIPTERA : CULICIDAE) FROM MANIPUR GENUS—ARMIGERES AND HEIZMANNIA

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INTRODUCTION

The genera *Armigeres* and *Heizmannia* are the vicious day biters of the Manipur state especially in the bamboo dominent hilly area (Rajput and Singh, 1986a) where they create a serious problem for the field workers even in the adjoining area also. Inspite of their painful biting no attention was paid for any scientific study except record of *Armigeres subalbatus* from Churachandpur and Ukhrul by Malhotra *et al.* (1983). The present communication deals with the distribution record of 11 *Armigeres* and single *Heizmannia* species from the surveys for the present distribution records were made during 1983 to 1985. The collection procedure, rearing technique and description of area & climate have already been described in the earlier paper (Rajput and Singh, 1986b).

The identification was done mainly on adult characters. The genital characters of larvae were also taken into consideration, whenever those forms were available. The work mainly follows Barraud (1934), Macdonald (1960) and Mattingly (1973) for identification Knight and Stone (1977) for classification and nomenclature.

COLLECTION RECORDS

1. **Armigeres durhami** Edwards

1917. *Armigeres kuchingensis* var. *durhami* Edwards, *Bull. Enit. Res.* 7 : 206 ; Barraud, 1934 : 318 ; *Armigeres durhami* Edwards, Thurman, 1958(1959) : 391 ; Knight and Stone, 1977 : 171.

The species has a wide distribution in the Oriental region. In India, recorded from Andaman Islands, Assam, probably Maharashtra, and Manipur.

Present records : Manipur : *Moreh* (150m.)—1 ♀ (14 Aug. '84) from mixed vegetation ; 1 ♀ (19 Aug. '84) from indoor human dwelling.

2. **Armigeres subalbatus** (Coquillett)

1860. *Armigeres obturbans* Walker, *J. Proc, Linn. Soc, Lond. Zool.* 4 : 91 ; Barraud, 1934 : 314-317 ; *Armigeres subalbatus* (Coquillett), La Casse and Yamaguti, 1950 : 53 ; Knight and Stone, 1977 : 172.

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* *Present address* : Central Tasar Research & Training Institute, Basic Seed Multiplication & Training Centre, Sundergarh, Orissa-770073, INDIA.

This species has wide distribution range in Oriental region and South-west Palaearctic region. The species is distributed all over India.

Present records : Manipur : *Bungmul* (850m.)-1 ♀ (27 Nov. '84) from herb vegetation. *Chandel* (1,500m.)-1 ♀ (22 Oct. '85) from forest. *Chingmeirong* (785m.)-5 ♂ ♂, 18 ♀ ♀ (11 Sept. '83-6 Nov. '83), 30 ♂ ♂, 57 ♀ ♀ (27 Jun. '84-25 Sept. '84) collected from shrubby vegetation, 7 ♀ ♀ (30 Oct. '83-6 Nov. '83) 66 ♀ ♀ (13 Jul. '84-14 Oct. '84), collected during day-biting, 29 ♂ ♂, 24 ♀ ♀ (18 Oct. '83) larvae were reared from Ant-wells in the grainage houses. *Churachandpur* (850m.)-1 ♂, 5 ♀ ♀ (1 Nov. '84) from herb vegetation. *Geljang* (850m.)-1 ♂ (27 Nov. '84) from shrubby vegetation. *Imphal* (785m.)-2 ♀ ♀ (1 Nov. '84) from cattle-shed. *Jiribam* (150m.)-15 ♂ ♂, 9 ♀ ♀ and 15 ♀ ♀ (7 Oct. '84) from herb vegetation and day-biting respectively, 44 ♀ ♀ (7 Oct. '84) from bovine-bait. *Kanglatongbi* (1,000m.)-3 ♂ ♂ (12 Aug. '84) from herb vegetation. *Khongampat* (785m.)-1 ♂, 1 ♀ (16 Dec. '84) from herb vegetation. *Khurkhul* (830m.)-1 ♀ (29 Jan. '84) from herb vegetation. *Mantripukhri* (785m.)-6 ♀ ♀ (20 Oct. '83-21 Nov. '83), 9 ♀ ♀ (11 Mar. '84-15 Sept. '84) collected from cattle-sheds, 1 ♂, 8 ♀ ♀ (11 Oct. '83-20 Nov. '83), 28 ♂ ♂, 16 ♀ ♀ (4 Jul. '84-20 Oct. '84) collected around bulb-light, 42 ♀ ♀ (23 Oct. '83-29 Nov. '83), 60 ♀ ♀ (11 Jun. '84-14 Oct. '84) collected from human-bait, 3 ♀ ♀ (14 Nov. '83-26 Nov. '83), 266 ♀ ♀ (25 Feb. '84-29 Oct.'84) from bovine-bait, 3 ♀ ♀ (13 Sept. '84) collected from human-bait. 3 ♂ ♂, 8 ♀ ♀ (9 Apr. '84-26 Sept. '84) from human dwellings. *Mao* (1,850m.)-2 ♀ ♀ (9 Sept. '85) from human-bait. *Moreh* (150m.)-4 ♂ ♂, 3 ♀ ♀ (18 Aug. '84-19 Aug. '84) from shrubby vegetation, 5 ♀ ♀ (18 Aug. '84) from human-bait, 3 ♀ ♀ (19 Aug. '84) from day-biting, 1 ♀ (19 Aug. '84) from human dwelling. *Nungba* (750 m.)-2 ♀ ♀ (8 Oct. '84) from herb vegetation, 2 ♀ ♀ (19 Oct. '84) larvae were reared from a discarded rain gauge. *Tuibang* (800 m.)-2 ♀ ♀ (8 Oct. '83) from herb vegetation. *Zaphou* (1,000 m.)-3 ♂ ♂, 40 ♀ ♀ (21 Oct. '85) from herbs near human dwellings. Associated breeders were *Aedes aegypti*, *A. albopictus*, *Culex quinquefasciatus*. *C. brevipalpis* and *C. fuscanus*.

3. **Armigeres theobaldi** Barraud

Armigeres theobaldi Barraud. 1934 : 319 ; Thurman, 1959 : 91 ; Knight and Stone, 1977 : 172.

The species has been recorded from Burma, India and Thailand. In India, it has been recorded from Bihar, Karnataka, Manipur, Meghalaya and Orissa.

Present Records : Manipur : *Moreh* (150 m.)-1 ♂, 7 ♀ ♀ (18 Aug. '84-19 Aug. '84) from shrubby vegetation in dense forest.

4. **Armigeres an nulitarsis** (Leicester)

1908. *Leicesteria annulitarsis* Leicester, *Stud. Inst. med. Res. F. M. S.* 99 ; Barraud, 1934 : 325-327 ; Macdonald, 1960 :.119 ; Knight and Stone, 1977 : 173.

This is an Oriental species, recorded from Assam, Karnataka, Maharashtra, Manipur, Meghalaya and Tamil Nadu, in India.

Present records : Manipur : *Nungba* (750 m.) – 1 ♀ (8 Oct. '84) from shrubby vegetation.

5. **Armigeres dentatus** Barraud

1927. *Armigeres dentaus* Barraud, *Indian J. Med. Res.* **14** : 547 ; Barraud, 1904 : 331-332 ; Macdonald, 1960 : 124 ; Knight and Stone, 1977 : 173.

The species has been reported from India and Thailand only. In India, it has been recorded from Manipur and Meghalaya only.

Present rccords : Manipur : *Nungba* (570 m.) – 5 ♀ ♀ (8 Oct. '84) during day-biting.

6. **Armigeres digitatus** (Edwards)

1914. *Leicesteria digitatus* Edwards, *Bull. Ent. Res.* 4 : 262 ; Barraud, 1934 : 330 ; Delfinado, 1966 : 88 ; Knight and Stone, 1977 : 173.

The species distribution is restricted to Oriental region only. In India, it has been reported from Karnataka, Manipur and West Bengal.

Present records : Manipur : *Nungba* (750 m.) – 16 ♀ ♀ (8 Oct. '84) collected from day-biting.

7. **Armigeres flavus** (Leicester)

1908. *Chaetomyia flavus* Leicester, *Stud. Inst. Med. Res. F.M.S.* : **101**, Barraud, 1934 : 321-324 ; Delfinado, 1966 : 89 ; Knight and Stone, 1977 : 173.

The species has its distribution range in Oriental region with its extension to South Palaearctic region. In India, it has been recorded from Assam, Goa, Kerala, Maharashtra, Manipur and West Bengal.

Present records : Manipur : *Jiribam* (150 m.) – 1 ♂ (7 Oct. '84) from Banana groves (*Musa balbisiana*) ; 1 ♀ (8 Oct. '84), during day-biting.

8. **Armigeres inchoatus** Barraud

1927. *Armigeres inchoatus* Barraud, *Indian J. Med. Res.* **14** : 544 ; Barraud, 1934 : 328 ; Macdonald, 1960 : 122 ; Knight and Stone 1977 ; 173.

This species has been recorded from India, Malaysia and Thailand. In India, recorded from Manipur and West Bengal only.

Present records : Manipur : *Nungba* (750 m.) – 3 ♀ ♀ (8 Oct. '84) collected during day-biting.

9. **Armigeres longipalpis** (Leicester)

1904. *Leicesteria longipalpis* Leicester, In Theobald, *Entomologist*, 37 : 211 ; Barraud, 1934 : 329-330 ; Macdonald, 1960 : 126 ; Knight and Stone, 1977 : 174.

Recorded from Oriental region only. In India, it has been noted to be distributed in Assam, Manipur, Meghalaya, and West Bengal.

Present records : Manipur : *Nungba* (750 m.) – 3 ♀ ♀ (8 Oct. '84) collected during day-biting. *Tamenglong* (1,200 m.) – 2 ♀ ♀ (8 Sept. '84) collected during day-biting in forest.

10. **Armigeres magnus** (Theobald)

1908. *Brevirhynchus magnus* Theobald, *Rec. Indian Mus.* 2 : 293 ; Barraud, 1934 : 324-325 ; Delfinado, 1966 : 91 ; Knight and Stone, 1977 : 174.

This species has its distribution in Oriental and Palaearctic region. In India, it has been recorded from Assam, Goa, Kerala, Maharashtra, Manipur and West Bengal.

Present records : Manipur : *Nungba* (750 m.) – 2 ♀ ♀ (8 Oct. '84) collected during day-biting.

11. **Armigeres omissus** (Edwards)

1914. *Leicesteria omissus* Edwards, *Bull. Ent. Res.* 5 : 76 ; Barraud, 1934 : 330-331 ; Delfinado, 1966 : 22 ; Knight and Stone, 1977 : 174.

Distributed in Oriental and South Palaearctic region. The species has been recorded from Maharashtra and Manipur only.

Present records : Manipur : *Nungba* (750 m.) – 34 ♀ ♀ (8 Oct. '84) collected during day-biting.

12. **Heizmanni A complex** (Theobald)

1910. *Bolbodeomyia complex* Theobald, *Rec. Indian Mus.* 4 : 31 ; Barraud, 1934 : 302 ; Knight and Stone, 1977 : 182.

The species has its distribution range in Oriental region only. It has been recorded from Assam, Manipur, and Meghalaya in India.

Present records : Manipur : *Chandel* (1,500 m.) – 1 ♀ (22 Oct. '85) from forest vegetation. *Kalinamei* (1,800 m.) – 1 ♀ (8 Sept. '85) reared from larva bamboo-cut. *Mao* (1,850 m.) – 13 ♂ ♂, 2 ♀ ♀ (8 Sept. '85) reared from larvae from a flower-pot. *Moreh* (150 m.) – 2 ♀ ♀ (18 Aug. '84) from tree-hole, 1 ♂, 4 ♀ ♀ (19 Aug. '84) from shrubby vegetation. *Nungba* (750 m.) – 6 ♀ ♀ (8 Oct. '84) from day-biting. Associated breeders were *Aedes albolateralis* and *A. pseudalbopictus*.

SUMMARY

The communication deals with distribution records of 12 species *viz.*, *Armigeres durhami*, *A. subalbatus*, *A. theobaldi*, *A. annulitarsis*, *A. dentatus*, *A. flavus*, *A. inchoatus*, *A. longipalpis*, *A. magnus*, *A. omissus* and *Heizmannia complex*. *Armigeres subalbatus* remained prevalent species in both hilly and valley region of the state, while other *Armigeres* species were mainly recorded from bamboo growing area of the hilly region. *Heizmannia complex* was also prevalent in the forested area of the hilly region of the state. The study is based on a collection of 140 ♂ ♂ and 824 ♀ ♀.

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"ADDITIONAL RECORDS OF SNAKES FROM NORTHEAST, WITH FOUR NEW RECORDS"

R. MATHEW

INTRODUCTION

This paper supplements the earlier account by Mathew (1980) and deals with 15 species recorded recently from the study areas. In the course of the study an attempt to confirm the distinguishing characters of the pit vipers, *Trimeresurus monticola* and *T. jerdoni* has been made. Included in the account that follows are 15 species referable to five families. The entire material studied barring one example of *Bungarus niger*, is deposited in the Eastern Regional Station, Zoological Survey of India, Shillong.

Order : SQUAMATA

Sub-order : SERPENTES

Family : TYPHLOPIDAE

1. **Typhlops tenuicollis** (Peters) (Peter's Blind Snake)

Material examined : 1 ex, India, Meghalaya, West Garo Hills, Selbalgiri, 28.iv.'88, Coll. V. T. Darlong & J. P. Sati, Regd. No. V/ERS 8769.

Measurement : 135 mm.

Distribution : Himalayas, Samagutin, Nagaland.

Remarks : First record from Meghalaya.

2. **Typhlops diardi müller**i Schlegel (Large Blind Snake)

Material examined : 1 ex, India, Meghalaya, West Garo Hills, Selbalgiri, 20.iv.85, Coll. J. R. B. Alfred, Regd. No. V/ERS 8160.

Measurement : 235 mm.

Distribution ; Burma, Siam and French Indo-China, South of lat. 14° ; the Malay Peninsula and Archipelago.

Family : COLUBRIDAE

3. **Ptyas korros** (Schlegel) (Indo-Chinese Rat Snake)

Material examined : 1 ex, India, Meghalaya, West Garo Hills, Selbalgiri, 2.v.84, Coll. J. P. Sati, Regd. No. V/ERS 3660.

Measurement : 400 mm. (in complete)

Distribution : The Indo-Chinese region east of longitude 98° ; in Assam as far north as the Mishmi Hills ; in Upper Burma to lat 28° ; Yunnan ; S. China ; Hainan ; Malaysia.

Remarks : First record from Meghalaya.

4. **Oligodon cyclurus** (Cantor) (Cantor's Kukri Snake)

Material examined : 1 ex, India, Meghalaya, East Khasi Hills, Kyrdem Kulai, 1.xi.'83, Coll. R. Zoramthanga, Regd. No. V/ERS 7028.

Measurement : 580 mm.

Distribution : N. E. India, Indo-Cnina.

5. **Oligodon albocinctus** (Cantor) (White-barred Kukri Snake)

Material examined : 2 exs; 1 ex, India, Arunachal Pradesh, on way to Mawsing village to Migging village, 12.xii.'85, Coll. C. Radhakrishnan, Regd. No. V/ERS 8253; 1 ex, Mizoram, Aibak road, 7.ix.'89, Coll. Y. P. Sinha, Regd. No. V/ERS 9281.

Measurement : 785 mm-860 mm.

Distribution : The Eastern Himalayas as far west as Sikkim ; Bengal (Rangpur, Kaligang); the whole of Assam; Chittagong province; Burma as far south as the Arrakan Hills.

6. **Oligodon dorsalis** (Gray & Hardwicke) (Spot tailed Kukri Snake)

Material examined : 1 ex, India, Meghalaya, Garo Hills, from a stream near Chinabat, 23.ii.'83, Coll. A. Hussain, Regd. No. V/ERS 8166.

Measurement : 245 mm.

Distribution : Meghalaya (Khasi & Garo Hills); Nagaland; Bangladesh; Burma, (N. Changyang in the Triangle, Chin Hills, Mansi, Katha district).

7. **Ahaetulla prasinus** Boie (Short-nosed Whip Snake)

Material examined : 1 ex, India, Meghalaya, West Khasi Hills, 23 km. away from Nongstoin on Syrkon road, 8.iv.'87, Coll. J. R. B. Alfred, Regd. No. V/ERS 8417.

Measurement : 2100 mm.

Distribution : From Bengal (Jalpaiguri district) and the Eastern Himalayas (Sikkim) throughout the whole of the Indo-Chinese region as far north as the Triangle in Upper Burma, to the Malay Peninsula and the Indo Australian Archipelago; Pulo condore off the coast of Cochin China.

Remarks : First record from Meghalaya.

8. **Lycodon aulicus** (Linnâeus) (Common Wolf Snake)

Material examined : 2 exs; India, Assam, Kaziranga, 20.iv.'85, Coll. C. Radhakrishnan, Regd. No. V/ERS 8164.

Measurement : 530 mm-560 mm.

Distribution : Sri Lanka; Maldive Islands; the whole of India, extending west to Sind and north to the Himalayas (Kangra district, Nepal, Sikkim) ; the whole of Indo-China ; Hongkong ; Southern China ; the Malay Peninsula and Archipelago, as far south as Timor ; the Andaman and Nicobar Islands ; Celebes and the Philippines ; Mauritius.

9. **Pseudoxenodon macrops** Blyth (False Cobra)

Material examined : 2 exs, 1 ex, India, Meghalaya, East Khasi Hills, Shillong (no other data), Regd. No. V/ERS 3078 ; 1 ex, East Khasi Hills, Upper Shillong, April, '77, Donated by Potato Research Institute, Shillong, Regd. No. V/ERS 3080.

Measurement : 790 mm-880 mm.

Distribution : The Eastern Himalayas as far west as Nepal ; Assam ; the whole of Burma as far north as lat. 28° and south to Tenasserim (Taok Plateau) ; Siam (Pa Meang in the extreme north) ; Annam (Langbian Plateau) ; Malay Peninsula (Cameron Highlands).

10. **Boiga cyanea** (Dum & Bibr.) (Green Cat Snake)

Material examined ; 1 ex, India, Meghalaya, East Khasi Hills, Kyrdem Kulai, 23.vi.'84, Coll. St. Peter's School, Shillong, Regd. No. V/ERS 3545.

Measurement : 1610 mm.

Distribution : Darjeeling district (Tindharia) ; Assam (Cachar, Sonapur, Monacherra) ; Burma (Maymyo, Rangoon district, Tavoy) ; Siam (Nakon Lampang, Dong Rek Mts. and islands of the Gulf, viz., Koh Pennan, Koh Pa-Ngan) ; Cambodia (Bokor) ; Cochin China ; Pulo Condore.

Remarks : First record from Meghalaya.

11. **Boiga cynodon** (Boie) (Bengal Cat Snake)

Material examined : 1 ex, India, Arunachal Pradesh, Nampong, 16.vi. 82, Coll, J. Joseph, Regd. No. V/ERS 8135.

Measurement : 1630 mm.

Distribution : Bengal (Jalpaiguri) ; Assam (Cachar, Samaguting, Nahar Khatiya) ;

Meghalaya (Garo Hills) Nagaland ; Burma, as far north as lat. 26° (Myitkyina) ; Siam ; Cambodia ; the Malay Peninsula and Archipelago.

Remarks : First record from Arunachal Pradesh.

Family : ELAPIDAE

12. **Bungarus bungaroides** (Cantor) (Himalayan Krait)

Material examined : 1 ex, India, Meghalaya, West Garo Hills, Selbalgiri 29.x. '86, Coll. J.P. Sati, Regd. No. V/ERS 8352.

Measurement : 400 mm.

Distribution : Eastern Himalayas (Darjeeling district ; Sikkim) Meghalaya (Khasi Hills) ; Assam (Cachar) ; Upper Burma (Matsatap and Ahke, N.E. of Fort Hertz).

13. **Bungarus niger** Wall (Black Krait)

Material examined : 1 ex, India, Meghalaya, West Garo Hills, Selbalgiri, 28.iv. '88, Coll. V.T. Darlong & J.P. Sati.

Measurement : 490 mm.

Distribution : Eastern Himalyas (Darjeeling district) ; Assam (Dibrugarh, Sadiya, Sibsagar) ; Meghalaya (Garo Hills).

Family : VIPERIDAE

14. **Echis carinatus** (Schneider) (Saw-Scaled Viper)

Material examined : 1 ex, India, Assam, 17.iv. '77, Coll. J. R. B. Alfred, Regd. No. V/ERS 8152.

Measurement : 352 mm.

Distribution : The whole of India South of the Ganges, except Bengal.

Family : CROTALIDAE

15. **Trimeresurus jerdoni** Günther (Jerdon's Pit Viper)

Material examined : 1 ex, India, Meghalaya, East Khasi Hills, Tripura Castle Road, Shillong, 30.vi.'86, Coll. S.C. Roy, Regd. No. V/ERS 8260.

Measurement : 720 mm.

Distribution : Smith's (1943) record for *monticola* is "Eastern Himalayas, the whole of Assam and Burma, S.E. Tibet, Yunnan, Siam" where as for *jerdoni* it is "Assam as far west as the Khasi Hills, Burma north of latitude 22° S.E. Tibet, Yunnan, Tong-King and China". From the above it is clear that *monticola* can be of common

occurrence in the present study area whereas for *jerdoni* Khasi Hills forms its western most limit of distribution.

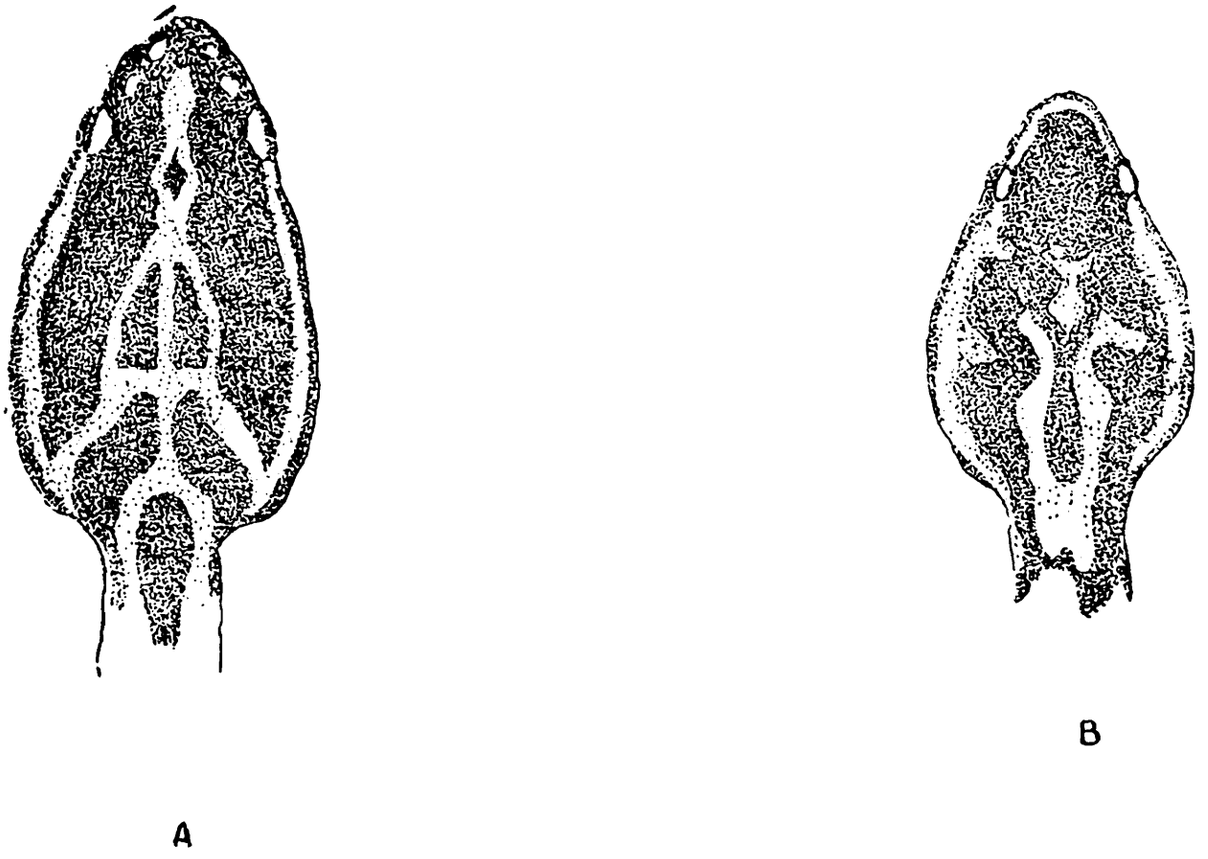

Fig. 1. A close-up of the colour pattern on the head of A. *Trimeresurus jerdoni* and B. *Trimeresurus monticola.*

Remarks :

Mathew (1980) has assigned 13 examples to *Trimeresurus monticola* and identified 10 examples as *Trimeresurus jerdoni.* However, a critical examination of the entire material of the two pit vipers revealed the fact that all the 23 specimens identified earlier as belonging to *T. monticola* and *T. jerdoni* are indeed the one and same species i.e. *T. monticola* and the other species i.e. *T. jerdoni* is scarcely represented in the ophidan collection of the Eastern Regional Station, Zoological Survey of India. The examination of the pattern on the head of the two vipers under discussion (See fig. 1) as well as their distribution (See above) also confirmed this fact.

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Scientist-'SF' and S. K. Chanda, Scientist-'SD', Zoological Survey of India, Calcutta for their encouragement and suggestions. The figures were drawn by my friend and colleague Dr. (Miss) N. Sen.

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RECORDS OF MOSQUITOES (DIPTERA : CULICIDAE) FROM MANIPUR : GENUS—AEDES

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INTRODUCTION

Aedine mosquitoes not only cause annoyance by blood sucking activities but also serve as main vectors for some important viral diseases like chikungunya and dengue (Myers *et. al.*, 1965 ; George and Soman, 1975). These diseases pose a serious health problem whenever they appear in the epedemic form.

The state of Manipur remained unknown for their aedine fauna except a record of most common *Aedes albopictus* and a forest species *Aedes albolateralis* by Malhotra *et al.* (1983). The present communication deals with the records of *Aedes* mosquitoes collected during 1983 to 1985 from the state. During the surveys attempts were made to collect the adults and immatures as well. The immatures were reared upto adult in the laboratory and the identification was done mainly on adult characters. The genital characters and characters of larvae were also taken into consideration whenever those forms were available. For identification the works of Barraud (1934), Huang (1972 and 1977), Reinert (1970 and 1973), Knight (1946) was mainly consulted. The classification and nomenclature used here are mainly based on the synoptic catalogue of mosquitoes of the world (Knight and Stone, 1977). The physiography of the study area, materials and methods have already been described in the earlier communication (Rajput and Singh, 1986).

Collection Records :

Genus **Aedes**

1. **Aedes alboscutellatus** (Theobald)

1905(a). *Lepidotomyia alboscutellatus* Theobald, *Ann. hist-nat. Mus. Hung.* 3 : 80 ; Barraud, 1934 : 250-251 ; Reinert, 1973 : 17 ; Knight and Stone, 1977 : 73.

The species has its distribution range in Oriental to Australian region with a northward extension up to Japan. In India, recorded from Assam, Bihar, Maharashtra and West Bengal.

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Present records : Manipur : *Khongampat* (785 m.)—1 ♀ (16 Dec. '84) from herb vegetation.

2. **Aedes caecus** (Theobald)

1901. *Culex caecus* Theobald, *Monogr. Cul.* 1 : 413 ; Barraud 1934 : 257-258 ; Knight and Stone, 1977 : 74.

This species has a wide distribution in Oriental region. In India, the species has been recorded from Assam, Kerala, and West Bengal.

Present records : Manipur : *Chingmeirong* (785 m.)—1 ♀ (11 Sept. '83), coming to bite during day. *Khongampat* (785 m.)—1 ♂, 1 ♀ (27 Nov. '83), from herb vegetation. *Jiribam* (150 m.)—12 ♂ ♂, 2 ♀ ♀ (7 Oct. '84), larvae were reared from a rainy-pool with heavy decaying of saw-dust. *Moreh* (150 m.)—14 ♂ ♂, 1 ♀ (19 Aug. '84), from rainy-pool in forest. Associated breeders were *Anopheles kochi*, *Culex fuscocephala* and *C. mimulus*.

3. **Aedes vexens** (Meigen)

1830. *Culex vexens* Meigen, *Syst. Bechr.* 5 : 241 ; Barraud, 1934 : 253 ; Reinert, 1973 : 66 ; Knight and Stone, 1977 : 83.

The species has wide range of distribution in Holarctic region, Oriental region, British Honduras, Guatemala, Mexico, Pacific Islands, Papuan area and Transvaal. Distributed almost all over India.

Present records : Manipur : *Chandel* (1,500 m.)—2 ♂ ♂, 1 ♀ (22 Oct. '85) from forest vegetation. *Chingmeirong* (785 m.)—1 ♂, 33 ♀ ♀ (2 Oct. '83—25 Dec. '83), 39 ♂ ♂, 26 ♀ ♀ (22 Jan. '84—25 Sept. '84), collected from shrubby vegetation, 9 ♀ ♀ (6 Nov. '83—29 Nov. '83), 14 ♀ ♀ (3 Jun. '84 – 14 Oct. '84) from day-biting in field, 6 ♂ ♂, 7 ♀ ♀ (14 Apr. '84) from herb vegetation. *Kanglatongbi* (1,000 m.)—2 ♀ ♀ (12 Aug. '84) from herb vegetation. *Khongampat* (785 m.)—1 ♂, 21 ♀ ♀ (27 Nov. '83), 2 ♂ ♂, 3 ♀ ♀ (29 Jan. '84) from herb vegetation. *Khurkhul* (830 m.)—2 ♂ ♂, 3 ♀ ♀ (29 Jan. '84), from herb vegetation. *Langol-hill* (785 m.)—3 ♂ ♂, 7 ♀ ♀ and 3 ♂ ♂ (26 Jan. '84) from dried leaves and pit shelters respectively, 6 ♀ ♀ (29 Jul. '84) from pit shelters, 1 ♂ (19 Feb. 84) from shrubby vegetation. *Mantripukhri* (785 m.)—2 ♀ ♀ (13 Feb. '84) from human-bait, 4 ♀ ♀ (10 Jun. '84—29 Oct. '84) from bovine-bait. *Mao* (1,850 m.)—1 ♀ (9 Sept. '85) from human-bait. *Pheidinga* (900 m.)—2 ♀ ♀ (29 Jan. '84) from herb vegetation.

4. **Aedes iyengari** Edwards

1923. *Aedes iyengari* Edwards, *Bull. Ent. Res.* 14 : 4 ; Barraud, 1934 : 273-275 ; Reinert, 1970 : 10 ; Knight and Stone, 1977 : 88.

The species restricts its distribution in Burma., India, Indonesia and Thailand. The species is known from Manipur and West Bengal in India.

Present records : Manipur : *Moreh* (150 m.)—1 ♀ (18 Aug. '84), from shrubby forest.

5. **Aedes albolateralis** (Theobald)

1908. *Stegomyia albolateralis Theobald Rec. Indian Mus.* 2 : 289 ; Barraud, 1934 : 205-208 ; Knight and Stone, 1977 : 90 ; Malhotra *et al.*, 1983, 25(2) : 80-83.

The species has its distribution range in Oriental region and south western Palaearctic region. In India, it is recorded from Assam, Himachal Pradesh, Karnataka, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Uttar Pradesh and West Bengal.

Present records : Manipur : *Kalinamei* (1,800 m.)—1 ♀ (8 Sept. '85) larva was reared from a bamboo-cut. *Mao* (1,850 m.)—7 ♀ ♀ (8 Sept. '85) from human-bait, 6 ♀ ♀ (9 Sept. '85) recorded from larvae from a tree-hole in forest. *Nungba* (750 m.)—4 ♀ ♀ (8 Oct. '84) collected biting during day in forest. The species associately breeds with *Aedes pseudalbopictus* and *Heizmannia complex*.

6. **Aedes chrysolineatus** (Theobald)

1907. *Howardina chrysolineatus* Theobald, *Monogr. Cul.* 4 : 218 ; Barraud, 1934 : 185-188 ; Knight and Stone, 1977 : 93.

This species has a wide distribution in Orintal region. In India, recorded from Karnataka, Maharashtra, Mizoram, Sikkim, and Tamil Nadu.

Present records : Manipur : *Khongampat* (785 m.)—1 ♂ (16 Dec. '84) from herbs below the trees.

7. **Aedes elsiae** Barraud

1923(a). *Aedes elsiae* Barraud, *Bull. Ent. Res.* 13 : 406 ; Barraud, 1934 : 180-883 ; Knight and Stone, 1977 : 94.

This species has been recorded from China, India, Kampuchea, Laos, Malaysia, Thailand and Vietnam. In India, it is recorded from Jammu & Kashmir, and Meghalaya.

Present records : Manipur : *Chandel* (Chiva river junction) (900 m.)—1 ♂, 1 ♀ (22 Oct. '85) larvae were reared from a rock pool at river margin. *Tamenglong* (1,200 m.) —4 ♂ ♂, 4 ♀ ♀ (Sept. '84) larvae reared from a pool on a pitch road. Associated breeder was *Aedes shortti*.

8. **Aedes formosensis** Yamada

1921. *Aedes formosensis* Yamada, *Annot. Zool. Jap.* 10 : 67 ; Barraud, 1934 : 189-190 ; Knight and Stone, 197 : 95.

This is an Oriental species. In India, it is recorded from Assam, Meghalaya, Sikkim, Uttar Pradesh, and West Bengal.

Present records : Manipur : *Jiribam* (150 m.)—1 ♀ (2 Oct. '84), from banana-groves (*Musa balbisiana*). *Nungba* (750 m.)—2 ♀ ♀ (8 Oct. '84) from day-biting in forest.

9. **Aedes shortti** (Barraud)

1923(b). *Finlaya shortti* Barraud, *Bull. Ent. Res.* 13 : 405 ; Barraud, 1934 : 183-184 ; Knight and Stone, 1977 : 104.

The species is distributed in Oriental region. Recorded from Jammu & Kashmir, Meghalaya, Uttar Pradesh and West Bengal in India.

Present records : Manipur : *Chandel* (Chiva stream junction) (1,500 m.)—1 ♂, 1 ♀ and many larvae (22 Oct. '85) collected from rock-pools. The associative breeder *Aedes elsiae.*

10. **Aedes lineatopennis** (Ludlow)

1905. *Taeniorhynchus lineatopennis* Ludlow, *Can. Ent.* 37 : 133 ; Barraud, 1934 : 269-271 ; Knight and Stone, 1977 : 120.

This species has wide range of distribution in Oriental region, Australia, Eastern and Southern Africa, Gabon & Gold Coast, Nigeria, and Upper Volta. Recorded from throughout India.

Present records : Manipur : *Bullian* (775 m.)—1 ♀ (8 Oct. '83) from shrubby vegetation of *Lithocarpus dealbata. Chingmeirong* (785 m.)—4 ♂ ♂, 4 ♀ ♀ (18 Sept. '83 —23 Oct. '83), 1 ♂, 5 ♀ ♀ (27 Jan. '84—13 Jul. '84) from day-biting, 2 ♀ ♀ (14 Oct. '83) were reared from larvae, collected from a shallow drain-pit. *Kwakta* (760 m.)—1 ♀ (8 Oct. '83) from shrubby vegetation. *Mantripukhri* (785 m.)—1 ♀ (15 Nov. '83) from human-bait, 5 ♀ ♀ (23 Jun. '84—9 Jul. '84) from bovine-bait, 2 ♂ ♂, 2 ♀ ♀ (4 Jul. '84— 1 Nov. '84) from bulb-light.

11. **Aedes aegypti** (Linnaeus)

1762. *Culex aegypti* Linnaeus, *Hasselquist's Reise nash Palestina* : 470 ; Barraud, 1934 : 224 ; Knight and Stone, 1977 : 154.

The species is cosmotropical (within the 20°C isotherm) in distribution. Also recorded from Ryukyu Islands. In India, it is distributed all over the big cities except some hilly states.

Present records : Manipur : *Imphal* (785 m.)—20 ♂ ♂, 14 ♀ ♀ and 97 larvae (31 Jul. '85) from a discarded tyre dump. The associative breeders were *Aedes albopictus, Armigeres subalbatas, Culex quinquefasciatus,* and *C. fuscanus.*

12. **Aedes albopictus** (Skuse)

1894. *Culex albopictus* Skuse, *Indian Mus. Notes.* 3 : 20 ; Barraud, 1934 : 233 ; Knight and Stone, 1977 : 156 ; Huang, 1977 : 13.

This species has its distribution range in Oriental region, Australian region and parts of Palaearctic and Ethiopian regions. This is the commonest *Aedes* species recorded from almost all over India.

Present records : Manipur : *Chandel* (1,500 m.)—1 ♀ (22 Oct. '85) from forest vegetation, *Chingmeirong* (785 m.)—9 ♂ ♂, 58 ♀ ♀ (11 Sept. '83-29 Sept. '83), 18 ♂ ♂, 28 ♀ ♀ (28 May '84-13 Sept. '14) were collected during day from human-bait, 23 ♂ ♂, 70 ♀ ♀ (18 Sept. '83-4 Dec. '83), 6 ♂ ♂, 32 ♀ ♀ (9 Jun. '84-24 Aug. '84) from shrubby vegetation of *Q. acutissima* ; 20 ♂ ♂, 15 ♀ ♀ (18 Oct. '83-5 Nov. '83), 79 ♂ ♂, 69 ♀ ♀ (17 Jun. '84-26 Aug. '84) were reared from larval collections from Ant-wells inside the grainage house ; 2 ♂ ♂, 3 ♀ ♀ (6 Nov. '83) reared from larvae from discarded tar-barrels ; 1 ♀ (8 Nov. '84) reared from larvae from discarded glass container. *Geljang* (850 m.)—1 ♀ (27 Nov. '84) from shrubby vegetation, 6 ♂ ♂, 4 ♀ ♀ (27 Nov. '84) reared from larvae from enamel basin inside the grainage house. *Jiribam* (150 m.)—1 ♀ (7 Oct. '84) adult collected from discarded motor tyre ; 23 ♂ ♂, 14 ♀ ♀ (7 Oct. '84) reared from larvae from a tree hole ; 6 ♂ ♂, 3 ♀ ♀ (7 Oct. '84) reared from larvae from a discarded tar-barrel ; 1 ♂, 5 ♀ ♀ (7 Oct. '84) reared from larvae from bamboo stumps ; 2 ♀ ♀ (7 Oct. '84) reared from larvae from discarded motor tyres. *Kalinamei* (1, 500 m.)—1 ♀ (8 Sept. '85) reared from larvae from bamboo-cut. *Khongampat* (785 m.)—1 ♀ (22 Aug. '84) from herb vegetation ; 2 ♂ ♂, 3 ♀ ♀ and 1 ♂ (12 Aug. '84) from tree hole and ant-wells respectively. *Koubru-Leikha* (1, 040 m.)—2 ♂ ♂, 3 ♀ ♀ (12 Aug. '84) from shrubby vegetation. *Mantripukhri* (784 m.)—1 ♀ (4 Jul. '84) from bulb light, during night, 1 ♀ (11 Jul. '84) from human bait ; 20 ♂ ♂, 15 ♀ ♀ (16 Jun. '84—13 Jul. '84) larvae were reared from tree holes ; 22 ♂ ♂, 26 ♀ ♀ (21 Jun. '84—14 Aug. '84) from discarded container ; 6 ♂ ♂, 7 ♀ ♀ (6 Jul. '84) were reared from bamboo stumps. *Moltam-hill* (820 m.)—1 ♀ (1 Nov. '84) from day biting. *Moreh* (150 m.)—1 ♀ (18 Aug. '84) from human bait collection ; 6 ♂ ♂, 4 ♀ ♀ (18 Aug. '84) from biting during day time, 8 ♂ ♂, 8 ♀ ♀ (19 Aug. '84) from shrubby vegetation ; 1 ♀ (19 Aug. '84) from human dwellings , 5 ♂ ♂, 4 ♀ ♀ (19 Aug. '84) were reared from larval collection from discarded motor tyres. *Nungba* (750 m.)—10 ♂, 6 ♀ ♀ (8 Oct. '84) from day biting ; 17 ♀ ♀, 15 ♂ ♂ and 6 ♂ ♂, 8 ♀ ♀ (9 Oct. '84) larvae were reared from discarded containers and broken rain gauge with decaying leaves, respectively. *Zaphou* (1,000 m.)—1 ♀ (22 Oct. '85) from human bait. The associative breeders were *Aedes aegypti, A. annandalei, A. craggi, Armigeres subalbatus, Culex quinquefasciatus, C. brevipalpis* and *C. fuscanus.*

13. **Aedes annandalei** (Theobald)

1910. *Stegomyia annandalei* Theobald, *Rec. Indian Mus.* 4 : 10 ; Barraud, 1934 : 227-229 ; Knight and Stone, 1977 : 157.

The species is mainly Oriental extending its distribution upto New Guinea in

Australian region. In India, it is recorded from Andaman Islands, Assam, Bihar, Maharashtra, Mizoram and West Bengal.

Present records : Manipur : *Jiribam* (150 m.)—2 ♀ ♀ (7 Oct. '84), larvae were reared from a bamboo-stump. *Nungba* (750 m.)—1 ♀ (8 Oct. '84) from shrubby vegetation. The associative breeders were *Aedes albopictus* and *A. craggi.*

14. **Aedes craggi** Barraud

1923. *Aedes craggi* Barraud, *Indian J. Med. Res.* **11** : 227 ; Barraud, 1934 : 229-230 ; Knight and Stone, 1977 : 158.

This species is restricted to India and Thailand only. In India the species has been reported from Assam, Meghalaya and West Bengal.

Present records : Manipur : Jiribam (150 m.)—1 ♂ (7 Oct. '84), larva reared from a bamboo-stump. The Associative breeders were *Aedes albopictus* and *A. annandalei.*

15. **Aedes gardnerii imitator** (Leicester)

1908. *Stegomyia gardnerii imitator* Leicester *Stud. Inst. Med. Res. F.M.S.* 3 : 89 ; Mattingly, 1962 : 36 ; Knight and Stone, 1977 : 160.

This has been recorded from China, Hong Kong, India, Kampuchea, Malaysia, Nepal, Taiwan, Thailand and Vietnam. The species has been recorded from Bihar, Manipur and West Bengal in India.

Present records : Manipur : *Nungba* (750 m.)—1 ♂ (8 Oct. '84) landing over human-bait in forest.

16. **Aedes pseudalbopictus** Borel

1928. *Aedes pseudalbopictus* Borel, *Arch. Insts. Pasteur Indochine* : 85 ; Barraud, 1934 : 235-237 ; Huang, 1972 : 28.

This is an Oriental species recorded from Burma, India, Java, Malaysia, Taiwan, Thailand and Vietnam. The species has been recorded from Maharashtra, Manipur and West Bengal.

Present records : Manipur : *Kalinamei* (1,800 m.)—1 ♂ (8 Sept. '85) larva was reared from a bamboo-cut. The associative breeders were *Aedes albolateralis* and *Heizmannia complex.*

17. **Aedes mediopunctatus** (Theobald)

1905(b). *Stegomyia mediopunctatus* Theobald, *J. Bomb. Nat. Hist. Soc.* **16** : 240 ; Barraud : 230-232 ; Knight and Stone, 1977 : 162 ; Huang, 1977, 14(1) : 36-40.

This species has been recorded from India, the Philippines (Palawan) and Sri Lanka. In India, the species has been reported from Assam, Karnataka, Kerala and Maharashtra.

Present records : Manipur : *Nungba* (750 m.)—2 ♀ ♀ (8 Oct. '84) from shrubby vegetation, 6 ♀ ♀ (8 Oct. '84) from human-bait in forest during day. *Tamenglong* (1,200 m.)—1 ♀ (8 Sept. '84) landing for biting in forest.

18. **Aedes andamanensis** Edwards

1922. *Aedes andamanensis* Edwards, *Indian J. Med. Res.* **10** : 272 ; Barraud, 1934 : 290 ; Delfinado, 1967 : 9 ; Knight, 1978 : 34.

The species has a wide range of distribution in Oriental region recorded from Andaman Islands, Assam and Kerala in India.

Present records : Manipur : *Chingmeirong* (785 m.)—5 ♂ ♂, 5 ♀ ♀ (6 Sept. '83—29 Sept. '83), 1 ♀ (27 Jun. '84) were collected from human-bait during day in *Q. acutissima* plantation. 6 ♀ ♀ (20 Oct. '83—4 Dec. '83), 1 ♂ (27 Jul. '84) were collected from shrubby vegetation. *Khongampat* (785 m.)—2 ♂ ♂ (27 Nov. '83), 1 ♀ (16 Dec. '84) from herb vegetation. *Langol-hill* (850 m.)—1 ♂, 1 ♀ (29 Jul. '84) from pit-shelters. *Mantripukhri* (785 m.)—1 ♀ (23 Oct. '83) from human-bait and 1 ♀ (20 Nov. '83), 3 ♂ ♂ (4 Jul. '84—8 Nov. '84) from bulb-light.

19. **Aedes vallistris** Barraud

1928. *Aedes vallistris* Barraud, *Indian J, Med. Res*, **16** : 369 ; Barraud, 1934 : 290-291 ; Knight, 1978 : 38.

The species has been recorded from Burma, India, Kampuchea and Thailand. Earlier known from Assam only in the country.

Present records : Manipur : *Chingmeirong* (785 m.)—3 ♀ ♀ (20 Oct. '83—30 Oct. '83), 4 ♀ ♀ (12 Jul. '84—24 Aug. '84) from shrubby vegetation of *Q. acutissima*. *Mantripukhri* (785 m.)—1 ♀ (23 Oct. '83) from human-bait.

SUMMARY

The communication presents distribution records with ecological notes for the 19 recorded species from the state of Manipur. The recorded species are—*Aedes alboscutellatus, A. caecus, A. vexens, A. iyengari, A. albolateralis, A. chrysolineatus, A. elsiae, A. formosensis, A. shortti, A. lineatopennis, A. aegypti, A. albopictus, A. annandalei, A. craggi, A. gardnerii imitator, A. pseudalbopictus, A. mediopunctatus, A. andamanensis*, and *A. vallistris*. The presence of *A. aegypti* and other potential vectors is notable to the public health workers.

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TAXONOMIC STUDIES ON SOME SPIDERS OF THE GENERA *GNAPHOSA* LATREILLE, *HAPLODRASSUS* CHAMBERLIN AND *SCOTOPHAEUS* SIMON (FAMILY : GNAPHOSIDAE) FROM INDIA.

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INTRODUCTION

The spiders of the family Gnaphosidae are very little known in the Indian Fauna. Pocock (1900) on Indian spiders contains no reference to this family. Caporiacco (1934) was the poineer worker and he has described 10 species of various genera from Himalaya. Recently Tikader (1962,66,73) described two species of *Gnaphosa* and two species of *Scotophaeus* from India. Patel and Patel (1975) described one species of *Scotophaeus* from Gujarat. Tikader & Gajbe (1977 a, b, c,) described two more species of *Gnaphosa*, 2 more species of *Haplodrassus* and one species of *Scotophaeus*. Tikader (1982) in his fauna of India series described two more species of *Scotophaeus* and one species of *Haplodrassus*.

While studying the spider collections of the family Gnaphosidae, I came across four new species of the genera *Gnaphosa*, *Haplodrassus* and *Scotophaeus* which are described in this paper.

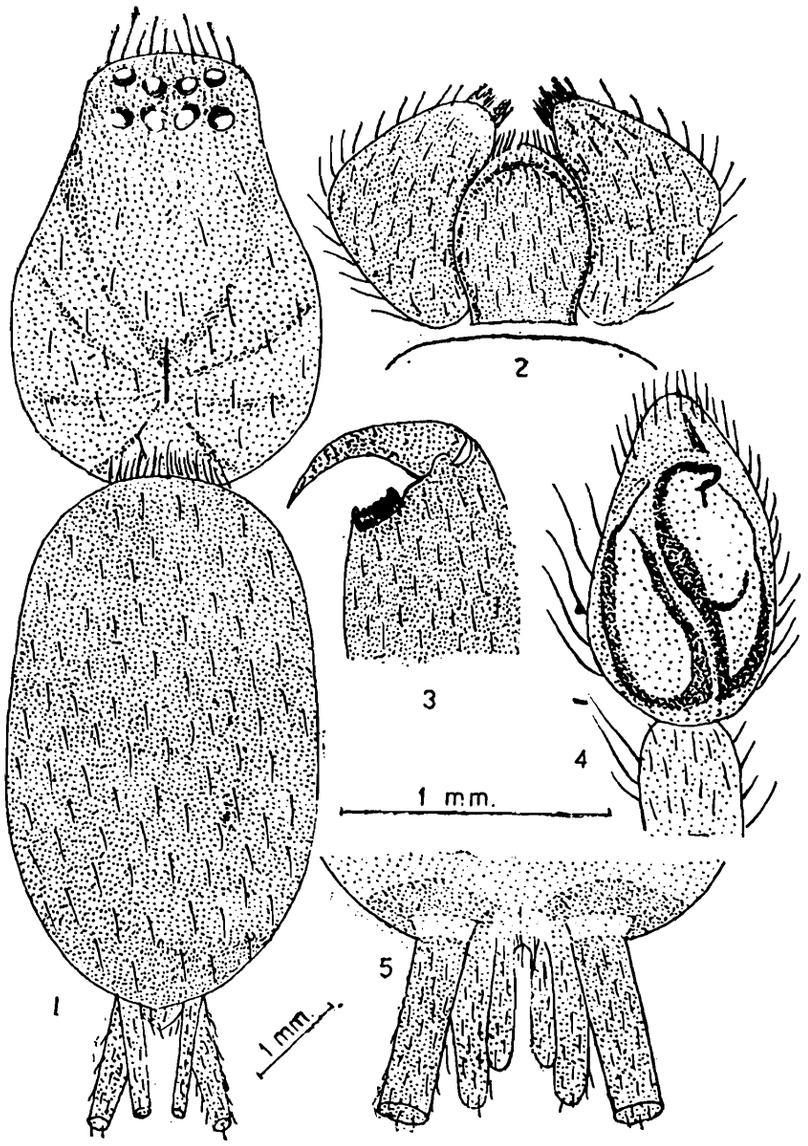
All type specimens are deposited in the National Zoological Collection, Zoological Survey of India, Calcutta.

1. **Gnaphosa rohtakensis** sp. nov.

General : Cephalothorax and legs reddish-green ; abdomen brownish-black. Total length 9.80 mm. Carapace 4.40 mm. long, 3.00 mm. wide ; abdomen 5.50 mm. long, 3.20 mm. wide.

Cephalothorax : Longer than wide, narrowing in front, slightly convex, clothed with long spinelike hairs ; posterior middle provided with conspicuous short fovea ; radiating streaks diverging from fovea to lateral sides of carapace. Eyes pearly white except anterior medians which are black ; posterior row longer than anterior row ; anterior row of eyes slightly procurved (as seen from in front), slightly smaller than laterals and closer to adjacent laterals than to each other ; posterior row of eyes slightly recurved with posterior medians conspicuously silvery white in colour, oval, slightly

larger than laterals and closer to each other than to adjacent laterals ; ocular area provided with small black setae ; median ocular quadrangle longer than wide, wider in front than behind. Clypeus provided with alternate short and very long setae as in fig. 1. Clypeal height more than diameter of anterior median eye. Chelicerae vertical, strong, clothed with long spinelike hairs, outer margin provided with one



Figs. 1-5. *Gnaphosa rohtakensis* sp. nov.

1. Dorsal view of Male, legs omitted. 2. Labium and maxillae. 3. Left chelicera. 4. Left male palp (ventral view). 5. Spinnerets.

small tooth and inner margin with sclerotized ridge as in fig. 3. Labium and maxillae longer than wide, clothed with black setae ; anterior portion provided with scopulae, with shape as in fig. 2. Sternum heart-shaped, narrow behind, rebordered laterally, clothed with black hairs. Legs relatively long, stout, clothed with hairs and spines ; leg formula 4123. Male palp as in fig. 4 Female unknown.

Abdomen : Longer than wide, nearly elliptical, uniform, clothed with long black hairs ; ventral side lighter than dorsal. Spinnerets prominent, clothed with small hairs as in fig. 5.

Type-specimen : *Holotype* male in spirit., other details as below

Type locality : India, Uttar Pradesh, Kalhawar on Rohtak-Delhi road, Rohtak Dist. 5. III. 1971. Coll *Asket Singh.*

This species closely resembles *Gnaphosa poonaensis* Tikader but differs from it as follows (i) Abdomen uniform but in *G. poonaensis* abdomen provided with chevrons (ii) Male palp structurally different in tibial apophyses and distally expanded tip of the embolus.

2. **Haplodrassus ambalaensis** sp. nov.

General : Cephalothorax and legs deep brown , abdomen reddish-green. Total length 6.40 mm. Carapace 2.30 mm. long, 1.90 mm. wide ; abdomen 4.20 mm. long, 2.20 mm. wide.

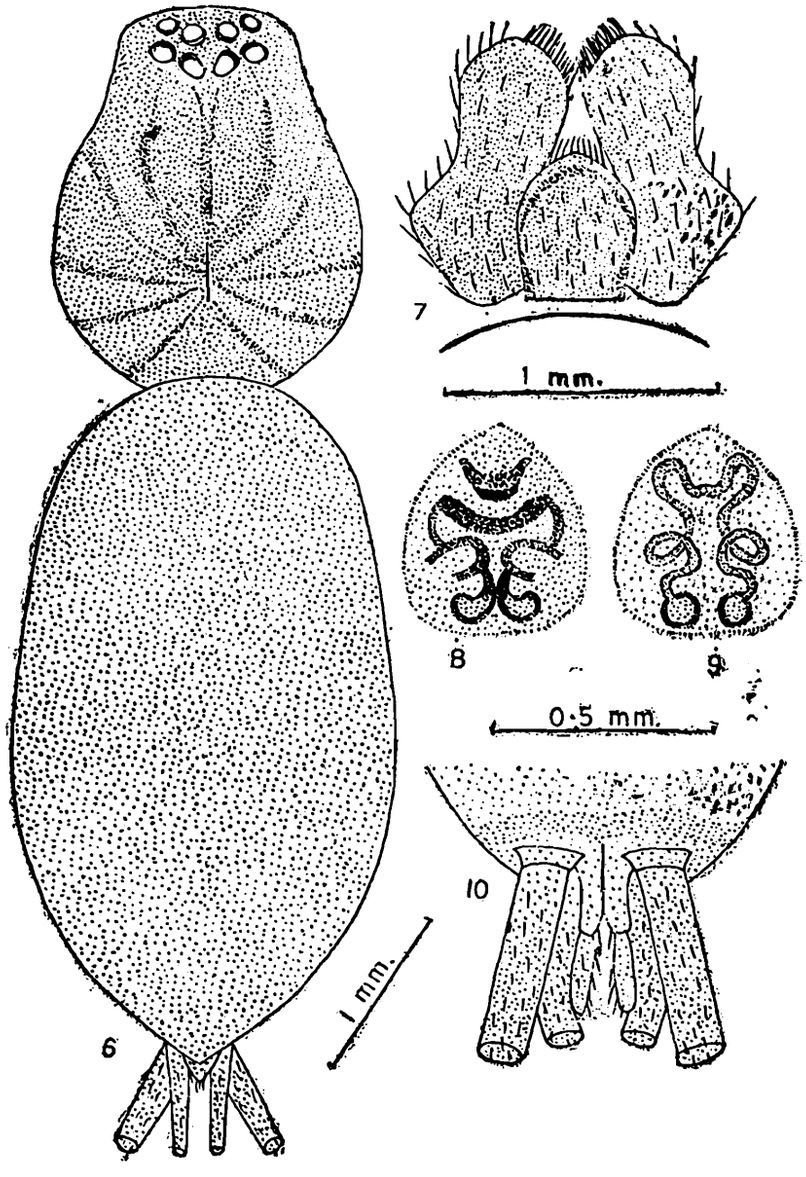
Cephalothorax : Longer than wide, broad in front, clothed with pubescence ; posterior middle provided with conspicuous fovea ; radiating streaks diverging from fovea to latertal sides of carapace ; cephalic region slightly high. Eyes pearly white except anterior medians which are black ; posterior row of eyes slightly longer than anterior row ; anterior row procurved (as seen from in front), with medians slightly larger than laterals and closer to adjacent laterals than to each other ; posterior row of eyes procurved, with medians oblique, larger than laterals and much closer to each other than to adjacent laterals as in fig. 6 : median ocular quadrangle longer than wide and wider in front than behind. Clypeal height greater than diameter of anterior median eye. Sternum heart-shaped, pointed behind, rebordered, clothed with fine hairs. Chelicerae moderately strong ; inner and outer margins provided with two and three teeth respectively. Labium and maxillae longer than wide ; anterior end of maxillae provided with conspicuous scopulae, with shape as in fig. 7. Legs relatively long and strong, clothed with hairs and spines ; metatarsi and tarsi of I and II provided ventrally with conspicuous scopulae and tarsi with prominent claw tufts ; leg formula 4123. Male unknown.

Abdomen : Longer than wide, narrowing anteriorly, widest behind middle, clothed with pubescence ; ventral side lighter than dorsal. Epigyne as in fig. 8. Spermathecae as in fig. 9. Spinnerets as in fig. 10.

Type-specimen : *Holotype* female in spirit, other details as below.

Type locality : INDIA, Punjab, Rupar, Ambala district, 14-1-1964, Coll. *T. D. Soota.*

This species resembles *Haplodrassus tehriensis* Tikader & Gajbe but differs from it is follows : (i) Carapace without W-shaped deep brown marking seen in *H. tehriensis*



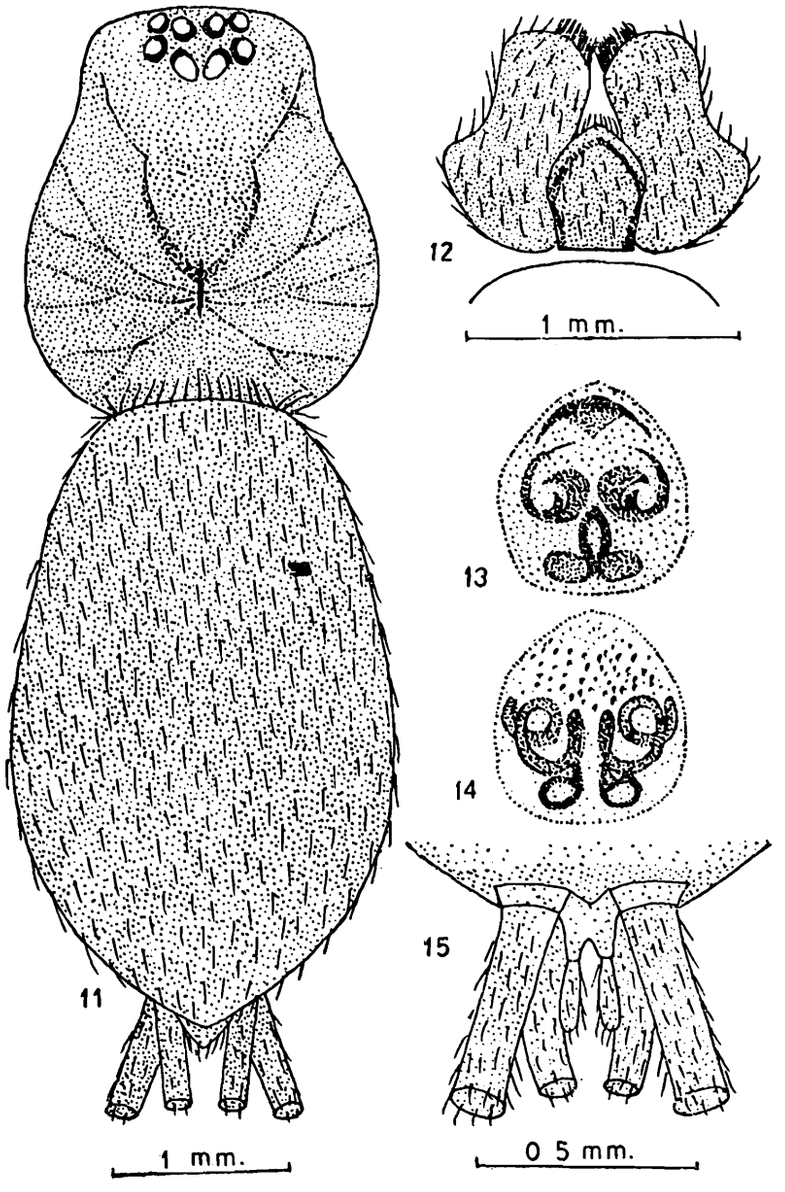
Figs. 6-10. *Haplodrassus ambalaensis* sp. nov.
6. Dorsal view of female, legs omitted. 7. Labium and maxillae. 8. Epigyne. 9. Spermathecae. 10. Spinnerets.

and with W-shaped conspicuous deep brown marking just above fovea. (ii) Abdomen without the brownish patches seen in *H. tehriensis*. (iii) Epigyne and spermathecae also structurally different as without concave lateral arms of the epigynum and spermathecae not elongate but oval.

3. **Haplodrassus bengalensis** sp. nov.

General : Cephalothorax and legs reddish green ; abdomen deep yellowish-green. Total length 6.30 mm. Carapace 2.60 mm. long, 2.10 mm. wide ; abdomen 3.80 mm. long, 2.20 mm. wide.

Cephalothorax : Longer than wide, broad in front, clothed with pubescence and some hairs, posterior to middle provided with conspicuous fovea with radiating streaks



Figs. 11-15. *Haplodrassus bengalensis* sp. nov.
11. Dorsal view of female, legs omitted. 12. Labium and maxillae. 13. Epigyne. 14. Spermathecae. 15. Spinnerets.

diverging from fovea to lateral sides of carapace. Eyes pearly white except anterior medians which are black ; posterior row of eyes slightly longer than anterior row ; anterior row of eyes procurved (as seen from in front), with medians very slightly smaller than laterals and closer to adjacent laterals than to each other ; posterior row of eyes procurved, with medians oblique, larger than laterals and much closer to each other than to adjacent laterals as in fig. 11. Median ocular quadrangle longer than wide, wider in front than behind. Clypeal height greater than diameter of anterior

median eye. Chelicerae moderately strong, vertical ; inner and outer margins provided with two and three teeth respectively. Sternum heart-shaped, pointed behind, rebordered, clothed with fine hairs. Labium and mixillae provided with conspicuous scopulae, its shape as in fig. 12. Legs relatively long and strong, clothed with hairs and spines ; metatarsi and tarsi I and II provided ventrally with conspicuous scopulae and tarsi with prominent claw tufts ; leg formula 4123. Male unknown.

Abdomen : Longer than wide, nearly elliptical, clothed with hairs, ventral side lighter than dorsal. Epigyne as in fig. 13. Spermathecae as in fig. 14. Spinnerets prominent as in fig. 15.

Type-specimen : *Holotype* female in spirit, other details as below.

Type-locality : India, West Bengal, Naihati village, 24 Pargannas district, 8.II.1967. Coll. *S. K. De.*

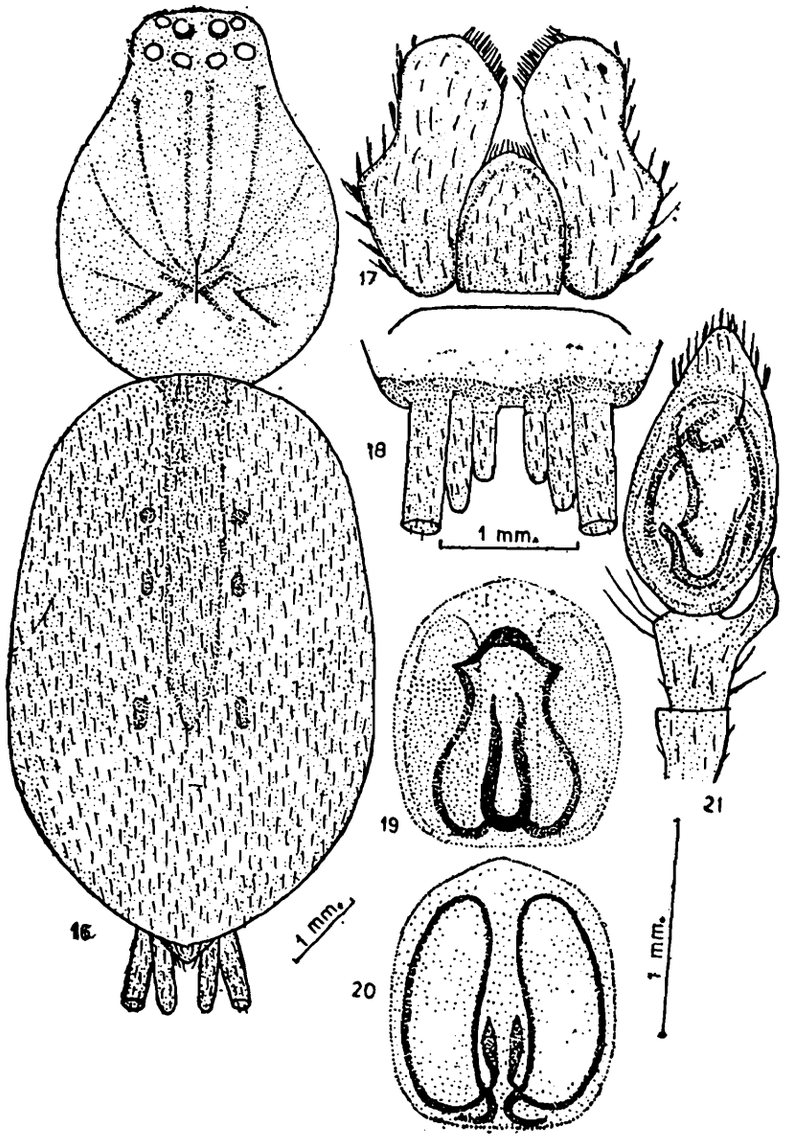
This species resembles *Haplodrassus sataraensis* Tikadar & Gajbe but differs from it as follows : (i) Anterior lateral eyes very slightly larger than anterior medians, but in *H. sataraensis* anterior medians are slightly larger than the anterior laterals. (ii) Abdomen uniform in colour but in *H. sataraensis* abdomen provided with chalk-white chevrons. (iii) Epigyne and spermathecae structurally different in concave arms of the epigynum and spermathecae are oval but not triangular.

4. **Scotophaeus kalimpongensis** sp. nov.

General : Cephalothorax and legs reddish-green ; abdomen light yellowish green, Total length 11.70 mm. Carapace 4.60 mm. long, 3.70 mm. wide ; abdomen 7.20 mm. long, 4.20 mm. wide.

Cephalothorax : Longer than wide, convex, narrow in front, clothed with pubescence and some hairs, posterior middle provided with conspicuous fovea. Eyes pearly white except anterior medians which are black ; posterior row of eyes slightly longer than anterior row ; anterior row of eyes slightly procurved (as seen from in front) ; anterior medians circular, black, larger than laterals and closer to adjacent laterals than to each other ; posterior row of eyes procurved, more or less equal and equidistant from each other ; posterior medians silvery white, elliptical in shape as in fig. 16 ; median ocular quadrangle longer than wide and wider in front than behind. Clypeus narrow, greater than the diameter of anterior median eye, provided with long black setae. Sternum nearly elliptical, pointed behind, with short sclerotized extensions to and between coxae, clothed with hairs. Labium nearly oval, longer than wide, notched at the base ; maxillae long, narrowed at middle, raised laterally, their anterior margin provided with conspicuous scopulae as in fig. 17. Chelicerae moderately strong,

vertical ; inner margin with one minute tooth and outer margin with five dissimilar teeth. Legs relatively long and strong, clothed with hairs and some spines, with



Figs. 16-21. *Scotophaeus kalimpongensis* sp. nov.
16. Dorsal view of female, legs omitted. 17. Labium and maxillae. 18. Spinnerets. 19. Epigyne. 20. Spermathecae. 21. Left male palp (ventral view).

scopulae extending up to base of metatarsi I and II ; leg formula 4123. Male specimen smaller, coloured as in female ; male palp as fig. 21.

Abdomen : Longer that wide, more or less elliptical, slightly narrowed behind, clothed with mousy hairs ; ventral side slightly lighter than dorsal. Epigyne as in fig. 19. Spermathecae as in fig. 20. Spinnerets prominent, posterior spinnerets longer and larger than others as in fig. 18.

Type-specimens : *Holotype* female, *allotype* male in spirit, other details as below.

Type-locality : India, West Bengal, Kalimpong, Darjeeling district, date of collection unknown, Coll. *Sutherland.*

This species resembles *Scotophaeus poonaensis* Tikader but differs from it as follows : (i) Cephalothorax reddish-green but in *S poonaensis* outer margin with three teeth. (ii) Epigyne and spermathecae also structurally different in long triangular hood of the epigynum and spermathecae with median projections.

Summary

Four new species of the genera *Gnaphosa* Latreille, *Haplodrassus* Chamberlin and *Scotophaeus* Simon, belonging to the family Gnaphosidae are described.

Acknowledgements

I am thankful to Dr. B. K. Tikader, Former Director, Zoological Survey of India, Calcutta, for guidance and encouragement and to Dr. P. D. Gupta, Officer-in-Charge, Zoological Survey of India, Central Regional Station, Jabalpur for necessary facilities.

I am also thanful to Dr. N. Platnick. Curator. American Museum of Natural History, New York, for help with literature.

I am indebted to Shri Satish Fadnavis, Artist, for preparation of some illustrations and to Miss Pratiksha Tiwari for typing the manuscript.

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Rec. zool. Surv. India, **91 (3-4)** : 313-317, 1992

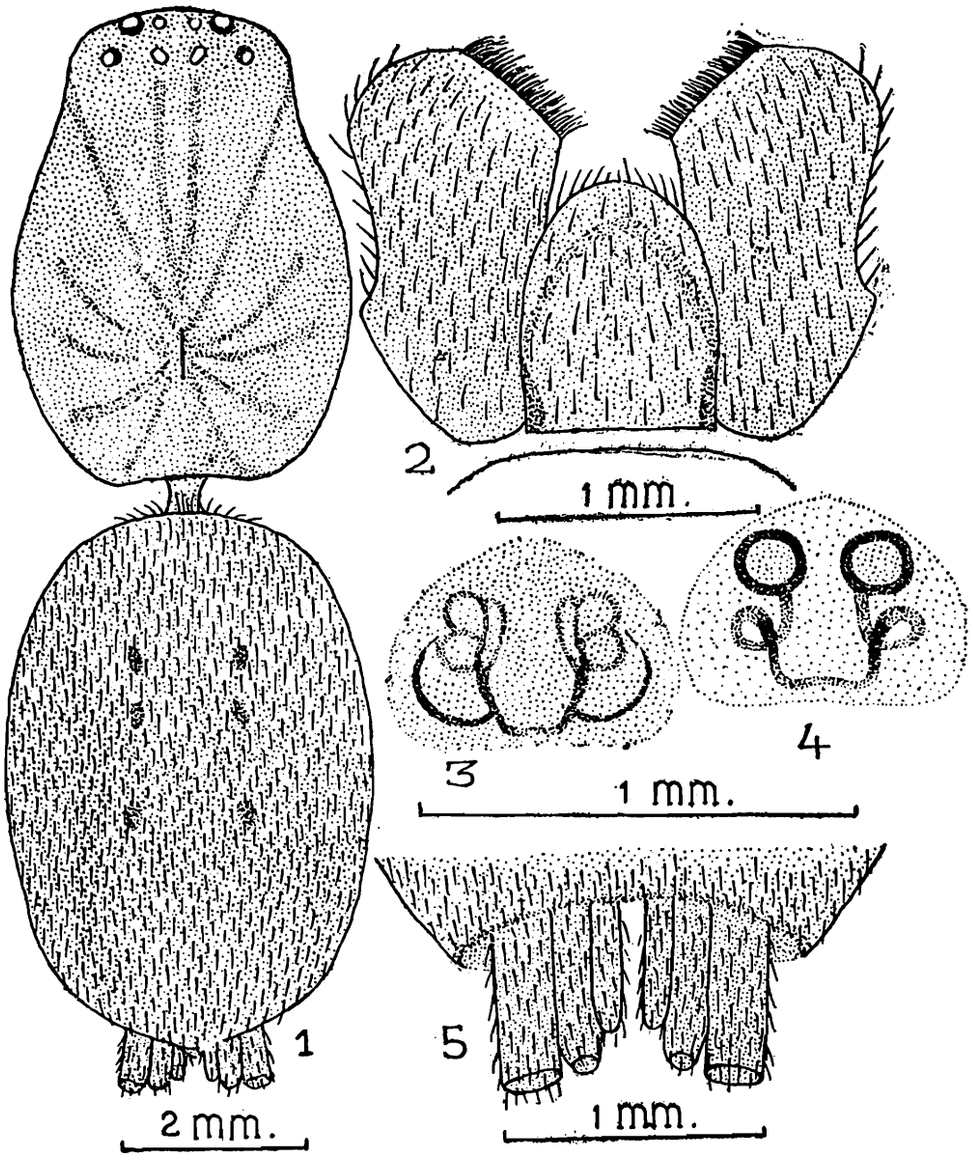
ON TWO NEW SPECIES OF *HAPLODRASSUS* SPIDERS FROM INDIA (ARANEAE : GNAPHOSIDAE)

U. A. GAJBE

Zoological Survey of India, Central Regional Station, 1544/A, Napier Town, Jabalpur (M. P.), India.

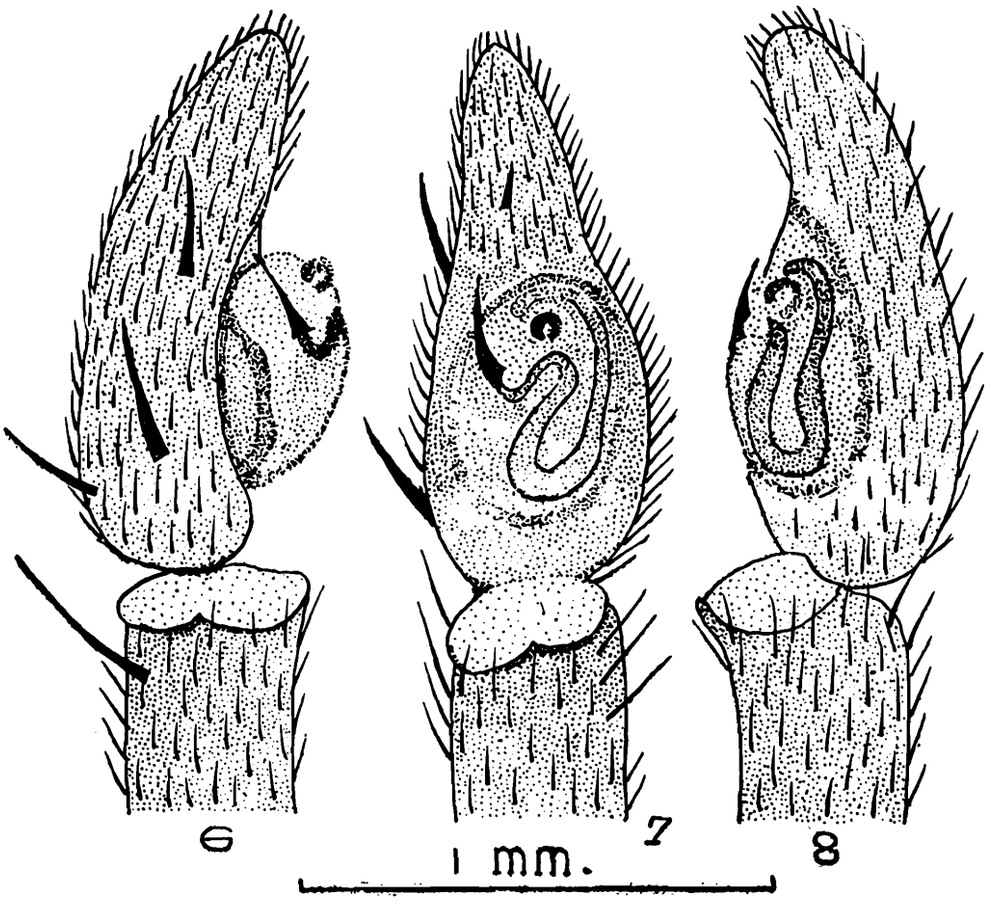
1. **Haplodrassus viveki** sp. nov.

General : Cephalothorax and legs reddish-green ; abdomen brown. Total length 12.00 mm. Carapace 5.30 mm. long, 3.90 mm. wide, abdomen 6.40 mm. long, 4.00 mm. wide.



Figs. 1-5. *Haplodrassus viveki* sp. nov.
1. Dorsal view of female, legs omitted. 2. Labium and maxillae. 3. Epigyne. 4. Spermathecae. 5. Spinnerets.

Cephalothorax : Longer than wide, broad in front, clothed with pubescence, provided with a conspicuous fovea at posterior middle with radiating streaks diverging from fovea to the sides. Eyes pearly white except anterior medians ; posterior row of eyes longer than antetior row ; anterior row slightly procurved (as seen from in front),



Figs. 6-8. *Haplodrassus viveki* sp. nov.

6. Left male palp, retrolateral view. 7. Left male palp, ventral view. 8. Left male palp, prolateral view.

with medians slightly smaller than laterals and closer to adjacent laterals than to each other ; posterior row slightly procurved, with medians oblique, larger than laterals and closer to each other than to adjacent laterals. Chelicerae moderately strong ; inner margin provided with two small teeth and outer margin with three teeth. Sternum heart-shaped, pointed behind, clothed with fine hairs. Maxillae and labium reddish-brown, with shape as in Fig. 2. Legs relatively long and strong, clothed with hairs and spines ; metatarsi and tarsi I and II provided ventrally with conspicuous scopulae, and tarsi with prominent claw tufts ; leg formula 4123. Colour and size of male almost like female, male palp as in fig. 6, 7, 8.

Abdomen : Longer than wide, nearly elliptical, clothed with thick hairs and provided with three pairs of segilla as in fig. 1. ventral side same in colour as dorsal,

Epigyne as in fig. 3. Spermathecae as in fig. 4. Spinnerets prominent ; anterior spinnerets cylindrical and longer than others as in fig. 5.

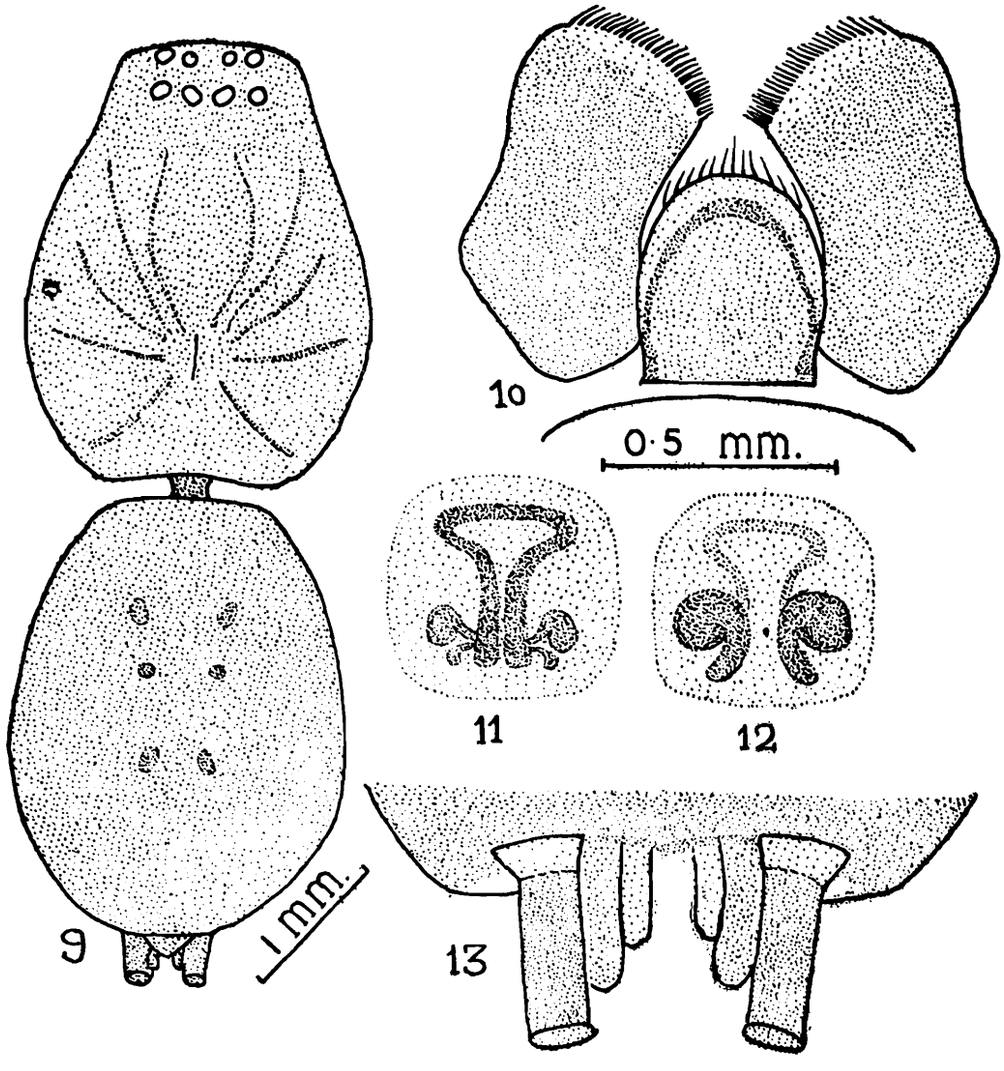
Holotype : Female (Reg No 5126/18), *paratype* two females (Reg. No. 5127/18), *allotype* one male (Reg. No. 5128/18) in spirit.

Type-locality : INDIA : Uttar Pradesh ; Daryakhals Landsdown, Dist. Pauri Garhwal, date 7. III. 1956. Coll. *T. D. Soota*.

This species closely resembles *Haplodrassus sataraensis* Tikader and Gajbe but differs from it as follows : (i) Abdomen with three pairs of sigilla but in *H. sataraensis* abdomen provided with chalk-white cheverons. (ii) Spermathecae rounded and spermathecal ducts coiled, cymbium more elongated and spiny, embolus pointed.

2. **Haplodrassus jacobi** sp. nov.

General : Cephalothorax and legs red ; abdomen light brownish green. Total



Figs. 9-13. *Haplodrassus jacobi* sp. nov.
9. Dorsal view of female, legs omitted. 10. Labium and maxillae. 11. Epigyne. 12. Spermathecae. 13. Spinnerets.

length 6.00 mm. Carapace 2.80 mm. long, 2.00 mm. wide ; abdomen 3·00 mm. long, 2·00 mm wide.

Cephalothorax : Longer than wide, broad in front, clothed with pubescence, provided with a inconspicuous fovea at posterior middle and with radiating stripes diverging from fovea to sides ; cephalic region slightly high. Eyes pearly white except anterior medians ; posterior row of eyes slightly longer than anterior row ; anterior row slightly procurved (as seen from in front), with medians slightly smaller than laterals and closer to laterals than to each other ; posterior row of eyes procurved with medians oblique, larger than laterals and closer to each other than to adjacent laterals. Chelicerae moderately strong ; inner margin with two similar teeth and outer margin with three dissimilar teeth. Sternum heart-shaped, pointed behind, clothed with fine hairs. Maxillae and labium light-reddish brown, with shape as in fig. 10. Legs relatively long and strong, clothed with hairs and spines ; metatarsi and tarsi I and II provided ventrally with conspicuous scopulae, and tarsi with prominent claw tufts ; leg formula 4123.

Abdomen : Longer than wide, narrowing anteriorly, broadest just behind middle, covered with pubescence and some hairs, uniform, provided with three pairs of sigilla as in fig. 9 ; ventral side same in colour as dorsal. Epigyne as in fig. 11. Spermathecae as in fig. 12. Spinnerets prominent ; anterior spinnerets cylindrical and longer than other as in fig. 13.

Holotype : Female (Reg No 5129/18) *paratype* one female (Reg. No. 5130/18) in spirit.

Type-locality : INDIA ; Meghalaya, Jamduar, Dist. Golpara. date 19. III. 1957. coll *B. K. Tikader*, *Paratype*, INDIA, M. P., Kalypatha Dist. Betul. date 3.XI.1971.coll. *V. D. Srivastava.*

This species closely resembles *Haplodrassus tehriensis* Tikader and Gajbe but differs from it as follows : (i) Cephalothorax without marking but in *H. tehriensis* cephalothorax with W-shaped deep brown markings. (ii) Abdomen uniform with three pairs of sigilla but in *H. tehriensis* abdomen provided with brownish patches. (iii) Epigynum suture elongate and spermathecae coiled.

SUMMARY

The present paper deals with two new species of *Haplodrassus* (*viveki* and *jacobi*) from India.

The genus *Haplodrassus* was established by Chamberlin (1922) with *H. hiemalis* (Emerton) as type. Since then Tikader and Gajbe (1977) described two new species. Tikader (1982) described two more species and Gajbe (1987) described one species from India.

While studying the spiders of the family Gnaphosidae the author encountered two new species of *Haplodrassus* which are described here as new to science.

The type specimens are deposited in the National Zoological Collection, Zoological Survey of India, Calcutta.

ACKNOWLEDGEMENTS

I am thankful to Dr. B. K. Tikader, Former Director, Zoological Survey of India, Calcutta, for guidance and encouragement and to Dr. K. Reddiah, Deputy Director, Zoological Survey of India, Central Regional Station, Jabalpur for necessary facilities.

I am also thankful to Dr. N. I. Platnick, The American Museum Natural History, New York for help with literature on Gnaphosidae.

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Rec. zool. Surv. India, **91** (3-4) : 319-323, 1992

RECORDS OF TWO CERCARIAE, *HETEROPHYES* SP. AND *HAPLORCHIS* SP. FROM THE SNAIL, *MELANOIDES TUBERCULATA* (MULLER) FROM TAMIL NADU.

N. VEERAPPAN AND H. N. ACHUTHAN

MAB Project on Gastropods and Cercariae,
Zoological Survey of India (SRS)
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INTRODUCTION

Specimens of *Melanoides tuberculata* from two different localities viz. Tiruthani and Tiruvencherry of Chingleput District of Tamil Nadu were examined for cercarial discharge. They yielded two species of cercariae, viz. *Heterophyes* and *Haplorchis*, both of which have not hitherto been recorded from Tamil Nadu.

Adults of these species have been recorded in carnivores and man (Rao and Ayyar, 1931 ; Rao and Kulkarni, 1964 ; Simha and Deshpande, 1964 ; Prakash and Pande, 1968 ; Rao and Anantaraman, 1969 and Mehra, 1980 and Srivastava, 1982).

Both live and preserved materials were studied, live material was examined under a coverslip. 5% formalin or 50% picric acid was used as fixative. Intravitum stains such as methylene blue and neutral red were employed for staining.

1. **Cercaria** of **Heterophyes** sp.
(Fig. 1)

115 examples of the Snail, *Melanoides tuberculata* were examined from Thiruvenchery village, out of which 22 discharged cercariae which closely resembled those of *Heterophyes* sp. described by Ito (1980).

DESCRIPTION

The Cercaria is small and the infected snails discharged them both in the morning and afternoon. They swim actively using the tail and occasionally exhibit creeping movements. The body is oval in shape with a narrower anterior end. The tail is simple, slender, longer than the body and provided with minute spines. There were 2 or 3 rows of spines on the oral sucker. The oral sucker leads to a small dilatation representing the pharynx. Oesophagus and intestinal caecae are not clearly seen. Penetration glands vary from 6 to 8 in number and occupy the posterior half of the

body, masking the structures below them. There is a pair of eyespot at the level of pharynx. The ventral sucker is situated a little below the median line of the body.

Cercaria of Heterophyes Sp.

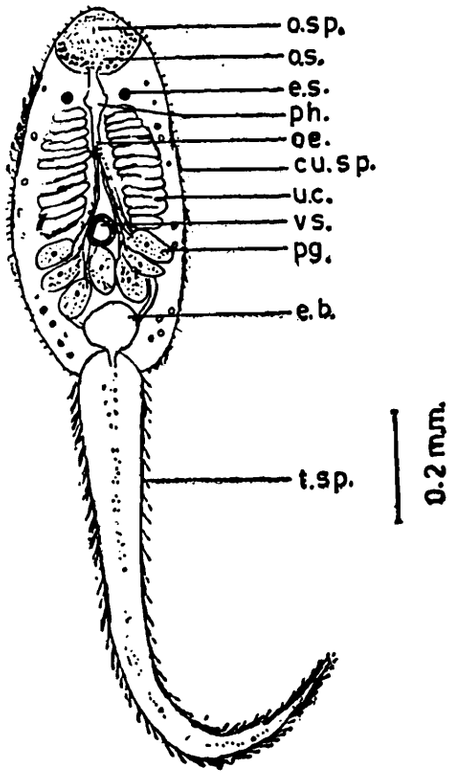

Fig. 1.

The excretory bladder is conspicuous and a tube arising from it is faintly seen. The rest of the excretory system could not be traced properly.

Table 1

Measurements of Cercaria of *Heterophyes* sp. along with those of *H. nocens* by Ito (1980)

		Heterophyes Sp.	*Heterophyes nocens*
Body	μ	335-340 × 128-135	355-375 × 150-165
Oral Sucker	μ	42-45 × 29-34	35-60 × 45-50
Ventral Sucker	μ	18-19 × 20-25	25-35 × 25-30
Pharynx	μ	15-18	21-22
Penetration glands	μ	30-35 × 15-18	50-60 × 20-23
Excretory bladder	μ	38-40 × 30-35	–
Tail	μ	150-165 × 48-50	147-162 × 45-50
Snail host		*Melanoides tuberculata*	*Cerithidea fluviatilis*

Rao and Ayyar (1931) recorded the adult to *Heterophyes indica* from a stray dog in Tamil Nadu. However its cercariae have not been recorded or described which has necessitated a comparison of the present specimens with closely related *Heterophyes* Sp. viz. *H. nocens* described by Ito (1980) from Japan, to determine the extent of agreement of important charcters. As could be seen from the table of measurments, the present cercaria nearly agrees with those of *H. nocens*. and therefore, is designated as *cercaria Heterophyes* sp. tentatively.

2. **Cercaria** of **Haplorchis** sp.

(Fig. 2)

Out of the 65 examples of *Melanoides tuberculata* which were examined from Tiruthani of Chingleput district, four shed cercariae. These share characters of *Haplorchis* sp. described by Ito (1980).

DESCRIPTION

The cercaria is very small and moves actively with its tail directed forwards. It

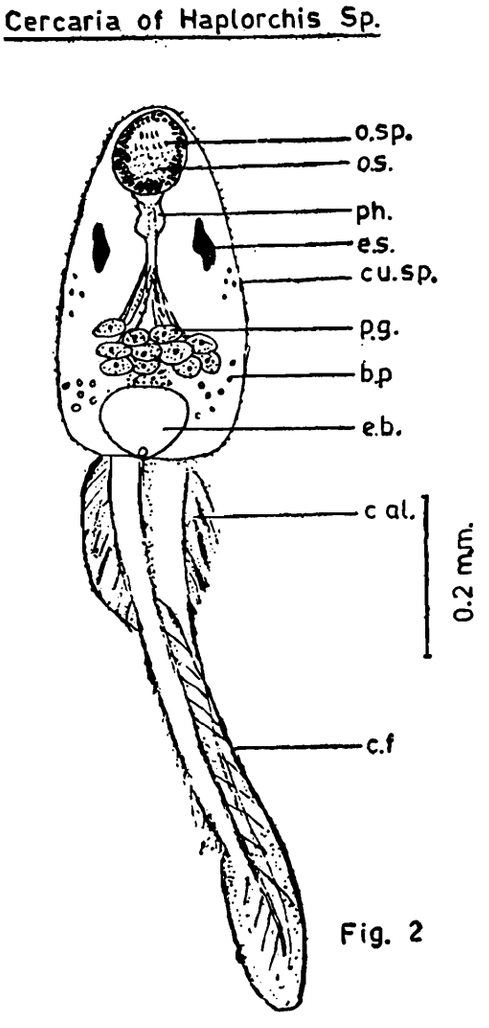

Fig. 2

was seen to be positively phototactic. The body is oval with a simple tail. There are a number of eight brownish pigments all over the body. The tail is long with a number

of very minute spines. The oral sucker is globular in shape leading to a small pharynx. The bifurcation of the oesophagus into the intestinal caecae is not clearly seen. There is a pair of eyespots. The oral sucker has rows of spines, the exact numbers of which could not be ascertained. Penetration glands numbering 6 to 7, almost occupy two-thirds of the body. Flame cells are not discernible. The ventral sucker is indistinct. The bladder is circular in shape. The caudal alae arise from the base of the tail extending upto the anterior one third. Terminal portion of the tail is expanded like a finfold. Only adult *Haplorchis* trematode worms have been recorded from Tamil Nadu. In Calcutta, Sewell (1922) has described *C. indicae* VIII from *M. tuberculata*.

TABLE II

Measurements of *cercaria* of *Haplorchis* sp. along with those of *C. I.* VIII of Sewell (1922) and *H, taichui* (Ito, 1980)

	Cercariae indicae VIII (Sewell, 1922)	*Haplorchis taichui* (Ito, 1980)	*Haplorchis* sp.
Body μ	210-288 × 158	89-124 × 31-43	90-130 × 33-35
Oral Sucker μ	—	19-25 × 17-20	22-25 × 15-20
Pharynx μ	—	7 × 6	5 × 4
Tail μ	386-456	250-350 × 16-22	258-365 × 20-25
Snail host	*Melanoides tuberculata*	*Melanoides Obliqui-granosa*	*Melanoides tuberculata*

The present Haplorchis sp. differs from *Cercariae indicae* VIII described by Sewell (1922) in being smaller and having distinct pharynx (rudimentary in *C. indicae* VIII) The excretory bladder is circular while in *C. indicae* VIII it is triradiate in shape.

No information is available on the occurrence of larval forms of *Haplorchis* in Tamil Nadu. The description and the measurements of the present cercaria agree with those of *H. taichi* given by Ito (1980). The presence of brownish yellow pigment granules in the middle of the body, cuticular alae at the base of the tail are all characters of *cercaria* of *Haplorchis*. Body and tail surface also show very fine minute spines. Although the measurements of the specimen under study appear to be more than those given by Ito (1980), the differerences are slight and therefore this cercaria is tentatively assigned to *Cercaria Haplorchis* species.

SUMMARY

Cercariae of *Heterophyes* sp. and *Haplorchis* sp. from the Snail, ***Melanoides tuberculata*** are described for the first time from Tamil Nadu and compared with related forms.

ACKNOWLEDGEMENT

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Rec. zool. Surv. India, **91** (3-4) : 325-334, 1992

THREE NEW SPECIES OF CERCARIAE FROM THE SNAIL, *INDOPLANORBIS EXUSTUS* (DESHAYES) IN TAMIL NADU

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INTRODUCTION

During the couase of a study of freshwater gastropods and their cercarial fauna in two districts of Tamil Nadu, viz., Thanjavur and Chingleput, a total of 53 specimens of *Indoplanorbis exustus* were examined. Of these 18, were found to be infected with three types of Furcocercous cercariae. Three localities of collection are Kadiramangalam pond and Keelapandi pond in Thanjavur district and Thiruporur pond in Chingleput district. These three cercariae could not be assigned to any of the known forms and are hence reported as new species.

Furcocercous group of cercariae consist of a wide variety of forms, all of which being characterised by the presence of a forked tail. Though a large number of Furcocercous cercariae have been described from India, only a few are known from Tamil Nadu.

In Bombay, Soparkar (1921) studied the cercarial fauna and identified the bovine schistosome, *Schistosoma spindalis* for the first time. Study by Sewell (1922) resulted in an outstanding publication on cercariae indicae, describing 62 kinds of cercariae from all over the country. Other notable contributions on Fureocercous cercariae are those of Rao (1932a, 1932b, 1933), Premvati (1953), Peter (1955), Gupta and Taneja (1969), Mathavan (1973), Mohands (1974), Murty (1975), Pandey and Agrawal (1977) and Ramachandrula and Agarwal (1986).

Cercariae were studied both in the live condition and preserved in fixatives such as Bouin's fluid, 70% alcohol and picric acid. They were also stained using intra vitum stains like neutral red and methylene blue.

1. **Cercaria kadiramangalamensis** sp. nov.

(Fig. 1)

DESCRIPTION

This large cercaria is an active swimmer and is capable of considerable degree of contraction and extension. The pyriform penetrating organ is situated anteriorly. A prominent feature of this cercaria is the sword like furcalrami which are at right angle to each other. The tail is longer than the body. The cercaria has both oral and

ventral suckers. The oral sucker is circular in shape and measures 30μ across. Three pairs of penetration glands are seen around and below the ventral sucker. There is no eyespot. A small bulbous pharynx is continued as a short oesophagus which travels upto the level of acetabulam and divides into two intestinal caecae. The ventral sucker measures 22μ in diameter. The excretory system consists of a bladder from which arise tubes laterally each dividing into anterior and posterior branches. Another

Cercaria kadiramangalamensis sp. nov.

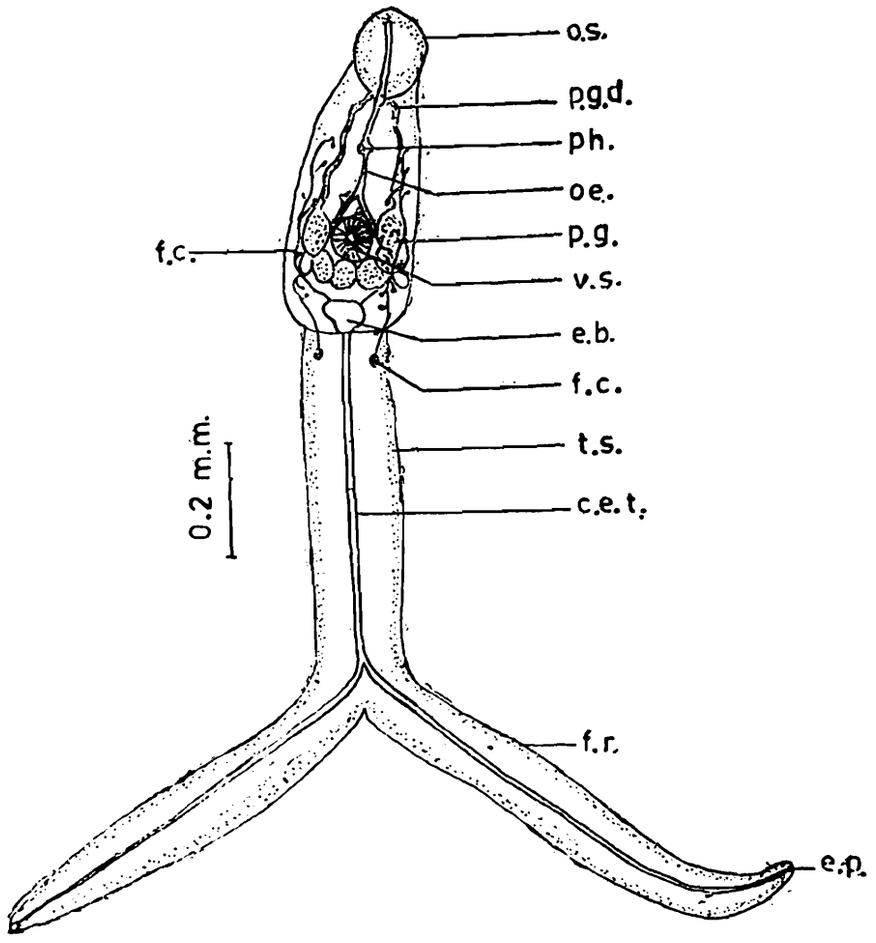

Fig 1.

tube arises posteriorly from the bladder and travels down to the tail stem and the furcae and terminate at the tip of the furcal rami. The anterior excretory canal has four pairs of flame cells while the posterior has three pairs. A single pair of flame cells could be seen at the base of the tail.

Discussion

The comparative measurements and characters of *Cercaria kadiramangalamensis* sp. nov. along with other related cercariae are furnished in Table I. Although resembling

TABLE—I

Characters and measurements of Cercariae kadiramangalamensis with other Cercariae

Sl. No.	Characters	*C. bombayensis* No. 9, Soparkar (1921)	*Cercariae indicae II* of Sewell, 1922	*C. Aszidat* (Dawes, 1968)	*C. pandei* Pandey and Agrawal, 1977	*C. kadiramangalamensis* sp. nov.
1.	Body (Length × breadth) μ	225 × 5	210-263 × 53-61	340 × 85	147 × 75	345 × 72
2.	Tail stem (Length × breadth) μ	325 × 38	263	225 × 40	266 × 39	410 × 39
3.	Furcal rami (Length × breadth) μ	Length 300	263	Length 280	64 × 32	398 × 22
4.	Oral sucker μ	–	39 × 28	—	40 × 29	30
5.	Ventral Sucker μ	–	–	–	18	22
6.	Eye spot	Faint, Circular	Absent	–	Absent	Absent
7.	Penetration glands	Three pairs below the ventral sucker.	Three pairs	Two pairs in the acetabular region.	Three pairs in the acetabular region.	Three pairs below the ventral sucker.
8.	Flame cells	Ten pairs	Ten pairs	Seven pairs	Six pairs	Eight pairs
9.	Notch at the hind end of the body	absent	absent	present	present	present
10.	Snail host	*Indoplanorbis exustus*	*Indoplanorbis exusnes*	*Lymnaea pereger*	*Indoplanorbis exustus*	*Indoplanotbis exustus*

Cercaria bombayensis No. 9 of Soparkar 1921, *C. kadiramangalamensis* differs from it in many respects. The present cercaria is larger and it has a distinct pharynx in contrast to *C. bombayensis* No. 9. Out of the three pairs of penetration glands in *C. bombayensis* No. 9, one pair is anterior to the ventral sucker. While other two pairs are below it. These in the present specimen are placed below and never anterior to the ventral sucker. Soparkar (1921) describes a pair of faint circular spots representing the vestigeal eyespot which are totally absent in the present specimen. The number and disposition of the flame cells are also different in the two.

There are four pairs of flame cells in the anterior excretory canal and a single pair in the tail totalling eight pairs in the present cercaria. *C. bombayensis* No. 9 has 10 pairs of flame cells in the body and two pairs in the tail.

Cercariae indicae II of sewell 1922, from *I exustus* though appears similar to the present specimen differs in possession of fine cuticular spines. The branches of the the excretory tubules in the furcae terminate at the middle of each of the furcal ramus while in the present specimen they extend to the tip of the furcal ramus to open as excretory pore. The pharynx has been described as rudimentary. The tail has two pairs of flame cells vis-a-vis the one pair in the present specimen. *Cercaria Aszidat*, 1924 (Dawes, 1968) discharged by *Lymnaea pereger* is also apharyngeate, longifurcate and non-ocellate cercaria. However, it is smaller in size than the present specimen and also differs in the excretory system having seven flame cells on each side. It has only two pairs of penetration gland situated in front of the ventral sucker. Pandey and Agrawal (1977) also describe the furcocercous, longifurcate cercaria, *Carcaria pandei* from *Indoplanorbis exustus*. The distinct, prominent notch at the union of the tail and the body is not present in the specimen under report. It has also only six pairs of flame cells and the cercaria is itself smaller in size.

The present specimen is distinct from *C. bombayensis* No. 9 of Soparkar (1921), *Cercariae indicae* II of Sewell (1922), *C. Aszidat* of Dawes (1968) and *C. Pandei* of Pandey and Agrawal (1977). The erection of a new taxon is thus justified to accommodate the present largesized, Furcocercous, longifurcate, pharyngeate and non-ocellate cercaria from *Indoplanorbis cxustus*. The specific name relates to the locality of collections.

Snail host : *Indoplanorbis exustus* (Deshayes)
Locality : Kadiramangalam pond, Thanjavur District.
Incidence of emergence : 9 out of 23 snaiis (39.1%)

2. **Cercaria anantaramani** sp. nov.

(Fig. 2)

This cercaria is comparatively large and swims rapidly by means of the vibrator movements of the tail. It is negatively geotropic and period of active swimming

alternate with periods of rest while at rest, it floats motionless with body hanging downwards.

DESCRIPTION

Oral sucker is prominent with a protrusible organ. It leads into a small pharynx followed by the oesophagus which bifurcated into the intestinal caecae. Just at the level of this bifurcation there is a mass of browntinted structures measuring 20-30μ. Acetabulam is placed anterior to the excretory bladder and there is no evidence of any

Cercaria anantaramani sp. nov.

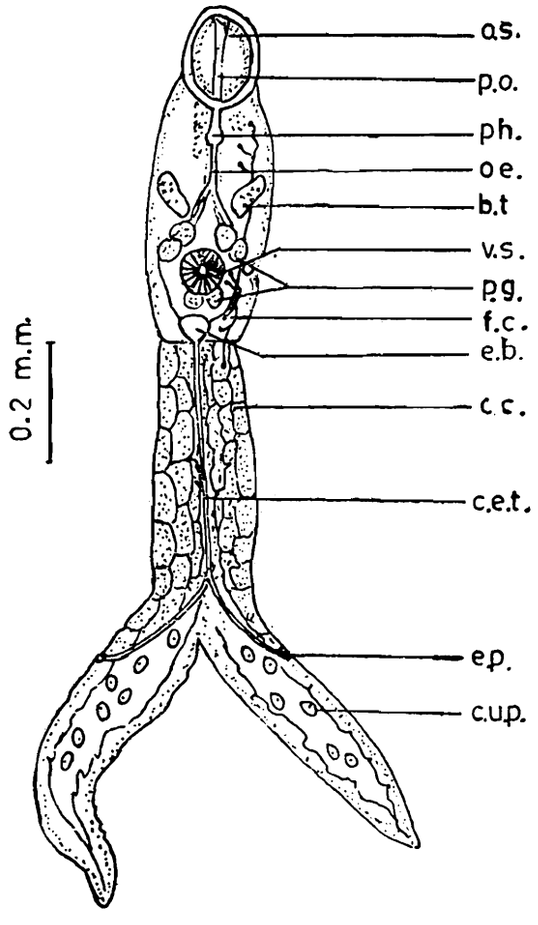

Fig. 2

eyespot or pigmentation. There are three pairs of penetration glands, one of which is below the acetabulam while the other two are anterior. The bladder is oval in shape. A total of seven pairs of flame cells are present, three pairs on each of the anterior and posterior excretory tubule and one pair at the base of the tail. Tail is continuous with the body. The tail stem is longer than the body and furcal rami are as long as the tail stem. The tail is broad with numerous caudal gland cells. The caudal excretory tubes

traverses the tail stem and divides to enter the furcalrami. There are 8 to 10 cuticular prominences or papillae-like structures on each ramus.

Discussion

The comparative measurements and characters of *Cercaria anantaramani* sp. nov. along with other related cercariae are furnished in Table II.

TABLE—II

Characters and measurements *Cercariae Indicae II* (*Sewell, 1922*) *with Cercaria anantaramani* sp. nov.

S. No.	Characters	*Cercariae indicae II* Sewell, 1922	*Cercaria anantaramani* sp. nov.
1.	Body (Length × breadth) μ	210-263 × 53-61	410 × 92
2.	Tail stem (Length × breadth) μ	263	420 × 87
3.	Furcal rami (Length × breadth) μ	263	390
4.	Oral sucker μ	39 × 28	42
5.	Ventral sucker μ	–	38
6.	Brown tinted structure	Absent	Present
7.	Penetration glands	3 pairs	3 pairs
8.	Flame Cells	Ten pairs	Seven pairs
9.	Circular caudal cells.	Present	Present
10.	Cuticular papillae-like structures on furcal rami.	Absent	8 to 11
11.	Spines on furcal rami.	Present	Absent

Sewell (1922) has described furcocercous cercariae from *Indoplanorbis exustus* as *cercariae indicae* II. These are smaller when compared to the present specimen and lack the brown-tinted structures which are characteristic of the present specimen.

Presence of the brown-tinted mass in the body and the cuticular papillae-like structures on the furcal rami make *Cercaria anantaramani* specifically distinct. It is being named after the late Prof. M. Anantaraman in appreciation of his outstanding contributions to Indian parasitology.

Snail host : *Indoplanorbis exustus* (Deshayes)

Locality : Keelapandi Pond, Thanjavur District

Incidence of emergence : 3 out of 7 snails (43%)

3. **Cercaria nudis** sp, nov. (Fig. 3)

These cercariae emerge in large number in the later part of the morning and are positively phototactic. They remain suspended with the body in a twisted position and move up and down freely and remain alive nearly for an hour under the coverslip.

DESCRIPTION

The body is cylindrical in shape and the tail contiguous. The oral sucker is elongate, oval in shape in which a spindle-shaped protrusible organ could be seen. Below the oral sukcer is a bulbous pharynx from which arises the oesophagus through small tube. Just above the middle of the body. The oesophagus divides into two intestinal caecae, which are sinuous and extend upto the posterior end of the body. No distinct ventral sucker is seen. The cuticle of the body has prominent annulations. Fine strands could faintly be seen connecting these annulation in the middle part of the

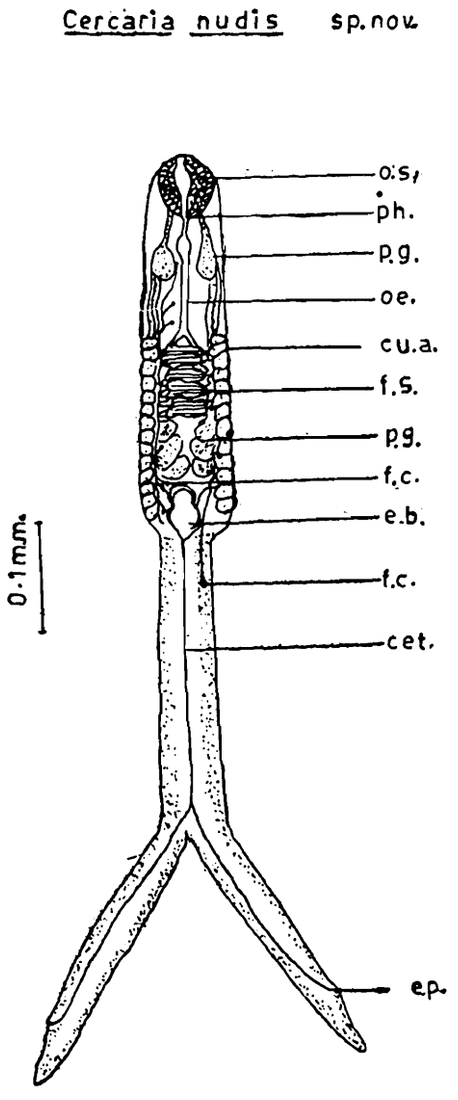

Fig. 3

body. Four pairs of penetration glands are present, three below the median line of the body and the fourth, near the oral sucker. Eyespots are not seen. The excretory bladder is hour-glass shaped, the two main collection canals arising from the anterior half of the bladder laterally. Excretory duct divides into anterior and posterior

collecting canals. The collecting canal has three pairs of flame cells while posterior has four pairs. A single pair of flame cells is seen just below the base of the tail. The caudal excretory canal divides and enters each furcal ramus and terminates as a bulbous structure.

Discussion

The comparative measurements and characters by *Cercaria nudis* sp. nov. along with *cercariae indicae* LXV of Murty (1975) are furnished in Table III.

TABLE—III

Characters and measurements of *Cercariae indicae* LXV (Sewll, 1922) with *Cercariae nudis* sp. nov.

S. No.	Characters	*Cercariae Indicae LXV* Sewell, 1922	*Cercaria nudis* sp. nov.
1.	Body (Length×breadth) μ	137×38	292×27
2.	Tail (Length×breadth) μ	207×22	270×15
3.	Furcal rami (Length×breadth) μ	208×18	198
4.	Oval Sucker μ	31×12	42
5.	Ventral Sucker	Vestigeal	absent
6.	Penetration glands	2 pairs	4 pairs
7.	Flame cells	10 pairs	8 pairs
8.	Body annulations	Seen only in the contracted state.	Present
9.	Bristles on body and tail	Present	absent
10.	Snail host	*Indoplanorbis exustus*	*Indoplanorbis exustus*

Strigeoid cercariae LXV described by Murty (1975) from Waltair, Andhra Pradesh is spinulate with circumoral spineless area and three pairs of lateral bristles over the body. The tail stem is without spines, longer than the body and has lateral bristles and cuticular annulations. The present specimen is larger and shows prominent cuticular annulations and fine strands connecting them in the middle of the body which are absent in *cercariae indicae* LXV. Besides the differences seen in the number of penetration glands and flame cells. The cuticular tailstem in the present specimen is without spines and annulations seen in *cercariae indicae* LXV.

Snail host : *Indoplanorbis exustus* (Deshayes)

Locality : Thiruporur pond, Chingleput District.

Incidence of emergence : 6 out 23 snails (25%)

SUMMARY

Three new species of Furcocercous cercariae from *Indoplanorbis exustus* from Tamil Nadu are described viz. *Cercaria kadiramangalamensis* sp. nov. *Cercaria anantaramani* sp. nov. *Cercaria anantaramani* sp. nov. and *Cercaria nudis* sp. nov. These are compared with related forms to bring out their specific distinction.

ACKNOWLEDGEMENTS

The authors are indebted to Dr. R. S. Pillai, Officer-in-charge, Zoological Survey of India, Madras for going through manuscript and for his suggestions. We are grateful to the Department of Environment and Forests, New Delhi for the financial assistance.

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ABBREVIATIONS

b. t.	—	brown tinted structure
c. c.	—	caudal cells
c. e. t.	—	caudal excretory duct
cu. a.	—	cuticular annulations
cu. p.	—	cuticular papillae
e. b.	—	excretory bladder
e. p.	—	excretory pore
f. c.	—	flame cells
f. r.	—	furcal rami
f. s.	—	fine strands
oe.	—	oesophagus
o. s.	—	oral sucker
p. g.	—	penetration glands
p. g. d.	—	penetration gland duct
ph.	—	pharynx
t. s.	—	tail stem

Rec. zool. Surv. India, **91** (3-4) : 335-341, 1992

SIGNIFICANCE OF ELECTROPHORETIC STUDIES IN RELATION TO THE SYSTEMATIC STATUS OF SOME SPECIES OF THE GENUS *ARIUS* (ARIIDAE : SILURIFORMES)

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INTRODUCTION

While the classical systematist studies organisms by counting and measuring various parts, the biochemical systematist uses techniques developed by the protein chemist. Many accounts of the theory and and practice of these techniques are available (Ferguson, 1980).

The maximum amount of biochemical systematic information is obtained when the complete amino acid sequence of a protein is known. To date 20 amino acids are commonly found in the protein of all living organism, sporadically one or two more occur but this twenty is an impressive demonstration of the common kinship of organisms (Needham, 1965).

It is an established fact that the electrophoretic mobility is inversely proportional to the size and weight of the molecule of a particular amino acid, through a supporting media such as starch gel or acrylamide gel. Thus it is evident that the differences in electrophoretic mobilities of different proteins are dependent on the arrangement of various amino acids in a particular protein, besides the pH of the buffer solution (Yureva and Melkova, 1979).

Until recently, the techniques for determining the primary structure of even quite small proteins were too slow and laborious to be of any value in fish systematic work. Recently, however, the process has been automated and sequences can now be determined relatively quickly (Davis, 1964) by 'Disk Polyacrylamide Gel Electrophoresis'.

If a taxanomic problem is not readily resolved by morphological and other comparisions, an experimental approach is needed to clarify the systematic confusion (O' Rourke, 1974). A number of workers such as Thompson (1960), Natarajan, *et al.* (1975) etc., have shown that muscle myogen patterns reveal a high degree of species specificity.

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With the advent of muscle myogen as one of the modern tools of ichthyotaxonomy, soluble eye lens proteins have received much attention. Antisera prepared against lenses of any of the vertebrate species give precipitive reactions with the lenses of all other vertebrates. The possibility, therefore, exists of using these proteins to obtain data on the inter-relationships (Manski and Halbert, 1964). For comparative studies, the eye lens proteins may provide valuable informations because of its inert nature and thus it becomes more suitable for these purposes (Reader and Bell, 1965, Fullhorst and Young, 1966), These nuclear lens proteins are very stable, tolerating temperatures as high as 79°C before precipitating with standing relatively harsh procedures (Smith, 1966). Further, unclear lens proteins do not fluctuate physiologically, rhythmically or seasonally throughout the post embryonic life of the animal. Moreover, these proteins are not present in very high concentration and are readily soluble in many of the commonly available media. Further, they are uncontaminated by proteins of other tissues such electrophoresis. Electrophoretic study of eye lens protein in fishes has thus proved to be an efficient and modern tool to clarify the taxanomic identity. Thus both the tissue i.e. muscle and eye lens were selected for the present investigation.

The aim of the present study is to find out whether protein specificity can serve as an additional aid in determining the taxonomic relationships in closely allied species of the genus *Arius*. This method is applied especially to reinforce the conclusion already drawn by means of conventional method.

Material and methods :

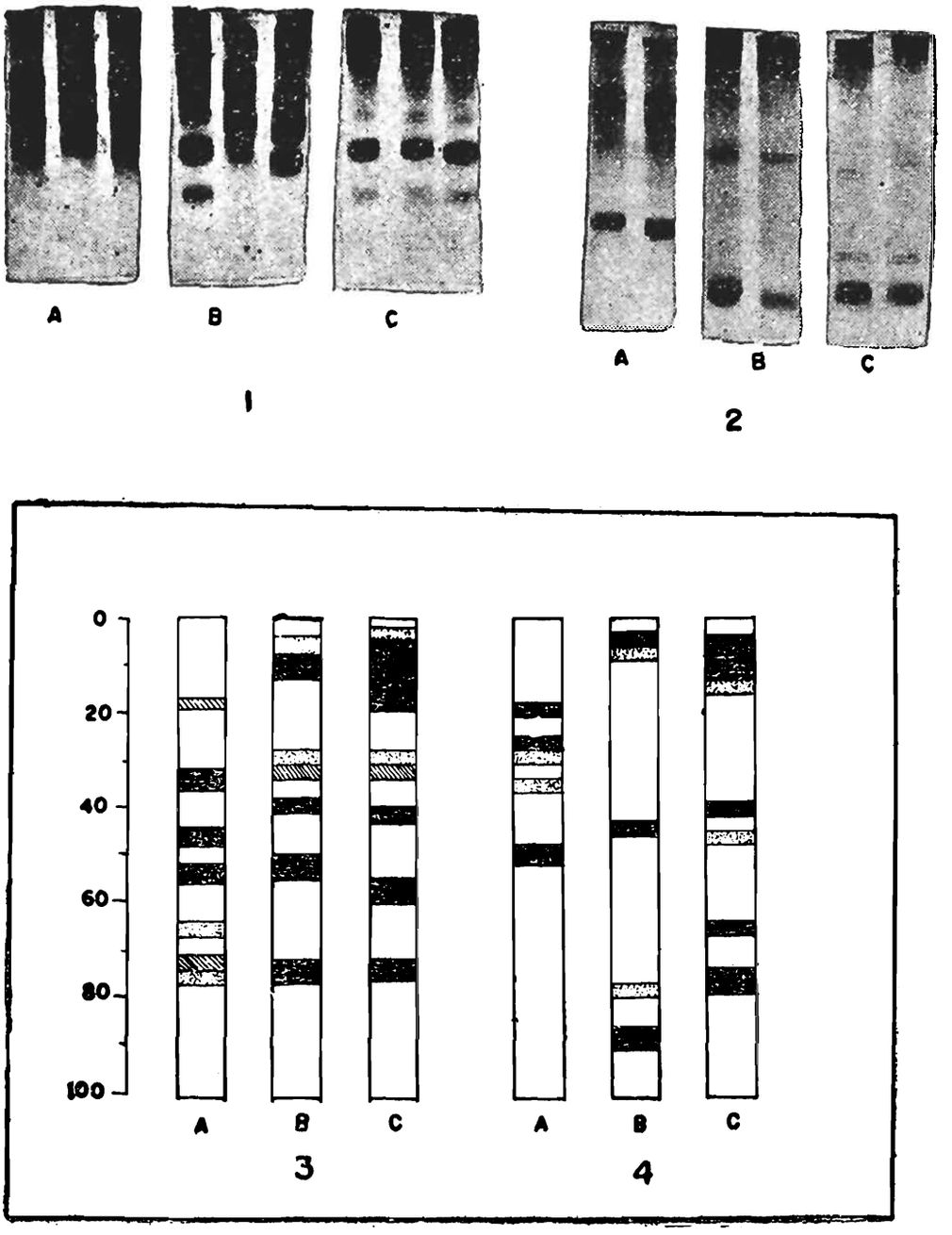
Live specimens of *A. arius* (Hamilton), 300—400 mm SL., were collected with the help of hook and line from Vellar estuary, while *A. caelatus* Val. and *A. thalassinus* (Ruppell) 250—400 mm SL., where procured from the 'commercial trawl catch' at Portnovo fish landing centre (Tamil Nadu). The specimens were transferred to an ice-box immediately after their collection. Electrophoretic experiments were carried out simultaneously on the muscle myogen and eye lens of the three species belonging to same sex and age group.

The muscle tissue was removed just below the first dorsal fin, washed thoroughly in distilled water and 75 mg of this was homogenized with 1 ml distilled water in a hand homogenizer. The extract was centrifuged at 3000 rpm for 15 minutes and the supernatant, containing water soluble proteins was subjected to electrophoretic analysis. The same procedure was repeated for the extraction of eye lens protein.

Three layer polyacrylamide gel electrophoresis (Davis, 1964) was employed.

OBSERVATIONS

In *Arius arius*, there are five major (easily discernible through naked eye) and two minor bands in the electropherogram of muscle myogens. Of the five major bands



Figs : 1. A. Electropherogrrm of muscle myogens of *A. arius*. B. Electropherogram of muscle myogens of *A. caelatus*. C. Electropherogram of muscle myogens of *A. thalassinus*.
2. A. Electropherogram of eye lens protein of *A. arius*. B. Electropherogram of eye lens protein of *A. caelatus*. C. Electropherogram of eye lens protein of *A. thalassinus*.
3. A. Diagrammatic representation of fig. 1A. B. Diagrammatic representation of fig. 1B. C. Diagrammatic representation of fig. 1C.
4. A. Diagrammatic representation of fig. 2A. B. Diagrammatic representation of fig. 2B. C. Diagrammatic representation of fig. 2C.

three are quite dark where as two faint (pl. 1, figs, A, 3A). In case of eye lens protein, there are only three widely separated major bands and two minor bands (pl. 1, figs. 2A, 4A).

In *A. caelatus*: although the total number of bands are same as in the preceding species in respect of both muscle myogens and eye lens proteins, but the intensity and Rm values of different bands are distinguishable. Of the five major bands four are dark and one faint in muscle myogen (pl. 1, figs. 1B, 3B) and the three major bands of eye lens electropherogram are quite apart from each other as compared to *A. arius* (pl. 1, figs. 2B, 3B).

The banding pattern in *A. thalassinus* shows some similarity with that of *A. caelatus* in case of muscle myogen but for the intensity and Rm of first and fourth major bands (pl. 1, figs. 1C, 3C). In case of eye lens, this species is quite distinct from those of preceding two species since there are four dark bands instead of three with different Rm values (pl. 1, figs. 2C, 4C). (Table 1).

TABLE—1

Electrophoretic banding pattern and relative mobility of proteins (Muscle myogen and eye lens) in the three species of the genus *Arius*.

Species	Number of bands		Period of separation	Rm value of different bands as percentage of the total distance travelled by electrolite.								
	Muscle myogen	Eye lens	in minutes	Muscle myogen 1	2	3	4	5	Eye lens 1	2	3	4
Arius arius	5+2	3+2	45	18	34	46	54	72	21	27	50	–
Arius caelatus	5+2	3+2	45	10.5	33	40	53	75	7.5	45	90	–
Arius thalassinus	5+2	3+2	45	15	33	42	57	75	9	40	65	77

The relative mobility of different fractions of the muscle myogens does not depict much significant differences that can readily distinguish the three species from each other. The Rm value of first major band in *A. arius* is 18, *A. caelatus* 10.5 ; and in *A. thalassinus*, 1.5 ; otherwise rest of the bands have more or less identical relative mobility (Table 1). On the other hand the electropherograms developed from the eye

lens proteins show significant differences in respect of the relative mobility of various bands which may prove the species specificity of these proteins in fishes of the genus *Arius* (Table 1).

DISCUSSION

The electrophoretic patterns for proteins from the muscle myogens of *A. arius*, *A. caelatus*, and *A. thalassinus*, although varying interspecifically, appear to have gross contours which are evident from the uniform number of seven bands (5 major and 2 minor). However, the density and the relative mobility of each corresponding band differ in each one of these species. In *A. arius*, the first and the last (5th) major bands having the Rm, 18 and 72 are faint, while in *A. caelatus* and *A. thalassinus* the corresponding bands are dark having the Rm, 10.5, 75 and 15, 75 respectively. The species differ in respect of minor bands association with the major bands. Two minor bands, in *A. arius* seem to be the subfractions of fourth and the fifth major bands whereas in the other two species they are the subfractions of the first and second major bands. Thus it would seem that the species specific nature of the muscle myogens lies in the density and to some extent in the relative mobility of various bands but not in the total number of fractions which are constant at least in the present case.

From the electrophoretic analysis of eye lens proteins, it is seen that the magnitude of differences at specific level is much greater than that of muscle myogens. The three specis (*A. arius*, *A. caelatus* and *A. thalassinus*) differ significantly in respect of the total number of bands, density and concentration of each protein fraction and more particularly in the degree of their relative mobility of each fraction (pl. 1, figs. 1-4, A, B, C) (Table 1). *A. thalassinus* can be easily distinguished from the other two species based on the total number of major bands i.e. four, instead of three in *A. arius*, and *A. caelatus*. The electropherograms developed from the eye lens protein of *A. arius* and *A. cealatus*, although represent three major fractions in each but the species are easily identifiable in respect of the relative mobility of each fraction, i.e. 21. *vs.* 7.5, first band ; 27 *vs.* 45, second band ; 50 *vs.* 90, third band ; in *A. arius vs. A. caelatus*. Further, unlike as the case of muscle myogen, no sexual dimorphism in respect of electrophoretic patterns was noted in the eye lens protein. These findings, perhaps may corroborate the earlier hypothesis of Rabaey (1964) that the lens proteins are species specific. The distribution of the soluble protein components in the crystalline lenses of fishes was demonstrated to be of species specific nature particularly in the family Sciaenidae (Cobb *et al.*, 1968).

It may be concluded that the eye lens proteins have more potentiality as compared to the muscle myogens from Chemo-taxonomic view point as demonstrated in the electropherograms of *A. arius*, *A. caelatus* and *A. thalassinus*. It is worth mentioning

that this method of analysis has a potential for clarifying the taxonomic interspecific affinities of the genera of the family Ariidae.

Summary

A comparative electrophoretic analysis of muscle myogens and eye lens proteins of three species of the genus *Arius* (*Arius arius*, *A. caelatus* and *A. thalassinus*) was carried out by three layer polyacrylamide gel disc-electrophoretic method.

It is seen that the relative electrophoretic mobility of various protein bands are species specific in respect of the muscle myogens, and the total number of protein fractions of the eye lens also differ specifically among the three species, beside the relative mobility. These findings corroborate the conclusion derived from the biometric comparision of the various taxonomic characters.

It may be concluded that the electrophoretic studies are of significant value in clarifying the systematic status of closely allied species of the genus *Arius*.

Acknowledgements

We are thankful to the Director, Zoological Survey of India, Calcutta, for the facilities and encouragement. We would like to express our gratitude to Prof. R. Natarajan, Director, C. A. S. in Marine Biology, Parto Novo, for his kind expertise help and laboratory facilities in carrying out the electropherotic analysis.

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Rec. zool. Surv. India, **91 (3-4)** : 343-351, 1992

INOPEPLIDAE AND ELACATIDAE (COLEOPTERA : HETEROMERA) FROM ARUNACHAL PRADESH, INDIA

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Introduction

Inopeplidae is a sufficiently distinct small family of the section Heteromera under the superfamily Cucujoidae of the suborder Polyphaga. Hetschko (1930) listed 3 of 52 species under the genus *Inopeplus* Smith from India, while treating it under the family Cucujidae (Cucujinae : Inopeplini). Blackwelder (1942) referred *Inopeplus* to the family Staphylinidae, because of apparent similarity of exposed abdoninal segments. Crowson (1955) recognised the distinct family status of Inopeplidae and included the genera *Inopeplus*, *Diagrypnodes* Waterhouse and *Aciphus* Oliff in it. Sengupta, Pal and Mukhopadhyay (1977) ascertained its systematic position and described three more species from India. Pal and Dutta (1982) added one more species from Andaman Islands, totalling the Indian species to 7. Elacatidae is also a small family of Heteromera and closely related to the Inopeplidae. Sengupta (1977) recorded this family in India with single species from West Bengal (Darjeeling District). Both the families inhabit mostly the subcorticolous part of fallen tree stumps.

In the present study both the families are recorded for the first time from Arunachal Pradesh including two new species of Inopeplidae.

Systematic Account

Family : INOPEPLIDAE

Genus : **Inopeplus** Smith

1. **Inopeplus biocellatus** (Motschulsky)

1859. *Euryplatus biocellatus* Motschulsky, *Etud. Ent* **8** : 98.

1908. *Inopeplus biocellatus* : Grouvelle, *Annls. Soc. ent. Fr.* **77** : 46.

1977. *Inopeplus biocellatus* : Sengupta, Pal & Mukhopadhyay, *Oriental Ins.* **11** : 399.

Material examined : 8 ex. India : Arunachal Pradesh, Lower Subansiri District, Seven Camp, 27 Km. 0-Kimin, 4 ex., 21-ix-1988, T. K. Pal, *ex.* under bark ; Lower

Subansiri District, nr. Pitapol, 10 Km. 0-Yazali, 2 ex., 19-ix-1988, T. K. Pal, *ex.* under bark ; Lower Subansiri District, Hawa Camp, 15 Km. 0-Kimin, 1 ex., 22-ix-1988, T. K. Pal, *ex.* under bark ; Lower Subansiri District, nr. Lichi, 23 Km. 0-Yazali, 1 ex., 16-ix-1988, T. K. Pal, *ex.* under bark (ZSI, APFS Reg. No. 948—955).

Distribution : India : Arunachal Pradesh (New Record), Meghalaya, West Bengal.

2. **Inopeplus nitidus** Sengupta, Pal & Mukhopadhyay

1977. *Inopeplus nitidus* Sengupta, Pal & Mukhopadhyay, *Oriental Ins.* : **11** 399.

Material examined : 8 ex. India : Arunachal Pradesh, Lower Subansiri District, Seven camp. 27 Km. 0-Kimin, 2 ex., 21-ix-1988. T. K. Pal, *ex.* under bark ; Lower Subansiri District, nr. Pitapol, 10 Km. 0-Yazali, 2 ex., 19-ix-1988, T. K. Pal, *ex.* under bark ; Lower Subansiri District, nr. Lichi, 23 Km. 0-Yazali, 3ex., 16-ix-1988, T. K. Pal, *ex.* under bark ; Lower Subansiri District, Hawa Camp, 15 Km. 0-Kimin, 1 ex., 22-ix-1988, T. K. Pal, *ex.* under bark (ZSI, APFS Reg. No. 956—963).

Distribution : India, Arunachal Pradesh (New record), Sikkim.

3. **Inopeplus jairajpurii** sp. nov.
(Figs. 1, 2)

General appearance (Text-fig. 1) elongated, flattened, shiny, blackish, elytra with pale spots, last three and half abdominal segments exposed.

Head broader than long, apical margin truncate, fronto-clypeal suture distinct and nearly straight, apical margin of frons with transverse depression, feeble medio-longitudinal impression on vertex ; puncturation on vertex little elliptical, coarse and dense, interspaces hardly as wide as punctures on sides and closer towards middle ; eyes moderately large and finely facetted, a semicircular depression surrounding inner margin of eye less distinct, a short oblique depression arises near antennal base. Antenna moderately long and slender, scape moderately large and curved, pedicel shorter and narrower than scape, segment 3 slightly wider and longer than pedicel, segments 4-10 subequal and little elongate, segment 11 elongate and acuminate at apex, scape to basal half of segment 3 reddish-brown and apical part of segment 3 to segment 11 blackish.

Prothorax transverse, flattened, widest beyond middle and gradually narrowed towards base ; lateral margin indistinctly sinuate near middle, finely bordered from base to posterior two-thirds ; puncturation on pronotum roundish, finer and sparser than on vertex, interspaces slightly wider than punctures.

Scutellum transverse, rounded at apex and impunctate.

Elytra broader than long, widest near apex, puncturtaion fine and sparser than on pronotum ; two pale spots on each elytron—one in both anterior and posterior halves, anterior one elongate-elliptical and posterior one oblique, margin of spots moderately distinct ; last three and half abdominal segments exposed.

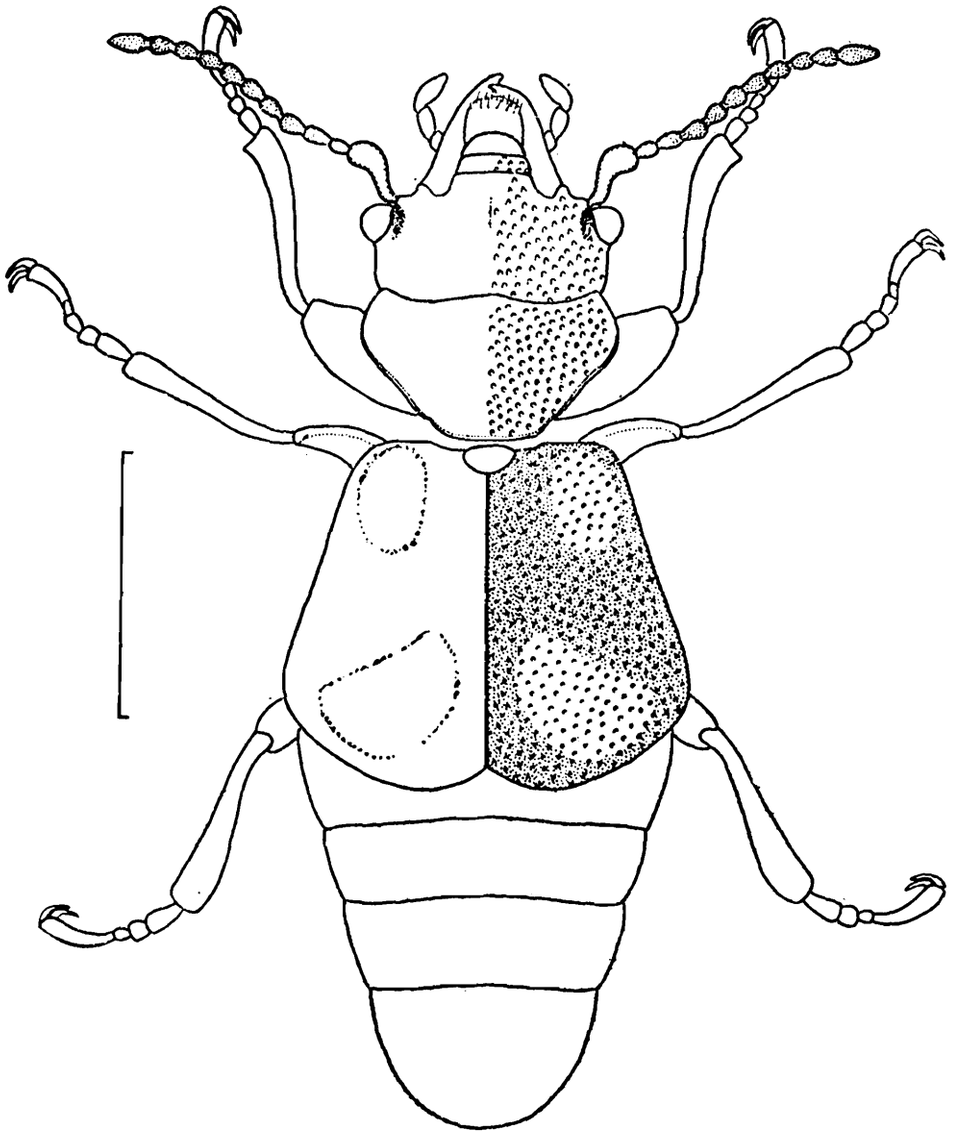

Fig. 1. *Inopeplus jairajpurii* sp. nov., dorsal view (scale=1.0 mm.).

Ventral surface shiny, fine punctures only on head and prothorax. Aedeagus (Text-fig. 2) with gradually narrowed and broadly pointed apex of median lobe ; broad, feebly bilobed and with a few setae at apex of each paramere.

Remarks : This species shows some resemblances with *I. nigricorpus* Sengupta, Pal & Mukhopadhyay and *I. andamanicus* Pal & Dutta. This can easily be separated from the former species by the presence of pale spots on elytra and more abdominal segments exposed. This species can be differentiated from the latter species in having different pattern of elytral spots, prothorax not abruptly narrowed in

posterior third and lateral margin not distinctly sinuated, coarser and denser punctuation on vertex of head. This species also shows similarity with *I. apatani* sp. nov., the differences of which are shown in the couplet 7 of the key to species.

Measurements of holotype : Total length 3.9 mm., width of head across eyes 0.92 mm., length of antenna 1.34 mm., length and width of prothorax 0.52 mm. and 0.92 mm., length and width of elytra 1.32 mm. and 1.50 mm.

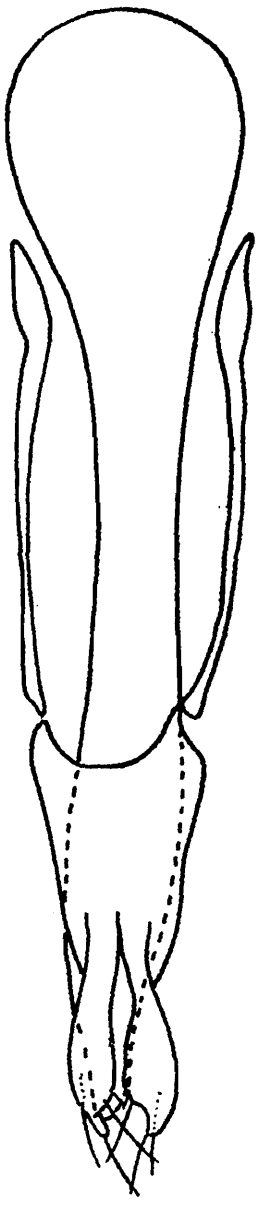

Fig. 2. Aedeagus of *Inopeplus jairajpurii* sp. nov.

Holotype ♂, India : Arunachal Pradesh, Lower Subansiri District, nr. Pitapol, 10 Km. 0-Yazali, 19-ix-1988, T. K. Pal, *ex.* under bark ; aedeagus dissected, mounted on cover-slip and pinned with the holotype.

Paratypes : 4 ex., data same as holotype ; 1 ex., Lower Subansiri District, nr. Lichi, 23 Km. 0-Yazali, 16-ix-1988, T. K. Pal, *ex.* under bark ; 1 ex., Lower Subansiri

District, Seven Camp, 27 Km. 0-Kimin, 21-ix-1988, T. K. Pal, *ex.* under bark ; (ZSI, APFS Reg. No. 973—979 ; Holotype and 5 Paratypes in Zoological Survey of India, Calcutta and 1 Paratype in Zoological Survey of India, Itanagar).

Etymology : This species is named in honour of Prof. M. S. Jairajpuri, an eminent nematologist and erstwhile Director of our Institute.

4. **Inopeplus apatani** sp. nov.

(Fig. 3)

General appearance (Fig. 3) elongated, flattened, shiny, blackish with elytra partially pale-coloured, last four abdominal segments exposed.

Head broader than long, apical margin truncate, fronto-clypeal suture distinct and nearly straight, apical margin of frons with a transverse depression, feeble medio-longitudinal impression on vertex ; puncturation on vertex little elongate, coarse and dense, interspaces narrower than punctures ; eyes moderately large and finely facetted, a semicircular depression surrounding inner margin of eye less distinct. Antenna moderately long and slender, scape moderately large and curved, pedicel shorter and narrower than scape, segment 3 slightly wider and longer than pedicel, segments 4-10 subequal and about as broad as long, segment 11 elongate and acuminate at apex, scape and pedical reddish-brown and segments 3-11 blackish.

Prothorax transverse, flattened, widest beyond middle and markedly narrowed towards base, lateral margin distinctly sinuated in posterior third, finely bordered from base to posterior two-thirds, a small notch close to marginal border of posterior third ; finely bordered from base to posterior two-thirds, a small notch close to marginal border of posterior third ; puncturation on pronotum roundish, finer and sparser than on vertex, interspaces wider than punctures.

Scutellum transverse, rounded at apex and impunctate.

Elytra broader than long, widest near apex, puncturation fine and almost similar as on pronotum, a rounded pale spot on posterior half of each elytron, the margin of which less distinct, last four abdominal segments exposed.

Ventral surface blackish, shiny and finely pubescent.

Remarks : This species resembles *I. nigricorpus* Sengupta, Pal & Mukhopadhyahy and *I. andamanicus* Pal & Dutta. This can be differentiated from the former species by entirely backish elytra, last two and half of abdominal segments exposed and vertex devoid of a short transverse depression from inner margin of eye in *nigricorpus*. This species can be readily distinguished from the latter by the anterior half of elytra paler, last abdominal segments exposed, finer and sparser puncturation of vertex, and without a marginal notch near base of pronotum in *andamanicus*.

Measurements of holotype : Total length 3.87 mm., width of head across eyes 0.91 mm., length of antenna 1.16 mm., length and width of prothorax 0.54 mm. and 0.91 mm., length and width of elytra 1.35 mm. and 1.50 mm.

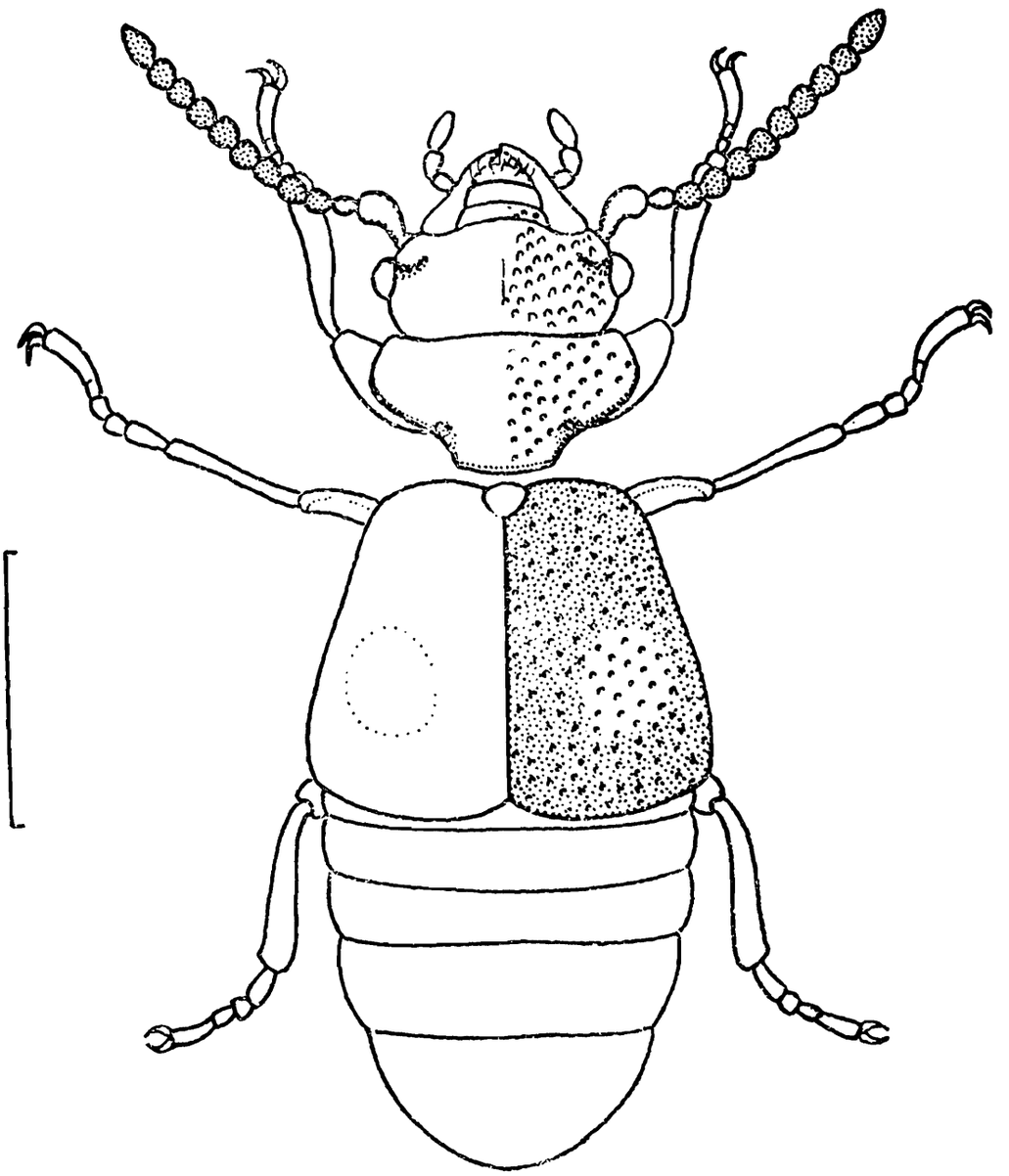

Fig. 3. *Inopeplus apatani* sp. nov., dorsal view (scale=1.0 mm.),

Holotype ♀, India : Arunachal Pradesh, Lower Subansiri District, Seven Camp, 27 Km. 0-Kimin, 21-ix-1988, T. K. Pal, *ex.* under bark ; ovipositor dissected, mounted on cover-slip and pinned with the holotype.

Paratypes : 2 ex., data same as holotype ; 1 ex., Lower Sunansiri District, nr. Pitapol, 10 Km. 0-Yazali, 19-ix-1988, T. K. Pal, *ex.* under bark (ZSI, APFS Reg. No. 980—983 ; Holotype and 2 Paratypes in Zoological Survey of India, Calcutta and 1 Paratype in Zoological Survey of India, Itanagar).

Etymology : This species is named after the tribe inhabiting the Lower Subansiri District from where the species is reported.

5. **Inopeplus albonotatus** (Motschulsky)

1859. *Euryplatus albonotatus* Motschulsky, *Etud. Ent.* 8 : 98.
1908. *Inopeplus albonotatus* : Grouvelle, *Annls. Soc. ent. Fr.* 77 : 462.
1977. *Inopeplus albonotatus* : Sengupta, Pal & Mukhopadhyay, *Oriental Ins.* 11 : 403.
1982. *Inopeplus albonotatus* : Pal & Dutta, *Rec. zool. Surv. India* 79 : 471.

Material examined : 1 ex. India : Arunachal Pradesh, Lower Subansiri District, Hawa Camp, 15 Km. 0-Kimin, 22-ix-1988, T. K. Pal, *ex.* under bark (ZSI, APFS Reg. No. 972).

Distribution : India : Arunachal Pradesh (New record), West Bengal, Andaman Is.

6. **Inopeplus decisus** (Walker)

1858. *Prognatha decisus* Walker, *Ann. Mag. Nat. Hist.* 2 (3) : 205.
1908. *Inopeplus decisus* : Grouvelle, *Annls. Soc. ent. Fr.* 77 : 462.
1977. *Inopeplus decisus* : Sengupta, Pal & Mukhopadhyay, *Oriental Ins.* 11 : 405.

Material examined : 8 ex. India : Arunachal Pradesh, West Siang District, Likabali, 12-iii-1989, T. K. Pal, *ex.* under bark (ZSI, APFS, Reg. No. 964-971).

Distribution : India : Arunachal Pradesh (New record), West Bengal, Uttar Pradesh, Kerala, Tamil Nadu ; Sri Lanka.

Key to the Indian species of INOPEPLUS

1. Head and prothorax reddish. ... 2
   Head and prothorax dark brown to deep black ... 3

2. Elytra Blackish with a whitish rounded spot on each elytron, abdominal segments 4 and 5 exposed ... *biocellatus* (Motschulsky)

   Elytra entirely black and without any spot, abdominal segment 2 partly and segments 3 to 5 completely exposed ... *itidus* Sengupta, Pal & Mukhopadhyay

3. Lateral margin of prothorax smooth ... 4
   Lateral margin of prothorax with two to four distinct denticles. ... 8

4. Head across eyes distinctly wider than prothorax, pedicel and segment 3 of antenna distinctly shorter and narrower than other segments, lateral margin of prothorax broadly bordered ... *distinctus* Sengupta, Pal & Mukhopadhyay

Head across eyes slightly narrower or about as broad as prothorax, pedicel and segment 3 of antenna about as long as segments 4-10 but slightly narrower, lateral margin of pronotum finely bordered ... 5

5. Elytra entirely metallic black, last two abdominal segments exposed ... *nigricorpus* Sengupta, Pal & Mukhopadhyay

Blackish elytra partially whitish or pale-coloured ... 6

6. Anterior half of elytra paler and posterior half blackish, only last three abdominal segments completely exposed, puncturation on vertex minute-roundish with interspaces distinctly wider ... *andamanicus* Pal & Dutta

Elytra blackish along its entire length with pale rounded spots—one or two pairs, more than last three abdominal segments exposed, puncturation on vertex coarse-elongate with interspaces narrower or about as wide as punctures ... 7

7. Two pairs of pale spots on elytra—one in both anterior and posterior halves, last three and half abdominal segments exposed, lateral margin of prothorax gradually narrowed and not markedly sinuate in posterior third, antennal segments slightly elongate and appear somewhat filiform ... *jairajpurii* sp. nov.

One pair of pale spots on posterior half of elytra, last four abdominal segments completely exposed, lateral margin of prothorax abruptly narrowed and distinctly sinuated in posterior third, antennal segments generally about as broad as long and distinctly moniliform ... *apatani* sp. nov.

8. Lateral margin of prothorax with two posterior denticles, a whitish testaceous spot near apex of each elytron ... *albonotatus* (Motschulsky)

Lateral margin of prothorax with one anterior and two posterior denticles, a whitish longitudinal spot from near base to apex of each elytron ... *decisus* (Walker)

Family : ELACATIDAE

Genus : **Elacatis** Pascoe

7. **Elacatis bengalensis** Sengupta

1977. *Elacatis bengalensis* Sengupta, *Oriental Ins.* **11**(4) : 537.

Material examined : 2 ex. India : Arunachal Pradesh, Lower Subansiri District, nr. Lichi, 25 Km. 0-Yazali, 19-ix-1988, T. K. Pal, *ex.* under bark (ZSI, APFS Reg. No. 984—985).

Distribution : India : Arunachal Pradesh (New record), West Bengal (Darjeeling District).

SUMMARY

38 examples of beetles of the heteromeran families Inopeplidae and Elacatidae collected from Arunachal Pradesh are worked out. These represent 6 species including 2 new species (*viz.*, *Inopeplus jairajpurii* and *inopeplus apatani*) of Inopeplidae, and 1 species of Elacatidae. Both the families are recorded for the first time from Arunachal Pradesh. A key to the Indian species of Inopeplidae is provided.

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Rec. zool. Surv. India, **91 (3-4)** : 353-360, 1992

ON A SMALL COLLECTION OF FISH FROM JAVADI HILLS, NORTH ARCOT DISTRICT, TAMIL NADU

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Introduction

Javadi Hills are a detached group of hills (Map 1) lying between 12°18′ and 12°54′ N and 78°35′ and 79°11′ E, situated in the southwest corner of North Arcot District, though spurs run down to South Arcot and Salem in Tamil Nadu. They are separated from the Eastern Ghats by the broad valley of the Palar and in the neighbourhood of Ambur, the Javadis almost join the Eastern Ghats and the gap widens again as it leaves North Arcot and passes into Salem. The average elevation of the range is approximately 760 metres and the highest point is 1166 metres. This range lies in the rainshadow of the Southeast monsoon, the rainfall being from October to December.

The Cheyyar which forms one of the main tributaries of Palar drains most of the Javadi Hills. The other less important rivers and mountain streams flow through Javadi.

Four surveys were undertaken during premonsoon, monsoon and postmonsoon periods, by the Zoological Survey of India team led by Dr K. R. Rao, during 1982-1984. A total of 974 fish specimens belonging to 15 species were collected.

Menon, 1951 [based on earlier records viz. Day (1878), Misra (1938), Hora (1938, 1940) and Chauhan (1947)] reported 119 species from Eastern Ghats. The present exhaustive collections are from Inner Javadi Hills. In the systematic account of the species are included the first reference, material examined, length range in mm SL, locality, altitude and date of collection, distribution and relevant remarks.

Systematic Account

Order : CYPRINIFORMES
Family : CYPRINIDAE
Subfamily : RASBORINAE

1. **Amblypharyngodon microlepis** (Bleeker)

1853. *Leuciscus microlepis* Bleeker, *Verh. Batav. Genootsch*, **25** : **41**,

(*Type locality* : River Hooghly)

Material : 2 exs., 31.0 mm SL, Amredi, 280 m, 3rd May 1984, F. 1616.

Remarks : D 2/7 ; A 3/5/1 ; Ll 50 ; L tr 4-5 ; a faint broad lateral band seen on body extending upto caudal base ; Ll pored upto the 12th scale.

Distribution : "From the Hooghly through Orissa and down the Coromandal Coast to Madras" (Day, 1878).

2. **Barilius bendelisis** (Hamilton, Buchanan)

1807. *Cyprinus bendelisis* Hamilton, *Journey Mysore*, 3 : 345, pl. 32.

(*Type locality* : Rivers of Mysore)

Material : 1 ex., 73.0 mm SL, Amredi, water falls, 250 m, 4th May 1984, F. 1614.

Remarks : D 3/7 ; A 3/8 ; Ll 43 ; L tr to ventral base 2 1/2 ; predorsal scales 20 ; body with about 10 vertical bars ; dorsal with rows of small spots and darkened on the upper half ; caudal edged with black and the lower lobe is longer. Vertical bars reported to disappear in adults is well marked in this specimen ; also an oblique black stripe from behind origin of opercls along the side.

Distribution : Throughout India. Nepal. Pakistan. Sri Lanka. Bangladesh.

3. **Esomus barbatus** (Jerdon)

1849. *Leuciscus barbatus* Jerdon, *Madras J. Lit. & Sci.*, 15 : 322.

(*Type locality* : Rivers and tanks all over Mysore and Carnatic)

Material : 13 exs., 33.0-47.0 mm. SL, Uttarakaveri aru, 310 m, 22nd Apr. 1984, F. 1627 and 16 exs., 36.0-46.0 mm. SL, Amredi, 280 m, 3rd May 1984, F. 1615.

Remarks : The predorsal scales number 18 ; the lateral line is complete and is pored upto the 30th scale. In a few specimens the Ll is discontinuous above the anal only. A bright lateral band is present from behind eye to caudal base. In *E. barbatus* the bright lateral band is reported to be absent (Hora & Mukerji, 1928). In *E. danricus* (Ham.) and *E. thermoicos* (Val.) the lateral band is conspicuous, but the lateral line is absent or nearly so in the former and the predorsal scale rows are 19-20 in the latter. The specimens from Javadi have been tentatively identified as *E. barbatus* which is characterized by a complete lateral line system.

Distribution : Peninsular India.

4. **Rasbora caverii** (Jerdon)

1848. *Leuciscus caverii* Jerdon, *Madras J. Lit. & Sci.*, 15 : 320.

(*Type locality* : River Cauvery, Coorg State.)

Material : 8 exs., 20.0-50.0 mm. SL, Pinnathurai, 415 m., 24th Apr. 1984, F. 1622 and 3 exs., 48.0-54.0 mm. SL, Amredi water falls, 250 m, 4th May 1984, F. 1613.

Remarks : The dorso-hypural distance when carried forwards falls behind posterior border of eye in the larger specimens and just reaches the posterior border of eye in the smaller specimens. In *R. daniconius* a closely related species this distance is greater and falls before the posterior border of eye.

Distribution : Peninsular India : Karnataka and Tamil Nadu.

Subfamily : CYPRININAE

5. **Puntius puckelli** Day

1868. *Puntius* (*Capoeta*) *puckelli* Day, *Proc. Zool. Soc*, : 197.

(*Type locality* : Bangalore.)

Material : 26 exs., 15.0–50.0 mm. SL, Bheemamadugu, 490 m, 24th Feb. 1984, F. 2966 ; 91 exs., 17.0-29.0 mm. SL, Jamnamathur, Motalapattu, 600 m, F. 2960 ; 89 exs., 13.0-48.0 mm. SL, Kanaru stream, 510 m, 26th Feb. 1983, F. 2959 ; 61 exs., 19.0-36.0 mm. SL, Vannanthurai, 590 m, 27th Feb. 1983, F. 2970 ; 126 exs., 14.0-50.0 mm. SL, Bheemamadugu, 500 m, 1st Mar. 1983, F. 2963 ; 23 exs., 23.0-31.0 mm. SL, Kanaru stream, 9th Mar. 1983, F. 2972 ; 8 exs., 18.0-23.0 mm. SL, Kavalur, Pannaikadu, 560 m, 1st Dec. 1983, F. 2716 ; 27 exs., 20.0-30.0 mm. SL, Utharakaveri aru, 300 m, 23rd Apr. 1984 ; 3 exs., 21.0-270 mm. SL, Vadavelakkal, Ambur, 360 m, F. 2203 ; 1 ex., 28.0 mm. SL, Utharakaveri aru, Odugathur, 310 m, 26th Apr. 1984 ; 3 exs., 23.0-27.0 mm. SL, Amredi, 280 m, 3rd May 1984 and 39 exs., 26.0-45.5 mm. SL, water falls, Amredi, 250 m, 4th May 1984, F. 2973.

Remarks : Day (1868) described *P. Puckelli* from a single specimen 3 inches long from Bangalore, characterised by the presence of 7 branched rays in the dorsal ; Ll 24, L tr 4/3 ; a spot in the dorsal and one from the 19th to 21st lateral line scale. Hora (1936) synonymised *P. puckelli* with *P. dorsalis* (Jerdon) on the basis that the former is the juvenile of the latter. In the present collection the significant observation made on a large series of specimens is that the number of branched rays is 7 in 442 specimens (13.0-50.0 mm. SL) and is 6 in one specimen (22.0 mm. SL). The specimens also bear resemblance to a Sri Lankan species *P. bimaculatus* (Bleeker). On an examination of the types of *P. bimaculatus* it was observed that two species are mixed up in the lot, some with 7 dorsal rays and others with 8 dorsal rays, apart from the difference in head length and body depth. A note on the biometric study of *P. puckelli* from Javadi Hills is in the press. Jayaram et al (1982) observed 8 dorsal rays in all the 162 specimens of *P. dorsalis* studied by him and the L tr was 2 1/2 in 64 specimens studied by him. In the present collection *P. puckelli* has 3-3 1/2 lateral row of scales in all the specimens examined.

Distribution : S. India : Cauvery drainage system, Karnataka to as far south as Tambaraparni system in Tamil Nadu.

6. **Puntius sophore** (Hamilton)

1822. *Cyprinus sophore* Hamilton, *Fish Ganges* : 310, 319, pl. 19, fig. 86.

(*Type locality* : Ponds of Bengal.)

Material : 5 exs., 22.0-45.0 mm. SL, Utharakaveri aru, 310 m, 22nd Apr. 1984, F. 1626.

Remarks : D 3/8, strong but articulated at tip ; Ll 25, complete, 21st and 22nd scales with a blotch ; L tr $5/3\frac{1}{2}$; predorsal 8-9 ; a bright round spot at the base of middorsal from the 3rd to the 6th rays ; no barbel.

Distribution : Throughout India. Pakistan, Bangladesh, Sri Lanka, Myanmar and China.

Subfamily : GARRINAE

7. **Garra mullya** (Sykes)

1841, *Chondrostoma mullya* Sykes, *Trans. Zool. Soc. London*, 2 : 359, pl. 62, fig. 3.

1964. *Garra mullya*, Menon, *Mem. Indian Mus.*, 14 (4) : 212.

(*Type locality :* The Bheema river at Daunde.)

Materinl : 1 ex., 28.0 mm. SL, Kannaru stream, 510 m, 26th Feb. 1983 ; 2 exs., 36.0-38.0 mm. SL, Vannanthurai, 590 m, 27th Feb. 1983, F. 2971 ; 1 ex., 23.0 mm. SL, Bheemamadugu, 500 m, 1st Mar. 1983 ; 2 exs., 39.0-44.0 mm. SL, Nellivasal, 720 m, 18th Nov. 1983, F. 1631 ; 51 exs., 17.0-250 mm. SL, Kataru, 640 m, 21st Nov. 1983, F. 1625 ; 1 ex., 75.0 mm. SL, water falls, Amredi, 250 m, 4th May 1984, F. 1611.

Remarks : In some specimens a dark lateral streak on body ending in a blotch in the caudal peduncle ; distance between anus to anal is 3 times in the distance between pelvic to anal.

Distribution : Throughout India except Assam and Himalayas.

Family : COBITIDAE

8. **Lepidocephalus thermalis** (Valenciennes)

1846. *Cobitis thermalis* Valenciennes, *Hist. nat. Poiss.*, 17 : 78.

(*Type locality* : Sri Lanka.)

Material : 1 ex., 30.0 mm. SL, Paramandai near Chengam road, 200 m, 5th Dec. 1983 ; 17 exs., 21.5-42.0 mm. SL, Utharakaveri aru, 310 m, 22nd Apr. 1984, F. 1630 ; 8 exs., 31.5-26.0 mm. SL. Utharakaveri aru, 300 m, 23rd Apr. 1984 ; 180 exs., 20.0-35.0 mm. SL, Vadavelakkal, Ambur, 360 m, 25th Apr. 1984, F. 2201 ; 6 exs., 29.5-42.0 mm. SL, Utharakaveri aru, Odugathur, 310 m, 26th Apr. 1984, F. 1998 ; 7 exs., 32.0-40.0 mm. SL, Pudupattu, 340 m, 28th Apr. 1984, F. 2958 ; 7 exs., 30.0-37.0 mm. SL,

Gururajapalayam, 200 m, 29th Apr. 1984, F. 2957 ; 48 exs., 25.5-37.0 mm. SL, Amredi, 280 m, 3rd May 1984, F. 1617 ; 12 exs., 23.0-48.0 mm. SL, water falls, Amredi, 250 m, 4th May 1984, F. 1612.

Distribution : Peninsular India : Southern Karnataka, Kerala, Tamil Nadu. Sri Lanka.

Family : HOMALOPTERIDAE

Subfamily : NOEMACHEILINAE

9. **Noemacheilus denisoni denisoni** Day

1867. *Nemachilus denisoni* Day, *Proc. Zool. Soc. Lond.* : 287.

1987. *Noemacheilus denisoni denisoni*, Menon, *The Fauna of India and Adjacent Countries*, Pisces IV, Part I *Homalopteridae* : 93-99, figs. 3 & 4, pl. 10.

(*Type locality* : Bhowany River, Base of Nilgiris.)

Material : 14 exs., 17.0-42.5 mm. SL, Bheemamadugu, 490 m, 24th Feb. 1983, F. 2000 ; 1 ex., 24.0 mm. SL, Kannaru stream, 510m, 26th Feb, 1983 ; 1 ex., 19.5 mm. SL, Vannanthurai, 590 m, 27th Feb. 1983 and 14 exs., 17.0-27.0 mm. SL, Bheemamadugu, 500 m, 1st Mar. 1983, F. 1999.

Remarks : Adults with about 14 vertical bands, young with rows of vertical blotches on sides separated from a row of spot in middorsal ; dorsal and caudal fins spotted in rows.

Distribution : Peninsular India.

Order : SILURIFORMES

Family : BAGRIDAE

10. **Mystus montanus** (Jerdon)

1849. *Bagrus montanus* Jerdon, *Madras J. Lit. Sci.*, 15 (2) : 337.

(*Type locality* : Malabar.)

Material : 1 ex., 41.0 mm. SL, Amredi, 280 m, 3rd May 1984, F. 1619 ; 1 ex., 51.5 mm. SL, Pinnathurai, 415 m, 24th Apr. 1984, F. 1624.

Remarks : In this specimen the adipose dorsal base is longer ; maxillary barbel reaches anal ; horizontal bands on body ; caudal peduncle with a prominent oval blotch, rayed dorsal and anal fins long and tipped black.

Distribution : India : Kerala, Karnataka, Tamil Nadu and M. P.

Order : ATHERINIFORMES

Family : ORYZIIDAE

11. **Oryzias melastigma** (Mc Clelland)

1839. *Aplocheilus melatigma* McClelland, *Asiat. Res.* 19, *Indian Cyprinidae* : 301, 427, pl. 42, fig. 3.

(*Type locality* : Tanks in Calcutta.)

Material : 8 exs., 14.0-26.0 mm. SL, Bheemamadugu, 490 m, 24th Feb. 1983, F. 2968 ; 7 exs., 11.0-25·0 mm. SL, Bheemamadugu, 500 m, 1st Mar. 1983, F. 2965 ; 2 exs., 20.0-24.0 mm. SL, Uttarakaveri aru, 300 m, 23rd Apr. 1984 and 2 exs., 17.5-22.0 mm. SL, Gururajapalayam, 200 m, 29th Apr. 1984.

Distribution : Throughout India. Myanmar. Pakistan. Sri Lanka.

Order : CHANNIFORMFS
Family : CHANNIDAE

12. **Channa orientalis** Schneider

1801. *Channa orientalis* Schneider, *Syst, Ichth.* : 496, pl. 90, fig. 2.

(*Type locality* : Ponds and ditches of Bengal)

Material : 1 ex., 41.5 mm. SL, Bheemamadugu, 490 m, 24th Feb. 1983, F. 2967 ; 1 ex., 60.0 mm. SL, Jamnamathur, Motalapattu, 600 m, 25th Feb. 1983, F. 2961 ; 1 ex., 71.0 mm. SL, Kannaru stream, 510 m, 26th Feb. 1983 ; 5 exs., 52.0-75.0 mm. SL, Vannanthurai, 590 m, 27th Feb. 1983, F. 2169 ; 3 exs., 57.0-88.0 mm. SL, Bheemamadugu, 500 m, 1st Mar. 1983, F. 2964 ; 10 exs., 19.0-47.0 mm. SL, Kalyanamandai, Kuttathur, 600 m, 1st Feb. 1983, F. 2717 ; 2 exs., 39.0-58.0 mm. SL, Pinnathurai, 415 m, 24th Apr. 1984, F. 1623 ; 1 ex., 29.0 mm. SL, Amredi, 280 m, 3rd May 1984, F. 1618.

Distribution : Throughout India. Afghanistan. Pakistan. Bangladesh. Sri Lanka. Myanmar. Thailand. Malaysisa. China. Viet-Nam. Laos. Hainan.

13. **Channa punctatus** (Bloch)

1793. *Ophiocephalus punctatus* Bloch, *Naturg. Ausland Fisch.*, 2 : 139, pl. 358.

(*Type locality* : Coromandal Coast)

Material : 1 ex., 32.0 mm. SL, Vadavelakkal, Ambur, 360 m, 24th Apr. 1984, F. 2202.

Distribution : Throughout India. Pakistan. Nepal. Bangladesh. Myanmar and Sri Lanka.

Order : PERCIFORMES
Family : GOBIIDAE

14. **Glossogobius giuris** (Hamilton)

1822. *Gobius giuris* Hamilton, *Fish. Ganges* :51, 366, pl. 33, fig. 15.

(*Type locality* : Ponds and freshwater rivers of Gangetic Provinces)

Material : 1 ex., 54.0 mm. SL, Utharakaveri aru, 310 m, 22nd Apr. 1984, F. 1628 ; 1 ex., 38.0 mm. SL, Utharakaveri aru, 300 m, 23rd Apr. 1984 and 3 exs., 32.0-61.0 mm. SL, Pinnathurai, 415 m, 24th Apr. 1984, F. 1621.

Distribution : Throughout India. Pakistan. Nepal. Bangladesh. Myanmar. Sri Lanka. Indo-Pacific.

Family : CICHLIDAE

15. **Oreochromis mossambica** (Peters)

1852. *Chromis mossambicus* Peters, *Montab, Akad. Wiss.* Berlin : 681.

(*Type locality* : Zambesi river, S. Africa.)

Material : 1 ex., 39.0 mm. SL, Bheemamadugu, 500 m, 1st Mar. 1983, F. 2962 ; 2 exs., 19.0-19.5 mm. SL, Utharakaveri aru, 310 m, 22nd Apr. 1984, F. 1629 and 1 ex., 93.0 mm. SL, Pinnathurai, 415 m, 24th Apr. 1984, F. 1620.

Distribution : East Africa to Natal ; widely distributed in India.

DISCUSSION

Misra (1938) reported 37 species of fish from various mountain ranges of Eastern Ghats lying below the Krishna River and of these 11 were recorded from Cheyyeru river in Cuddapah District. Material from interior Javadi Hills were not studied by him. Recently Lazarus et al (1988) in their check-list included 11 species of fishes from Javadi Hills. In this report some current nomenclatural changes were overlooked viz. *Puntius stigma* (Val.) and *P. tetraupagus* (Ham. Buch.) are junior synonyms of *P. sophore* (Ham.) and *P. chola* (Ham.) respectively. *P. bimaculatus* (Blkr.) is a Sri Lankan species and the two spotted barbs encountered in plenty in the present collection are referable to *P. puckelli* Day.

With this report the fishes so far known from Javadi Hills totals to 25. The fishes that were collected earlier and not represented in the present collection are *Notopterus notopterus* (Pallas), *Cirrhinus fulungee* (Sykes), *Puntius ticto* (Ham.), *Heteropneustes fossilis* (Bloch) and *Channa striatus* (Bloch) (Misra, 1938) and *P. chola* (Ham.), *P. amphibius* (Val.), *Danio rerio* (Ham. Buch.), *Mystus armatus* (Day) and *Macrognathus aculeatus* (Bloch) (Lazarus et al, 1988). The species being reported for the first time from Javadi Hills are *Barilius bendelisis bendelisis* (Ham. Buch.), *Rasbors* (*Rasbora*) *caverii* (Jerdon), *Puntius puckelli* Day, *Noemacheilus denisoni denisoni* Day, *Mystus montanus* (Jerdon) and *Oryzias melanostigma* (McCl.). Besides, *Oreochromis mossambica* (Peters) reported here is an exotic species.

SUMMARY

Studies on a small collection of fish fauna from Javadi Hills, in the Eastern Ghats, has revealed 15 species of which 6 are reported here for the first time from these Hills.

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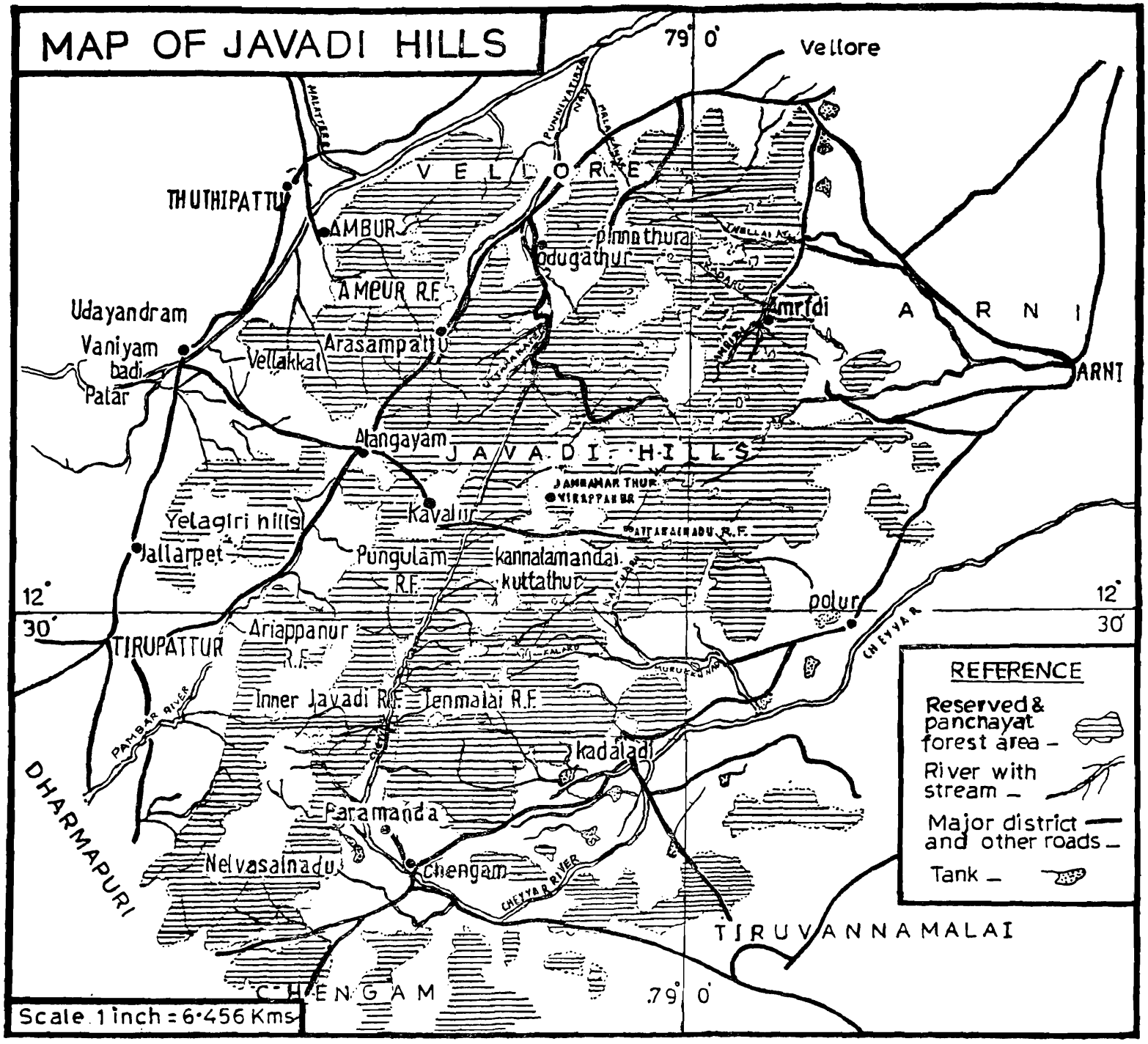
MAP OF JAVADI HILLS
79° 0'
Vellore
VELLORE
THUTHIPATTU
AMBUR
Pinnathura
Odugathur
AMBUR R.F.
Udayandram
Vaniyambadi
Patar
Vellakkal
Arasampattu
Amrtdi
ARNI
ARNI
Atangayam
JAVADI HILLS
JAMNAMAR THUR
VIRAPPANUR
Kavalur
Yelagiri hills
Jallarpet
Pungulam R.F.
kannalamandai
kuttathur
ATTARAINADU R.F.
12° 30'
polur
12° 30'
TIRUPATTUR
Ariappanur R.F.
CHEYYAR
REFERENCE
Reserved & panchayat forest area
River with stream
Major district and other roads
Tank
Inner Javadi R.F.
Jenmalai R.F.
PAMBAR RIVER
kadaladi
DHARMAPURI
Paramanda
Nelvasalnadu
Chengam
CHEYYAR RIVER
TIRUVANNAMALAI
CHENGAM
79° 0'
Scale 1 inch = 6·456 Kms

Rec. zool. Surv. India, **91** (3-4) : 361-366, 1992

SURVEY OF SEASONALLY ICE-COVERED SURAJ TAL LAKE IN NORTHWEST HIMALAYA

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INTRODUCTION

The only information available on the seasonally snow covered high altitude lakes above 4,000 m. is that of Thomson (1852), Hutchinson (1933, 1937), Loffler (1969), James and Hubbick (1969), Singh and Sharma (1985) and Kumar *et al.* (1989). High altitude lakes have simple trophic structure and harbour few species predominated by arthropods. The present paper on Suraj Tal Lake gives a preliminary account of limnological and biological features on the high altitude lake of the Great Himalayan Range of which nothing is known.

AREA INVESTIGATED

Suraj Tal Lake is situated at an altitude of 4,800 m. AMSL (Lati : 32°45 'N ; Longi : 77°25 'E) on the Great Himalayan Range in the Lahaul-spiti valley of Himachal-pradesh. The lake (Fig. 1) is larger than the lakes present in the pir-panjal Range of

Table 1. Morphometric features of Suraj Tal Lake

Parameters	Values
Surface area (ha)	2.76
Max. lenght (Km)	0.29
Max. breath (Km)	0.14
Mean breath (Km)	96.80
Max. depth (m)	14.00
Mean depth (m)	4.50
Relative depth (%)	7.4
Volume (m^3)	125×10^3
Volume development*	0.97

*No unit, since a ratio.

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Northwest Himalaya, particularly in the Kullu valley and remains covered by snow and ice for about 9-10 months in a year. It is located slightly above the permanent snow-line and fed by melt water from the winter snow beds and glaciers all around the region. The shore is formed by stones and boulders. The southern shore of the lake is deterred with debris of frequent avalanches from the Great Himalayan Range, with snow-caped peaks arising over 20,000 ft. AMSL. The debris often causes the extension of littoral zone on the southern shore. The narrow western end of the lake is marked by a undergrground out-let through which the water drains into river Bhaga. The morphometry of the lake is given in Table 1.

Material and Methods

The Suraj Tal Lake was surveyed twice during June 1985 and 1986. During June 1985, it was partially covered with ice and ice foils floating on the surface of the water while in 1986 the lake water was clear without any snow or ice deposits.

Water samples were taken by dragging St John's water sampler on the surface. A battery operated portable digital electronic kit was used to record the data on water temperature, pH, conductivity and dissolved oxygen. All the other ionic solutes (Table 2) were determined in the laboratory following Mackereth (1963). The aquatic fauna was collected by using plankton nets with 50μ mesh size and chironomid adults with butterfly nets. The collection was sorted out groupwise and preserved in pample's fluid. Identification and counting of specimens were made under light microscope.

Results and Discussion

Physico-chemical features :

The air temperature fluctuates from 5.5-10.0°C. The lake water is slightly alkaline with pH 7.9 and high dissolved oxygen concentration (14.9 ppm), which is to be attributed to the low temperature rather than the photosynthetic activity of the phytoplankton (Welch 1952). Water analysis of the lake shows that the lake represents a simplified trophic structure, with low mineral content (Table 2). The conductivity value is low (128.0μ mhos) and hence lake can be classified as oligotrophic.

Table 2. Physico-Chemical features of the surface water of Suraj Tal Lake recorded in 1986.

Parameters	Mean Values
Water temperature (°C)	5.5 – 10.0
pH	7.9
Total alkalinity (mg/1 $Caco_3$)	–
Conductivity (μmhos cm^{-1})	128.0
Dissolved Oxygen (mg/1)	14.9
PO_4-P (mg/1)	0.53
NH_4-P (mg/1)	0.14
NO_2-N (mg/1)	0.02
NO_3-N (mg/1)	0.11
Cl– (meq/1)	0.78
Co_3^{--} (meq/1)	0.66
HCO_3^- (meq/1)	0.73
Ca^{++} (mg/1)	2.20
Mg^{++} (mg/1)	0.63
Na^+ (mg/1)	8.10
K^+ (mg/1)	0.85
Mn^{++} (mg/1)	0.14
Cu^{++} (mg/1)	0.03
Zn^{++} (mg/1)	0.51
Sio_3 (mg/1)	3.8
SO_4 (mg/1)	2.8

Biological features :

Suraj Tal Lake supports considerable amount of phytoplankton and rich aquatic fauna. Phytoplankton is largely represented by Chlorophyceae, Myxophyceae and Bacillariophyceae. The aquatic fauna predominantly consists of the insect population representing 90.3% of the total catch, followed by crustaceans 9.7%. The insect community is represented by Collembola, Trichoptera, Plecoptera and Diptera (Table 3). The Diptera is represented by the family Chironomidae and constitutes the preponderant element. Collembola, Trichoptera and Plecoptera constitute the minor groups of insects (Fig. 3). The benthos is also rich in chironomid larvae and pupae as characteristic of high altitude lakes (Hutchinson 1933, Kaisila 1952, oliver 1964, James & Hubbick 1969 and Kumar et al 1989). The significant feature of the benthic fauna of Suraj Tal Lake is the predominance of chironomid larvae and the absence of other

groups especially Amphipoda. The paucity of amphipods is also reported by oliver (1964) in the large Nettilling lake. However in large oligotrophic lakes amphipods occur in larger numbers, often outnumbering the chironomid larvae (Rawson 1953, 1960, Oliver 1960 and Kumar *et al*, 1989). The characteristic swarming behaviour of the chironomid adults was however not observed. The adults keep themselves close to the water surface to escape the hazards of wind. Taxonomically the Chironomidae is represented by the genera *Himatendipes.*, *Corynoneura*, *Pseudodiamesa*, *Diamesa*, *Metriocnemus* and *Protanypus.*

Table 3. Faunal composition of Suraj Tal Lake during 1986.

Arthropod fauna	No. of specimens
Insecta	
Diptera (Chironomidae)	
Imagines	267
Immature stages*	680
Collembola	220
Trichoptera	70
Plecoptera	63
Crustacea*	
Cladocera	
Chydoridae	32
Copepoda	
Diaptomidae	86
Ostracoda	
Cyridae	21

*No. of specimens calculated as individuals/litre.

Crustacea, Rotifera and very few protozoa constitute the zooplankton population of the lake. The Crustacea is represented by the orders Cladocera, Copepoda and Ostracoda (Table 3)· The cladocerans are represented by the species *Chydorus sphaericus* Muller and *Daphnia pulex* Leydig (Chydoridae). The Copepoda is largely represented by two undescribed species of genus *Allodiaptomus* (Diaptomidae). The Ostracoda is represented by the genus *Eucypris* Hartmen (Cypridae). The Crustacea of Suraj Tal exhibits phenomenon of diurnal migration. During the hours of bright sunshine the Crustacea were found either inside the bottom silt or under the shelter of submerged stones and boulders. Just before sunrise and in the evening, the density of the Crustacea in the upper layers of water was greatly enhanced. With the increase in intensity of sunlight, they retreat into the deeper layers of the lake water, exhibiting the phenomenon of "photophobia".

The arthropodfauna of Suraj Tal Lake is characterized by pronounced body pigmentation and reduction in body size as also reported by Mani & Singh (1961). The melanism of high altitude insects is also known in Alps in Europe and North American mountains (Erhard 1929, Petersen 1956). Animal life in the lake undergoes hibernation to tide over the prolonged snow-covered icy winters for 9-10 months a year. All their life activities are completed within the short and fleeting summer. Summarily, the lake can be termed as oligotrophic with a very simple trophic structure of the extreme environment conditioned by short growing period, low temperature and abundance of benthic chironomid larvae. This large freshwater lake supports a remarkable variety of animals and needs detailed investigation for the preservation of endangered freshwater germplasm.

SUMMARY

Suraj Tal is a freshwater high altitude lake with a simplified trophic structure and low mineral content. The aquatic fauna is mainly represented by insects and crustaceans. Significant fearture of the lake is the predominance of chironomid larvae and the absence of amphipods. The arthropods hibernate to tide over the long icy-winters.

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DIURNAL VARIATIONS OF PHYTOPLANKTON IN LAKHOTIA LAKE OF PALI

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INTRODUCTION

The present knowledge of diurnal studies comes through a number of workers who explored various freshwater habitats not only in south-north part of India but also in the east-west regions of the country. Most of the research work focussed either on physical, physico-chemical and biological parameters in one season. The details of diurnal studies on phytoplankton are wanting particularly in Rajasthan which is the second largest state in area in the country yet information available in the field of present study is relatively less. Hence, an attempt was made to know the diurnal rhythms of phytoplankton in different seasons in tropical lake of Western Rajasthan.

STUDY AREA

Lakhotia lake is located in the heart of Pali city, which comes in the western part of Rajasthan and passes through three seasons namely summer (March-June), Monsoon (July-October) and winter (November-February). Lakhotia is a manmade, rain-fed, parennial lake roughly triangular in shape having a maximum length of 1825 m on the east-west direction and a breadth of 950 m on the north-south direction with a maximum depth of 4·5 m during the study period. The lake receives water through a channel coming from an adjacent temporary impoundment 'Lhoria', situated on its eastern side. The loss of water is due to evaporation and seepage. The vegetation around the vicinity of the lake is mainly confined to the southern side consisting of xerophytic shrubs and trees. In the littoral zone an aquatic grass *Scirpus tuberosus* grows only on the eastern bank. The colour of the water was generally yellowish green due to muddy nature of the bed. For details of study area see Khatri (1983).

METHODS

In order to know the seasonal and vertical movements of phytoplankton in Lakhotia lake, three diurnal studies-one each in summer, monsoon and winter were conducted. The samples were collected from surface, 1m and the bottom at three hourly intervals,

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over a period of 27 hours from a place located almost in the centre of the lake. The time and dates of three diurnal studies are given in Table—1. Water samples for the collection of phytoplankton were taken in 500 ml wide mouth, screw—capped polythene bottles. The phytoplanktons were fixed in the bottles by adding Lugol's iodine solution and preserved in 3% formalin. The phytoplankton cells were counted by sedimentation method using Sedgvick rafter slide under a binocular compound microscope. Identification was done only up to generic level after Edmondson (1965) and Chapman and Chapman (1975). Results were expressed in units / 1.

Table—1

The dates and time of the three diurnal studies conducted in Lakhotia lake of Pali.

S. No.	Season	Date	Hours
1.	Summer	23 & 24 May, 1977	1200 hrs (1st day) to 1200 hrs (2nd day)
2.	Monsoon	27 & 28 Sept., 1977	—do—
3.	Winter	25 & 26 Jan., 1978	—do—

Results

Total phytoplankton exhibited a definite diurnal trend of increase in day time and decrease in night hours at the surface in summer while in monsoon and winter seasons no such trends were observed. In summer population of total phytoplankton attained its peak position at 1500 hrs. A gradual decrease in density was observed from 1800 hrs onwards, minimizing it at the surface at 2400 hrs and 1m and bottom at 0300 hrs (Plate--1, Fig. 1). In monsoon total phytoplankton showed marked fluctuations in population. The maximum population was 220×10^3 units / lit. recorded at the surface at 1800 hrs and minimum was 106×10^3 units/lit. at the bottom at 0900 hrs (Plate—II, Fig—1). In winter total phytoplankton showed two maxima, the first at 2100 hrs and the second at 0900 hrs both at the surface and 1m. At the bottom only one peak (at 2100 hrs) was observed. The minimum number of phytoplankton was recorded at 0300 hrs at the surface and 1 m and at 0900 hrs at the bottom (Plate—III, Fig. 1).

The phytoplankton population composed of members of Chlorophyceae, Cyanophyceae and Bacillariophyceae. The various genera in each family identified during three seasons are given in Table—2. The dominant genera in summer, monsoon and winter in each family are described as under.

Ankistrodesnus showed its presence throughout the summer diurnal cycle. The maximum number was recorded during day time and minimum during night hours. The

population was found to be richer at 1m depth than at the surface and bottom (Plate—I, Fig. 2). In monsoon its population was maximum at 1500 hrs at the surface and 1800 hrs at 1 m and bottom. Minimum number was present at 2100 hrs at the surface and 1 m and at 2400 hrs at the bottom (Plate—II, Fig. 2) During winter it showed no marked fluctuations in the population. The population was at its peak at 1500 hrs and was minimum at 0600 hrs (Plate—III, Fig. 2)

Table—2

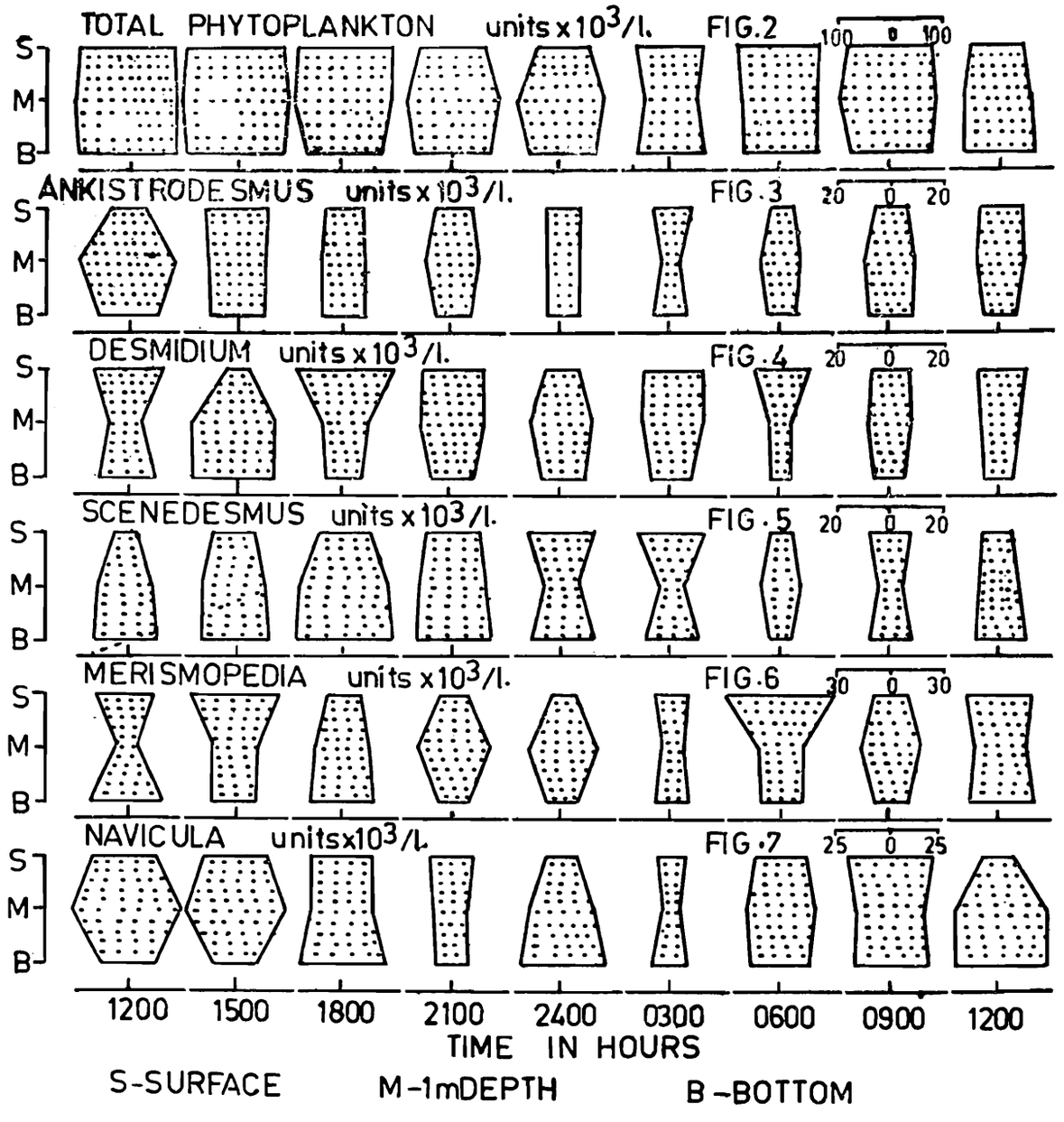
Occurrence of various genera of phytoplankton during three diurnal studies in Lakhotia lake of Pali.

Season	Chlorophyceae	Cyanophyceae	Bacillariophyceae
Summer	*Actinastrum*	*Lyngbya*	*Anomoeneis*
	Ankistrodesmus	*Merismopedia*	*Diatomus*
	Cosmarium	*Spirulina*	*Navicula*
	Desmidium		*Pleurosigma*
	Kirchneriella		
	Pediastrum		
	Scenedesmus		
Monsoon	*Actinastrum*	*Anabaena*	*Navicula*
	Ankistrodesmus	*Lyngbya*	
	Botryococcus	*Merismopedia*	
	Pediastrum		
	Cosmarium		
	Scenedesmus		
Winter	*Actinastrum*	*Anabaena*	*Navicula*
	Ankistrodesmus	*Lyngbya*	*Diatoma*
	Botryococcus	*Merismopedia*	
	Chlorococcus	*Spirulina*	
	Cosmarium		
	Pediastrum		
	Mougeotia		
	Scenedesmus		

Desmidium showed considerable variation in number along the vertical profile of the lake during summer and monsoon. The population was maximum at 1800 hrs at the surface. It decreased during night hours at the surface and increased at 1 m depth (Plate—I, Fig. 2). In monsoon its population ranged from nil to 22×10^3 units/lit. at the surface, 8 to 20×10^3 units/lit. at 1 m depth and 2 to $18 \times 10^{\frac{3}{2}}$ units/lit. at the bottom (Plate—II, Fig. 3).

Scenedesmus exhibited an increasing trend in population from 1500 to 0300 hrs at the surface and 1200 to 1800 hrs at 1 m and bottom during summer (Plate—I, Fig. 4). In monsoon a decreasing trend in number was observed at the surfaee from 2400 to 0900 hrs but at 1 m and bottom a reverse trend was noticed during the same period (Plate – II, Fig. 4). In winter the maximum population was recorded at 2100 hrs at all depths while minimum density was at 1200 hrs at the surface, 1500 hrs at the bottom and 0600 hrs at 1 m (Plate—III. Fig. 5).

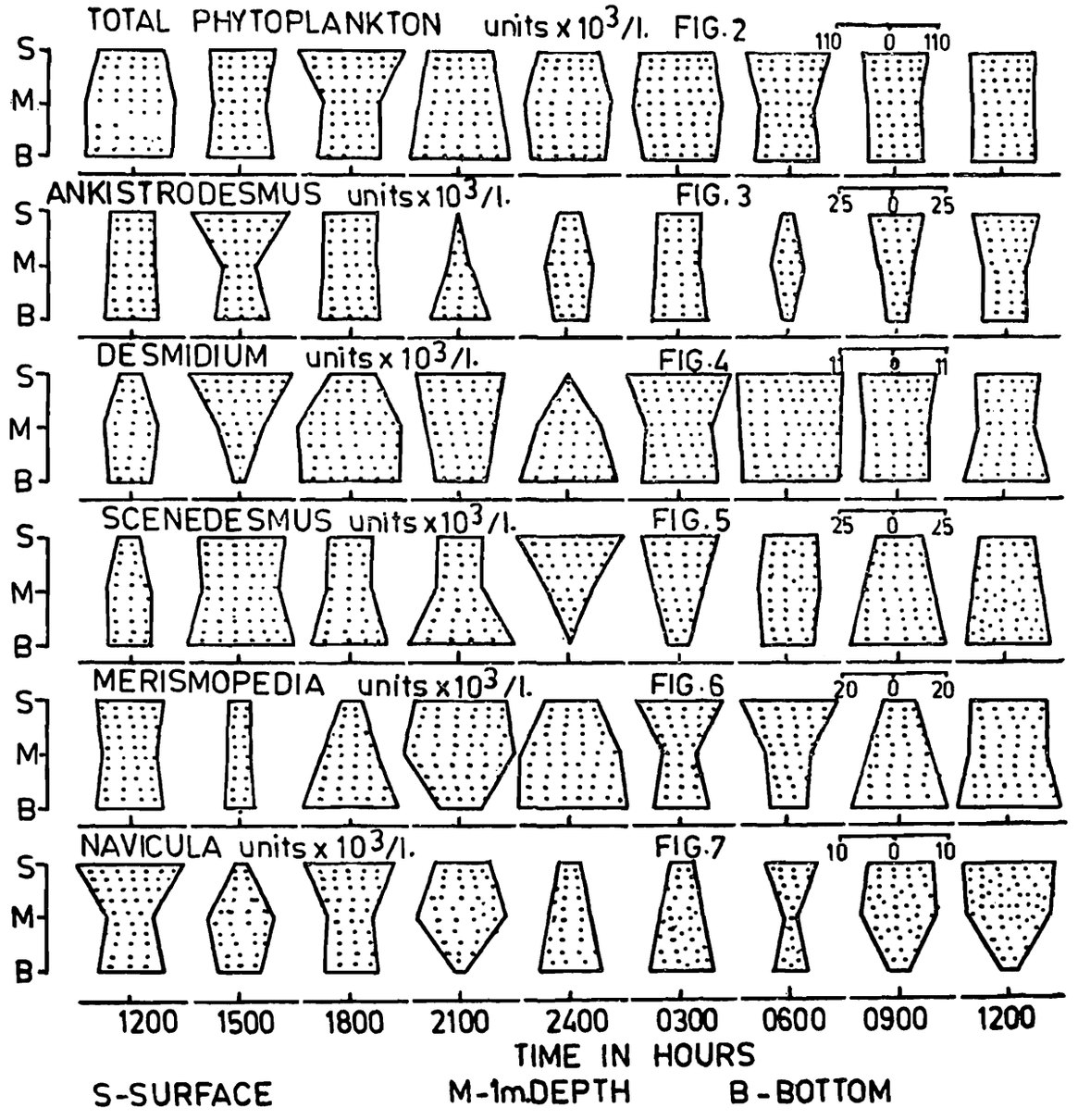
PLATE-I



Chlorococcus was observed only during winter and showed movements along the vertical profile of the lake. The population moved upwards from bottom to the surface during day time, while at night hours it again moved to the bottom. The population ranged from 2 to 28×10^3 units/lit. at the surface, 6 to 32×10^3 units/lit. at 1 m and 4 to 24×10^3 units/lit. at the bottom (Plate—III, Fig. 4).

The maximum population of *Merismopedia* was observed during day hours at the surface (1500 hrs) and bottom (1200 hrs) and at night hours at 1 m (2100 hrs) during summer. The minimum number at surface and bottom was during night hours while

PLATE-II

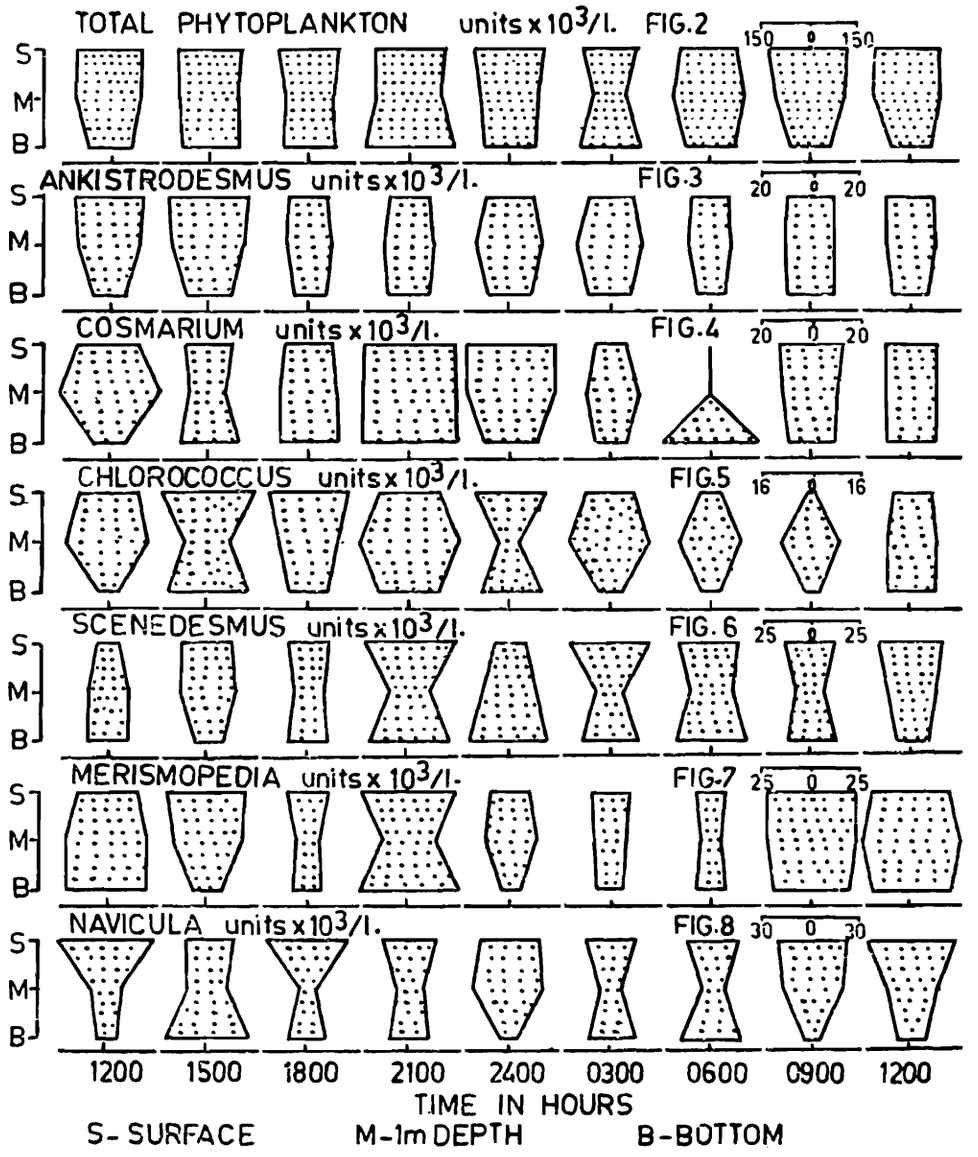


at 1 m during day time (Plate—I, Fig. 5). In monsoon vertical movement was shown by *Merismopedia*. The population was maximum at 1500 hrs at all depths while maximum was recorded at 2100 hrs at the surface and 1 m and 2400 hrs at bottom (Plate—II, Fig. 5). Unlike in the diurnal studies of summer and monsoon season, it showed vertical movements during winter studies as was evident by increase in population at the surface during day time and at the bottom at night hours. The population fluctuated from 16 to 48×10^3 units/lit. at the surface, 4 to 50×10^3 units/lit. at 1 m and 8 to 50×10^3 units/lit. at the bottom (Plate—III, Fig. 6).

In summer the population of *Navicula* was maximum at 1200 hrs at the surface

and 1 m. Then from 1500 hrs onwards the number decreased, reaching its maximum at 0300 hrs on the following day. At the bottom the population was minimum at 1500 hrs and maximum at 2100 hrs of the same day (Plate—I, Fig. 6). Its population was poor in monsoon in comparison to that of the summer and showed vertical

PLATE - III



movements. The population moved from bottom to 1 m and then at the surface from 1200 to 1800 hrs and thereafter showed downward movements (Plate—II, Fig. 6). In winter the population of *Navicula* was higher at the surface in comparison to 1 m and bottom, during day hours. But during night hours, due to downward movement the population increased at the lower layers (Plate—III, Fig. 7). Vertical distribution of *Chlorococcus* during winter is shown in Plate—III. Fig. 4.

DISCUSSION

The phytoplankton flora was rich qualitatively as well as quantitatively in winter studies. In summer Chlorophyceae and Bacillariophyceae, in monsoon Cyanophyceae and Bacillariophyceae and in winter Chlorophyceae and Cyanophyceae were found dominant. The results showed that *Ankistrodesmus*, *Scenedesmus*, *Merismopedia* and *Navicula* were the permanent members in all the three seasons. *Desmidium* occurred in summer and monsoon seasons, whereas *Chlorococcus* appeared during the winter only. All these genera, with the exception of *Desmidium*, exhibited vertical movements.

Ankistrodesmus was observed to be maximum at the surface during the summer and the winter during day hours and minimum at the night time. *Navicula* also showed a similar trend during the summer and the monsoon seasons. But surprisingly, *Scenedesmus* and to some extent *Merismopedia* showed reverse trends i.e., the maximum concentration at the surface during night time and minimum in day hours. It is difficult to explain this unusual reversal of the trend which has been reported for the first time.

SUMMARY

Diurnal variations of phytoplankton in summer, monsoon and winter seasons have been discussod in a tropical lake of western Rajasthan. Phytoplankton showed a definite vertical movement in summer. *Ankistrodesmus*, *Scenedesmus*, *Merismopedia* and *Navicula* were present in all seasons. *Desmidium* occurred in summer and monsoon and *Chlorococcus* appeared in winter. All genera except *Desmidium* exhibited vertical movements.

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A DISTRIBUTIONAL ANALYSIS OF THE UROPELTID SNAKES OF INDIA AND SRI LANKA

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INTRODUCTION

The uropeltids are all primitive burrowers having an interesting mode of life history. These snakes, easily distinguished by the presence of modified scales at the tip of the short tail, are small inoffensive creatures living under logs and stones in the damp localities of the mountainous forests of South India and Sri Lanka, often at high altitudes, thus evading easy observation and collection. Smith (1943) has given a consolidated accout of these snakes which have been studied in recent years by Chari (1952-1955), Constable (1949), Deraniyagala (1941, 1954), Gans (1966, 1913), Murthy (1982) and Rajendran (1977, 1985).

In this paper, the pattern of distribution of the uropeltids found only in South India (see maps 1-7a) and Sri Lanka is discussed. It is interesting to note that these snakes are found to inhabit the forested mountainous regions of southwestern India Sri Lanka and are totally absent in the rest of the globe.

The present day uropeltids are known by 44 species and 2 races contained in eight genera of a single family. An analysis of their geographical distribution in India and Sri Lanka is indicated in Table 1.

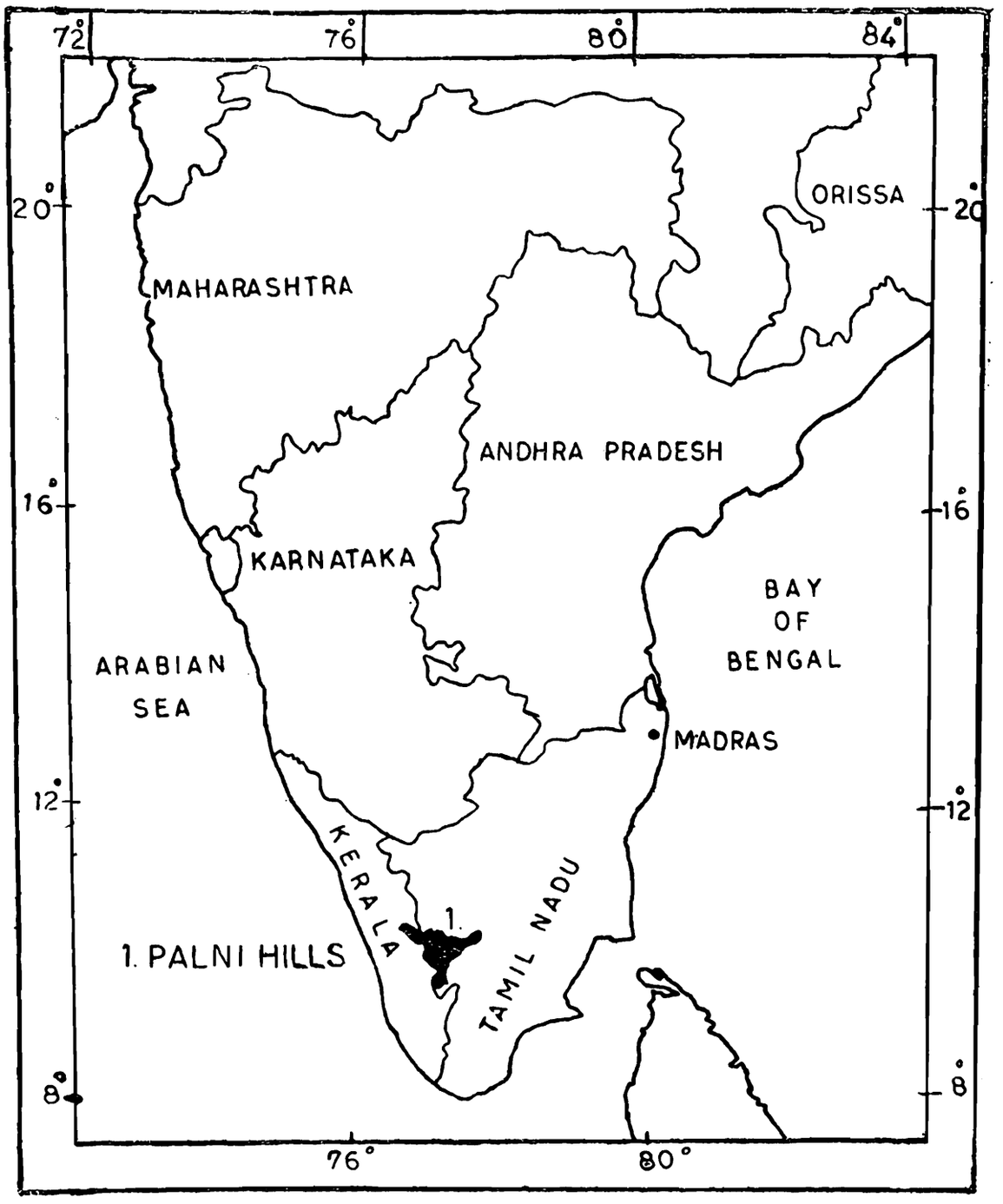
Due to the current interest in the biota of the Western Ghats of which snakes form an important component and also in view of the fact that the status of several species of uropeltids as well as other kinds has been seriously threatened becaute of the depletion of forests, it is hoped that this paper will stimulate an interest in the ophiology of Western Ghats thereby encouraging the biologists/conservationissts to collect these unique reptiles from the areas that have not yet been thoroughly investigated.

Table I—Distribution of the uropeltids of India Sri Lanka
(Serpentes : Uropeltidae)

Note : Species marked with an asterisk are rare/known by a few specimens only.

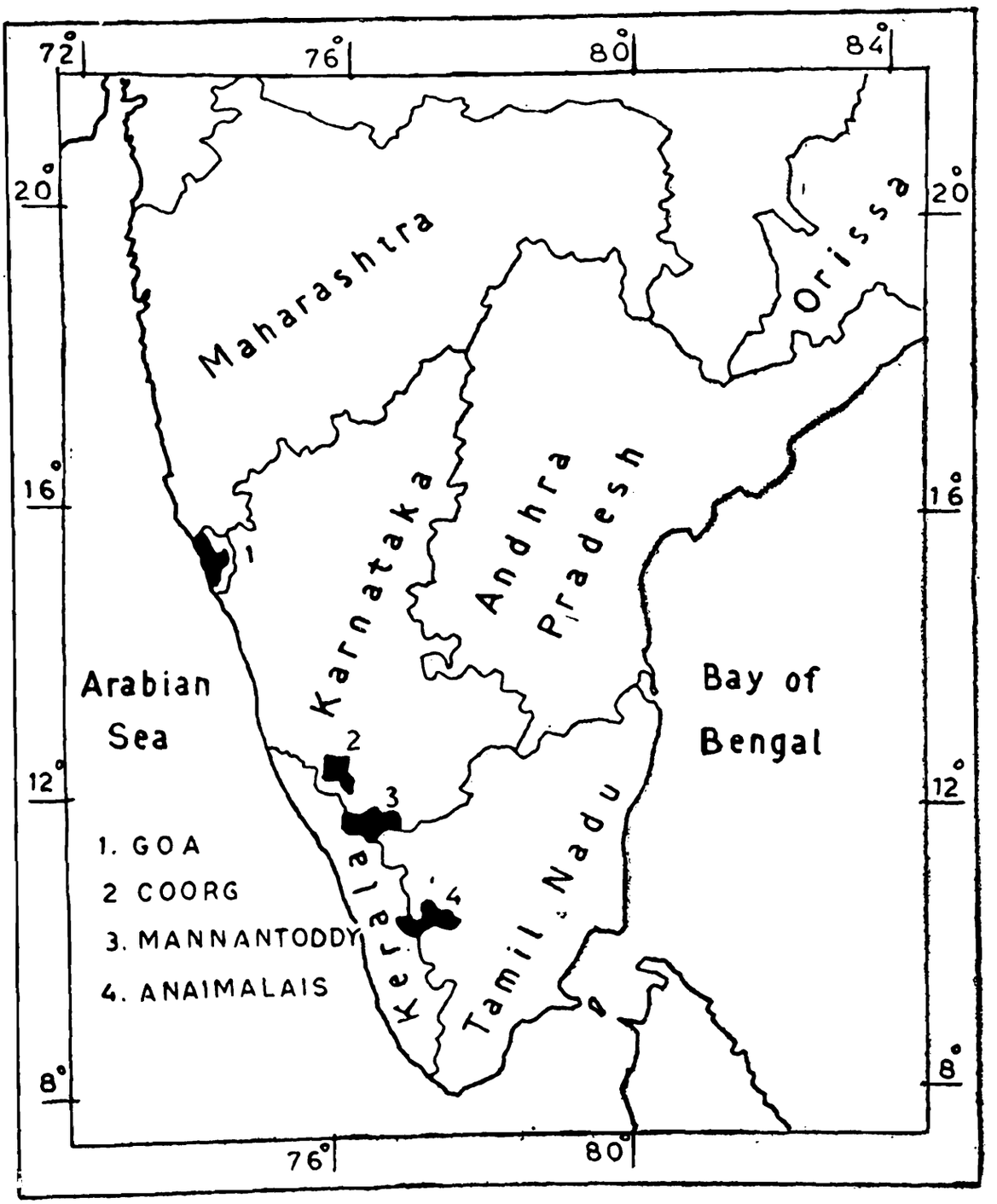
Genera and Species 1	India 2	Sri Lanka 3	Remarks 4
I. *Brachyophidium* Wall			
1. *B. rhodogaster* Wall	+	–	Sacred Heart College, Shembaganur, Palni Hills.

1	2	3	4
II. *Melanophidium* Guenther			
2. **M. bilineatum* Beddome	+	–	Peria and Tirrhioot peaks, West of Manan toddy Kerala. Known from three specimens only.



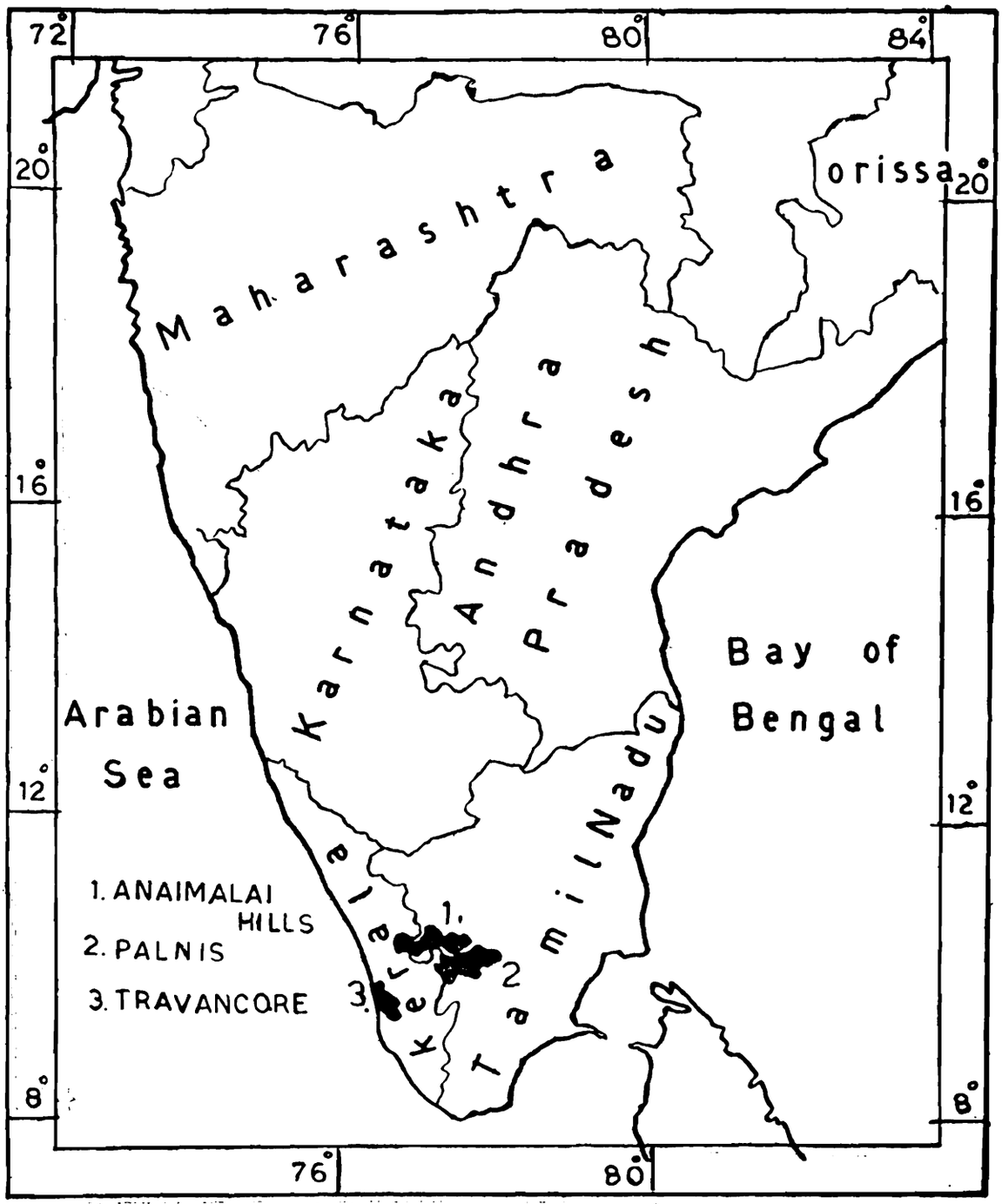
Map no.1 Distribution of BRACHYOPHIDIUM

1	2	3	4
3. *M. punctatum* Beddome	+	–	Peermade, Kerala, Srikundra, Anaimalais and Goa frontier.
4. **M. wynaudense* Beddome	+	–	Manantoddy, Kerala and Coorg, Karnataka.



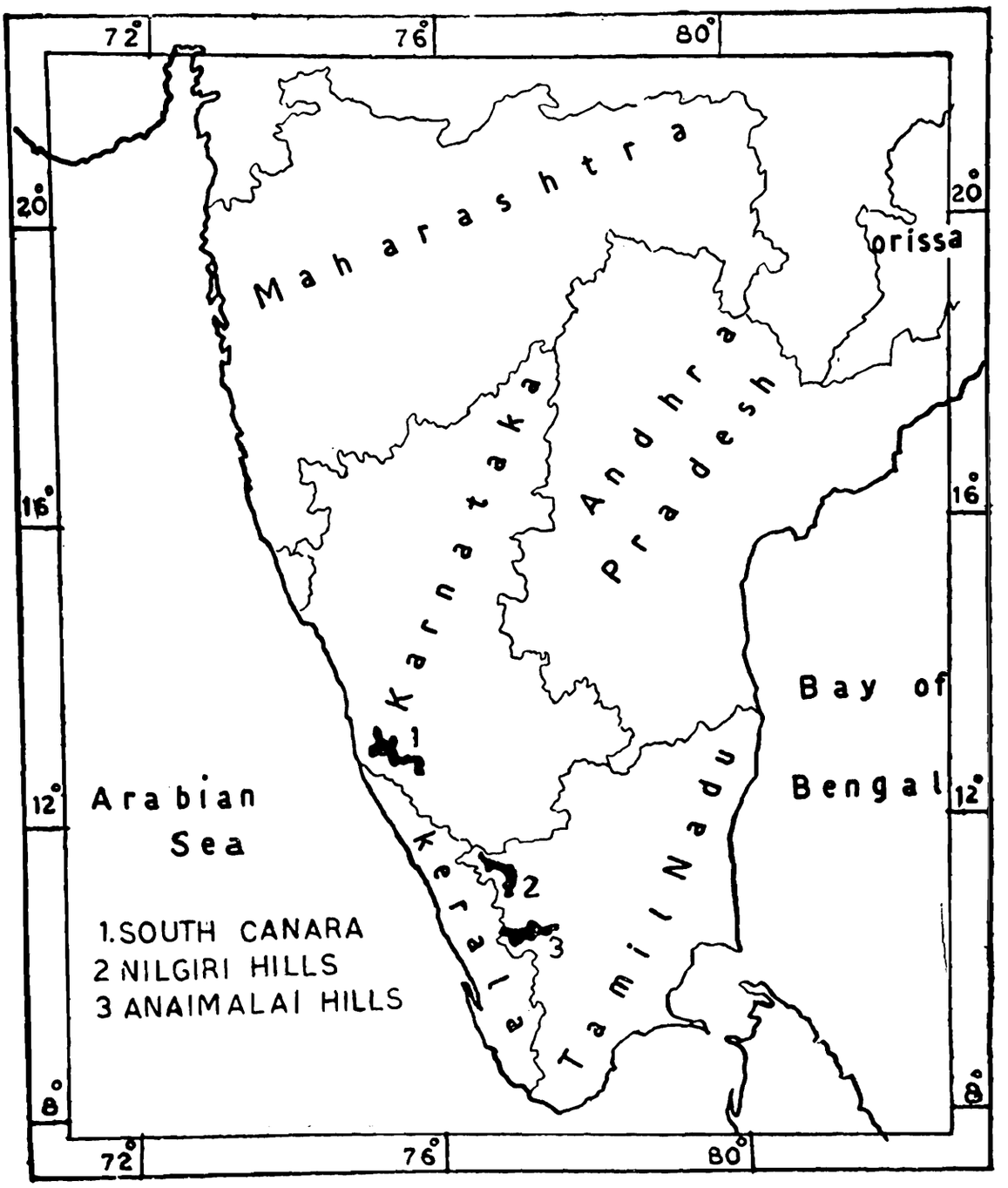
Map no. 2 Distribution of MELANOPHIDIUM

1	2	3	4
III. *Platyplectrumus* Guenther			
5. *P. madurensis* Beddome	+	+	South India and Sri Lanka.
5a. *P. madurensis madurensis* Beddome	+	–	Shembaganur and Kodaikanal, Palnis and Munnar, Kerala.
5b. *P. m. ruhanae* Deraniyagala	–	+	Southern Province, Sri Lanka.



Map no. 3 Distribution of PLATYPLECTRURUS

1	2	3	4
6. *P. trilineatus* (Beddome)	+	–	Shembaganur, Palnis and Anaimalais.

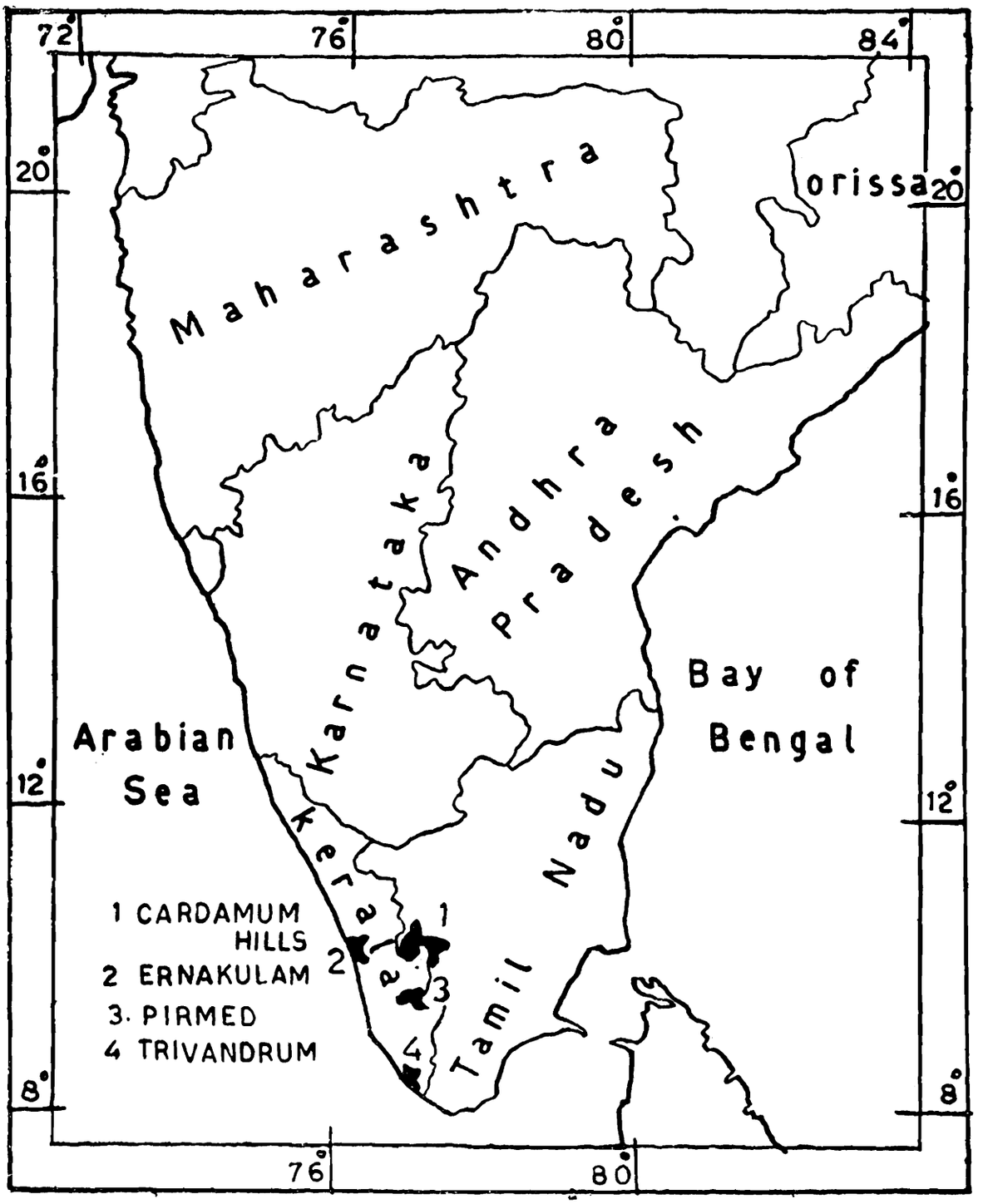


Map no.4 Distribution of PLECTRURUS

IV. *Plectrurus* Dumeril

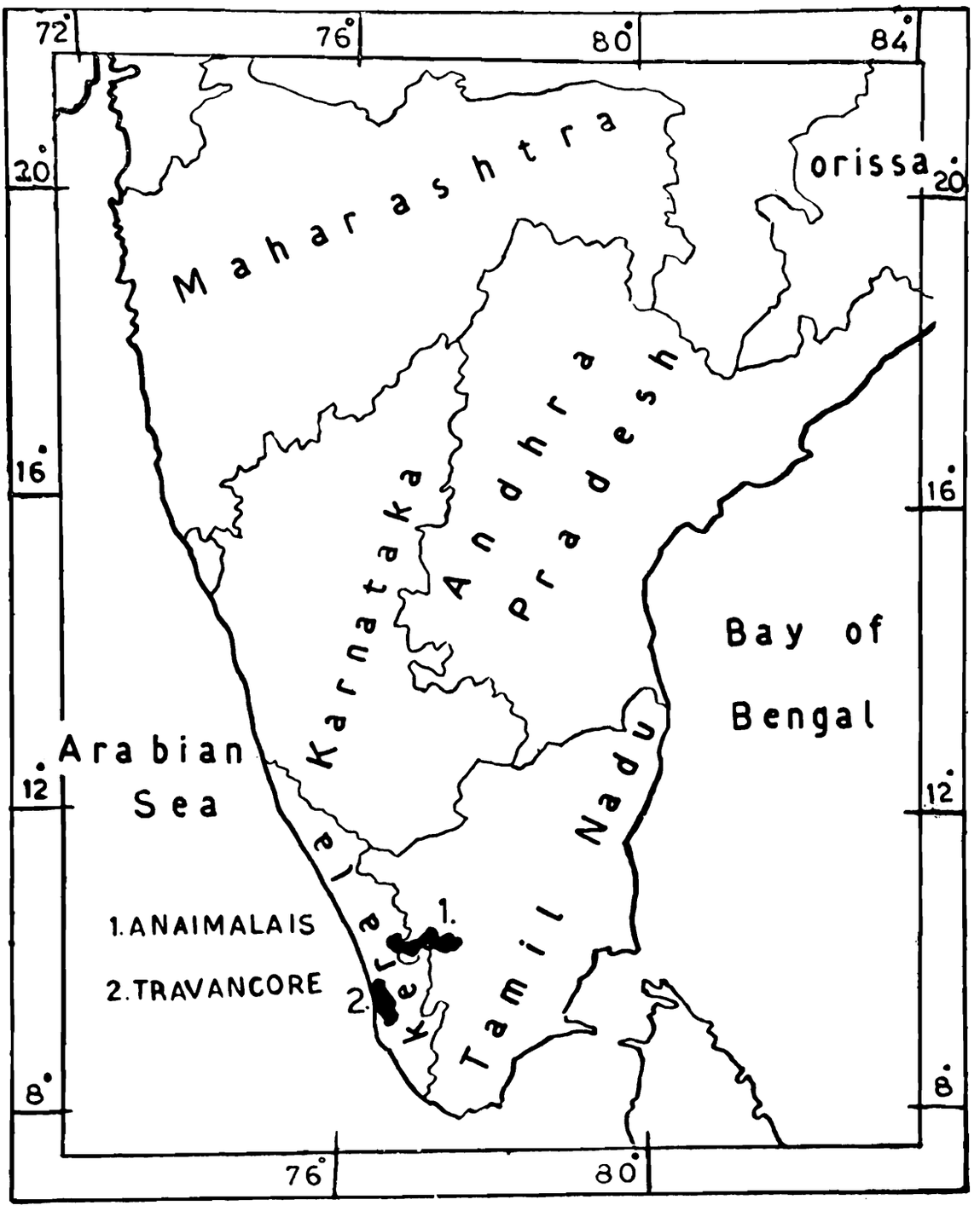
7. **P. aureus* Beddome	+	–	Chambra Hill, Kerala.
8. **P. canarius* (Beddome)	+	–	Kudremukh, Karnataka.

1	2	3	4
9. *P. guentheri* Beddome	+	–	Kundapur, Karnataka ; Ooty and Coonoor, Nilgiris.
10. *P. perroteti* Dum. & Bibr.	+	–	Nilgiris and Anaimalais. Common in the Nilgiris.



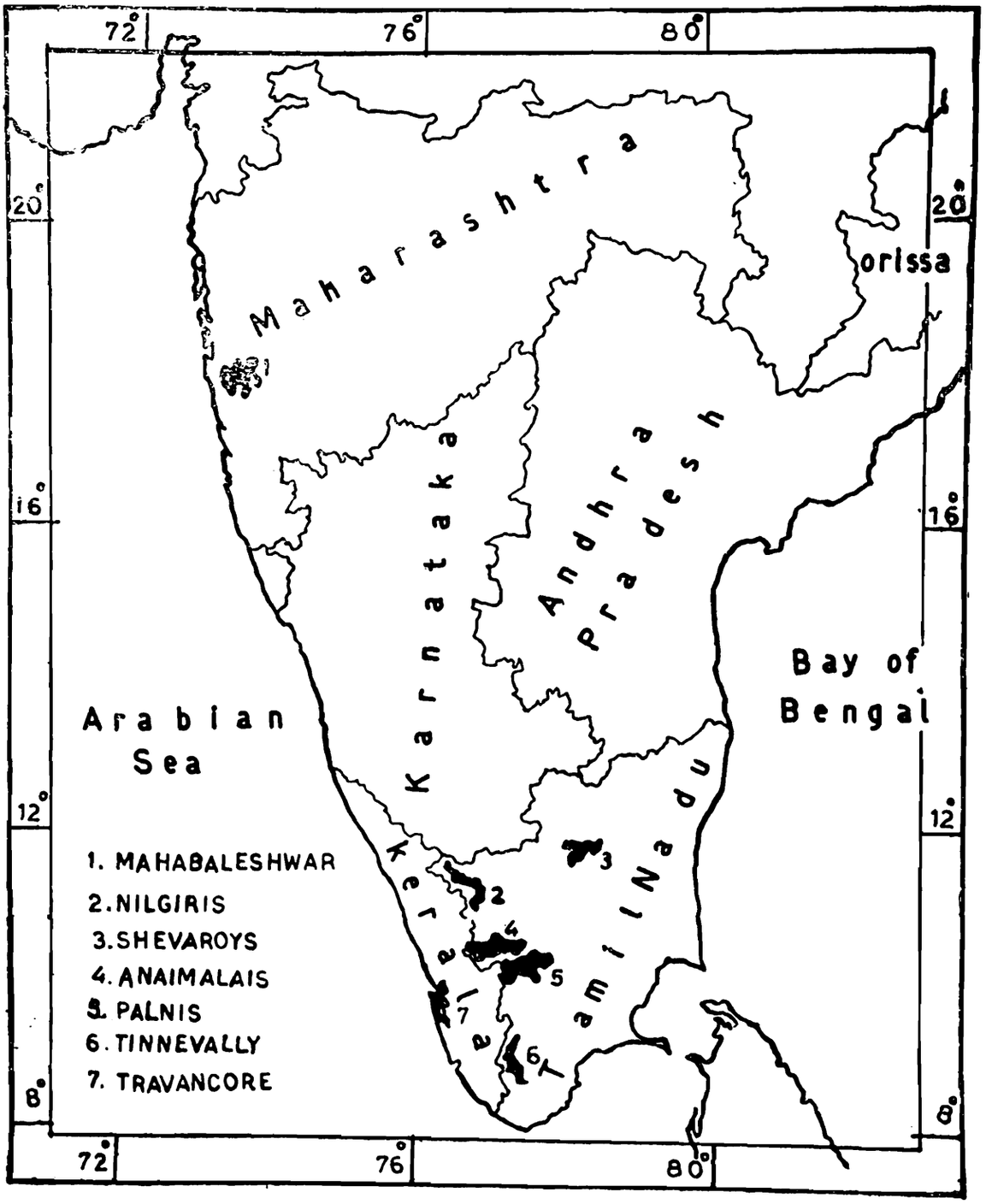
Map no. 5 Distribution of RHINOPHIS

1	2	3	4
V. *Pseudotyphlops* Schlegel			
11. *P. philippinus* Schlegel	+	–	At low elevations in Trincomalee, Matara, Kolonne, Korle, Badullo.



Map no. 6 Distribution of TERETRURUS

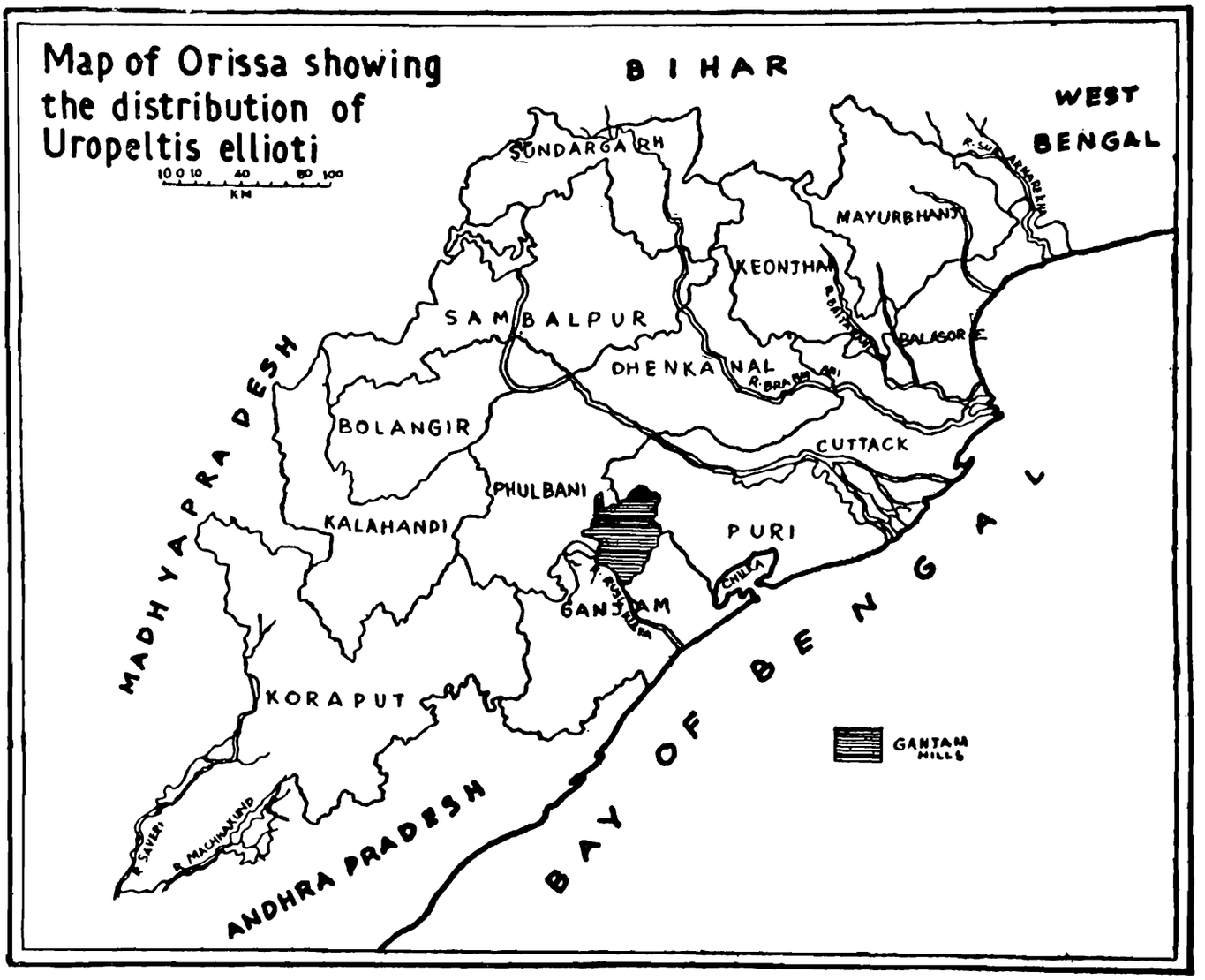
1	2	3	4
VI. *Rhinophis* Hemprich			
12. *R. blythii* Kelaart	–	+	Hills of the Central and Southern Provinces.
13. **R. dorsimaculatus* Deraniyagala	–	+	Northwestern Province.



Map no. 7 Distribution of UROPELTIS

1	2	3	4
14. *R. drummondhayi* Wall	–	+	Hills of Central and Uva Provinces.
15. **R. ferqusonianus* Boulenger	+	–	Cardamon Hills, Kerala.
16. *R. oxyrhynchus* (Schneider)	–	+	The low country in the Northern and Eastern Provinces, Mullativu ; Vavoniya ; Trincomalee.
17. *R. philippinus* (Cuvier)	–	+	Hills in the Sabaraganuva and Central Provinces.
18. *R. punctatus* Mueller	–	+	Hills in the Central and Noathwestern Province.
19. *R. sanguineus* Beddome	+	–	Koppa and Kalsa, Karnataka ; Wynad, Kerala ; Nilgiris and Tirunelveli Hills.
20. *R. travancoricus* Boulenger	+	–	Tirunelveli Hills, Tamil Nadu ; Munnar, Kerala.
21. *R. trevelyana* (Kelaart)	–	+	Hills of Sabaragamuva ; Central and Uva Provinces.
VII. *Teretrurus* Beddome			
22. *T. sanguineus* (Beddome)	+	–	Tirunelveli and Munnar Hills.
VIII. *Uropeltis* Cuvier			
23. *U. arcticeps* (Guenther)	+	–	Muvathupuzha and Alleppy, South Kerala Hills ; High Wavy Mountains, Madurai District and Tirunelveli Hills, Tamil Nadu.
24. **U. beddomii* Guenther	+	–	Anaimalais.
25. *U. broughami* (Beddome)	+	–	Palnis, Sirumalais and Nilgiris.
26. *U. ceylanicus* Cocteau	+	–	Sholayar, Murugolai and Valaparai, Anamalais ; Vandamedu and Bonaccord, Kerala ; Koppa and Kot igehar, Karnataka ; Shevroy Hills, Eastern Ghats.

1	2	3	4
27. *U. dindigalensis* (Beddome)	+	–	Sirumalais, Tamil Nadu.
28. *U. elliotti* (Gray)	+	–	Courtallam and Manjolai, Tirunelveli Hills ; Munnar, Kerala ; Shevroy Hills Javadi and Ganjam Hills, Eastern Ghats.
29. *U. liura* (Guenther)	+	–	Madura and Tirunelveli Hills.
30. *U. macrolepis* (Peters)	+	–	



Map no. 7a

30a.	*U. macrolepis macrolepis* (Peters)	Bombay Hills between latitudes 18°7′ and 19°7′ N.
30b.	*U. macrolepis mahablesh-warensis* Chari	Mahableshwar, Powai Lake Salsette Island, Maharastra.

1	2	3	4
31.	**U. macrorhynchus* (Beddome)	+	–	Anaimalais
32.	*U. maculatus* (Beddome)	+	–	Anaimalais and Hills of South Kerala.
33.	*U. melanogaster* (Gary)	–	+	Hills of the Central Province.
34.	**U. myhendrae* (Beddome)	+	–	Hills of South Kerala and Nilgiris.
35.	**U. nitidus* (Beddome)	+	–	Anaimalais, Cochin side.
36.	*U. ocellatus* (Beddome)	+	–	Western Ghats south of the Goa gap ; Common in the Anaimalais
37.	**U. petersi* (Beddome)	+	–	Anaimalais.
38.	*U. philipsi* (Nicholls)	+	–	Maousakanda Estate, Gammaduva, East Matale.
39.	*U. pulneyensis* (Beddome)	+	–	Palnis ; Alagar Hills ; Munnar Hills.
40.	*U. rubrolineatus* (Guenther)	+	–	Bhimshanker and Pune, Maharastra ; Anaimalais and Hills of South Kerala.
41.	*U. rubromaculatus*	–	+	Anaimalais and Nilgiris.
42.	*U. ruhanae* Deraniyagala	–	+	Galle District, Southern Province.
43.	**U. smithi* Gans	+	–	Anaimalais.
44.	*U. woodmasoni* (Theobald)	+	–	Palnis ; Anaimalais ; Hills of Tirunelveli and South Kerala ; one specimen from the Nilgiris.

DISCUSSION

An analysis of the table shows that out of the eight genera known, majority are confined to the Western Ghats, South India ; the entire family is, however, autochthnous to the Indian subregion. The pattern of peculiar distribution of these snakes shows that while some forms are allopatric, others are highly endemic.

Of the eight uropeltid genera, the genus *Uropeltis* is known by 22 species followed by 10 species of the genus *Rhinophis*. Only one species, *Uropeltis ellioti* (Gray) extends from Shevroys to Ganjam Hills in the Eastern Ghats besides being found in the Western Ghats. The Bombay Hill uropeltid, *Uropeltis macrolepis* (Peters) occurs in the Bombay Hills between latitudes 18°7′ and 19°7′ N. Three uropelts namely, *Uropeltis melanogaster* (Gray), *U. phillipsi* (Nicholls) and *U. ruhanae* are endemic to Sri Lanka. Of the remaining 6 genera, *Pseudotyphlops* is the only genus that is endemic to Sri Lanka,

represented by a single species ; all the others viz., *Brachyophidium*, *Melanophidium*, *Platyplectrurus*, *Plecturus* and *Teretrurus* are confined to the Western Ghats, India. A new subspecies of *Platyplectrurus madurens's* namely, *P. madurensis ruhanae* has been described by Deraniyagala (1955).

To summarise, the fact that these interesting burrowing forms are to be found only in South India, and Sri Lanka amply suggests that South India itself is a distinct faunal centre having close affinities with Sri Lanka. It is also clear that the fauna of Sri Lanka and South India have been derived distinctly and are separated from the rest of the Indian subregion. The fact that very few of the uropeltids have penetrated Sri Lanka suggests their different phases of dispersal in the geological time scale.

Summary

The limited distribution of the uropeltid snakes of India and Sri Lanka is discussed. A table indicating the geographical distribution of thi eight genera including 44 species known so far is provided with localities of their occurrence in South India and Sri Lanka. Distributional maps for the genera occurring in India are given.

Acknowledgements

It is largely because of my association with the Southern Regional Station of the Zoological Survey of India (ZSI) that I am motivated to present this paper. I will, therefore, ever remain grateful to this pioneering research organisation and the Director, ZSI.

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Rec. zool. Surv. India, **91 (3-4)** : 389-393, 1992

A NEW SPECIES OF *OXYOPES* LATREILLE AND ONF OF *PEUCETIA* THORELL FROM UTTAR PRADESH, INDIA (ARANEAE, FAMILY : OXYOPIDAE)

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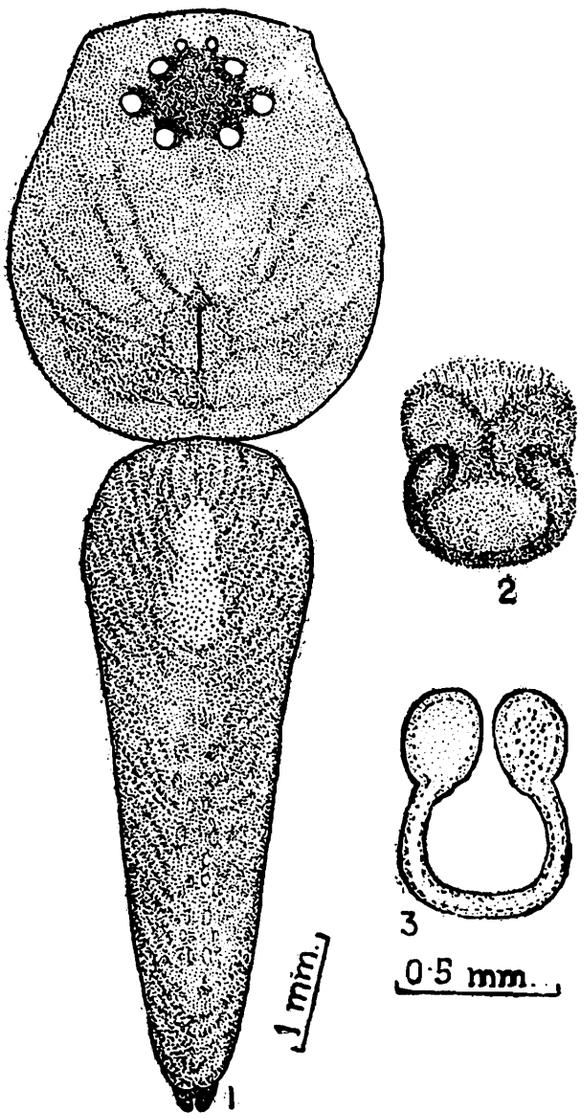
1. **Oxyopes pawani** sp. nov.

(Figs. 1 to 3).

General : Cephalothorax and legs brownish-green ; abdomen dark brown. Total length 9.70 mm. Carapace 3.90 mm. long, 3.20 mm. wide ; abdomen 5.80 mm. long, 2.00 mm. wide.



Figs. 1-3. *Oxyopes pawani* sp. nov.

1. Dorsal view of female, legs omitted. 2. Epigyne. 3. Spermathecae.

Cephalothorax : Longer than wide, convex, with cephalic region high and broad, clothed with white pubescence ; posterior half proveded with conspicuous fovea. Anterior row of eyes strongly recurved (as seen from in front), with medians smaller than laterals, and with eyes equally spaced ; posterior row of eyes procurved, with eyes equal in size and equidistand from each other ; all eyes encircled with black patch. Clypeus long, provided with chalk-white patch extending from anterior median eyes to near base of fang of chelicerae. Chelicerae moderately strong ; inner margin provided with one small tooth and outer margin with two dissimilar teeth. Labium and maxillae longer than wide, brownish green ; maxillae provided with scopula. Sternum heart-shaped, pointed behind, provided with hairs and some short spines. Legs relatively long and strong, clothed with hairs and conspicuous long spines.

Abdomen : Long, narrowing behind, clothed with white pubescence and muscular corrugations as in text-fig. 1 ; ventral side provided with midventral black patch and two longitudinal white patches extending from epigastric furrow to base of spinnerets. Epigyne as in text-fig. 2. Spermathecae as in fig. 3.

Male : Unknown.

Holotype : Female in spirit.

Type-locality : INDIA : Uttar Pradesh ; Golakur near Lucknow, date 14. xi. 1976. Coll. *P. L. Tondon.*

This species closely resembles *Oxyopes sitae* Tikader but differs from it as follows : (I) Clypeus provided with chalk white patch but in *Oxyopes sitae* clypeus provided with two black lines. (II) Abdomen dorsally provided with muscular corrugations but in *Oxyopes sitae* abdomen dorsally provided with longitudinal black lines. (III) Epigyne without sclerotized rim and spermathecae having central cavity larger, oval and seminal receptacle oval with fertilization duct elongate.

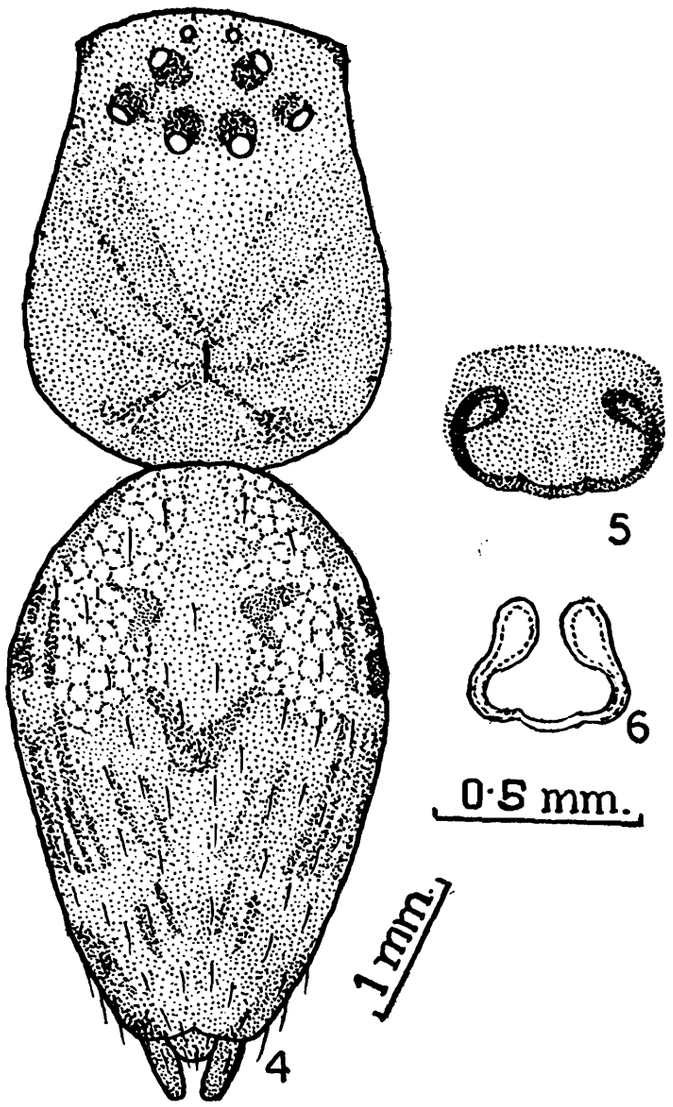
2. **Peucetia ketani** sp. nov.

(Fig. 4 to 6)

General : Cephalothorax and legs brownish-green ; abdomen dirty chalk white. Total length 7.30 mm. Carapace 3.20 mm. long, 2.50 mm. wide ; abdomen 4.10 mm. long, 2.60 mm. wide.

Cephalothorax : Longer than wide, moderately high, clothed with pubescene and few short spines, provided with conspicuous short fovea on posterior half. Anterior row of eyes strongly recurved, with anterior medians smaller than laterals and with eyes equally spaced ; posterior row of eyes slightly procurved, with eyes equidistant from each other and equal in size. Clypeus long. Chelicerae moderately strong. Labium and maxillae longer than wide and provided with scopula. Sternum oval, pointed behind, clothed whit hairs. Legs relatively long, clothed with hairs and spines.

Abdomen : Longer than wide, narrowing behind, clothed with hairs and some spines, provided with some black patches and mid dorsally with silvery white patches as



Figs. 4-6. *Peucetia ketani* sp. nov.
4. Dorsal view of femame, legs omitted. 5. Epigyne. 6. Spermathecae.

in fig. 4. Ventral side same in colour as dorsal but provided with a deep brown longitudinal band extending from epigastric furrow to base of spinnerets. Epigyne as in fig. 5. Spermathecae as in fig. 6.

Male : Unknown

Holotype : Female in spirit

Type-locality : INDIA : Uttar Pradesh, Golakum near Lucknow, date 14-xi-1976. Coll. *P.L.Tondon.*

This species closely resembles *Peucetia latikae* Tikader but differs from it as follows : (I) Clypeus without black lines but in *Peucetia latikae* clypeus provided with

black lines. (II) Cephalothorax with black spots but in *Peucetia latikae* cephalothorax provided with conspicuous black spots. (III) Abdomen dorsally provided with black and silvery white patches but in *Peucetia latikae* abdomen provided with longitudinal brown band. (IV) Epigyne with sclerotized rim and spermathecae having central cavity larger, nearly triangular and seminal receptacle curved with fertilization duct small.

Summary

The present paper deals with two new species, *Oxyopes pawani* and *Peucetia ketani*, from Uttar Pradesh, India.

Spiders of the family Oxyopidae have received very little attention in India. Pocock (1901, 1901) described four and three new species of *Oxyopes* and *Peucetia* respectively. Sherriff (1951) redescribed and figured Pocock's species of *Oxyopes* found in the oriental region. Tikader (1965, 1969, 1970) described a number of species of Oxyopidae from India.

Recently while examining a spider collection received from Dr. K. L. Chadha, Project Coordinator, Central Mango Research Station, Mahanagar, Lucknow, I came across two species of the genera *Oxyopes* and *Peucetia* which are described here as new to science.

The type specimens will be deposited in the National Zoological collections, Zoological Survey of India, Calcutta.

Acknowledgements

I am thankful to Dr. B. K. Tikader, Former Director, Zoological Survey of India, Calcutta, for guidance and encouragement. I am thankful to Dr. K. Reddiah, Deputy Director, Zoological Survey of India, Central Regional Station, Jabalpur, for necessary working facilities and to Shri Satish Fadnavis of this station for some drawings.

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Rec. zool. Surv. India, 91 (3-4) : 395-397, 1992

A NEW *MONAESES* SPIDER FROM MADHYA PRADESH, INDIA (ARANEAE : THOMISIDAE)

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MATERIAL

The description is based on two female and one male specimens.

The genus *Monaeses* was erected by Thorell with the type species *Monastes paradoxus* Lucas, 1846, which was renamed by Thorell (1869) as *Monaeses paradoxus*, from Algeria. Tikader (1963) described *M. mukundi* from Poona (Maharashtra). The description of another new species *M. jabalpureusis* is given.

The type specimens are deposited in the National Zoological Collections, Zoological Survey of India, Calcutta.

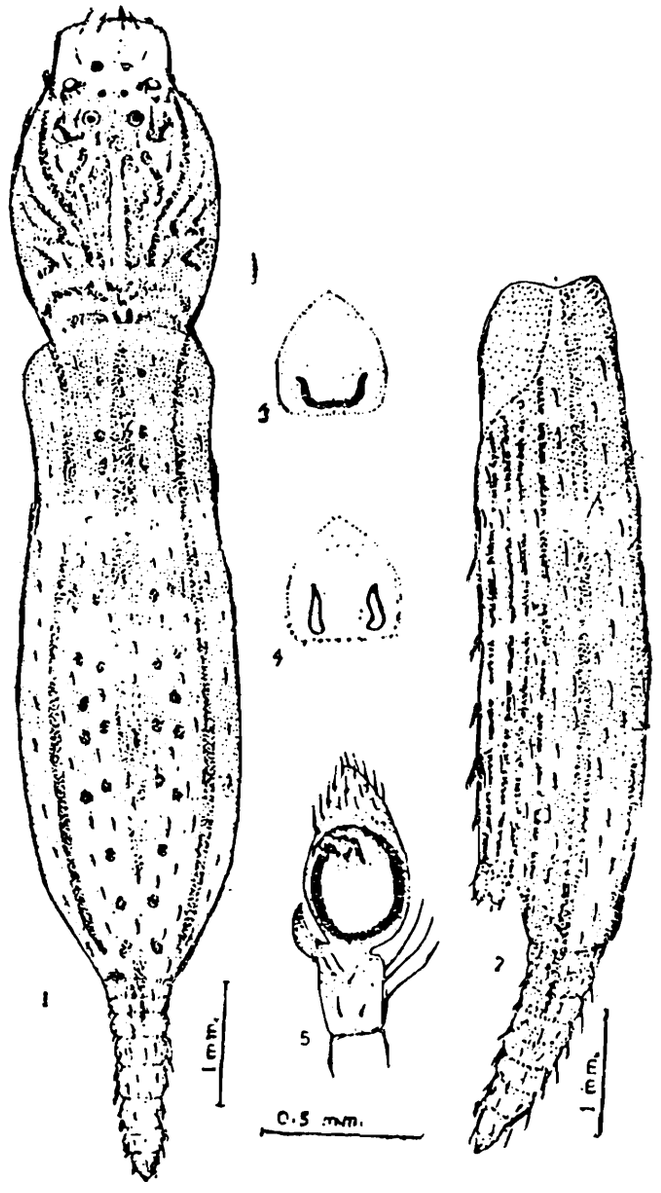
Monaeses jabalpurensis sp. nov.

General : Cephalothorax and legs light brownish green ; abdomen yellowish green. Total length 8.90 mm. Carapace 2.30 mm. long, 1.60 mm. wide ; abdomen 6.70 mm. long, 1.70 mm. wide.

Cephalothorax ; Longer than wide, convex and sparsely spined ; clypeus long, rectangular and provided with two pairs of spines. Eyes dark, in two rows with lateral eyes larger and ringed with white tubercles ; anterior row slightly recurved, and posterior slightly more recurved than the anterior ; median ocular area longer than wide and wider behind than in front. Chelicerae long and directed forward, provided dorsally with long spines. Legs long, slender, especially I and II clothed with spiny hairs.

Abdomen : Very long and slender, slightly overlapping base of cephalothorax in front, dorsally clothed with short spines and provided with three longitudinal black bands as in fig. 1. Ventral side slightly lighter than dorsal side and provided laterally with brownish longitudinal discontinuous bands. Lateral side provided with four brown longitudinal almost parallel lines extending from the anterior extremity to near the spinnerets as in fig. 2. Caudal part of abdomen extending much past the spinerets and covered with numerous folds, clothed with short spines. Epigyne as in fig. 3.

Spermathecae as in fig. 4. Male specimen nearly one third length of female, dark in colour. Male palp as in fig. 5.



Figs. 1-5. *Monaeses jabalpurensis* sp. nov.
1. Dorsal view of female, legs omitted. 2. Lateral view of abdomen.
3. Epigyne. 4. Spermatheeae. 5. Right male palp (Ventral view).

Type specimens : *Holotype* ♀, *paratype* 1 ♀, and allotype 1 ♂, in spirit, other details as below.

Type-locality : India, Madhya Pradesh, Barela village, Jabalpur dist., 15 ix. 1981. Coll. *U. A. Gajbe.*

This species resembles *Monaeses parvati* Tikader but differs from it as follows :

(i) Cephalothorax and legs light brownish-green but in *M. parvati* cephalothorax pale yellowish-olive green and legs green.

(ii) Abdomen laterally provided with four brown longitudinal lines but in *M. parvati* abdomen laterally provided with five lines.

(iii) Epigyne and spermathecae also structurally different.

SUMMARY

Monaeses jabalpurensis sp. nov. (Family-Thomisidae) from Jabalpur district, Madhya Pradesh is described.

ACKNOWLEDGEMENT

We are grateful to Dr. B. K. Tikader, former Director, Zoological Survey of India, for guidance and constant encouragement in research work. We are thankful to Dr. P. D. Gupta, Officer-in-Charge, Central Regional Station, Zoological Survey of India, Jabalpur for going through the manuscript and making valuable suggestions and for necessary facilities and to Miss Pratiksha Tiwari for typing the manuscript. We are also thankful to Dr. Mrs. A. S. Dippenaar-Schoeman, Plant Protection Research Institute, Pretoria, for help with literature.

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Rec. zool. Surv. India, 91 (3-4) : 399-416, 1992

MAMMALS OF HARYANA

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INTRODUCTION

Haryana State (Fig. 1.) was extensively surveyed in 1986 by survey parties of the Northern Regional Station, Zoological Survey of India, Dehra Dun for the study of fauna. The present paper records 30 species of mammals from that State, mostly based on sight records by the author, and some from published literature. Their status were also assessed by the author in the field by visual observation, as well as discussion with the authorities of forest and wildlife departments.

Haryana* is a small State, situated in northern India and is bounded in the north by Himachal Pradesh, north-west by Punjab and west and south-west by Rajasthan and in the east by Uttar Pradesh. Delhi forms an enclave on its eastern boundary. The State has an area of 44,222 sq. km. The topography of Haryana is more or less flat and featureless. On its western part, which is contiguous with the desert conditions of Rajasthan, the area is dotted with sand dunes. The Aravalli mountain system, one of the oldest in the country is extending into Haryana.

In Haryana, mainly being an agricultural State, the forest cover is limited to a small area of 3·7% only. Half of this constitutes the forest blocks and the remaining half is in the from of narrow strips along roads, canal, railway lines, drains and flood-protection embankments. The State is having semi-arid conditions in most parts. Insecticides which are extensively used for better yield of agricultural products, have adversely affected the mammalian fauna. Small mammals are no exception.

In the present paper, classification is based on Simpson (1945). Distribution and other characters are after Blanford (1880), Pocock (1939), Ellermann and Morrison-Scott (1951), Walker (1968), Prem *et al.* (1970), Prater (1971), Dhir *et al.* (1976), Anderson (1981), Sc Later (1981), Ahuja and Bajaj (1982), Bhoria and Bajaj (1983), Bhoria *et. al.* (1984), Tripathi *et al.* (1985), Singh and Ranga (1986), Bhatia and Kumar (1987) and Sinha (in press).

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*The State was created in 1966 with seven districts. Five more distrtcts were created in early seventies. It is proposed to create four more districts viz. Kaithal, Yamunanagar, Panipat and Rewari from November, 1989. The actual boundary of these new districts are not known.

Systematic Account

Order : INSECTIVORA

Family : ERINACEIDAE

1. **Hemiechinus auritus** (Gmelin)

Long-eared Hedgehog

1770. *Erinaceus auritus* Gmelin, *Nov. Comment. Acad. Sci. Petrop*, **14**: 519 (Type locality; Astrakhan, South-eastern Russia).

Diagonostic characters : Snout pig-like with clumsy body, short tail, stumpy legs with claws. There is a dense mat of spines which cover the back and sides. During danger, they roll their body in to a ball of bristles.

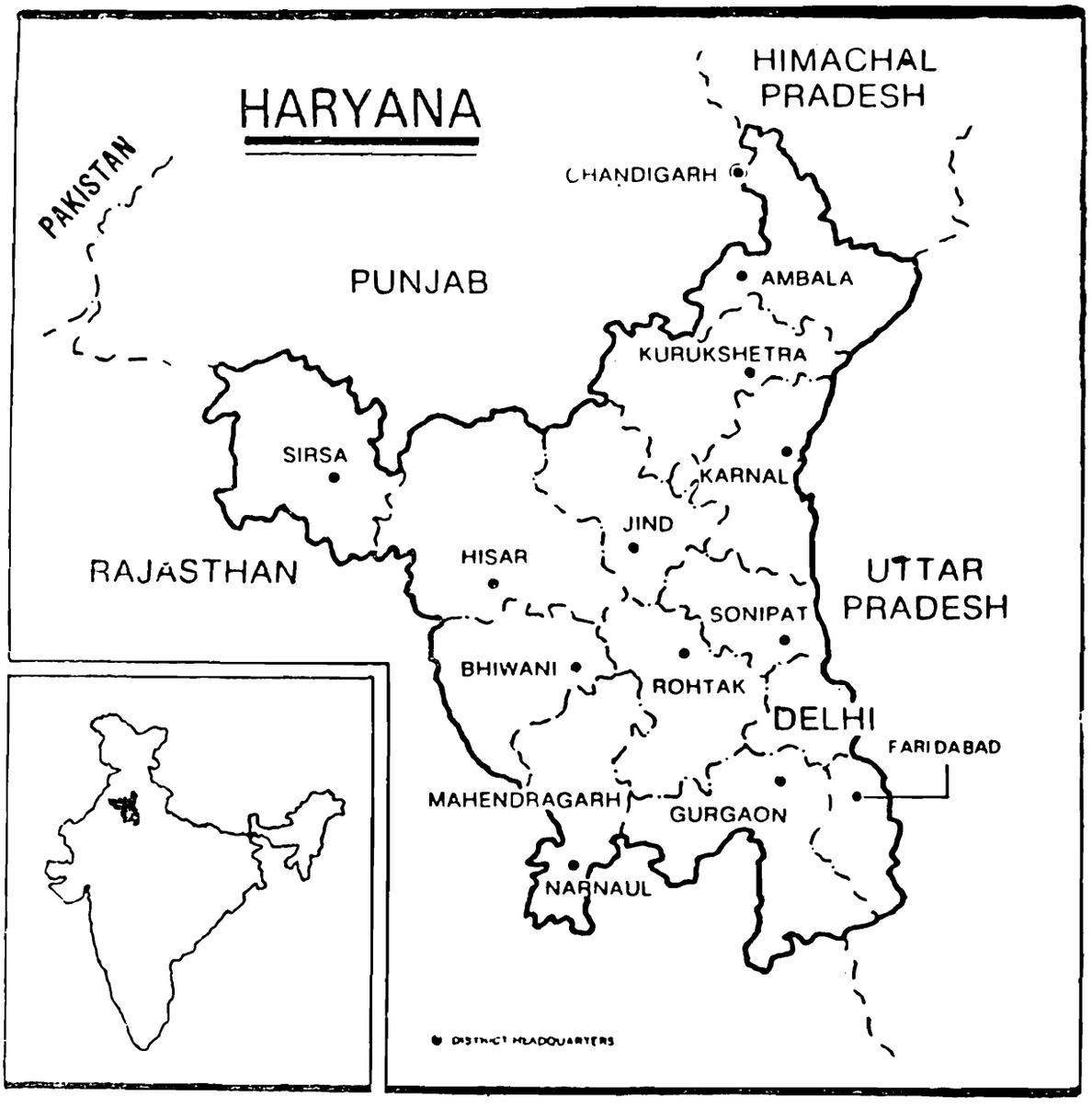

Fig.1. Map of Haryana showing various districts.

Distribution : Widely distributed in Africa, Middle East, Western Asia, Asia Minor, Chinese Turkestan, Mongolia, Russia and Pakistan. In India, the species is confined mainly in dry plains and desert zones of Cutch, Punjab and neighbouring tracts.

Status in Haryana : Two specimens were noticed at embankment near Panipat (Karnal district) by the author at dusk. This constitutes the first record of the species from Haryana State. Though they are quite common, they seem to have escaped attention earliar because of their open habitat preference and nocturnal habits.

Remarks : Hedgehog is nocturnal, taking shelter during day in holes in the sand or beneath thorny bushes or grasses, but coming out to feed at dusk and retiring again at down. It is omnivorous and feed on insects, worms, slugs, lizards, rats, mice and eggs of vertebtrates, various kinds of fruits and roots. The species covers long distances in the rambles, going at a steady trot.

Family : SORICIDAE

2. **Suncus murinus** (Linnaeus)

House Shrew

1766. *Sorex murinus* Linnaeus, *Syst. Nat. 12th ed.* 1 : 44 (Type Locality : Java).

Diagonostic characters : The long pointed snout projecting beyond the lower lip, two front curved teeth, depressed ears, small eyes, with feet and tail sparsely clad with hairs, make them easily identifiable from rats.

Distribution : Throughout temperate and tropical regions of Europe, Africa, North America and Asia. This is the commonest shrew in India and is found throughout the Indian subcontinent.

Status in Haryana : Very common. Seen moving in the camps at Karnal and Gurgaon by the author during early nights. Also reported from Ambala district (Bhoria *et al.*, 1984), Bhiwani district (Ahuja and Bajaj, 1982), Hissar district (Bhatia and Kumar, 1987) and Jind district (Singh and Ranga, 1986.)

Remarks : Shrews are nocturnal and enter houses in search of insects. The loud squeaking cry and unpleasant musky odour are instant causes for their being killed. They are useful animals and get rid of cockroaches and other pests. Shrews are intolerant to rats and drive them away. It is generally believed that the food articles it touches get contaminated, which is not true. Two to three youngones are born at a time and are very active after birth and follow their mother by holding her tail, one after another, in a trailing fashion.

Order : CHIROPTERA

Family : VESPERTILIONIDAE

3. **Hesperoptenus tickelli** (Blyth)

Tickell's Bat

1851. *Nycticejus tickelli* Blyth, *J. Asiat. Soc. Bengal*, 20 : 57. (Type locality : Chaibasa, Bihar, India).

Diagonostic characters : The body colour is yellowish grey, with head grey. Tufts

of whitish hair present at the base of ears. Tail-tip naked. Wings long and third finger having a third phalange.

Distribution : Throughout India, Mayanmar (Burma), Bhutan and Sri Lanka.

Status in Haryana : A common species in Haryana and is recorded from Ambala district (Bhoria *et al.*, 1984), Bhiwani district (Ahuja and Bajaj, 1982), Hissar district (Bhatia and Kumar, 1987) and Jind district (Singh and Ranga, 1986.)

Remarks : An early evening flier with slow flight which is limited to its territory. A single young is born in summer.

4. **Scotophilus heathi** (Horsfield)

Greater Yellow Bat

1831. *Nyeticejus heathi* Horsfield, *Proc. zool. Soc. Lond.*, 113. Type locality : Madras, India),

Diagonostic characters : The body colour is yellowish-brown above and underparts some what canary-yellow.

Distribution : China and its adjoining south-eastern parts, Mayanmar, Bhutan, and Sri Lanka. The species is found throughout India.

Status in Haryana : A common species in Haryana and is recorded from Ambala district (Bhoria *et al.*, 1984), Bhiwani district (Ahuja and Bajaj, 1982), Hissar district (Bhatia and Kumar, 1987) and Jind district (Singh and Ranga, 1986.)

Remarks : Early flier, in small groups. A very noisy bat quarrelling among themselves. Roosts in small colonies in cracks and holes in roofs. Food consists of flying ants and similar insects. Usually two young are born in monsoon.

Order : PRIMATES

Family : CERCOPITHECIDAE

5. **Macaca mulatta** (Zimmermann)

1780. *Circopithecus mulatta* Zimmermann, *Geogr. Gesch. Mensch.*, 2 : 195 (Type loeality : India).

Diagonostic characters : Face, loin and rump are of orange red colour. Squat and thickset body built. The crown-hairs radiate backwards from forehead, without central parting.

Distribution : Afghanistan, Nepal, Mayanmar, east to Vietnam, Southern China and Tibet. Widely distributed in India from the river Tapti and Godavari in south to whole of central and northern parts including Himalayas where the species is found up to 2340 m altitude.

Status in Haryana : Widely distributed in whole of Haryana and is recorded by the author in all the districts he surveyed. Also recorded from Ambala district (Bhoria *et al.*, 1984), Bhiwani district (Ahuja and Bajaj, 1982), Gurgaon district (Bhoria and

Bajaj, 1983), Hissar district (Bhatia and Kumar, 1987), Jind district (Singh and Ranga, 1986), Karnal district (Dhir *et al.*, 1976), and Rohtak district (Prem *et al.*, 1970.)

Remarks : A common monkey of northern India which prefers open country. Large troops live near human settlement in grooves, tanks, temples, railway station, etc. In forested zones they prefer to live at periphery. Food comprises of various types of crop, fruits, plants and cooked food ; also insects and spiders. The social organisation is an open type and is dominated by large male. The mating is observed in all seasons, with peak from October to December ; majority of youngones are born between March and June, suggesting a gestation period of 6 months.

6. **Presbytis entellus** (Dufresne)

Hanuman Langur

1797. *Simia entellns* Dufresne, *Bull. Soc. Philom. Paris*, (I) 7 : 49 (Type locality : Bengal, India).

Diagonostic characters : Long-limbed, long-tailed, black faced monkeys seen as much about towns and villages as in forests.

Distribution : Practically the whole of India, except western deserts, Sri Lanka and Southern Tibet.

Status in Haryana : A troop of 23 individuals were seen feeding in forest near Karnal township (Karnal district) by the author. Also recorded from Ambala district (Bhoria *et al.*, 1984), Bhiwani district (Ahuja and Bajaj, 1982), Hissar district (Bhatia and Kumar, 1987), Jind district (Singh and Ranga, 1986) and Rohtak district (Prem *et al.*, 1970.)

Remarks : The langur is vegeterian and lives in groups which are led by males. The marked period of breeding is between April and May in northern India.

Order : CARNIVORA

Family : CANIDAE

7. **Canis lupus** Linnaeus

Wolf

1758. *Canis lupus* Linnaeus, *Syst. Nat.*, 10th ed. 1 : 39 (Type lolality : Sweden).

Diagonostic characters : The large-sized skull and teeth instantly distinguish them from other carnivores.

Distribution : North America, Europe, USSR, Northern Greece, Turkey, Asia and practically whole of India.

Status in Haryana : Not common. Occasionally been recorded from Bhiwani district (Ahuja and Bajaj, 1982), Gurgaon district (Bhoria and Bajaj, 1983) and Rohtak district (Prem *et al.*, 1970.)

Remarks : The wolf lives in bare and open regions in holes, caves and cavities of rocks, thickets of reeds and shrubs and in burrows dug in sand dunes in the deserts. The species hunt both during the day and night and its main food is cattle, but occasionally it kills human babies and lone adult. The mating takes place during the end of rainy season and youngones, numbering up to three, are born in December.

8. **Canis aureus** Linnaeus
Asiatic Jackal

1758. *Canis aureus* Linnaeus, *Syst. Nat.* 10th ed. 1 : 40 (Type locality : Province of Lar, Iran).

Diagonostic characters : Deep-chested body, with long, slender limbs and bushy tail. The muzzle is long and slender, and the ears are large and errect. The first digit on the fore foot and the hind foot is reduced. The species is pale dirty yellow mixed with reds and blacks and has a reddish-brown tail with a black tip.

Distribution : South-eastern Europe, south-western Asia, throughout India, Nepal, Sri Lanka, extending a little into Mayanmar and south-eastern Thailand.

Status in Haryana : Widely distributed and are found in forests, crop-fields, wastelands and shrub throughout the Haryana (Bhoria *et al.*, 1984 ; Ahuja and Bajaj, 1982 ; Bhoria and Bajaj, 1983 ; Bhatia and Kumar, 1987 ; Singh and Ranga, 1986 ; Dhir *et al.*, 1976 ; and Prem *et al.*, 1970). The author has also recorded it from Karnal and Gurgaon districts in singles and paires.

Remarks : A best adapted animal to its evnironment, it is found anywhere from humid forests to dry open plains or deserts and upto 3,660 metres in Himalayas. It live in holes on the ground or in dense grass and shrubs. Jackals' call is eerie, the howling at night is perhaps most familiar to most people than the animal itself. There is no distinct breeding season.

9. **Vulpes bengalensis** (Shaw)
Bengal Fox or the Indian Fox

1800. *Cuon bengalensis* Shaw, *Gen. Zool.* (I) 2 : 330 (Type locality : Bengal).

Diagonostic characters : Indian fox is similar to jackal except for its size which is smaller. It has distinct black-tipped tail.

Distribution : Whole of India.

Status in Haryana : One specimen has been seen in the agriculture field near Panipat (Karnal district) in the morning by the author. It is very common species in agricultural fields, forests and wasteland, especially on the banks of irrigation channels, throughout Haryana State (Bhoria *et al.*, 1984 ; Ahuja and Bajaj, 1982 ; Bhoria and Bajaj, 1983 ; Bhatia and Kumar, 1987 ; Singh and Ranga, 1986 ; Dhir *et al.*, 1976 ; Prem *et al.*, 1970).

Remarks : The species is an inhabitant of open country, lives in durrows in wasteland and cultivated fields. The Indian Fox is nocturnal. Food comprises of small mammals, reptiles, crabs and insects ; and at times melon, ber fruit, shoots and pods. Those living near human settlements enter compounds and gradens, but seldom attack poultry. The mating takes place in winter and the youngones, numbering usually four, are born between February and April.

Family : VIVERRIDAE

10. **Viverricula indica** (Desmarest)
Rasse or Small Indian Civet

1819. *Viverra indica* Desmarest, *Nouv. Dict. Nat. Hist.*, 7 : 170 (Type locality ; India).

Diagonostic characters : There is no dorsal crest which distinguishes it from the large Indian Civet. A tawny grey or greyish brown animal with typically civet-like built, lined and steaked on back and croup ; spotted more or less in rows along the flanks, with usually cross bars on the neck.

Distribution : Southern China, further to south-eastern Asia, Bhutan, Mayanmar and throughout India, except Himalayas.

Status in Haryana : Rare. Hitherto these are reported from Bhiwani district (Ahuja and Bajaj, 1982), Hissar district (Bhatia and Kumar, 1987) and Jind district (Singh and Ranga, 1986).

Remarks : Economically important for 'Civet', which is extracted from scent glands. Inhabits long grasses or shrubs in forests but mostly live near human settlements, finding refuge in holes under rocks or lies down in grass or under bushes, in drains and abondoned houses. Being nocturnal, the food consists of rats, squirrels, small birds, lizards, snakes, etc., and also takes fruits, roots and other vegetable matters. There is no marked breeding period. Youngone are seen round the year. Litter consists of four to five youngones.

11. **Herpestes edwardsi** (Geoffroy)
Indian Grey Mongoose

1818. *Ichneumon edwardsii* Geoffroy, *Deser. Egypte*, 2 : 139 (Type locality : Madras, India).

Diagonostic characters : A tawny yellowish-grey mongoose with no stripes on the side of neck. The tail which is as long as its body is tipped with white or yellowish-red.

Distribution : Western Asia, Pakistan, Napal, Sri Lanka and throughout India, except Himalayas.

Status in Haryana : Quite a few have been seen in fields in Karnal district, Gurgaon district and Faridabad district by the author. Common and widely distributed in Haryana and is recorded from Ambala district (Bhoria *et al.*, 1984), Bhiwani district

(Ahuja and Bajaj, 1982), Gurgaon district (Bhoria and Bajaj, 1983), Hissar district (Bhatia and Kumar, 1987) and Jind district (Singh and Ranga, 1986).

Remarks : Usual habitat is open land, shrub jungles, cultivated fields, hedgs rows, thickets and grooves of trees, taking shelter under rocks, bushes, holes in the ground and tree hollows. The species is both, diurnal and nocturnal and the food consists of rats, mice, snakes, lizards, frogs, etc. Breeding has been recorded round the year.

Family : HYAENIDAE

12. **Hyaena hyaena** (Linnaeus)

Hyaena

1758, *Canis hyaena* Linnaeus, *Syst. Nat.* 10th ed. 1 : 40 (Type locality : Laristan, southern Iran).

Diagonostic characters : Dog like ; head and front part of body massive ; jaws specially built for crushing hard bones. Heavy dorsal crest of long hairs present. Trnssverse stripes on dirty-white coat are prominent.

Distribution : Southern Russia, south-western Asia Minor, northern Africa, Nepal (Terai) and throughout India.

Status in Haryana : Not common in Haryana, hitherto reported only from Bhiwani district (Ahuja and Bajaj, 1982) and Rohtak district (prem *et al.*, 1970) in the recent past.

Remarks : Usually prefers to live in open country where low hills and ravines offer convenient holes and caves for shelter. Being nocturnal, the hyaena comes out in pack of 2 to 5 or 6 individuals and tramps many a kilometer in quest for food. The food usually consists of left-overs, but when hungry the species can even deprive leopards of their food. The mating takes places in cold weather and youngones are born in hot season.

Family : FELIDAE

13. **Felis chaus** Guldenstaedt

Jungle Cat

1776. *Felis chaus* Guldensteydt, *Nov. Com. Acad. Petrop.*, 20 : 483 (Type locality : Terek river, north of Caucasus).

Diagonostic character : Distinct in appearance with long legs and comparatively short tail. The eyes pale green, which give a cruel experssion. Body colour sandy yellowish-grey. The wild cat walks gracefully like leopard,

Distribution : Widely distributed from north Africa thriugh south-estern Asia, Indo-China, Sri Lanka, Mayanmar and throughout India.

Status in Haryane : Very common in the districts (Bhoria *et al.*, 1984 ; Ahuja

and Bajaj, 1982 ; Bhoria and Bajaj, 1983 ; Bhatia and kumar, 1987 ; Singh and Ranga, 1986 ; Dhir et al., 1976 ; Prem et al., 1970).

Remarks : The species prefers grssland, shrub jungle, reed-bank and marshes. The species is diurnal and more active during the mornings and evenings. The food consists of small mammals, birds and poultry. It is generally believed that two litters are produced in a year.

14. **Panthera pardus** (Linnaeus)

Leopard

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

Diagonostic character : Body colour bright fulvus ; marked with small close-set thick rimmed rosettes.

Distribution : Widely distributed in Russia, Asia Minor, Parts of African continent, western Asia, China, Tibet, east to Vietnam, Malaysian States, whole of India, Mayanmar and Sri Lanka.

Status in Haryana : Commoly found in the State in the past but now very rare and restricted to Kalsia-Kaleshar forests of Ambala district (Anon, 1984).

Remarks : Not restriced to forests only, but it also inhabits open country as among rocks and shrubs. Being more tolerent to sun, the leopard also hunts during the day time. The food comprises domesticated cattles, artiodactyles, monkeys, small beasts of prey, rodents birds, reptiles, crabs etc. There is no marked breeding season and the gestation period is about 100 days. Two to four cubs are born at a time.

15. **Panthera tigris** (Linnaeus)

Tiger

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

Diagonostic characters : A rich coloured striped animal. The limbs are sinewy ; the fore foot has five digits and the hind toot four. The claws are retractile, large, compressed, strongly curved and sharp. Except for the naked pads, the feet are well haired to aid in the silent stalking of prey.

Distribution : Widely distributed in parts of Russia and China, Iran, most parts of India except the desrt zone, Mayanmar, Vietnam, Malasian States, Sumatra, Java and Bali.

Status in Haryana : The tiger was quite common in the past but their existence is doubtful in Haryana.

Remarks : The tiger lives in a variety of ecological conditions varying from humid evergreen forests to open jungles and in the grassy swamps of Terai. In

Sunderbans it leads an amphibious life in a terrain of trees, mud and water. The mating generally takes place after the rainy season and the majority of youngones are born between February and May. Gestation lasts for 105-120 days. Two to three, rarely six, cubs are born at a time.

Order : ARTIODACTYLA

Family : SUIDAE

16. **Sus scrofa** Linnaeus

Wild Boar

1758. *Sus scrofa* Linnaeus, *Syst. Nat., 10th ed.*, 1 : 49 (Type locality ; Germany).

Diagonostic characters : There is a full crest or mane of back bristles reaching from nape down the back. The tushes are well developed in the males and both the upper and lower tushes curve outward and project from the mouth.

Distribution : Widely distributed throughout the world.

Status in Haryana : Due to loss of habitat and expansion of agriculture, the species is losing its foothold and is found in Hissar district (Bhatia and Kumar, 1987) and Rohtak district (prem *et al.*, 1970) and its adjoining areas.

Remarks : It inhabits scanty bush-jungle, sometimes in forests. The wild boar is most destructive to crop and raids crop fields. Being omnivorous, food comprises roots, tubers, offal and carrion ; insects, snakes, etc. Mostly diurnal, the wild boar is intelligent and show great courage and determination at the time of danger. Highly prolific and breeds in all the seasons.

Family : CERVIDAE

17. **Axis porcinus** (Zimmermann)

Hog Deer (para)

1780. *Cervus porcinus* Zimmermann, *Geog. Geseh.*, 2 : 131 (Type locality : Bengal, India).

Diagonostic characters : Hog deer has squat, pig-lik appearance and hog-like movement, with low head, long body, shorter legs and stouter built. The body fur has speckly appearance with white hair-tip. Antlers are small, on long bony pedicels.

Distribution : Low alluvial grass plains in northern India from Sind and Punjab to Assam extending into neighbouring Mayanmar, east to Vietnam. Introduced in Sri Lanka.

Status in Haryana : Uncommon and found only in the reserve forests of Karnal district (Dhir *et al.*, 1975).

Remarks : The species inhabits a variety of habitats, including short grassy meadows to grass covered delta islands and shrub jungles. Normally the hog deer roams solitary, but herds upto 18 individuals have also been in records. Youngones are born twice a year in early summer and monsoon months. Gestation lasts for about 240 days.

18. **Axis axis** (Erxleben)

Spotted deer, Chital, Axis Deer

1777. *Cervus axis* Erxleben, *Syst. Regn. Anim.* : 312 (Type locality : Bank of Ganges, India).

Diagonostic characters : Body coat bright rufous-fawn, profusely studded with white spots at all stages and in all seasons. Males having antlers with three tines.

Distribution : Nepal, Sri Lanka and practically whole of India upto an elevation of about 1,000 metres.

Status in Haryana : Found in the reserve forests of Kaithal in Kurukshetra district (Anon, 1984).

Remarks : Herds of chital number something between a small group of two to several hundred individuals. The species inhabits grassy forest and shaded streams, where its association with monkeys is a common sight. The food consists of a variety of grass, leaves and fruits. The species is prolific breeder and sometimes they breed twice in a year.

19. **Cervus unicolor** (Kerr)

Sambar

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

Diagonostic characters : Typical nocturnal forest-deer of south eastern Asia, with coarse and shaggy body coat and prominent mane. The males are having stout and rugged antlers.

Distribution : India, Mayanmar and Sri Lanka, extending through Indo-China, Siam, Malaysian countries and eastward to Philippines and beyond.

Status in Haryana : Sambar found in forest blocks of Kalsia-Kaleshar in Ambala district (Anon., 1984).

Remarks : The food consists of leaves and a variety of wild fruits. Crop fields are also raided by sambar. The species is less gregarious and upto 3-4 individuals is commonly met. Males fight for possession of harem. Mating takes place in winter and one young is born in summer.

Family : BOVIDAE

20. **Boselaphus tragocamelus** (Pallas)

Nilgai ; Blue Bull

1766. *Antilope tragocamelus* Pallas, *Misc, Zool.*, : 5 (Type locality : Plains of peninsular India).

Diagonostic character : A horse-like animal with high withers, low rump and dark bluish mane. Male possess distinctive tufts of stiff black hair on the throat and stout cone-like horn.

Distribution : Whole of peninsular India and its adjoining areas in north and north-West.

Status in Haryana : Very common in Haryana and has been seen by the author in Karnal, Kurukshetra, Ambala and Gurgaon districts. It has also been recorded from Bhiwani district (Ahuja and Bajaj, 1982), Gurgaon district (Bhoria and Bajaj, 1983), Hissar district (Bhatia and Kumar, 1987), Jind district (Singh and Ranga, 1986) and Karnal district (Dhir *et al.*, 1976) and Rohtak district (Prem *et al.*, 1970).

Remarks : Nilgai being highly gregarious inhabit open forest with grass and patches of scrub in hilly country. Being attached with the religious sentiments of Hindus, the nilgai have got immunity from persecution and as a result, the population has increased uncontrolled and is now a menace to our ctop fields adjoining to their habitation. The gestation period is about 240 to 270 days.

21. **Antilope cervicapra** (Linnaeus)

Blackbuck

1758. *Capra cervicapra* Linnaeus, *Syst. Nat., 10th ed.*, 1 : 69 (Type locality : Trivendram, India).

Diagonostic character : Recognised by striking black colour and spiral horns.

Distribution : India from Punjab, Kathiawar and Peninsula.

Status in Haryana : A group of five blackbuck have been seen grazing in the crop field near Karnal-Kaithal road in Karnal district by the author. The species is also reported from Bhiwani district (Ahuja and Bajaj, 1982), Gurgaon district (Bhoria and Kumar, 1987), Jind district (Singh and Ranga, 1986) and Karnal district (Dhir *et al.*, 1976).

Remarks : Blackbuck is an animal of open country, with scrub and cultivation and have great tolerance to sun. The species is highly gregareous, herd varies from 20-30 individuals to several hundred individuals depending on the density of population. Territoriality is maintained by the males, who keep a harem of does. Breeding goes on round the year and one youngone is born after a gestation period of about 180 days.

22. **Gazella gazella** (Pallas)
Chinkara

1766. *Antilope gazella* Pallas, *Misc. Zool.* : 7 (Type locality ; Syria).

Diagonostic characters : Chinkara is a small, slender, graceful animal with white streak down each side of face and a dusky patch above nose. Horns are not sex-linked character and can be present in both the sexes.

Distribution : Northern and central Africa, western Asia, Nepal. In India, chinkara is found in Rajasthan, Cutch and Kathiawar, Punjab, Hariyana, Uttara Pradesh and parts of peninsula.

Status in Haryana : Common in suitable pockets and reported from Bhiwani district (Ahuja and Bajaj, 1982), Hissar district (Bhatia and Kumar, 1987), Jind district (Singh and Ranga, 1986), Karnal district (Dhir *et al.*, 1976) and Rohtak district (Prem *et al.*, 1970).

Remarks : The preferred habitat of species is scattered bushy patches, thin forests, broken lands of ravines and rivulets, where it live in herds of upto 20 individuals. Chinkara can live without water for longer periods and it is presumed that they have developed the mechanism of recycling of water within body. Food consists of grass, various types of leaves, crops and fruits. There is no marked breeding season. Interbreeding with blackbuck is not uncommon.

Order : LAGOMORPHA
Family : LEPORIDAE

23. **Lepus nigricollis** Cuvier
Indian Hare, Black-naped Hare

1823. *Lepus nigricollis* Cuvier, *Diet. Sci. Nat.*, 26 : 307 (Type locality : Madras, India).

Diagonostic characters : There is a dark brown or black patch on back of neck from ear to shoulder. Upper surface of the tail black.

Distribution : Practically whole of India, Pakistan, Nepal, Mayanmar, Sri Lanka, Bhutan and Java.

Status in Haryana : Commonly found in suitable habitats throughout Haryana. Seen in the field during night drive in Karnal and Sonipat districts by the author. Also reported from Ambala district (Bhoria *et al.*, 1984), Bhiwani district (Ahuja and Bajaj, 1982), Jind district (Singh and Ranga, 1986).

Remarks : Large tracks of bush and jungle alternating with cultivated plains afford them ideal conditions to live. Many also live in neighbourhood of villages and cultivation. Youngs are born with open eyes and are able to walk within 12 hours of birth.

Order : RODENTIA
Family : SCIURIDAE

24. **Funambulus pennanti** Wroughton

Northern Palm Squirrel

1905. *Funambulus pennanti* Wroughton, *J. Bombay nat. Hist. Soc.* **16 (3) : 411 (Type locality : Surat, India).**

Diagonostic characters : There are five stripes on back, three median, pale ; dorsal stripes flanked on each side with a suplimentary pale stripe.

Distribution : Pakistan, Nepal and throughout India, except southern States.

Status in Haryana : Most common of all the mammals and found practically everywhere in the State by the author. It is also reported from Ambala district (Bhoria *et al.*, 1984), Bhiwani district (Ahuja and Bajaj, 1982), Hissar district (Bhatia and Kumar, 1987), Jind district (Singh and Ranga, 1986) and Rohtak district (Prem *et al.*, 1970).

Remarks : The species is most common and familiar of all wild animals of India and can be seen near human settlements in houses, gardens, grooves, hedges and road side tress. Food consists of fruits, nuts, young shoots, buds, pods, insects, eggs of birds, etc., and the species drink nector from flowers. Female mates with more than one male. Gestation period is about 45 days and two to three youngones are produced in an untidy nest.

Family : HISTRICIDAE

25. **Hystrix indica** (Kerr)

Indian Crested Porcupine

1792. *Hystrix cristata* var. *indica* Kerr, *Anim. Kingd.* : 213 (Type locality : India).

Diagonostic characters : Body hairs modified into formidable spines or quills, measuring 15 to 30 cms. These quills profusely crown the neck, shoulder region and back. Each quill is ornamcnted with deep brown or black and white rings.

Distribution : Western Asia, southern Arabia, parts of Turkestan, Transcaucasia, Sri Lanka, Nepal and widely distributed in north-western, northern and peninsular India.

Status in Haryana : Rare, found in western parts in the districts of Bhiwani (Ahuja and Bajaj, 1982), Hissar (Bhatia and Kumar, 1987) and Jind (Singh and Ranga, 1986).

Remarks : Preferred habitat is rocky hill sides, but can live in any habitat including Himalayas upto an elevation of 2,400 metres. The Indian porcupine is brave and good fighter which can even kill animals like tiger and leopard. Nocturnal.

Family : MURIDAE

26. **Rattus rattus** (Linnaeus)

House Rat ; Black Rat

1758. *Mus rattus* Linnaeus, *Syst. Nat., 10th ed.*, **1** : 61 (Type locality : Sweden).

Diagonostic character : The dorsal fur is black and the belly smoky-gray.

Distribution : Widely distributed throughout world including India.

Status in Haryana : Very common in Haryana and is reported from Ambala district (Bhoria *et al.*, 1964), Bhiwani district (Ahuja and Bajaj, 1982), Gurgaon district (Bhoria and Bajaj, 1983), Hissar district (Bhatia and Kumar, 1987) and Jind district (Singh and Ranga, 1986).

27. **Mus musculus** Linnaeus

House Mouse

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

Diagonostic character : In general built and appearance, the house mouse is a miniature replica of the common house rat (*R. rattus*), measuring 5 to 8 cms. without tail, which is of equal length.

Distribution : Distributed throughout world including India.

Status in Haryana : Most common in Haryan and is reported from Ambala district (Bhoria *et al,*, 1984), Bhiwani district (Ahuja and Bajaj 1982), Gurgaon district (Bhoria and Bajaj, 1983), Hissar district (Bhatia and Kumar, 1987) and Jind district (Singh and Ranga, 1986).

Remarks : prefer to live in houses, gardens and fields near human settlements. The house mouse is prolific breeder and gives birth to 4-5 youngones after every 2 to 4 months. The youngones attain maturity at an early age of a month and starts breeding.

28. **Bandicota bengalensis** (Gray and Hardwicke)

Lesser Bandicoot Rat "Indian Mole Rat"

1833. *Arvicola bengalensis* Gray & Hardwicke, *Illus. Indian Zool* , **2**, pl. 21 (Type locality : Bengal, India).

Diagonostic characters : The species has a robust form, rounded head and ears with short broad muzzle. The body coat colour is dark greyish-brown with underside paler.

Distribntion : South eastern Asia including whole of India.

Status in Haryana : The species is recorded only from Rohtak district (Prem *et al.*, 1976).

Remarks : Inhabit cultivated plains, gardens, pasture land, westland and forest. The species' presence is made know by a pile of fresh earth resembling a large mole hill from which its name "mole rat" has been derived. Youngone get sexual maturity at an early age of 90 days and can produce 10 to 12 youngs at a time.

29. **Tatera indica** (Hardwicke)

Indian Gerbil ; Antelope Rat

1807. *Dipus indicus* Hardwicke, *Trans. linn. Soc. Lond.*, 8 : 297 (Type locality : Uttar Pradesh, India).

Diagonistic characters : Tail is covered with more hairs at tip, the hind legs are longer which help in leaps.

Distribution : Arab countries, Pakistan, Sri Lanka and throughout India,

Status in Haryana : Common on western part adjoining Rajasthan. The species is also recorded from Ambala district (Bhoria *et al.*, 1984), Bhiwani district (Ahuja and Bajaj, 1982), Hissar district (Bhatia and Kumar, 1987) and Jind district (Singh and Ranga, 1986).

Remarks : The Indian Gerbil builds its burrow near hedges and thickets in open areas bordering cultivation. Sexes live in separate burrows. Food consists mainly of grain, roots, leaves and grasses. A prolific breeder, usually four youngones are born at a time.

30. **Meriones hurrianae** (Jerdon)

Indian Desert Gerbil

1867, *Gerbillus hurrianae* Jerdon, *Mamm. India*, 186 (Type locality : Hissar, Haryana, India).

Diagonostic characters : Tail clothed with hair and ends in tassel. Hind feet are longer than fore feet. Its body and limbs are sandy-yellow ; underparts dirty white.

Distribution : Desert and semi desert zones of north-west and central India.

Status in Haryana : Recorded from Hissar district (Jerdon, 1967).

Remarks : Habits similar to Indian Gerbil except that it is more gregarious and lives in small colonies. Diurnal in habit, seen up and about at all hours of the day, in all seasons. Food comprises mainly of seeds, supplimented by bulbus roots, grass, leaves, flowers and nuts. The species breed throughout the year with two peak birth seasons in late winter and in monsoon.

SUMMARY

A comprehensive list of 30 species of mammals observed in Haryana State during 1987 has been furnished. This includes actual observation in the field, supplemented

with informations from the published records. The status of each species in Haryana, has been assessed by visual observation and after gathering information from the authorities of the wildlife and Forest departments.

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DISTRIBUTION OF SOME CHAETOGNATHA IN THE INDIAN OCEAN

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Introduction

Chaetognaths occur in all the oceans, at the surface and at different depths. Every species has its own pattern of distribution generally controlled by the hydrographic features, salinity and temperature. Further, light and pressure also influence the vertical distribution. In the open ocean, light affects the distribution of epi-and upper meso-planktonic species, while pressure affects the vertical distribution of the lower meso and bathy-planktonic species. Results of a study on horizontal and vertical distribution of 20 species of Chaetognatha found in samples collected from various parts of the Arabian Sea, Bay of Bengal and Indian Ocean, are presented in this paper.

Material and Methods

1,56,650 specimens of chaetognaths from 406 zooplankton samples collected from 259 stations in the Arabian Sea, Bay of Bengal and Indian Ocean during the expedition cruises of Indian Navy Ships Darshak, Kistna, Royal Indian Marine Surveyor 'Investigator', Russian Research Vessel 'Vityaz' and the regular cruises of Indo-Norweigian Research Vessel 'Varuna', were examined for this study. Among the 406 samples, 256 were collected from 200 metres below surface, while the remaining samples were from various depths ranging between 300 and 1730 metres. Twenty species belonging to the genera, *Eukrohnia* Ritter-Zahony, *Krohnitta* Ritter-Zahony, *Pterosagitta* Costa and *Sagitta* Quoy and Gaimard, present in the samples were examined.

Results and Discussion

The distribution of chaetognaths was studied under two major heads namely, horizontal and vertical.

Horizontal distribution : The 20 species of chaetognaths can be grouped under, cosmopolitan, Indo-Pacific and endemic species.

Cosmopolitan species : Ten species of this category from the present samples are, *Sagitta bibunctata* Quoy and Gaimard, *S. decipiens* Fowler, *S. enflata* Grassi, *S. macrocephala* Fowler, *S. maxima* (Conant) *Krohnitta subtilis* (Grassi), *Pterosagitta draco* (Krohn) and *Eukrohnia fowleri* Ritter-Zahony. These species found in the surface and sub-surface waters of the Atlantic, Indian and Pacific Oceans are considered as cosmopolitan species.

Indo-Pacific species : Out of the remaining 10 species, the following 8 species are common to the Indian and Pacific Oceans : *S. bedoti* Beraneck, *S. ferox* Doncaster, *S. neglecta* Aida, *S. pacifica* Tokioka, *S. pulchra* Doncaster, *S. regularis* Aida, *S. robusta* Doncaster and *K. pacifica* (Aida). This may be due to the fact that the Indian and Pacific Oceans are connected and the exchange of water between the two Oceans takes place through the Indonesian Archipelago. It is said that the warm water species of the Indian and Pacific Oceans are connected along the Indonesian Sea and the cold water species are connected along the Australian-Tasmanian Sea (Alvarino, 1964).

Endemic species : The remaining 2 species, *S. bombayensis* Lele and Gae and *Eukrohnia minuta* Silas and Srinivasan are believed to be endemic to the Indian Ocean. *E. minuta* has been described as a meso-planktonic form and the same species has been recorded from the deeper waters of the Arabian Sea by Srinivasan (1972). *S. bombayensis* was described from Bombay Harbout, while Rao (1958) reported it from Lawsons Bay, Waltair and Pathansali (1974) from Malaysian waters. This is a typical neritic species seen in coastal waters.

Vertical distribution : Chaetognaths occur at all depths of the sea. Species found in the upper 200 metres of the sea are epi-planktonic, those between 200 and 1000 metres are meso-planktonic and those that occur below 1000 metres are bathy-planktonic.

Epi-planktonic species : The 14 species listed under this category are : *S. bedoti, S. bibunctata, S. bombayensis, S. enflata, S. lyra, S. hexaptera, S. neglecta, S. pacifica, S. pulchra, S. regularis, S. robusta, P. draco, K. subtilis* and *K. pacifica.* Generally large number of species are seen in the upper 200 metres of the ocean than in deeper waters and the number of specimens of each species decreases with increasing depth. The general pattern of distribution of chaetognaths from the west coast of India shows that they are more abundant in the continental shelf regions than in the adjacent oceanic waters (Srinivasan, 1976).

Among the chaetognaths along the west coast of India, *S. enflata* is the dominant species representing 56% of the specimens from the shelf area, while the remaining are from the oceanic waters (Srinivasan, 1976). Further, the numerical abundance of this species is more before the south west monsoon than during the monsoon (June-August) and post-monsoon (September-December). *S. bedoti* is the next abundant species in the shelf area than in the oceanic waters, with 65% of the specimens from the shelf waters and the remaining from oceanic waters.

Unlike *S. bedoti* and *S. enflata, S. pacifica* is more abundant in the oceanic waters, than in the shelf areas, with 70% of the specimens from the oceanic waters and the remaining from the shelf region. Similarly 64% of *P. draco* are from the samples of the oceanic waters. Among the remaining 10 species of the epi-planktonic region, the

6 species *S. bibunctata*, *S. hexaptera*, *S. pulchra*, *S. regularis*, *S. robusta* and *K. pacifica* are seen in more abundance in the oceanic waters than in the shelf waters, while 4 species, *S. bombayensis*, *S. ferox*, *S. neglecta* and *K. subtilis* are found in more numbers in shelf waters than in oceanic waters.

Meso-planktonic species : The 5 meso-planktonic species are *S. decipiens*, *S. lyra*, *S. macrocephala*, *S. maxima* and *E. minuta*, collected from various depths (1730-0 m, 1300-0 m, 700-0 m, 400-0 m and 300-0 m). As all the specimens were collected from vertical open tows, the exact depth at which they were caught cannot ascertained. But these species are well known as meso-planktonic forms (Fagetti, 1972 ; Nair, 1978 ; Silas and Srinivasan, 1969). On the west coast of India, Srinivasan (1976) encountered more than 84% of the specimens of *S. decipiens* from the oceanic region and the rest from the shelf region. Even in the shelf region, this species was not seen during the pre-mosoon and monsoon periods (January-August). It is assumed that this species could have been transported into the shelf area along with the upwelled sub-surface waters along the west coast of India during August to October (Banse, 1968).

Bathy-planktonic species : Only one species, *E. fowleri* falls under this category, but the exact depth at which this species occurred in the net was not known as the samples were from various depths to surface. However, the species has been placed under this category by several earlier workers (Colman, 1959 ; Fagetti, 1972 ; Nair, 1978 ; Silas and Srinivasan, 1969) from Atlantic, Indian and Pacific Oceans. The species was collected from the Arabian Sea at a minimum depth of 600-0 metres, while the maximum number of specimens (44) was obtained from the sample collected between 1200-0 metres.

SUMMARY

Horizontal and bathymetric distribution of 20 species of Chaetognatha belonging to the Genera *Eukrohnia*, *Krohnitta*, *Pterosagitta* and *Sagitta* from various parts of the Arabian Sea, Bay of Bengal and Indian Ocean, revealed that 10 species are cosmopolitan, 8 are Indo-Pacific and the remaining 2 are endemic to Indian Ocean. Their vertical distribution showed, 14 species are in the upper 200 metres, 5 species are between 200 and 1000 metres and the remaining one species below 1000 metres. Among the 14 epi-planktonic species, 6 are abundant in the shelf area while the remaining are more numerous in the offshore waters.

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HEAVY METAL CONCENTRATIONS IN THE FIDDLER CRABS INHABITING THE ADYAR ESTUARY AND BACKWATER.

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INTRODUCTION

In India, there has been a growing awareness about the heavy metal pollution along the entire coast line in the last few years. However, baseline data on the concentrations of metals in the sediments, sea water and tissues of organisms and their effects on the physiology of organism and the ecosystem are very limited.

It has been estimated that about 7,75,000 litres of industrial effluents carrying heavy metal complement are discharged into the Adyar estuary every day. In addition, more than 225 million litres of untreated domestic sewage drains into the Adyar estuarine system enhancing the risk factor (Sornavel, 1978 ; Nammalwar, 1982 ; Tamilnadu water Supply and Sewage Board Report, 1982). Pollution induced mass fish kills have been reported in the Adyar estuary (Nammalwar, 1984). After the North-east monsoon period the river becomes either partially or fully detached from the sea by sand bank raised by breakers ; the Adyar backwater extends upto four kilometers into the city, the banks of which are virtually formed of all kinds of refuse right from waste paper onto the discarded automobiles, unused coaltar, woodshavings, animal and human excreta.

There has been a long felt need to study the ecological conditions of the Adyar estuary in relation to heavy metal pollution through a sentinel species and hence this work has been taken up.

Material and Methods

The experimental animal is the fiddler crab belonging to two species, *U.* (*C.*) *lactea* and *U* (*C.*) *tringularis* of the Adyar estuarine system.

For analysis of the sea water and sediments a 1% APDC (Ammonium pyrrolidine dithiocar bamate) was employed to chelate and IBMK (Isobutyl methyl ketone) to concentrate the metals at a pH of 2.2—2.8. The method prescribed in the FAO Fisheries Technical paper No. 137 was followed for atomic absorption spectrophotometry.

For estimating metal contents in animals, tissues from not less than 25 fiddlers were dissected and each type of tissue was pooled to arrive at one gram dry weight. The tissues were washed in demineralized water and dried in an oven at 120°C for 24 hours. The dry material was digested with 6N Nitric acid, followed by concentrated Nitric acid and then Perchloric acid or Hydrogen peroxide-Nitric acid mixture until the matrix became clear. The digested material was made up to the desired (25 ml) volume with 0.01 N Nitric acid. This was directly aspirated into the IL 457 Atomic absorption spectrophotometer and the concentrations of the metals were read directly under appropriate wave length recommended for each metal. Collection of material and laboratory analyses were done atleast once a month for a period of two years. The averages of multiple samples were considered to be nearer to the actual concentrations.

Results and Discussion

The ranges of occurrence of five heavy metals in the sea water, sediments and tissues are presented in Tables I,

Table 1. Heavy metal concentration ranges in the Adyar Estuary during 1982-1983

Nature of sample	Cd	Cu	Ni	Pb	Zn	
Sediments	BDL to 0.23	0.73 to 42.48	1.50 to 5.28	BDL to 10.63	1.46 to 45.00	µg/gm
Brackish water	BDL to 0.032	BDL to 0.352	0.011 to 0.195	BDL to 0.404	0.032 to 0.694	mg/lit

The concentrations of heavy metals did not fluctuate appreciably in the brackish water and Zn, Pb, Cu, Ni, Cd were in descending order. In the sediments there were significant fluctuations of Cu, Pb, and Zn indicating the differential sedimentation of these metals from water. The concentrations of all metals were more in the sediments when compared with the brackish water collected at any time of the year.

U. (C.) lactea annulipes inhabits sandy and sandy mud areas of the Adyar estuary while *U. (C.) triangularis bengali* inhabits muddy-clayey substratum. Ono (1965) indicated that the finer the particle size in the substratum, the more is the N-content leading to the growth of microbial organisms which maintain the food supply to the fiddlers. The sandy mud and clayey substrata of the Adyar backwater and some

locations in the Adyar estuary which have richer populations of *triangularis bengali* show the presence of finer particles when compared with the sandy areas inhabited by *lactea annulipes*. Should heavy metal concentrations be more in the areas inhabited by *triangularis*, it will be reflected by the higher concentrations of these metals in the body of *triangularis*. Evidently it indicates the presence of heavy metals in higher concentrations in *triangularis*. Since males and females forage on the same sediments there are no appreciable differences in the concentration of these metals.

Table II. Average heavy metal concentrations in the *fiddler crabs* of The Adyar Estuary During 1982-1983 (μg/gm dry weight).

Sample Detail	Cd	Cu	Ni	Pb	Zn
Whole animal :					
U. (C.) lactea annulipes					
male	0.57 to 1.83	93.00 to 133.04	BDL to 1.94	BDL to 9.50	92.73 to 141.23
female	0.83 to 1.77	93.22 to 119.64	2.66 to 5.53	4.54 to 18.84	115.80 to 131.40
U. (C.) triangularis bengali male	2.02 to 2.91	126.53 to 141.23	3.01 to 3.98	6.59 to 11.37	101.11 to 157.05
female	1.26 to 2.28	96.44 to 133.60	5.23 to 5.55	5.75 to 10.95	80.33 to 161.06

The analysis of whole animals indicates the presence of Cu and Zn in higher concentrations in males and females in both *lactea* and *triangularis*. Similar levels of Cu and Zn may be considered to be due to identical potential of both the species to mobilise them from the environment. The concentration factor rose considerably at each level of the ecosystem many fold. The concentration of Zn in the sediments was 65 times when compared to brackish water and on reaching the body of *annulipes* it shot up by another three times indicating the presence of Zn approximately two hundred times more than the brackish water. Cu concentrations went up to 120 times in the sediments and in *annulipes* it was concentrated three fold indicating 360 times mobilization from the brackish water. Cd level rose 7 times in sediments and another

8 fold increase could be noticed in *lactea* when compared to the sediments. Twenty-seven fold increase occurred in Ni concentrations in sediments and no increase occurred in the body of the animal indicating conformity with the environment. In the case of Pb, sediments received 26 times the concentration of it in the water and the animal showed conformity with the environment. The heavy metal concentrations are comparable in *lactea annulipes* and *triangularis bengali* and in the latter concentrations were relatively more.

Assay of the different parts of the body indicated the differential distribution of metals (Table). Ni appears to be picked up by gills, hepatopancreas and ovary. Cu is

Table III. Heavy metal concentration ranges in *U.* (*C.*) *lactea annulipes* of the Adyar estuary and backwater during 1982-1983. (μg/gm dry weight)

Nature of sample	Cd	Cu	Ni	Pb	Zn
Carapace and appendages	0.59 to 2.35	43.24 to 77.98	0.88 to 9.90	BDL to 18.84	40.04 to 78.39
Gills	0.99 to 28.13	56.77 to 466.94	BDL to 21.24	BDL to BDL	24.90 to 390.50
Hepatopancreas	BDL to 4.99	66.73 to 345.92	BDL to 17.24	BDL to 41.01	32.55 to 394·15
Ovary	BDL to 6.52	21.21 to 97.75	BDL to 17.56	BDL to 32.90	42.90 to 465.13

concentrated in the hepatopancreas appreciably. Ovigerous females showed the accumulation of Zn in the ovary. High concentrations of Cu and Zn in the gills may be partly attributed to adsorption. Pb gets accumulated in the hepatopancreas and ovary. It is interesting to note that the gills do not retain Pb. Both males and females appear to concentrate Pb to similar levels. The concentration of Pb in the algae of this region being 23.64 μg on average, gets magnified twice and incorporated into the hepatopancreas. Female *lactea annulipes* accumulates more Ni and Pb and *triangularis bengali* Ni only when compared to males. Carapace and appendages carry lower load of metals and a significant quantum of it may account for adsorption as well.

Daniel and Ramakrishna (1985 Unpublished) noted that all these heavy metals

were in higher concentrations in *Uca* when compared to another shore living crustacean *Ocypoda quadrata*. Translocation of metals from gills to hepatopancreas when optimal salinity and temperature occurred in the environment is a known phenomenon (Vernberg and Vernberg, 1975 ; Vernberg et al, 1974). Cu and Zn are regulated to some extent by crustaceans. Since Cu has a direct physiological bearing on the crustacean blood, it is preferentially accumulated. Further, Cu concentration may vary from individual to individual due to the moult-intermoult cycles and hence the vast difference between the minima and maxima.

SUMMARY

Studies on heavy metal concentrations show the magnification of discharged metals as they pass on from one trophic level to another. Amongst the fiddlers, *triangularis* appears to pick up a higher load of metals than its relative. No significant difference has been observed between males and females. Nickel appears to be taken up by the gills, hepato pancreas and ovary. Copper gets accumulated in the hepato pancreas. Ovigerous females exhibit higher concentrations of zinc in the ovary.

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A NEW *MIMETUS* SPIDER FROM INDIA (ARANEAE : MIMETIDAE)

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MATERIAL

The description is based on one female specimen.

The spiders of the family Mimetidae are comparatively little known. This family was established by Simon (1890) with *Mimetus* as type genus and *interfector* Hentz as type species. Simon (1893) described many species of the family Mimetidae from various parts of the world and in 1906 the first species, *Mimetus indicus* from India. Kaston (1978) gave illustrations of three known species of *Mimetus* out of 10 species known from North America. Brignoli (1974, 1980) described two species, *Mimetus ridens* and *M. vespillo* from the Philippines and Italy respectively.

While studying the collection of spiders from Madhya Pradesh, I have encountered a new species of *Mimetus* which is described here as a second species from India.

The type specimen is deposited in the National Collections, Zoological Survey of India, Calcutta.

The species is named after Dr. B. K. Tikader, a well known arachnologist as a token of the high regard which the author has for him.

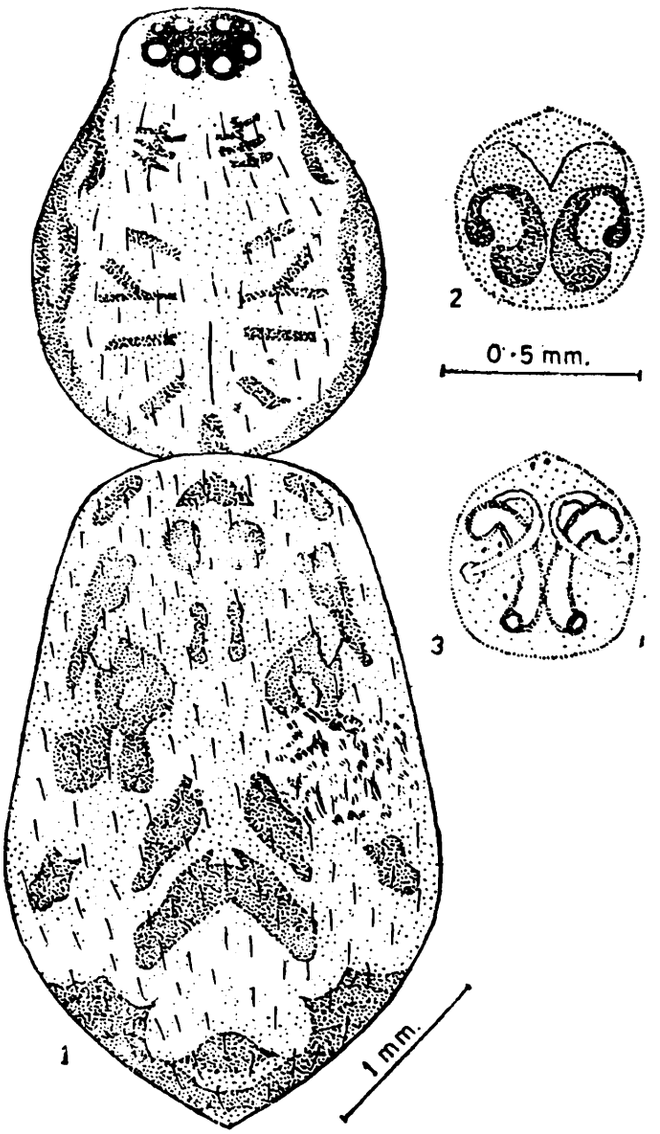
Mimetus tikaderi sp. nov.

General : Cephalothorax and legs light yellowish green ; abdomen deep yellowish-green. Total length 6.20 mm. Carapace 2.50 mm. long, 2.00 mm. wide ; abdomen 3.80 mm. long, 2.40 mm. wide.

Cephalothorax : Longer than wide, narrow in front, convex, clothed with pubescence and some long hairs, with inconspicuous short fovea at posterior middle, laterally bordered by black patch and middorsally provided with five pairs of black irregular patches. Ocular region dark ; eyes compact on ocular region, posterior row of eyes slightly longer than anterior row ; anterior row slightly recurved (as seen from in front), with medians black, rounded larger than laterals, closer to laterals than to each other, and with laterals light in colour and oval in shape ; posterior row of eyes slightly procurved (as seen from in front) ; with medians dark, larger than laterals and equidistant to laterals and with laterals light, oval in shape ; median ocular quadrangle longer than wide and wider behind than in front. Clypeus clearly shorter than length

of the eye region. Labium triangular, as long as wide, provided with scopulae ; maxillae vertical, yellowish, with anterior portion provided with black seopulae. Chelicerae vertical provided with conspicuous heavy bristles on inner margin about two-thirds the distance from base to fang grove. Sternum light yellow, heart-shaped, smooth, ending with an obtuse point and with small hairs. Legs moderately long, with black patches on patella and tibia, provided with long spines and hairy ; tibia and metatarsus I and II with a prolateral row of long spines, in the intervals between which is a row of much shorter spines.

Abdomen : Longer than wide, nearly pentagonal, widest behind middle, clothed with hairs and provided with some black patches as in fig. 1. Ventral side slightly



Figs. 1-3. *Mimetus tikaderi*. sp. nov.

1. Dorsal view of female, legs omitted. 2. Epigyne. 3. Spermathecae.

lighter than dorsal provided with orange coloured patches. Epigyne as in fig. 2. Spermathecae as in fig. 3.

Type-specimen : *Holotype* female in spirit, male unknown, other details as below :

Type-locality : India, Madhya Pradesh, Bargaon village, Narayanpur Taluka, Bastar district, 24. XII 1983. Coll. *U. A. Gajbe.*

Discussion : This species resembles *Mimetus ridens* Drignoli from Philippines but can be separated by the structure of epigyne and spermathecae, it can be distinguished from other already known species by colour, general morphology, epigyne and spermathecae.

SUMMARY

Mimetus tikaderi sp. nov. (Family-Mimetidae) from Bastar district, Madhya Pradesh, is described.

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I am grateful to Dr. B. K. Tikader, Former Director, Zoological Survey of India for assigning the project, help with literature and constant encouragement in my research work. I am also thankful to Dr. P. D. Gupta, Officer-in-Charge, Central Regional Station, Zoological Survey of India, Jabalpur for providing necessary facilities, going through the manuscript and making valuable suggestions and to Miss Pratiksha Tiwari for typing the manuscript. I am also thankful to Prof. Dr. P. M. Brignoli from Italy for halp with literature.

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FRESHWATER ROTIFERS FROM DARBHANGA CITY, BIHAR, INDIA.

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INTRODUCTION

Eventhough the systematic studies on Indian Rotifera were initiated by Anderson (1889), comprehensive regional investigations from many states in this country are still lacking (Sharma & Michael, 1980). Earlier contributions to these organisms from Bihar in Eastern India are much limited (Donner, 1949 ; Nasar, 1973 ; Laal & Nasar, 1977). The present study provides additional information to the rotifer fauna of this state based on the collections from Darbhanga City. Among the examined taxa, five represent new records from India, while 40 are new to Bihar. Some of these important taxa are briefly described and illustrated in this paper, with remarks on their distribution.

MATERIAL AND METHODS

Material for this study was collected, by one of us (VKD), from various ponds, ditches, swamps and puddles in and around Darbhanga City (Lat. 26°10′ N ; Long. 85°57′ E) during February, 1985—March, 1986. The samples were collected with a plankton net and preserved in 5% formalin. Individual taxa were mounted in Polyvinyl alcohol-lactophenol mixture. Illustrations were made with a Leitz-Dialux phase contrast microscope using a drawing tube attachment. All the measurements are given in micrometers (μm). The classification followed in this account is after Koste (1978).

The reference slides of the examined taxa are deposited in Freshwater Biology Laboratory, Department of Zoology, North-Eastern Hill University, Shillong.

LIST OF THE EXAMINED TAXA

Class : ROTIFERA
Subclass : EUROTATORIA
Superorder : MONOGONONTA
Order : PLOIMIDA

Family : BRACHIONIDAE

Anuraeopsis fissa (Gosse, 1851)
Brachionus angularis Gosse, 1851
B. calyciflorus calyciflorus Pallas, 1766
B. calyciflorus anuraeiformis (Brehm, 1909)
B. caudatus personatus (Ahlstrom, 1948)
B. caudatus aculeatus (Hauer, 1937)
B. diversicornis (Daday, 1883)
B. falcatus Zacharias, 1898
B. forficula Wierzejski, 1891
B. forficula minor (Voronkov, 1913)
B. mirabilis (Daday, 1897)
B. patulus (O. F. Müller, 1786)
B. quadridentatus quadridentatus Hermann, 1783
B. quadridentatus melheni (Barrois & Daday, 1894)
Keratella tropica (Apstein, 1907)
Platyias quadricornis (Ehrenberg, 1832)

Family : EUCHLANIDAE

Euchlanis dilatata Ehrenberg, 1832
E. triquetra Ehrenberg, 1838
Dipleuchlanis propatula (Gosse, 1886)
Beauchampiella eudactylota (Gosse, 1886)

Family : EPIPHANIDAE

Epiphanus macrourus (Barrois & Daday, 1894)

Family : MYTILINIDAE

Mytilina ventralis macracantha (Gosse, 1886)

Family : COLURELLIDAE

Colurella uncinata (O. F. Müller, 1773)
Lepadella (Lepadella) patella (O. F. Müller, 1786)

L. (L.) ovalis (O. F. Müller, 1786)
L. (L.) acuminata (Ehrenberg, 1834)
L. (Heterolepadella) heterostyla (Murray, 1913)

Family : LECANIDAE

Lecane (Lecane) curvicornis (Murray, 1913)
L. (L.) leontina (Turner, 1892)
L. (L.) ludwigi (Eckstein, 1883)
L. (L.) luna (O. F. Müller, 1776)
L. (L.) papuana (Murray, 1913)
L. (L.) signifera signifera (Jennings, 1896)
L. (L.) ungulata (Gosse, 1887)
L. (Monostyla) closterocerca (Schmarda, 1859)
L. (M.) bulla (Gosse, 1851)
L. (M.) lunaris (Ehrenberg, 1832)
L. (M.) pyriformis (Daday, 1905)
L. (M.) quadridentata (Ehrenberg, 1832)
L. (M.) thalera (Harring & Myers, 1926)
L. (M.) unguitata (Fadeev, 1925)

Family : TRICHOCERCIDAE

Trichocerca (Trichocerca) bicristata (Gosse, 1887)
T. (T.) rattus carinata (Ehrenberg, 1830)
T. (T.) pusilla (Lauterborn, 1898)
T. (Diurella) similis (Wierzejski, 1893)
T. (D.) weberi Jennings, 1903

Family : NOTOMMATIDAE

Scaridium longicaudum (O. F. Müller, 1786)

Family : SYNCHAETIDAE

Synchaeta cf. *longipes* Gosse, 1887
Polyarthra vulgaris Carlin, 1943

Family : ASPLANCHNIDAE

Asplanchna priodonta Gosse, 1850

Order : GNESIOTROCHA
Suborder : FLOSCULARIACEA

Family : HEXARTHRIDAE

Hexarthra mira (Hudson, 1871)

Family : FILINIIDAE

Filinia longiseta longiseta (Ehrenberg, 1834)
F. longiseta saltator (Gosse, 1886)
F. opoliensis (Zacharias, 1898)
F. terminalis (Plate, 1886)
F. pejleri Hutchinson, 1964

Family : TESTUDINELLIDAE

Testudinella patina (Hermann, 1783)
T. emarginula (Stenroos, 1898)

Superorder : DIGONONTA
Order : BDELLOIDEA

Family : PHILODINIDAE

Rotaria neptunia (Ehrenberg, 1832)

Observations

1. TAXA NEW TO INDIA

Mytilina ventralis macracantha (Gosse, 1886)
(Fig. 1)

1886. *Salpina macracantha* Gosse, In : Hudson & Gosse, Rotifera, vol, 2, p. 82, pl. 22, fig. 6.
1912. *Mytilina macracantha* (Gosse) : Sache, Süsswasserfauna Deutchlands, vol. 4, p. 152 Fig. 307.
1978. *Mytilina ventralis* var. *macracantha* (Gosse) : Koste, ROTATORIA : Die Rädertiere Mitteleuropas, p. 147, T. 42 : 6a-b ; Michelangelli *et al.*, 1979/80, Cah. O.R.S.T.O.M. ser. Hydrobiol., vol. Xiii, p. 56, Fig. 10.

Material Examined : 10 parthenogenetic females.

Lorica relatively elongated and dorsal keel ending into distinct posterior spines. Lorica length 210-236 ; postero-dorsal spines 36-42 ; postero-ventral spines 90-100. It is a little known taxon. Besides its original description by Gosse (*loc. cit.*), it has been documented only from Venezuela (Michelangelli *et al.*, 1979/80).

Trichocerca bicristata (Gosse, 1887)
(Figs. 2-4)

1887. *Mastigocerca bicristata* Gosse, Jour. Roy. Micr. Soc., p. 2, pl. 1, fig.5.
1903. *Rattulus bicristatus* Jennings, Bull. U. S. Fish. Comm., (1902), vol. 22, p. 330, pl. 9, figs. 77-80.
1913. *Trichocerca bicristata* (Gosse) : Harring, Bull. U. S. Natl. Mus., vol. 81, p. 102 ; Kutikova, 1970, Rotifer Fauna of USSR, p. 316, Fig. 313.
1978. *Trichocerca bicristata bicristata* (Gosse) : Koste, ROTATORIA : Die Rädertiere Mitteleuropas, p. 395, T. 137 : 3 a-m.

Material Examined : 18 parthenogenetic females.

Characterised by two distinct keels extending upto 2/3 or even more the length of its dorsum. Left toe longer than body ; right toe reduced. Trophi diagnostic. Body length (including foot) 260-272 ; left toe 280-290 ; right toe 28-32 ; trophi 79-82.

It is a cosmopolitan species and designated as an indicator of oligosaprobic waters (Koste, 1978).

Trichocerca rattus carinata (Ehrenberg, 1830)

(Fig. 5)

1830. *Mastigocerca carinata* Ehrenberg, Abh. Akad. Wiss. Berlin, p. 66.
1877. *Monocerca carinata* Eyferth, Mikr. Süsswasserbew., p. 52. Fig. 87.
1890. *Acanthodactylus carinatus* Tessin, Arch. Naturg. Mecklenburg, vol. 43, p. 156, pl. II, fig. 15.
1903. *Rattulus carinatus* Jennings, Bull. U. S. Fish. Comm., (1902), vol. 22, p. 332, pl. XI, figs. 95-97.
1913. *Trichocerca cristata* Harring, Bull. U. S. Natl. Mus , vol. 81, p. 102.
1923. *Rattulus cristatus* Hofstein, Zool. Bdr., vol. 4, p. 865.
1939. *Trichocerca carinata* (Ehrenberg) : Meuche, Arch. Hydrobiol., vol. 34, p. 408.
1970. *Trichcerca rattus carinata* (Ehrenberg) : Kutikova, Rotifer Fauna USSR, p. 319, Fig. 321.
1978. *Trichocerca rattus* f. *carinata* (Ehrenberg) : Koste, ROTATORIA : Die Rädertiere Mitteleuropas, p. 398, T. 137a : 7, 139 : 1a-d.

Material Examined : 12 parthenogenetic females.

Differentiated from typical *T. rattus* in having clearly high dorsal keel and broader anterior body-opening. Body length 135-138 ; left toe 158-164 ; maximum width 74-76 ; anterior width 40-42.

Apparently cosmopolitan in its distribution and is reported to co-occur with typical specimens (Koste, 1978). However, in the material from Darbhanga, typical *T rattus* was not observed.

Synchaeta cf. **longipes** (Gosse, 1887)

(Fig. 6)

1887. *Synchaeta longipes* Gosse, Jour. Royal Micro. Soc., p. 5, pl. 2, fig. 15 ; Harring, 1913, Bull. U. S. Natl. Mus., vol. 81, p. 98 ; Koste, 1978, ROTATORIA : Die Rädertiere Mitteleuropas, p. 423, T. 151 : 1a-c.

Material Examined : 2 parthenogenetic females.

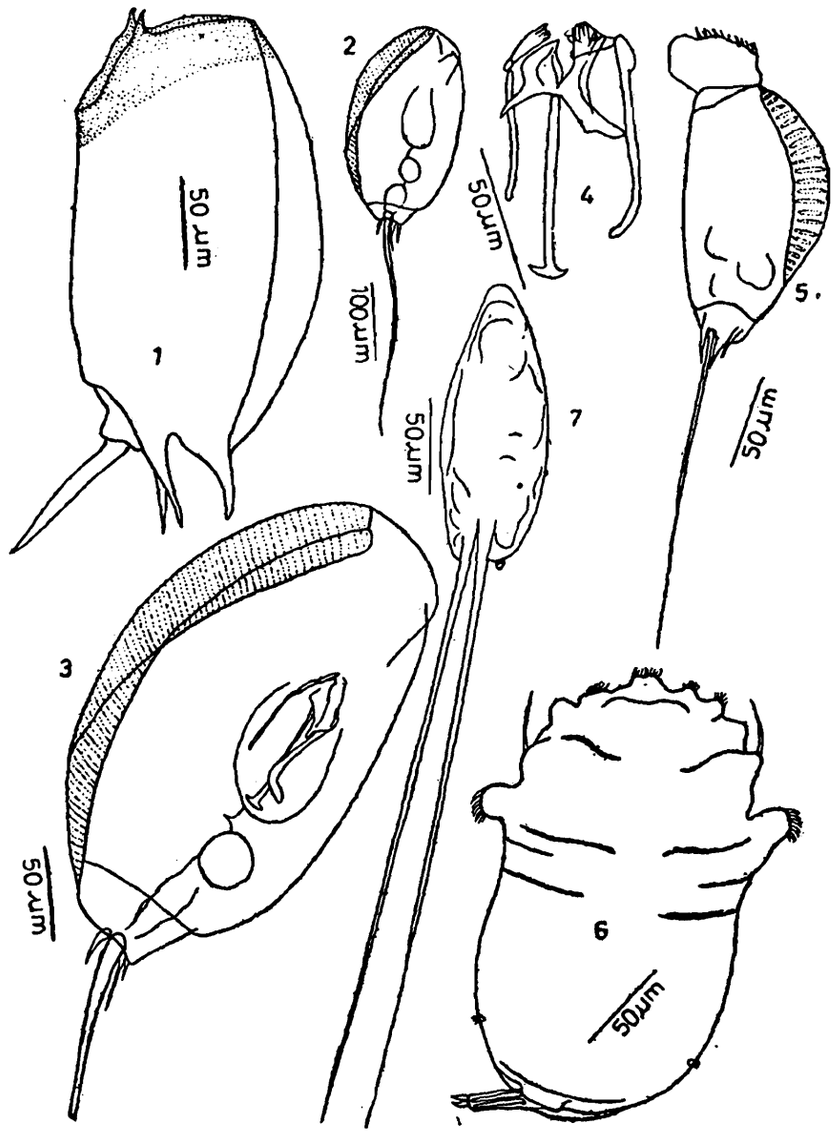
The specimens noticed in this study are broadly identical with *S. longipes* in the shape of corona, in general body outline and in having an elongated cylindrical foot. Body length 230-234 ; maximum width 128-130 ; foot 32-34 ; toes 6-8.

This warm-stenothermic species is reported so far only from Europe, Asia, North America and South America.

Filinia longiseta saltator (Gosse, 1886)

(Fig. 7)

1886. *Pedetus saltator* Gosse, In : Hudson & Gosse, Rotifera, vol. 2, p. 8, figs. 13, 16.
1953. *Filinia longiseta* var. *acaudata* Hauer, Arch. Hydrobiol., vol. 48, p. 166, Abb. 8, a-b.
1975. *Filinia longiseta* f. *saltator* (Gosse) : Pourriot, Cah. O.R.S.T.O.M. ser. Hydrobiol., vol. 9, p. 89, fig. 5.
1978. *Filinia longiseta* var. *saltator* (Gosse) : Koste, ROTATORIA : Die Rädertiere Mitteleuropas, p. 571, T. 217 : 1g-h, Abb. 59a-b.



Figs. 1-7. *Mytilina ventralis macracantha* (Gosse) : Fig. 1, lateral view ;
Trichocerca bicristata (Gosse) : Fig. 2, lateral view (left side), Fig. 3, body (enlarged), Fig. 4, Trophi ;
Trichocerca rattus carinata (Ehrenberg) : Fig. 5, lateral view (right side) ;
Synchaeta cf. *longipes* Gosse : Fig. 6, dorsal view ;
Filinia longiseta saltator (Gosse) : Fig. 7, dorsal view.

Material Examined : 15 parthenogenetic females.

Body cylindrical and elongated ; anterior setae longer, posterior seta lacking. Body length 138-156 ; maximum width 58-68 ; anterior setae 336-340.

This is another little known and interesting rotifer previously reported from South America, Antilles and West Africa. The present specimens were longest and had longer setae those examined so far by Pourriot (1975), Koste (1978) and Coussement & Dumont (1980).

2. OTHER RARE AND INTERESTING TAXA :

Brachionus mirabilis Daday, 1897

(Fig. 8)

1897. *Brachionus mirabilis* Daday, Math. Term. Ert., vol. 15, p. 140, fig. 8 ; Harring, 1913, Bull. U. S. Natl. Mus , vol. 81, p. 22 ; Ahlstrom, 1940, Bull. Amer. Mus. Nat. Hist., vol. 77, p. 167, pl. XI, figs. 5-8.

1978. *Brachionus quadridentatus mirabilis* (Daday) ; Koste, ROTATORIA : Die Rädertiere Mitteleuropas, p. 75, T. 11 : 5a-d ; Koste & Shiel, 1987, Invertebr. Taxon., vol. 7, p. 980, figs. 12, 16 : 3.

Material Examined : One parthenogentic female.

Charcterised by its long postero-ventral spines, directed at an angle of 45°. This brachionid is known to be distributed in Africa, South & Central America, Neu-Guinea, Thailand, India, Malaysia and Singapore. Its occurrence in India is restricted to West Bengal (Sharma, 1979a) and Assam (Sharma, 1980). The presently examined specimen is smaller than previously documented Indian material.

Epiphanes macrourus (Barrois & Daday, 1894)

(Fig. 9)

1894. *Notops macrourus* Barrois & Daday, Math Term. Ert., vol 12, p. 226, tab. VII, figs. 7, 16.

1896. *Brachionus mollis* Hempel, Bull. Illinois State Lab. Nat. Hist., vol. 4, p. 312, pl. XXIV, figs. 7, 8.

1930. *Brachionus pala* f. *nova* Wesenberg-Lund, Mem. Acad. Roy. Soc. Letts., Denmark, vol. 9, ser. II (1), p. 116, pl. vi, fig. 2.

1932. *Notops mollis* De Beauchamp, Linn. Soc. J. Zool., vol. 38, p. 256, text fig. A-D.

1938. *Epiphanes macrourus* (Barrois & Daday) : Ahlstrom, J. Elisha Mitchel Sci. Soc., vol. 54, p. 96 ; Koste, 1978, ROTATORIA : Die Rädertiere Mitteleuropas, p. 59, T, 3 : 1a-k, T. 5 : 1a-d.

Material Examined : 12 parthenogenetic females.

Identical with the description given by Koste (1978). This is a little known species among Indian Rotifers and has been reported from Meghalaya (Patil, 1978) and Delhi (Sarma, 1988).

Euchlanis triquetra Ehrenberg, 1838

(Figs. 10 & 11)

1838. *Euchlanis triquetra* Ehrenberg, Infusionsth., p. 461, pl. 57, fig. 8 ; Harring, 1913, Bull U. S. Natl. Mus., vol. 81, p. 47 ; Kutikova, 1970, Rotifer Fauna of USSR, p. 574, Fig. 903 ; Koste, 1978, ROTATORIA : Die Rädertiere Mitteleuropas, p. 142, T. 38 : 5.

1854. *Euchlanis hyolina* Leydig, Zeitschr. Wiss. Zool., vol. 6, p. 60.

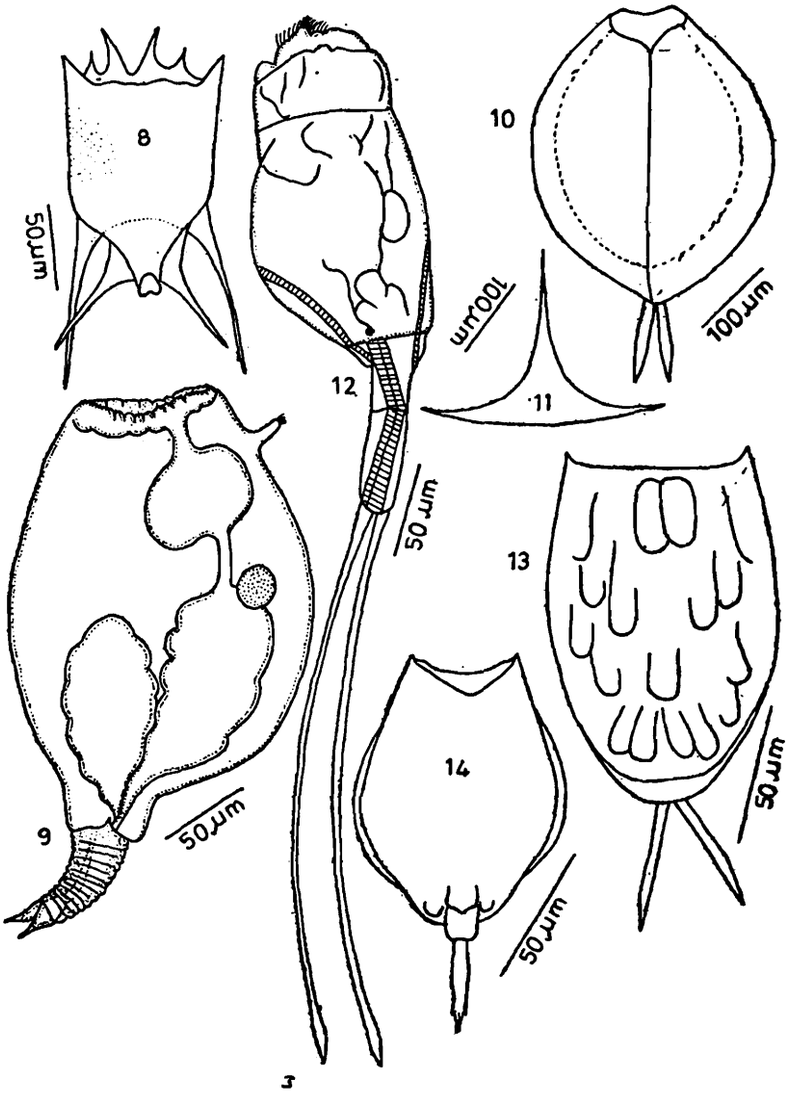
1854. *Euchlanis unisetata* Leydig, Zeitschr. Wiss. Zool., vol. 6, p. 61, pl. 4, fig. 45.

1921. *Euchlanis pellucida* Harring, Rept. Canadian Arctic Exped. 1913-1918, vol. 8, p. 6. pl. 2.

1934. *Dapidia carinata* Carlin-Nilson, Ark. Zool., vol. 26A, p. 6, fig. 2.

1934. *Dapidia lata* Carlin-Nllson, Ark. Zool., vol. 26A, p. 7, fig. 3.

1955. *Euchlanis triquetra pterigoidea* Grese, In : Notizen Zur Fauna u. Flora Sibiriens, vol. 18, p. 60, pl. 15, 19 (in russian).



Figs. 8-14. *Brachionus mirabilis* Daday : Fig. 8, ventral view ;
Epiphanes macrourus (Barrois & Daday) : Fig. 9, lateral view (contracted) ;
Euchlanis triquetra Ehrenberg : Fig. 10, dorsal view, Fig. 11, cross-section ;
Beauchampiella eudactylota (Gosse) Fig. 12, lateral view ;
Lecane (*Lecane*) *signifera signifera* (Jennings) : Fig. 13, dorsal view ;
Lecane (*Monostyla*) *thalera* (Harring & Myers) : Fig. 14, ventral view.

Material Examined : 4 parthenogenetic females.

This euchlanid is characterised by its strong median keel, with sharply concave sides. This cosmopolitan species is so far reported in India only from Orissa (Sharma, 1987a).

Beauchampiella eudactylota (Gosse, 1886)

(Fig. 12)

1886. *Scaridium eudactylota* Gosse, In : Hudson & Gosse, Rotifera, vol. 2 p. 74, pl. XXI, fig. 4.

1929/33. *Beauchmpiella eudactylota* (Gosse) : Remane, Rotatoria, In : Bronns und Ordnungen des tierriechs, vol. 4, p. 107.

1927. *Eudactylota eudactylota* (Gosse) : Manfredi, Memoria, ser. B. vol. 1, p. 8, 29 ; Kutikova, 1970, Rotifer Fauna of USSR, p. 578, Fig, 906.

1965. *Manfredium eudactylota* (Gosse) : Arora, Hydrobiologia, vol. 26, p. 454.

1978. *Beauchampiella eudactylota eudactylota* (Gosse) : Koste, 1978, ROTATORIA : Die Rädertiere Mitteleuropas, p. 134, Abb11a : 1a-f.

Material Examined : 7 partheongentic females.

Body transparent, pear-shaped and second foot-segment longer ; toes long and distally dilated. This species was reported in India from Madhya Pradesh (Arora, 1965 as *Manfredium eudactylota*) and Andhra Pradesh (Dhanapathi, 1974 as *B. eudactylotum*).

Lecane (Lecane) signifera signifera (Jennings, 1896)

(Fig. 13)

1896. *Distyla signifera* Jennings, Bull. Michigan Fish. Comm , No. 6, p. 92, figs. 1, 2.

1913. *Cathypna signifera* (Jennings) : Murray, J. Roy. Micr. Soc., p. 552, pl. 23, fig. 13,

1913. *Lecane signifera* (Jennings) : Harring, Bull. U.S, Natl. Mus., vol. 81, p. 62 ; Harring & Myers, 1926, Trans. Wisc. Acad. Sci. Arts & Letters, vol. 22, p. 333, pl. XIII, figs. 3, 4.

1978. *Lecane signifera signifera* (Jennings) : Koste, ROTATORIA : Die Rädertiere Mitteleuropas, p. 209, T. 69 : 1a-b, 2c ; Sharma, 1987, Rev. Hydrobiol. trop., vol. 20, p, 103, fig. 7.

Material Examined : 5 parthenogenetic females.

Lorica oblong, relatively broad anteriorly and with small spines at external angles ; dorsal plate with characteristic pattern of surface markings.

It is a cosmopolitan lecanid which was rare in the examined material and documented in this country only from Meghalaya State (Sharma, 1987b).

Lecane (Monostyla) thalera (Harring & Myers, 1926)

(Fig. 14)

1926. *Monostyla thalera* Harring & Myers, Trans. Wisc. Acad. Sci. Arts & Letters, vol. 22, p. 394, pl. XXXIX, figs. 3, 4.

1936. *Monostyla conspicua* Hauer, Zool. Anz., vol. 115, p, 78, Abb. 2.

1957. *Lecane* (*Monostyla*) *thalera* (Harring & Myers) : Voigt, ROTATORIA, 2. 236, Taf. 43, fig. 98 ; Kutikova, 1970, Rotifer Fauna of USSR, p. 474, Fig. 670 ; Sharma, 1978, Hydrobiologia, vol. 58, p. 151, figs. 62 & 63.

1968. *Monostyla paradecipiens* Nayar, Hydrobiologia, vol. 31, p. 180, Figs. 20 & 21.

1978, *Lecane* (*Monostyla*) *lamellata thalera* (Harring & Myers) : Koste ROTATORIA : Die Rädertiere Mitteleuropas, p. 254, T. 83 : 5a-b, 7a-b.

Material Examined : One parthenogenetic female.

The specimen observed in this study is identical with the figures given by Koste (1978) except for its smaller toe. It is distributed in Eastern Europe, North America, India and Ceylon ; known in India from Madras (Hauer, 1936), Rajasthan (Nayar, 1968) and West Bengal (Sharma, 1978).

Trichocerca pusilla (Lauterborn, 1898)

(Fig. 15)

1898. *Mastigocerca pusilla* Lauterborn, Biol. Zbl., vol. 18, p. 175.

1903. *Rattulus pusillus* Jennings, Bull. U. S. Fish. Comm., (1902), vol. 22, p. 339, pl. 9, figs. 81-85.

1913. *Trichocerca pusilla* (Jennings) : Harring, Bull. U.S. Natl. Mus., vol. 81, p. 104 (considered *M. pusilla* Lauterborn to be *nomen nudum*).

1970. *Trichocerca pusilla* (Lauterborn) : Kutikova, Rotifer Fauna of USSR, p. 323, Fig. 329 ; Koste, 1978, ROTATORIA : Die Rädertiere Mitteleuropas, p. 401, T. 140 : 1a-f, 4.

Material Examined : 3 parthenogenetic females.

This small species was rare in the examined material from Darbhanga. It has been recently reported from Delhi (Sarma, 1988) and also examined by one of the authors (BKS) from Orissa and some States in North-Eastern India.

Trichocerca weberi Jennings, 1903

(Figs. 16 & 17)

1903. *Diurella weberi* Jennings, (1902), Bull. U. S. Fish. Comm., vol. 22, p. 309, pl. I, figs. 11-14, pl. XIII, figs. 116, 117,

1898. *Coelopus porcellus* Weber, Rev. Sussie Zool., vol. 5, p. 512, pl. 20, figs. 2-4 (in part) ; Hilgendorf, 1903, Proc. New Zealand Inst. Wellington, vol. 35, p. 269.

1903. *Rattulus unicornuta* Hilgendorf, Proc. New Zealand Inst. Wellington, vol. 35, p. 303.

1950. *Trichocerca weberi* (Jennings) : Donner, Zool. Anz., vol. 145, p. 140, Abb. 2 ; Koste, 1978, ROTATORIA : Die Rädertiere Mitteleuropas, p. 387, T. 134 : 3a-h,

Material Examined : 6 parthenogenetic females.

It is a cosmopolitan and variable species. The only earlier Indian report (Edmondson & Hutchinson, 1934) gave no description or illustration to enable comparison. However, Bihar specimens resembled with those from Ontario (Chengalath & Mulamoottil, 1975).

Filinia pejleri Hutchinson, 1964

(Fig. 18)

1964. *Filinia pejleri* Hutchinson, Postilla, vol. 81, p. 1-8, Fig. 1a ; Koste, 1978, ROTATORIA : Die Rädertiere Mitteleuropas, p. 575, T. 217 f3 ; Sharma, 1979b, Hydrobiologia, vol. 65, p. 46, Pl. III, Fig. 10 ; Sharma, 1987a, State Fauna of Orissa, Part I, p. 337, Fig. 41.

Material Examined : 5 parthenogenetic females.

An interesting tropical and subtropical species ; it is characterised by its fusiform body and terminally located broad-based posterior seta. *F. pejleri* has so far been documented in this country from Rajasthan (Nayar, 1968), West Bengal (Sharma, 1979b) and Assam (Sharma, 1980).

3. TAXA INDICATING INFRASPECIFIC VARIATIONS :

Brachionus calyciflorus Pallas, 1766

1766. *Brachionus calyciflorus* Pallas, Elench. Zooph., p. 93 ; Harring, 1913, Bull. U. S. Natl. Mus., vol. 81, p. 19 ; Koste, 1978, ROTATORIA : Die Rädertiere Mitteleuropas, p. 87.
1803. *Brachionus longispinus* Schrank, Fauna Bioca, vol. 3, p. 133.
1826. *Brachionus bicornis* Bory de St. Vincent, Class. Anim. Micr., p. 83.
1886. *Brachionus decipiens* Plate, Jen, Zeitschr. Naturw., vol. 19, p. 73.

Material Examined : 15 parthenogenetic females.

It is represented by *B. calyciflorus calyciflorus* (Fig. 19) and *B. calyciflorus anuraeiformis* (Fig. 20) ; these are differentiated by the relative length of their median occipital spines.

Brachionus caudatus Barrois & Daday, 1894

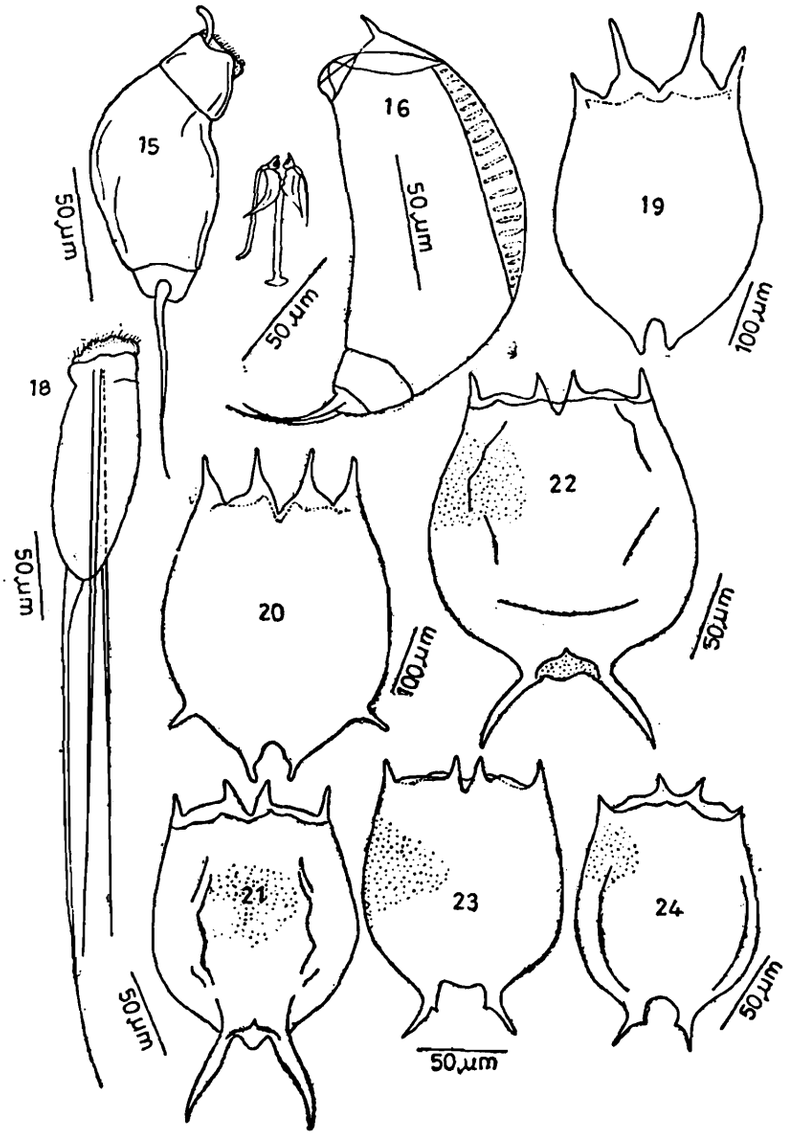
1894. *Brachionus caudatus* Barrois & Daday, Math. Termz. Ert., vol. XII, p. 232, pl. VII, figs. 9, 10, 13 ; Ahlstrom, 1940, Bull. Amer. Mus. Nat. Hist., vol, 77, p. 155 ; Koste, 1978, ROTATORIA : Die Rädertiere Mitteleuropas, p. 94.

Material Examined : 20 parthenogenetic females.

Includes subtropical *B. caudatus personatus* (Figs. 21 & 22) and the pantropical *B. caudatus aculeatus* (Figs. 23 & 24). The former is identified by the size of its occipital spines and by its divergent posterior spines. The latter is notable for the presence of spur-like outgrowths on the inner side near base of each posterior spine.

Brachionus forficula Wierzjeski, 1891

1891. *Brachionus forficula* Wierzjeski, Bull. Soc. Zool. France, vol. 16, p. 51, fiig. 3 ; Ahlstrom, 1940, Bull. Amer. Mus. Nat. Hist., vol. 77. p. 162 ; Koste, 1978, ROTATORIA : Die Rädertiere Mitteleuropas, p. 95.



Figs. 15-24. *Trichocerca pusilla* (Lauterborn) : Fig. 15, lateral view (left side) ;
Trichocerca weberi Jennings : Fig. 16, lateral view (right side), Fig. 17, Trophi ;
Filinia pejleri Hutchinson : Fig. 18, lateral view ;
Brachionus calyciflorus calyciflorus Pallas : Fig. 19, dorsal view ;
Brachionus calyciflorus anuraeiformis (Brehm) Fig. 20, dorsal view ;
Brachionus caudatus personatus (Ahlstrom) : Figs. 21 & 22, ventral views ;
Brachionus caudatus aculeatus (Hauer) : Fig. 23, dorsal view, Fig. 24, ventral view.

Material Examined : 35 parthenogenetic females.

It is widely distributed in tropics and subtropics. This brachionid is presently represented by typical specimens exhibiting variable morphotypes (Figs. 25-27) and *B. forficula minor* (Figs. 28 & 29), which is notably much smaller than the former.

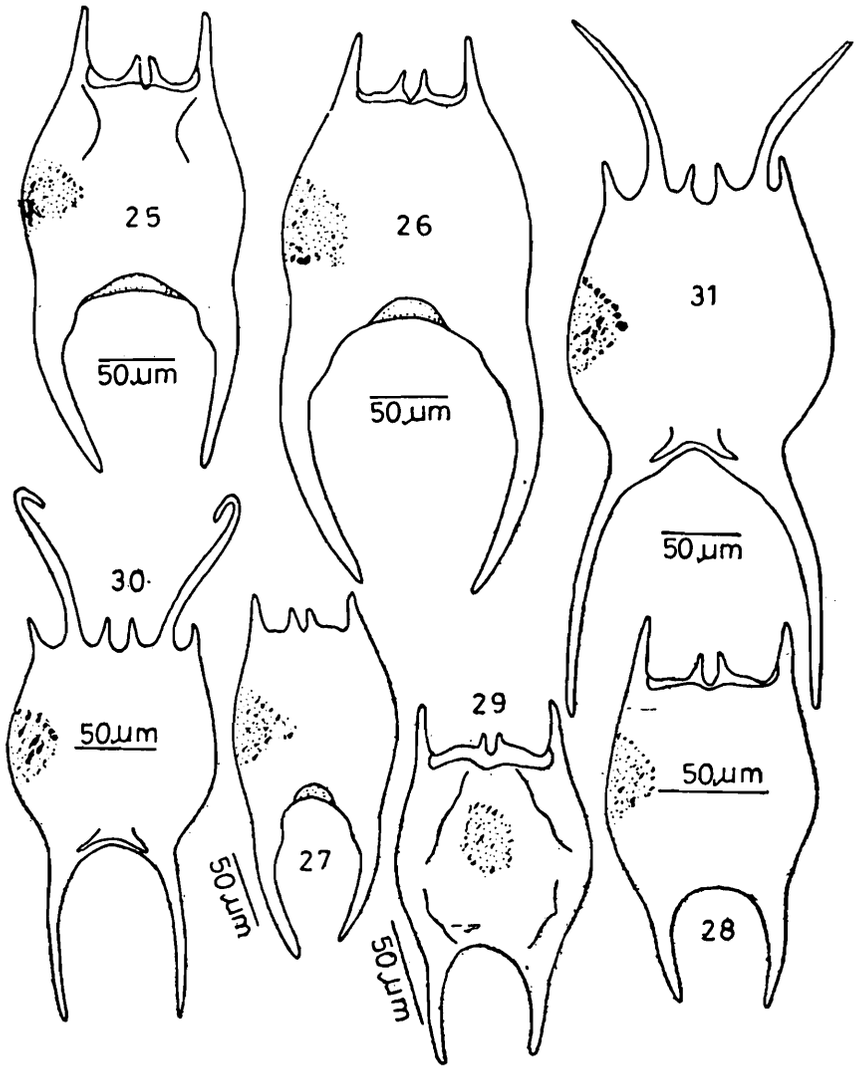
Brachionus falcatus Zacharias, 1898

1898. *Brachionus falcatus*, Forschungsbr. Biol. Stn. Plön, vol. 6, p, 133, pl. 1, fig. 4 ; Ahlstrom, 1940, Bull. Amer. Mus. Nat. Hist., vol. 77, p. 164 ; Koste & Shiel, 1983, Trans. R. Soc. S. Aust. vol. 107, p. 123-114.

1911. *Brachionus dichotomus* Shephard, Proc. Roy. Soc. Victoria, n. ser. vol. 24, p. 57, pl. 22, figs. 3, 4.

Material Examined : 40 parthenogenetic females.

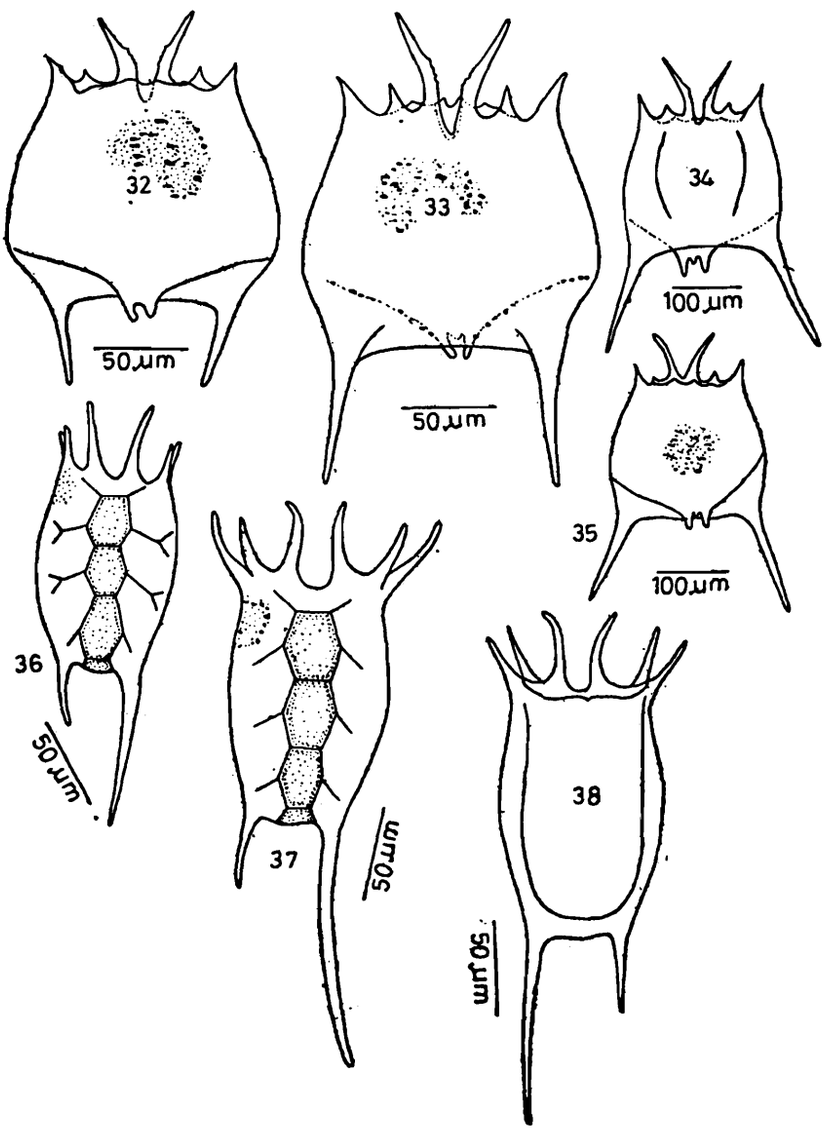
It is one of the variable species of *Brachionus* (Ahlstrom, 1940). Variations in this species were also observed by Chengalath *et al.*, (1973) from Sri Lanka and Koste & Shiel (1980, 83) from Australia. The previous Indian specimens resembled with slender S. E. Asian form (cf. Koste & Shiel, 1983, Fig. 3, f). However, the material from Darbhanga included two morphotypes (Figs. 30 & 31) which are identical with the material from Sri Lanka (Chengalath *et al.*, *loc. cit.* : Figs. 24 and 25).



Figs. 25-31. *Brachionus forficula* Wierzejski : Figs. 25 & 26, ventral views, Fig. 27, dorsal view ;
Brachionus forficula minor (Voronkov) : Figs. 28 & 29, ventral views ;
Brachionus falcatus Zacharias : Figs. 30 & 31, dorsal views (morphotypes).

Barchionus quadridentatus Hermann, 1783

1783. *Brachionus quadridentatus* Hermann, Naturforscher Halle, vol. 19, p. 47, Taf. II, fig. 9; Ahlstrom, 1940, Bull. Amer. Mus. Nat. Hist., vol. 77, p. 165, pl. XI, fig. 9, pl. XII, figs. 1-9, pl. XIII, fig. 3.
1786. *Brachionus bakeri* Müller, Anim. Infus., p. 359, Taf. XLVII, fig. 13, Taf. L, figs. 22, 23.
1803. *Brachionus quadricornis* Schrank, Fauna Boica Landshut, vol. 3, p. 134.
1803. *Brachionus bicornis* Schrank, Fauna Boica Landshut, vol. 3, p. 135.
1826. *Brachionus octodentatus* Bory de St. Vincent, Class. Anim. Micr., p. 83.
1830. *Noteus bakeri* Ehrenberg, Abh. Akad. Wiss. Berlin, p. 48.
1854. *Brachionus latissimus* Schmarda, Akad, Wiss, Wien, Math.-Naturw Klasse, vol. 7, p. 18, pl. IV, fig. 4.
1859. *Brachionus chilensis* Schmarda, Neue Wirbell. Thiere, vol. 1, p. 64, pl. XV, fig. 136.
1859. *Brachinous ancylognathus* Schmarda, Neue Wirbell. Thiere, vol. 1, p. 65, pl. XV, fig. 137.
1859. *Brachionus polyceros* Schmarda, Neue Wirbell. Thiere, vol. 1, p. 65, pl. XV, fig. 138.
1859. *Brachionus pustulatus* Schmarda, Nue Wirbell. Thiere, vol. 1, p. 65, pl. XV, fig. 139.
1889. *Brachionus longipes* Anderson, J. Asiat. Soc. Beng., vol. 58, p. 357, pl. XXI, fig. 12.
1892. *Brachionns tuberculus* Turner, Bull. Scil, Lab. Denison Univ., Granville, Ohio, vol. 6, p, 65, pl. I, fig. 6.
1894. *Brachionns entzii* France, Terms. Fuzt, Budapest, vol. 17, p. 166, pl. V, figs. 1, 2,



Figs. 32-38. *Brachionus quadridentatus quadridentatus* Hermann : Fig. 32, ventral view, Fig. 33, dorsal view ; *Brachionus quadridentatus melheni* (Barrois & Daday) : Fig. 34, dorsal view, Fig. 35, ventral view ; *Keratella tropica* (Apstein) : Figs. 36 & 37, dorsal views, Figs. 38, ventral view.

Material Examined : 15 parthenogenetic females.

Includes typical specimens (Figs. 32 & 33) and *B. quadridentatus melheni* (Figs. 34 & 35). The latter can be differentiated by its large median occipital spines, divergent and widely separated postero-lateral spines and relatively large spines flanking foot-opening.

Keratella tropica (Apstein, 1907)

1907. *Anurea valga* f. *tropica* Apstein, Zool. Jahrb. Syst., vol. 25, p. 210, Fig. F.
1921. *Anurea aculeata* var. *tropica* Tschughnov, Arb. Biol. Wolga Stat., vol. 6, figs. 13-14.
1926. *Keratella quadrata* Spandl, Arch Hydrobiol., vol. 16, fig. 4.
1934. *Keratella valga* f. *tropica* : Edmondson & Hutchinson, Mem. Conn. Acad. Arts Sci., vol. 10, Figs. 4 C-E.
1938. *Keratella quadrata valga* f. *asymmetrica* Ueno, Annot. Zool. Jap., vol. 17, figs. 16-17.
1943. *Keratella tropica* (Apstein) : Ahlstrom, Bull. Amer. Mus. Nat. Hist., vol. 80, p. 451, Pl. 42, Figs. 1-20 ; Berzins, 1955, Ark. Zool., vol. 8, p. 554, Figs. 2-3.

Material Examined : 25 parthenogenetic females.

Besides usual cyclomorphic variations in the length of the posterior spines, the examined material indicated narrow occipital margin (Fig. 36) and divergent occipital spines (Figs. 37 & 38).

REMARKS

Fifty five eurotatorian species (60 taxa) belonging to 15 families and 22 genera are documented in this account. Of these, *Trichocerca bicristata, T. rattus carinata, Mytilina ventralis macracantha Synchaeta* cf. *longipes* and *Filinia longiseta saltator* are new to India, while 40 taxa comprise new records from Bihar. The present study raised the number of known species from this state to 61 as against 24 species reported by earlier workers.

Cosmopolitan taxa comprise a dominant fraction (about 75%) of the studied fauna and a majority of them comprise eurytopic alkaline species. Tropical and subtropical elements are also well represented and these include *Brachionus caudatus personatus, B. caudatus aculeatus, B. diversicornis, B. mirabilis, B. forficula, B. forficula minor, Lecane curvicornis, L. ludwigi, L. leontina, L. papuana* and *Filinia pejleri.* Further, *Brachionus mirabilis, Epiphanes macrourus, Euchlanis triquetra, E. incisa, Beauchampiella eudactylota, Mytilina ventralis macracantha, Lecane signifera signifera, L. thalera, Trichocerca bicristata, T. rattus carinata, T. weberi, Synchaeta* cf. *longipes, Filinia longiseta saltator* and *Testudinella emarginula* are of regional biogeographical importance in Indian Rotifera.

The monogononts form a bulk of the documented species, while bdelloids are very poorly represented (only one species). Planktonic and periphytic elements are well observed. Lecanidae (14 species) and Brachionidae (12 species) are the dominant

families, while Trichocercidae, Filiniidae, Colurellidae and Euchlanidae are also important in this material. The rotifer community of Darbhanga proved to be fairly rich and diversified with regard to the overall generic and specific diversity. The species composition of planktonic taxa is broadly comparable with the adjacent state of West Bengal. However, common alkalophilic species like *Brachionus rubens* and *B. plicatilis* were not observed in the present collections, although they were previously reported from this state.

Horaëlla brehmi was an interesting element described from Bihar (Donner, 1949), but its absence in this study is notable. The dominance of the species of *Lecane*-complex and common occurrence of the various brachionids in general and *Brachionus* spp. in particular imparts a typically tropical character to the rotifer fauna of Darbhanga City.

Summary

This study revealed 55 species (60 taxa) belonging to 22 genera and 15 eurotatorian families. Five taxa are new to India while 40 taxa comprise new records from Bihar, thereby, raising the number of known species from this state to 61 species. Cosmopolitan elements form about 75% of the examined taxa. Tropical and subtropical species are also well represented. The members of the families Lecanidae and Brachionidae constitute an important component of the documented species, exhibiting a broadly tropical character.

Acknowledgements

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VERTEBRATE FAUNA OF TANSA WILDLIFE SANCTUARY, MAHARASHTRA

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INTRODUCTION

At the turn of the century, India's jungles were teeming with wildlife, but a lethal combination of senseless shikar and thoughtless habitat destruction has led to a sharp decline in a number of species.

To check our fast depleting wildlife, the Government of India has established a number of National Parks, Sanctuaries and Game reserves all over the country. Thanks to these, many species which would have joined the "extinct" list have been assured a future. The state of Maharashtra now has 4 National Parks, 21 Wildlife Sanctuaries and one Tiger reserve.

From 1984, the Zoological Survey of India has taken up a project on the survey of the faunal resources of conservation areas within the country. The present contribution is on one such area in Maharashtra. Ali & Ripley (1968), Ellerman & Morrison-Scott (1951), Daniel (1963-75), Day (1875-78), Deoras (1981), Jayaram (1981), Murthy (1985), Prater (1980) and Smith (1943) were consulted.

Just short of 90 km northeast of Bombay, cradled in the foothills of the Sahyadris (Western Ghats) lies the Tansa Wildlife Sanctuary. The sanctuary gets its name from Tansa river which dissects the 304 sq km area into two. This area had its importance as one of the earliest trade routes between the east and central Deccan. The river valley of Vaitarna also brought some of the earliest Aryan settlers. The Greek geographer, Ptolemy, (AD 135-150) had also mentioned about this area (Gazetter of India, 1982). Mahuli fort, situated on a 762 m high hill (highest in the sanctuary) of the same name, too finds a place in history. The fortification was built by the Mughals in the early 14th century. During its long history it was captured by a succession of invaders. Today the fort lies in ruins with only the wild animals as it inhabitants.

A number of tribal villages are present within the sanctuary. The tribals are mainly the Varlis, Malhar, Mahadev Kolis and the Katkaris. The latter are Kath (catechu) makers. They till the land but quite often sell firewood, wild honey and also hunt animals.

The Study Area

Topography :

Tansa wildlife sanctuary (Fig. 1) is situated in Thane district of Maharashtra state and lies between 19°35′ and 19°55′ north latitude and 73°20′ and 73°35′ east longitude. It is about 90 km by road from Bombay. The southeastern boundary of the sanctuary

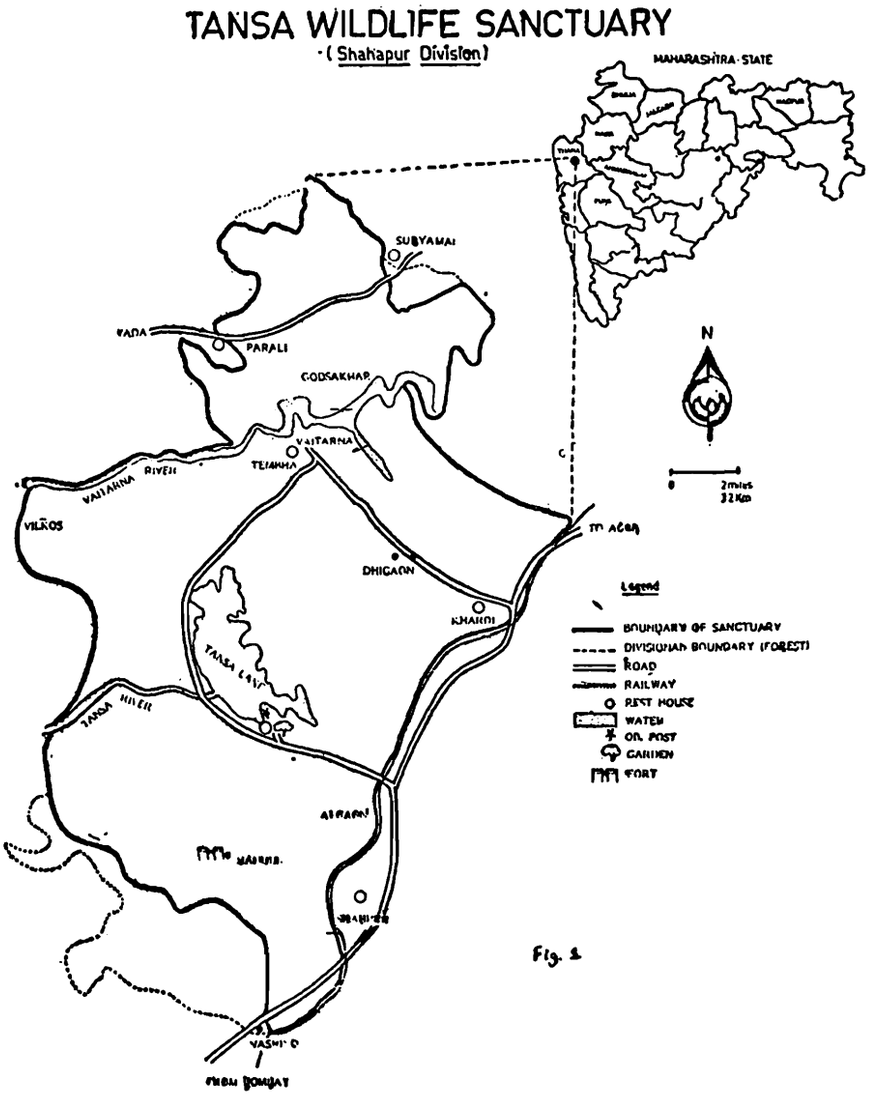

Fig. 1

Fig. 1. Moist deciduous forest of Tansa Sanctuary

adjoins the Bombay-Agra National Highway No. 3. The sanctuary can also be reached by a local train from Bombay (2 hrs journey), the alighting point being Atgaon Railway station. Tansa is just 13 km from the station. Although the road to the sanctuary is good, the transport arrangement is inadequate.

Tansa is a comparatively new sanctuary, being established in 1970. At that time its area was 216.75 sq. km, but later on in 1985 it was extended to 304.81 sq. km. This extension brought the Suryamal hill range (known tiger habitat) within the sanctuary cover. Now the sanctuary covers part of Shahpur, Vada and Mokhada talukas of Thane district.

From the ateep scarps of the Sahyadris (to the NE of Tansa), the land falls through a succession of plateaus towards the north-east and further westerwards. In the northeast lies the Jowhar-Mokhada plateau at an elevation of 300-400 m, that descends further to form Vada plateau in the west (150-300 on elevation). To the southeast of Vada plateau lies the Shahpur upland at an elevation of about 300 m. This plateau country which forms the sanctuary area is dotted with a number of spurs or offshoots from the Sahyadris mountains. Besides the western spurs of the Sahyadris, a number of isolated hills are present, the prominent being Mahuli, rising at a height of 762m, being situated in the southern part of the sanctuary. A ruined fort can still be seen at the top.

Rivers :

Two major rivers, the Vaitarna and Tansa drain the sanctuary area, the Vaitarna is the largest. It originates from the western slopes of the Sahyadris near Trimbakeshwar in Nasik district, at an altitude of about 670 m. It traverses a distance of about 126 km before meeting the Arabian sea. This river has a mention in the Mahabharata as one of the four sacred streams. The river has a catchment area of 2,572 sq. km. In 1948, a dam was constructed to form a reservoir name Modaksagar, having a water spread area of 9.06 sq. km. Water from this reservoir is drawn off and supplied to Bombay through a 77 km long pipeline. It is also a source of hydel power. The entire Modaksagar area now comes under the sanctuary limits.

Tansa river originates near Khardi village, traverses the sanctuary and finally meets Vaitarna. This river too has been dammed (1886) to form a reservoir having 19.42 sq. km water spread area. Water from this reservoir too is being supplied to Bombay.

Forest :

Tropical moist deciduous type of forest clothes the region (Dikshit, 1986) and comprises mainly of : Teak (*Tectona grandis*), Ain (*Terminalia tomentosa*), Khair (*Acacia catechu*). Haldu (*Adina cordifolia*), Kalam (*Stephegyne parvifolia*), Bibla (*Pterocarpus marsupium*), Palas (*Butea monosperma*), Dhavada (*Anogeissus latifolia*) and a few thickets of Bamboo (*Dendrocalamus strictus*).

The Fauna :

Tansa wildlife sanctuary contains a variety of fauna, representing 144 genera of Vertebrates. These have been listed in Appendix I alongwith their current status. Over 50 species of mamrls are known to inhabit this sanctuary. 37 species of birds were sighted during the surveys conducted in 1984 and 1986. Tigers have been reported from Suryamal range only in the northern part of the sanctuary while leopards prefer the hilly areas. The lesser cats such as the leopard cat and palm civet are also found here but being nocturnal, are seen less frequently. The Jackal is commonly seen.

Of the three species of deer that are found here, the mouse deer (*Tragulus meminna*) is rarely seen. The fourhorned antelope (*Tetracerus quadricornis*) is perhaps the most interesting ungulate. The males have two extra rudimentary horns which give the animal a unique distinction of being the only four horned species in the world.

Tansa has something for the bird watchers too : Darters, egrets, storks, Jacanas, are found near the lakes, while racket-tailed drongoes, golden orioles, tree pies, paradise flycatchers and many other species are seen in the nearby forest. About 37 species of birds have been sighted during the surveys.

Tansa sanctuary is the home of the muggar (*Crocodylus palustris*). It has been sighted in the Vaitarna. A few species of turtles and tortoises are found in and around the lakes, The Indian python, viper, cobra and krait also inhabit Tansa as do monitors and other lizards. The water of Tansa and Vaitarna abound with large-sized fishes like Catla, Channa and freshwater eel.

Although Tansa has an interesting variety of fauna, we think this region should be declared as a sanctuary for the four-horned antelope. This will offer complete protection for the survival of this species which is known to occur at only a few places in the Western ghats.

Recommendations

1. It should be declared a four-horned antelope sanctuary.
2. Attractive posters and display boards can be put up at Atgaon railway station and transport be provided for the public to take due notice of this sanctuary.
3. The zoo is presently too small and hence should be enlarged. Local fauna can be well represented here.
4. The facility of crocodile breeding at Tansa and Vaitarna reservoirs can be explored.

Summary

The vertebrate fauna of Tansa wildlife sanctuary (Maharashtra) was surveyed. 144 vertebrate genera were recorded from the area. Tiger was sighted from Suryamal range. Four-horned antelope is present in large numbers. The rusty spotted cat also makes its abode in this sanctuary. About 37 species of birds have been sighted during the surveys. The waters of Tansa and Vaitarna contain the Indian muggar and large-sized fishes like catla, channa and freshwatar eel.

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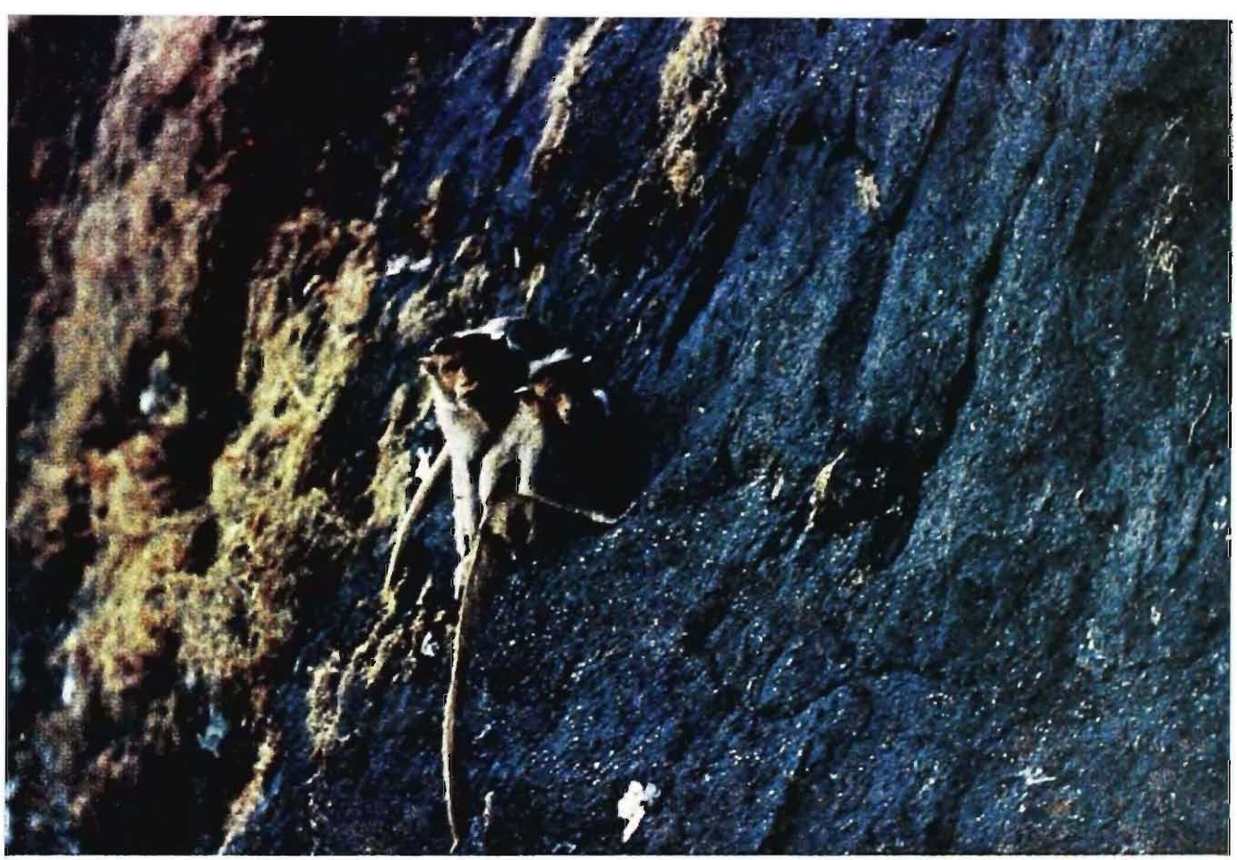
SINGH & PRADHAN PLATE 1

Modaksagar reservoir.

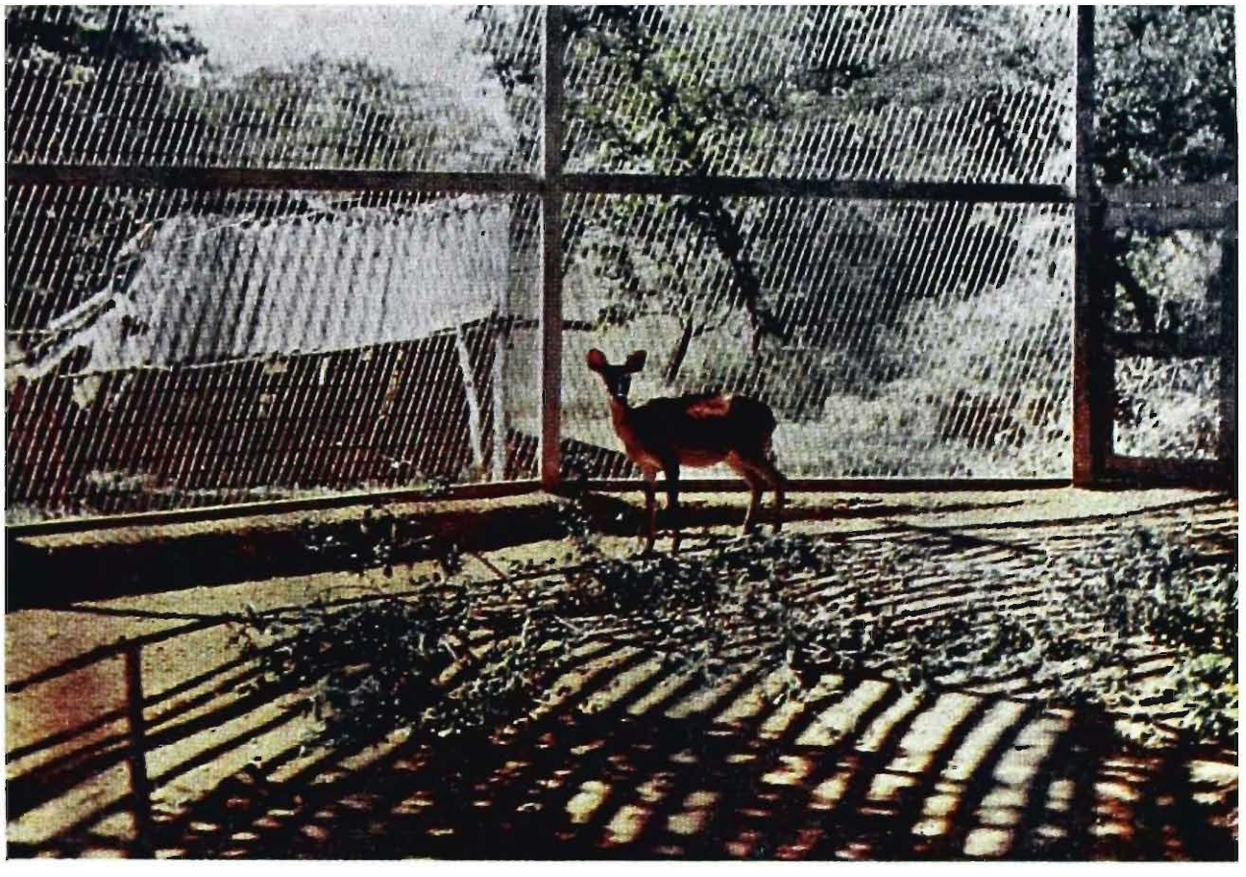
SINGH & PRADHAN

PLATE 2



Camera shy Bonnet monkeys in Tansa sanctuary.

SINGH & PRADHAN PLATE 3



Four-horned antelope captivity

Forest Department, for providing transport and other facilities during night observations. Thanks are also due to Dr. A. S. Mahabal, Scientist S. D. for checking the list of **bird** species.

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APPENDIX—I

Class : MAMMALIA

Order : INSECTIVORA

Family : SORICIDAE

1. **Suncus murinus** (Linn.) House Shrew

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

Status : Common near human habitations.

2. **Suncus stoliczkanus** (Anderson)

1877. *Crocidura* (*Pachyura*) *stoliczkana* Anderson. *J. Asiat. Soc. Bengal* 46 : 270, Bombay, India.

Status : Occasional, along river banks.

Order : CHIROPTERA
Suborder : MEGACHIROPTERA
Family : PTEROPIDAE

3. **Pteropus giganteus** (Brunnich) Flying fox

1782. *Vespertilio gigantea* Brunnich, *Dyrenes Historia* 1 : 45, Bengal, India.

Status : Common.

4. **Cynopterus sphinx** Vahl. Short-nosed fruit bat

1797. *Vespertilio sphinx* Vahl. *Skr. Nat. Selsk. Copenhagen*, 4, 1 : 123, Tranquebar, Madras, India.

Status : Common.

Suborder : MICROCHIROPTERA
Family : MEGADERMATIDAE

5. **Megaderma lyra** Geoffroy Indian False Vampire

1810. *Megaderma lyra* E. Geoffroy. *Ann. Mus. H. N. Paris*, 15 : 190 India.

Status : Occasional.

Family : RHINOLOPHIDAE

6. **Rhinolophus rouxi** Temminck Horse shoe Bat

1835. *Rhinolophus rouxi* Temminck, *Mon. Mamm.* 2 : 306 Pondicherry and Calcutta, India.

Status : Brosset (1962) reported this species from the Western Ghats.

7. **Rhinolophus lepidus** Blyth

1844, *Rhinolphus lepidus* Blyth, *J. Asiat. Soc. Bengal*, 13 : 486, Calcutta.

Status : Brosset (1962) reported this species from the Western Ghats.

8. **Hipposideros bicolor** (Temminck) Leaf-nosed Bat

1834. *Rhinolophus bicolor* Temminck, *Tijdschr. Natuur. Gesch.* 1. i, 19, Pl. 1, Fig. 3. Anjer Coast, Java.

Status : Brosset (1962) reported this species from the Western Ghats

Family : VESPERTILIONIDAE

9. **Myotis peshwa** (Thomas)

1915. *Leuconoe peshwa* Thomas *Jour. Bombay nat. Hist. Soc.* 23 : 611, Poona, Bombay, India.

Status : Distribution of this rare species has been reported from Thana district by Brosset (1962).

10. Pipistrellus ceylonicus (Kelaart) Kelaart's Pipistrelle

1852. *Scotophilus ceylonicus* Kelaart, *Prodr. Faun. Zeylan*, 22, Trincomalee, Ceylon.

Status : Common.

Order : PRIMATE
Family : CERCOPITHECIDAE

11. Macaca radiata (Geoffroy) Bonnet macaque

1812. *Cercocebus radiatus* E. Geoffroy, *Ann. Mus. H. N. Paris*, 19 : 98.

Status : Common. Sighted a small troop near Tansa lake.

12. Macaca mulatta (Zimmermann) Rhesus macaque

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

Status : Introduced. Forest authorities have confirmed the release of some domesticated Rhesus monkeys in the sanctuary.

13. Presbytis entellus (Dufresne) Langur

1797. *Simia entellis* Dufresne, *Bull. Soc. Philmon, Paris.* 1. 7 : 49 Bengal, India.

Status : Common.

Order : PHOLIDOTA
Family : MANIDAE

14. Manis crassicaudata Gray Indian Pangolin

1827. *Manis crassicaudata* Gray in *Griffith's Cuvier Anim. Kingd.* 5 : 282, India.

Status : Occasional.

Order : CARNIVORA
Family : CANIDAE

15. Canis aureus Linn. Jackal

1758. *Canis aureus* Linnaeus, *Syst. Nat. 10th ed.* 1 : 40, Province of Lar, Persia.

Status : Occasional.

16. Vulpes bengalensis (Shaw) Indian Fox

1800. *Canis bengalensis* Shaw, *Gen. Zool.* 1, 2 : 330, Bengal.

Status : Common.

Family : MUSTELIDAE

17. Lutra (Lutagale) perspicillata I. Geoffroy Smooth-coated Indian Otter

1826. *Lutra perspicillata* I. Geoffroy, *Dict. Class H. N.* 9 : 519, Sumatra.

Status : Occasional. A small group (2—3) of otters was sighted near Tansa lake by the forest officials.

Family : VIVERRIDAE

18. **Viverricula indica** Desmarest Small Indian Civet

1817. *Viverra indica* Desmarest, *Nouv. Dict. N. H.* 7 : 170.

Status : Common. Sighted in Tansa forest as well as Khardi village.

19. **Paradoxurus hermaphroditus** (Pallas) Common Palm Civit

1777. *Viverra hermaphrodita* Pallas in *Schreber. Saiigeth.* 36 : 426, India.

Status : Common.

Family : HERPESTIDAE

20. **Herpestes edwardsi** (Geoffroy) Common Mongoose

1837. *Ichneumon edwardsi* E. Geoffroy, *De scr. Egypte.* 2 : 139. "East Indies" (Madras, Pocock, 1933).

Status : Common.

21. **Herpestes smithii** Gray Ruddy Mongoose

1837. *Herpestes smithii* Gray, *Charlesu. Mag. N. H.* 1 : 578, said to be from near Bombay, India.

Status : Rare. Reported from areas near Bombay by Ellerman & Morrison-Scott, 1951.

Family : HYAENIDAE

22. **Hyaena hyaena** (Linn). Striped Hyaena

1758. *Canis hyaena* Linnaeus, *Gyst. Nat.* 10th ed. 1 : 40 Benna Mountains, Laristan, Southern Persia.

Status : Common.

Family : FELIDAE

23. **Felis libyca ornata** Gray Indian Desert Cat

1830. *Felis ornata* Gray, *Illustr. Ind. Zool. I.*, pl. 2, India,

Status : Rare. One specimen was sighted in the thick forested areas in core zone by forest officials in 1983.

24. **Felis chaus** Guldenstaedt Jungle Cat

1776. *Felis chaus* Guldenstaedt, *Nov. Com. Acad. Petrop.* 20 : 483, Terek River, north of Caucasus.

Status : Common. One specimen was sighted in the forest near Suryamal.

25. **Felis bengalensis** Kerr Leopard cat

1792. *Felis bengalensis* Kerr *Anim, Kingd.* 151, Southern Bengal,

Status : Occasional.

26. **Felis rubiginosa** Geoffroy Rusty-Spotted Cat

1851. *Felis rubiginosa* I. Geoffroy *Belanger. Voy. Ind. Orient. Zool.* 140. Pondicherry, Southern India.

Status : Rare. One specimen was sighted in the forested areas, west of Khardi village by the forest officials.

27. **Panthera pardus** (Linn.) Leopard or Panther

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

Status : Common

28. **Panthera tigris** (Linn.) Tiger

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

Status : A family of two was occasionaly sighted near Suryamal range by local tribals and forest authorities in 1986.

Order : ARTIODACTYLA

Family : SUIDAE

29. **Sus scrofa** Linn. Indian Wild Boar

1758. *Sus scrofa* Linnaeus, *Syst. Nat.* 10th ed. 1 : 49, Germany.

Status : Common.

Family : TRAGULIDAE

30. **Tragulus (Moschiola) meminna** (Frxleben) Mouse deer

1777. *Moschus meminna* Erxleben *Syst. Regn. Anim. Mamm.* 322 : Ceylon.

Status : Occasional.

Family : CERVIDAE

31. **Muntiacus muntjack** (Zimmermann). Barking deer

1780. *Cervus muntjack* Zimmermann, *Geogr. Gesch* 2 : 131, Java.

Status : Common.

32. **Axis axis** (Erxleben) Chital or Spotted deer

1777. *Cervus axis* Erxleben, *Syst. Regn. Anim.* : 312, Bank of Ganges, India.

Status : Common. A small herd was sighted in the forested areas, west of Khardi village.

33. **Cervus (Rusa) unicolor** Kerr Sambar

1792. *Cervus axis unicolor* Kerr, *Anim. Klngd.* 300, Ceylon.

Status : Occasional.

Family : BOVIDAE

34. **Tetracerus quadricornis** (Blainville) Chowsingha or Four horned antelope

1816. *Cercophorus (Cervicarya) quadricornis* Blainville, *Bull. Soc. Philom. Paris*, 75 and 78. **Plains of Peninsular India.**

Status : Occasional. A pair shot near Shahapur by poachers in 1986, was examined.

35. **Boselaphus tragocamelus** (Pallas) Nilgai or Blue Bull

1766. *Antilope tragocamelus* Pallas, *Misc. Zool.* 5. **Plains of Peninsular India.**

Status : Reported to inhabit the bordering forested areas of the sanctuary. Forest authorities and tribals have confirmed the occurrence of a small group.

Order : LAGOMORPHA

Family : LEPORIDAE

36. **Lepus nigricollis** Cuvier Black-naped Hare

1823. *Lepus nigricollis* F. Cuvier, *Dict. Sci. Nat.* 26 : 307, Madras.

Status : Common.

Order : RODENTIA

Family : SCIURIDAE

37. **Funambulus pennanti** Wroughton Five striped Palm Squirrel

1905. *Fuuambulus pennanti* Wroughton, *Jour. Bombay nat. Hist. Soc.* 16 : 411, Mandvi taluka, Surat dist. Gujarat, India.

Status : Common.

38. **Funambulus t. tristriatus** (Waterhouse) Jungle striped Squirrel

1837. *Sciurus tristriatus* Waterhouse, *Charlesworth's Mag. nat. Hist.* 1 : 496.

Status : Common. (One specimen, Reg. No. M/461 was collected from bordering locality-Jawahar).

Family : HYSTRICIDAE

39. **Hystrix indica** Kerr Indian Porcupine

1792. *Hystrix cristata* var. *indica* Kerr, *Anim. Kingd.* 213, India.

Status : Common.

Family : MURIDAE

40. **Tatera indica indica** (Hardwicke) Indian Gerbil or Antelope rat

1807. *Dipus indicus* Hardwicke, *Trans. Linn. Soc. London*, 8 : 279, Northern India.

Status : Commonly seen in paddy fields in the buffer zone.

41. **Vandeleuria oleracea** (Benett) Longtailed Tree mouse

1832. *Mus oleracea* Bennett, *FZS*, 121, Deccan, India.

Status : Occasional.

42. **Millardia m. meltada** (Gray) Metad or softfurred field rat

1837. *Golunda meltada* Gray, *Mag. Nat. Hist.* 1 : 586.

Status : Occasional.

43. **Rattus blanfordi** (Thomas) White tailed wood rat

1881. *Mus blanfordi* Thomas, *Ann. Mag. N. H.* 7 : 24, Madras, India.

Status : Occasional.

44. **Rattus rattus rufescens** (Gray) House rat

1837. *Mus rufescens* Gray, *Ann. Mag. N. H.* 1 : 585, Dharwar India.

Status : Common.

45. **Mus musculus castaneus** (Waterhouse) House mouse

1843. *Mus castaneus* Waterhouse, *Ann. Mag. N. H.* 12 : 134, Philippine Islands.

Status : Common.

46. **Mus musculus homourus** Hodgson

1845. *Mus homourus* Hodgson, *Ann. Mag. N. H.* 15, 268, Nepal.

Status : Common.

47. **Mus booduga** (Gray) Indian Pygmy Field mouse

1837. *Leggada booduga* Gray, *Charlesworth's mag, N. H.* 1 : 586, Southern Mahratta, India.

Status : Common.

48. **Mus dunni** (Wroughton)

1912. *Leggada dunni* Wroughton *Jour. Bombay nat. Hist. Soc.* 21 : 339, Ambala, Punjab.

Status : Occasional.

49. **Mus (Pyromys) platythrix platythrix** Bennett Indian Spiny mouse

1832. *Mus platythrix* Bennett, *PZI*, 121, Deccan, India.

Status : Occasional.

50. **Mus (Pyromys) saxicola** Elliot

1839. *Mus saxicola* Elliot, *Madras J. Litt. Sci.* 10 : 215, Madras.

Status : Occasional.

51. **Golunda ellioti ellioti** Gray Indian Bush rat

1837. *Golunda ellioti* Gray, *Charlesworthe's ma. nat. Hist.* **1** : 586, Dharwar, India.

Status : Common. One specimen (Reg. No. M/422) was collected from paddy field near the bordering area of Jawhar.

52. **Golunda ellioti gujerati** Thomas

1923. *Golunda ellioti gujarati* Thomas, *Jour. Bombay nat. Hist. Soc.* 29 : 2, Palanpur, Gujarat.

Status : Occasional. Two specimens (Reg. No. M/344 & M/345) were collected from bushes near the bordering areas.

53. **Bandicota bengalensis kok** Gray Lesser Bandicoot or Indian mole rat

1837. *Mus kok* Gray, *Charlesworth's mag. nat. Hist.* **1** : 585, Dharwar, India.

Status : Common.

54. **Bandicota indica indica** (Bechstein) large Bandicoot Rat

1800. *Mus indicus* Bechstein, *Veber Viert Thiere* 2 : 497, Pondicherry, India.

Status : Common.

Class : AVES
Order : PODICIPEDIFORMES
Family : PODICEPEDIDAE

1. **Podiceps ruficollis capensis** Salvadori Dabchick

1884. *Podiceps capensis* Salvadori, *Ann. Mus. Civ. Genova*, (2), I : 252, Shoa, Africa.

Status : Common.

Order : PELECANIFORMES
Family : PHALACROCORACIDAE

2. **Phalacrocorax niger** (Viellot) Little Cormorant

1817. *Hydrocorax niger* Viellot, *Nouv. Dict. Hist. Nat.* **8** : 88, East Indies, Bengal.

Status : Resident.

3. **Anhinga rufa melanogaster** Pennant Darter or Snake Bird

1769. *Anhinga melanogaster* Pennant, *Indian Zool.* **13** : 12, Ceylon.

Status : Common.

Order : CICONIIFORMES
Family : ARDEIDAE

4. **Ardeola g. grayii** (Sykes) Indian Pond Heron

1832. *Ardea grayii* Sykes, *Proc. Zool. Soc. London* : 158.

Status : Common in ponds.

5. **Bubulcus ibis coromandus** (Boddaert) Cattle Egret

1783. *Cancroma coromanda* Boddaert *Table. Pl. enlum* : 54.

Status : Common.

Family : CICONIIDAE

6. **Egretta g. garzetta** (Linn.) Little Egret

1766. *Ardea garzetta* Linnaeus, *Syst. Net. ed.* 12 : 1 : 237.

Status : Common.

7. **Anastomus oscitans** (Boddaert) Openbill Stork

1783. *Ardea oscitans* Boddaert, *Table Pl. enlum.* : 55, Pondicherry.

Status : Common.

Family : THRESKIORNITHIDAE

8. **Pseudibis papillosa papillosa** (Temminck) Indian Black Ibis

1824. *Ibis papillosa* Temminck *Pl. Col. Livr.* 51 pl. 304, India.

Status : Common.

Order : ANSERIFORMES

Family : ANATIDAE

9. **Tadorna ferruginea** (Pallas) Brahminy Duck

1764. *Anas ferruginea* Pallas, *Vroeg, Cat. d, Ois, Adumbr :* 5, Tartary.

Status : Winter migratory.

10. **Anas c. crecca** Linn Common Teal

1758. *Anas crecca* Linnaeus, *Syst. Nat.* ed. 10, 1 : 126, Sweden.

Status : Common.

Order : FALCONIFORMES

Family : ACCIPITRIDAE

11. **Accipter badius dussumieri** (Temminck) Indian Shikra

1824. *Falco dussumieri* Temminck, *Pl. Col. Live.* : 52, Bengal India.

Status : Common.

Order : GALLIFORMES

Family : PHASIANIDAE

12. **Pavo cristatus** Linnaeus Indian Peafowl

1758. *Pavo cristatus* Linnaeus, *Syst. Nat.* ed. 10, 1 : 156, India.

Status : Common.

Order : GRUIFORMES
Family : RALLIDAE

13. **Amaurornis phoenicurus chinensis** (Boddaert) White Breasted water hen

1783. *Fulica chinensis* Boddaert, *Table Pl.* enlum, : 54, China.

Status : Common.

14. **Porphyrio porphyrio poliocephalus** (Latham) Indian Purple Moorhen

1801. *Gallinula poliocephala* Latham, *Index Orn. Suppl.* 68, India.

Status : Common.

15. **Fulica a. atra** Linn, Coot

1758. *Fulica atra* Linnaeus *Syst. Nat.* ed. 10, 1 : 152, Europe.

Status : Common.

Order : CHARADRIFORMES
Family : JACANIDAE

16. **Hydrophasianus chirurgus** (Scopoli) Pheasant-tailed Jacana

1786. *Tringa chirurgus* Scopoli, *Del. Flor. et Faun. Insubr., Fasc.* 2 : 92.

Status : Common.

17. **Metopidius indicus** (Latham) Bronzewinged Jacana

1790. *Parra indica* Latham, *Index Orn.* 2 : 765, India.

Status : Common.

Order : PSITTACIFORMES
Family : PSITTACIDAE

18. **Psittacula krameri manillensis** (Bech.) Roseringed Parakeet

1800. *Psittacula manillensis* Bechstein, *Stubenvogel*, 2nd Gotha ed. : 612, Phillippines.

Status : Common.

Order : CUCULIFORMES
Family : CUCUKIDAE

19. **Eudynamys s scolopacea** (Linn.) Koel

1758. *Cuculus scolopaceaus* Linnaeus, *Syst. Nat. ed. 10* : 1 : 111, Malabar.

Status : Common.

20. **Centropus s. sinensis** (Stephens) Crow-pheasant

1815. *Polophilus sinensis* Stephens in Shaw's *Genl. Zool.* 9 (1) : 51, China.

Status : Common.

Order : STRIGIFORMES
Family : STRIYIDAE

21. **Tyto alba stertens** Hartert Indian Barn Owl

1929. *Tyto alba startens* Hartert, *Nov. Zool. Soc.* 35 : 98, Cachar.

Status : Common.

22. **Bubo bubo bengalensis** (Franklin) Great Horned Owl

1831. *Otus bengalensis* Franklin, *Proc. Zool. Soc. London* : 115, Ganges.

Status : Common.

Order : CORACIFORMES
Family : ALCECEDIDAE

23. **Ceryle rudis leucomelanura** Reichbach Pied Kingfisher

1851. *Ceryle leucomelanura* Reichenbach, *Handb. Spec. Orn.* 21, Ceylon.

Status : Common.

24. **Alcedo atthis bengalensis** Gmelin Small Blue Kingfisher

1788. *Alcedo bengalensis* Gmelin, *Syst. Nat.* 1 (1) : 450, Bengal.

Status : Common.

25. **Haloyon smyrensis fusca** (Boddaert) White brested Kingfisher

1783. *Alcedo fusca* Boddaert *Table Pl. enlum* : 54, Malabar Coast.

Status : Common.

Family : MEROPIDAE

26. **Merops o. orientalis** Latham Common Green Bee-eater

1790. *Merops orientalis* Latham, *Index Orn. Suppl.* xxxiii, India.

Status : Common.

Order : PASSERIFORMES
Family : ORIOLIDAE

27. **Oriolus oriolus kundoo** Sykes Golden Oriole

1832. *Oriolus kundoo* Sykes, *Proc. Zool. Soc. London*, 187, Dukhun.

Status : Common,

Family : DICRURIDAE

28. **Dicrurus adsimilis albirictus** (Hodgson) Black Drongo

1836. *Bhuchanga albirictus* Hodgson, *Ind. Rev.* 1 (8) : 326, Nepal,

Status : Common.

29. **Dicrurus paradiseus grandis** (Gould) Racket-tailed Drongo

1836. *Edolins grandis* Gould, *Proc. Zool. Sco. London*, 5, Nepal.

Status : Common.

Family : STURNIDAE

30. **Acridotheres t. tristis** (Linn) Indian Myna

1766. *Paradisea tristis* Linnaeus, *Syst. Nat. ed.* 12, 1 ; 167, Calcutta.

Status : Common.

Family : PYCNONOTIDAE

31. **Pycnonotus c. cafer** (Linn.) Redvented Bulbul

1766. *Turdus cafer* Linnaeus, *Syst. Nat.* ed. 12, 1 : 295, Pondicherry.

Status : Common.

32. **Pycnonotus jocosus fuscicaudatus** (Gould) Redwhiskered Bulbul

1866. *Otocompsa fuscicaudata* Gould, *Proc. Zool. Sco. London*, 3 : 664, Madras.

Status : Common.

Family : MUSCICAPIDAE

33. **Pellorneum r. ruficeps** Swainson Spotted Babbler

1832. *Pellorneum rufiieaps* Swainson *Fauna Boreoli-Americana* : 487, India.

Status : Common.

34. **Terpsiphone p. paradisi** (Sinn.) Paradise flycatcher

1758. *Corvus paradisi* Linnaeus, *Syst. Nat.* ed. 10, 1 : 107, India.

Status : Common.

Family : CORVIDAE

35. **Dendrocitta vagabunda pallida** (Blyth) Tree Pie

1846. *Cr.* (*ypsirina*) *pallida* Blyth *Jour. Asiat. Soc. Bengal*, 15 : 30, Western Himalaya.

Status : Common.

Familly : MOTACILLIDAE

36. **Motacilla c. caspica** (Gmelin) Wagtail

Status : Winter migratory.

Family : PLOCEDIAE

37. **Ploceus phillippinus phillippinus** (Linn.) Indian Baya

1766. *Loxia phillippina* Linnaeus, *Syst. Nat.* ed. 12, 1 ; 305, Ceylon.

Status : Common.

Class : REPTILIA
Order : LORICATA
Family : CROCODILIDAE

1. **Crocodylus palustris** Lesson Marsh crocodile

1834. *Crocodylus palustris* Lesson, *Belang. Voy. Ind. Or. Zool.* 305, Ganges.

Status : Occasionally seen in Vaitarna river.

Order : TESTUDINES
Family : EMYDIDAE

2. **Geomyda trijuga** (Schweigger) Pond Tortoise

1814. *Emys trijuga* Schweigger, *Prodr. Monog. Chel.* : 41, Java.

Status : Occasionally trapped in fishermen's net

Order : SQUAMATA
Suborder : SAURIA
Family : GEKKONIDAE

3. **Hemidactylus brooki** Gray House Gecko

1845. *Hemidactylus brooki* Gray, *Cat. Liz. Brit. Mus.* : 153, Borneo.

Status : Common.

4. **Hemidactylus maculatus** Dum & Bibr. Rock Gecko

1836. *Hemidactylus maculatus* (in part) Dum & Bibr. *Exp. Gen.* iii : 358, India (Bombay).

Status : Occasional.

Family : AGAMIDAE

5. **Calotes versicolor** (Daudin) Common Calotes

1802. *Agama versicolor* Daudin, *Hist. Nat. Rapt. iii* : 395, India.

Status : Occasionally seen.

Family : SCINCIDAE

6. ***Mabuya macularia*** Blyth Skink

1853. *Euprepes macularius* Blyth *J. Asiat. Soc. Beng.* xxiii : 652, Bengal.

Status : Common.

Family : VARANIDAE

7. **Varanus bengalensis** Linnaens Common Monitor

1758. *Lacerta bengalensis* Linnaeus, *Syst. Nat.* ed. x : 201, India.

Status : Occasionally seen.

Suborder : SERPENTES
Family : TYPHLOPIDAE

8. **Typhlops braminus** Daudin Common Worm snake

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

Status : Occasional,

9. **Python molurus** (Linnaeus) Indian Python

1758. *Coluber molurus* Linnaeus, *Syst. Nat.* ed. 10th : 225, India.

Status : Rarely seen.

10. **Eryx johnii** (Russell) Red or Blunt-tailed sand boa

1801. *Boa johnii* Russell *Ind. Serp.* ii : 18 & 20 pls. xvi & xvii, Tranquebar.

Status : Occasionally seen.

11. **Fryx conicus** (Schn.) Common sand boa

1796. In Russell, *Ind. Serp.* i : 5, Madras.

Status : Common.

Family : COLUBRIDAE

12. **Elaphe helena** Daudin Trinket snake

1796. In Russell, *Ind. Serp.* i : 37, pl. 32, Vizagapatam.

Status : Occasionally met with.

13. **Ptyas mucosus** (Linn.) Dhaman or rat snake

1758. *Coluber mucosus* Linnaeus, *Mus. Ad. Frid.* I : 37 pl. 23, India.

Status : Common.

14. **Argyrogena fasciolatus** (Shaw)·Banded Racer

1796. In Russell, *Ind. Serp*, i : 26 pl. xxi, India.

Status : Occasionally seen.

15. **Lycodon aulicus** (Linn.) Wolf snake

1754. *Coluber aulicus* Linnaeus, *Mus. Adolph. Frider.* I : 29 pl. xii.

Status : Occasionally seen.

16. **Oligodon taeniolatus** (Jerdon) Kukri snake

1853. *Coronella taeniolata* Jerdon, *J. Asiatic. Soc. Bengal* xxii : 528.

Status : Occasional.

17. **Dendrelaphis tristis** (Daudin) Indian Bronze-back Tree snake

1803. *Coluber tristis* Daudin, *Hist. Nat, Rept.* vi : 430.

Status : Occasional.

18. **Natrix piscator** (Schn.) Checkered Keelhack

1799. *Hydrus piscator* Schneider, *Hist. Amph.* i : 247, East Indies.

Status : Common.

19. **Ahaetulla nasuta** (Lacépède) Vine snake

1789. *Coluber nasutus* Lacépedè, *Hist. Nat. Serp.* i : 100 & ii, Ceylon.

Status : Occasionally seen.

Family : ELAPIDAE

20. **Bungarus caeruleus** (Schn.) Common Indian Krait

1801. *Pseudoboa caerulea* Schneider, *Hist. Amphib.* ii : 284, Vizag.

Status : Occasionally seen.

21. **Naja naja** (Linn.) Common Cobra

1758. *Coluber naja* Linnaeus, *Syst. Nat.* ed. 10th : 221, India.

Status : Occasionally seen.

Family : VIPERIDAE

22. **Vipera russelli** Shaw, Russell's Viper

1797. *Coluber russelli* Shaw, *Nat. Misc.* viii, pl. 291.

Status : Occasionally seen.

23. **Echis carinatus** (Schn.) Saw-scaled Viper

1801. *Pseudoboa carinatus* Schneider, Hist. Amphib, ii : 285.

Satus : Common.

24. **Trimeresurus gramineus** (Shaw) Bamboo Pit Viper

1802. *Coluber gramineus* Shaw, *Gen. Zool.* iii : 420, Vizagapatam.

Status : Rare in the region.

Class : AMPHIBIA
Order : SALIENTIA
Family : BUFONIDAE

1. **Bufo melanostictus** Schn. Common Indian Toad

1799. *Bufo melanostictus* Schneider, *Hist. Amph. Jena*, I : 216.

Status : Common.

Family : MICROHYLIDAE

2. **Microhyla ornata** (Dum & Bibr.) Ornate Microhylid

1841. *Emgystoma ornatum* Dumeril & Bibron *Erpet. Gen. Paris*, 8 : 745.

Status : Occasionally seen.

Family : RANIDAE

3. **Rana cyanophlyctis** Schn. Skipper frog

1799. *Rana cyanophylictis* Schneider, *Hist. Amph. Jena*, 1 : 137.

Status ; Common.

4. **Rana tigrina** Daudin Bull frog

1803. *Rana tigrina* Daudin *Hist. Rain. Gren. Crap.* : 64, pl. 20.

Status : Common.

5. **Rana limmocharis** Weigmann Indian Cricket frog

1835. *Rana limnocharia* Weigmann, *N. Acta Ac. Leop. Carol.* 17 (1) : 255.

Status : Occasional.

The following species of fishes are collected from Tansa and Vaitarna rivers.

Order : OSTEOGLOSSIFORMES

Family : NOTOPTRIDAE

1. **Notopterus notopterus** (Pallas)

1769. *Gymnotus notopterus* Pallas, *Spicil. Zool.* Petersburg 7 p. 40, pl. 6, fig. 2. Type-loc Indian Ocean.

Order : CYPRINIFORMES

Family : CYPRINIDAE

2. **Barilius bendelisis** (Ham.)

1822. *Cyprinus bendelisis* Hamilton, *Fishes of Ganges*. Edinburgh, pp. 270, 385. Type-loc : Rivers of Mysore.

3. **Danio aequipinnatus** (McClelland)

1839. *Perilampus aequipnnatus* Mc Clelland, *Asiatic Res.* Calcutta, 19, p.3, pl. 60. Fig 1. Type-loc : Assam.

4. **Rasbora daniconius** (Hamilton)

1822. *Cyprinus daniconius* Hamilton *Fishes of Ganges*. Edinburgh, pp 327, 329, pl. 15, fig. Type-loc : Rivers of southern Bengal.

5. **Labeo rohita** (Hamilton)

1822. *Cyprinus rohita* Hamilton, *Fishes of Ganges*, Edinburgh, pp. 301, 388, pl. 36, fig. 85. Type-Loc : Freshwater rivers of Gangetic Provinces.

6. **Labeo boggut** (Sykes)

1841. *Chondrostoma boggut* Sykes, *Trans. Zool. Soc.* London, 2, p. 359, Type-loc : Poona.

7. **Catla catla** (Ham.)

1822. *Cyprinus catla* Hamilton. *Fishes of Ganges* Edinburgh, pp 287, 318, 387, pl. 13, fig 81. Type-loc : Rivers and tanks of Bengal.

8. **Cirrhinus mrigala** (Ham.)

1822. *Cyprinus mrigala* Hamilton. *Fishes of Ganges,* Edinburgh, pp 279, 386, pl. 6. Type-loc : Pends and freshwater rivers of Gangetic Provinccs.

9. **Puntius amphibius** (Val.)

1842. *Capoeta amphibia* Valenciennes. *Hist. Nat. Poissons,* Paris, 16, pp 282, pl. 478, Type-loc : Bombay.

10. **Puntius sarana** (Ham.)

1822. *Cyprinus sarana* Hamilton, *Fishes of Ganges,* Edinburgh, pp. 307, 388, Type-Loc : Ponds and rivers of India.

11. **Puntius ticto** (Ham.)

1822. *Cyprinus ticto* Hamilton, *Fishes of Ganges,* Edinburgh pp. 314, 389, pl. 8, fig. 87, Type-Loc : South east part of Bengal.

12. **Garra gotyla** (Gray)

1832-33. *Cyprinus gotyla* Gray *Ill. Indian Zoology* 2 pl 88, Figs 3, 3A, Type-Loc : Northern India.

13. **Garra mullya** (Sykes)

1841. *Chondrostoma mullya* Spkes, *Trans. Zool. Soc.* London 2, p. 359, pl. 62, fig. 3. Type-Loc : Poona.

Family : COBITIDAE

14. **Lepidocephalus (Lepidocephalichthys) guntea** (Ham)

1822. *Cobitis guntea* Hamilton, *Fishes of Ganges,* Edinburgh, pp. 353, 394, Type-Loc : Ponds and freshwater rivers of Bengal.

15. **Noemacheilus denisonii** Day

1867. *Noemacheilus denisonii* Day, Proc. Zool. Soc. Lond. p. 287, Type-Loc : not given.

16. **Oreonectes evezardi** (Day)

1878. *Nemachilus evezardi* Day, *Fish. India,* p. 613, fig 11, Type-Loc : Poona.

Order : SILURIFORMES

Family : BAGRIDAE

17. **Mystus seenghala** (Sykes)

1839. *Platystomus seenghala* Sykes, *Trans. Zool. Soc.* Lond. 2, p. 371, Type-loc : Mola Mota river at Poona.

18. **Aorichthys aor** (Ham.)

1822. *Pimelodus aor* Hamilton, *Fishes of Ganges*, pp 205, 379, pl. 20, fig. 68. Type-Loc : Rivers of Bengal and upper parts of Gangetic estuaries.

Family : HETEROPNEUSTIDAE

19. **Heteropneustes fossilis** (Bloch)

1794. *Silurus fossilis* Bloch, *Auslandische Fische*, Berlin, 6, p. 370, fig. 2. Type-Loc : Tranquebar.

Order : ATHERINIFORMES

Family : POECILIDAE

20. **Gambusia affinis** (Baird and Girard)

1853. *Heterandia patruelis* Baird and Girard, *Proc. Acad. nat. Sci.* Philad, 6, p. 360, Type-Loc : Rio Sabinal, Texas, U. S. A.

Family : CYPRINODONTIDAE

21. **Aplocheilus lineatum** (Val.)

1846. *Panchax lineatum* Valencinnes, *Hist. Nat. Poissons*, Paris, 18, p, 381, Type-Loc : Bombay.

Order : CHANNIFORMES

Fsmily : CHANNIDAE

22. **Channa marulius** (Ham.)

1822. *Ophiocephalus marulius* Hamilton, *Fishes of Ganges*, pp. 65, 367, pl. 17, fig. 19. Type-Loc : Ponds and freshwater rivers of India.

23. **Channa punctatus** (Bloch)

1793. *Ophiocephalus punctatus* Bloch, *Auslandische Fische*, Berlin, 6, p. 139, pl. 358, Type-Loc : Malabar.

Order : PERCIFORMES

Family : CHANDIDAE

24. **Ambassis ranga** (Ham.)

1822. *Chanda ranga* Hamilton, *Fishes of Ganges*, Edinburgh, p. 113, 371, pl. 16, fig. 38. Type-Loc : Freshwater rivers of Gangetic Provinces.

Family : GOBIIDAE

25. **Glossogobius giuris** (Ham.)

1822. *Gobius giuris* Hamilton, *Fishes of Ganges*, Edinburgh, pp. 51, 366, pl. 33, fig 15. Type-Loc : Ponds and freshwater rivers of Gangetic Provinces.

Order : MASTACEMBELIFORMES

Family : MASTACEMBELIDAE

26. **Mastacembelus guentheri** Day, **Proc. Zool. Soc.** London, p. 37.

Rec. zool. Surv. India, 91 (3-4) : 471-474, 1992

DISTRIBUTION OF FIDDLERS IN INDIA

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More than sixty two species of fiddler crabs thrive in the tropical and subtropical regions of the world, of which nine species taxonomised under five subgenera have been reported to occur in the East, West coasts and the Andaman and Nicobar Islands of India (Fig. 1). The differential distribution of tropical and temperate fiddlers is considered to be the result of differential genotypic expressions of the ability to withs-

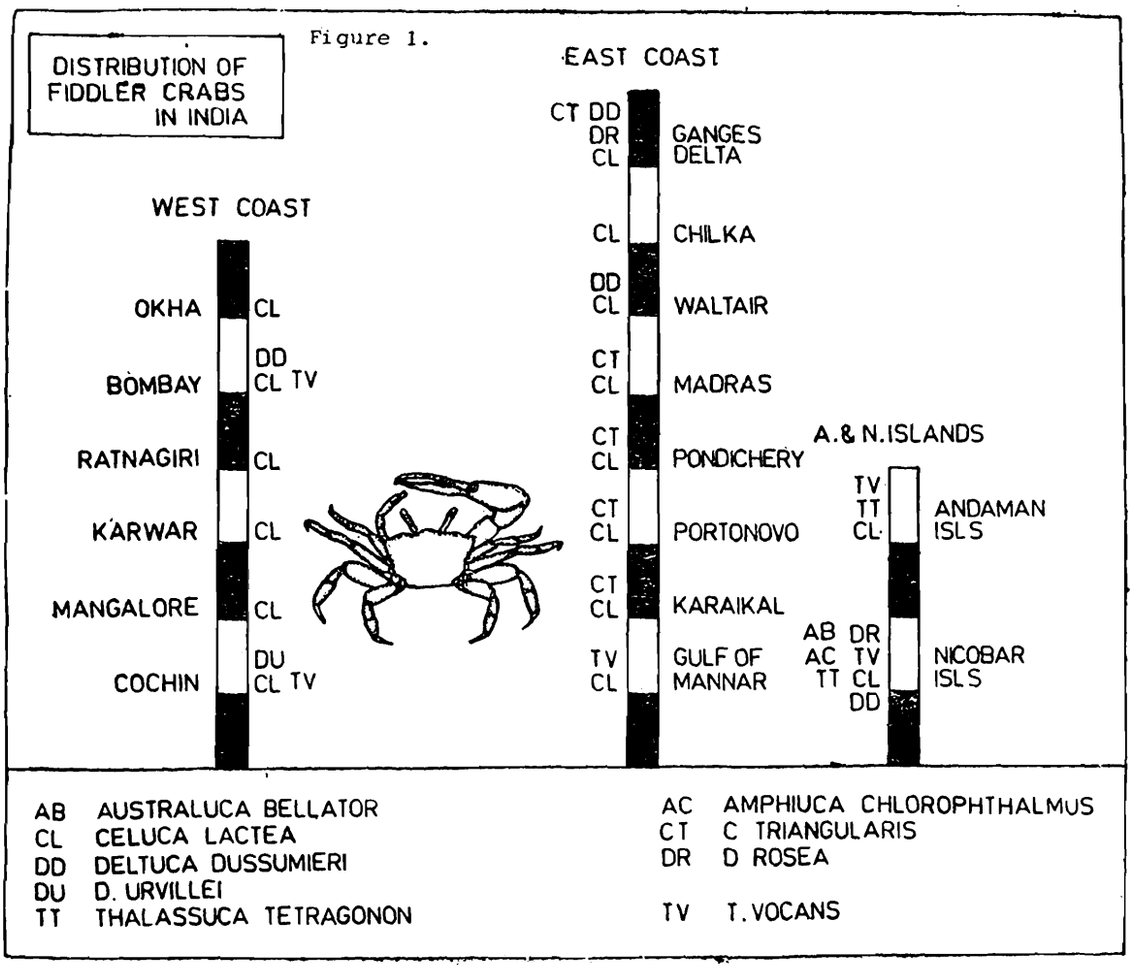


Fig. 1

tand extremes of temperature (Vernberg and Tashian, 1959). Vernberg (1959 a, b) noticed pronounced physiolgical differences between tropical and temperate fiddlers and stated that during evolution and distribution different patterns of thermal acclimation

have resulted. The available literature on the distribution of fiddlers in India is scattered and hence this attempt to present a comprehensive list with a note on taxonomy.

From the distribution point of view, *Uca* (*Thalassuca*) *vocans*, *U.* (*T.*) *tetragonon* *U.* (*Deltuca*) *rose*, *U.* (*Celuca*) *triangularis* and *U.* (*Amphiuca*) *chlorophthalmus* are tropical Indo-Pacific ; *U.* (*C.*) *lactea* and *U.* (*D.*) *dussumieri* are Indo-Pacific ; *U.* (*D.*) *urvillei* tropical anp subtropical western Indo-Pacific and *U.* (*Australuca*) *bellator central* Indo-Pacific. The record of the presence of *U.* (*Australuca*) *bellator* at Nancowry of the Nicobar group of Islan has been considered to be questionable by Crane (1975) due to the dubious, inherently impossible to somewhat unlikely place of occurrence. This view remains to be verified.

In the Wess coast, four species belonging to three subgenera recorded i. e. *U.* (*C.*) *lactea*, *U.* (*D.*) *dussumieri*, *U.* (*D.*) *urvillei*, and *U.* (*T.*) *vocans* are of common occurrence *Uca marionis* has been synonimised to be *U.* (*T.*) *vocans* ; *vocans* extends from the west coast (Bombay) to the South-east coast (Gulf of Mannar).

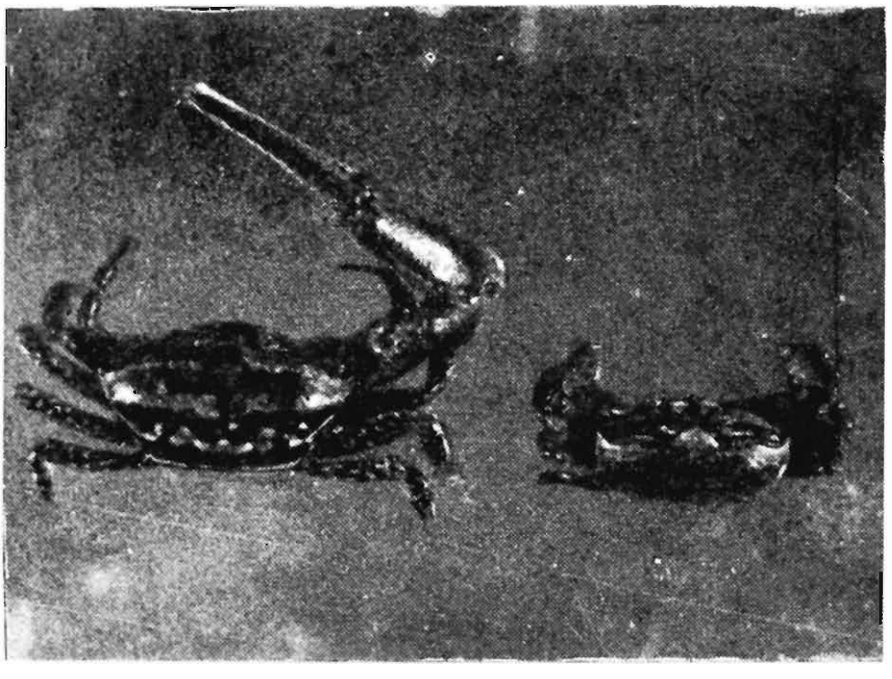
In the East coast five species brought under three subgenera, i. e. *U.* (*C.*) *triangularis*, *U.* (*D.*) *dussumieri*, *U.* (*D.*) *rosea* and *U.* (*T.*) *vocans* occur. U. (D.) rosea has been noticed to occur in the Gangetic delta and in the east eoast upto Chilka. *U.* (*D.*) *acnta* of Alcock's collections deposited in the Zoological Survey of India turned out to be *U.* (*D.*) *rosea on closea* examination (Misra, 1986 Personal commumication).

U. (*C.*) *triangularis* occurs in localities of optimal summer rainfall (South-West monsoon), high relative humidity and temperature, the maximum of which lies in between 30 and 40°C. In Australia also a similar distribution pattern has been noticed by Jones (1986 Personal communication). The occurrence of *triangularis* has not been reliably recorded so far from the West coast and hence it is practically evident that it is an East coast species in India. It is interesting to note that *triangularis* of Australia also inhabit predominantly the north-east to the East coast, from Melville Island near Darwin to Mackay in Queensland (Jones, 1986 Personal communication).

U. (*C.*) *lacta* and *triangularis* sometimes occur sympatrically with marginal mix up in the Gangetic delta and South-east coast of India.

Nobili (1903) recorded the presence of *triangularis* in the South-east coast at Pondicherry and Henderson (1893) at Madras. Panikkar and Aiyar (1939) reported the absence of *triangularis* at Madras. *U.* (*C.*) *triangularis bengali* does occur in Madras (Ennore and Adyar estuaris, Plate-1) and exhibits a patchy distribution, restricted to the high saline areas where the substratum is clay-mud.

The Aneaman and Nicobar group of Island harbour a richer fiddler tauna with seven species broght under five subgenera of which four species are found in common



Uca (*Celuca*) *triangularis bengali*

to the East coast. One can observe that *U.* (*D.*) *urvillei* is restricted to the West Coast, *U.* (*C.*) *triangularis* to the east coast and *U.* (*T.*) *tetragonon*, *U.* (*Australuca*) *bellator* and *U.* (*Amphiuca*) *chlorophthalmus* to the A & N Islands. It is evident that two subgenera enjoy peninsular distribution while the other three insular. *U.* (*D.*) *dussumieri*, *U.* (*C.*) *lactea* and *U.* (*T.*) *vocars* are common to the East, West coasts and the Islands.

The taxonomy of the fiddlers had always been a point of disagreement among the workers. Crane (1957) divided the fiddlers into two non-systematic groupings based on form and complexity of the species-typical waving displays by the males. The narrow fronted primitive fiddlers exhibit vertical waves while the more advanced broad fronts show in addition to the vertical components a lateral waving display pattern. Quite unfortunately, intermediates are also of common occurrence. von Hagen (1976) added "jerker or Ruckwinker" group. Bott (1973) accommodated the fiddlers in ten genera. Crane (1975) constructed a likely phylogeny of the genus with nine subgenera based on morphological characters and male waving display. The lock and key concept of the reproductive apparatus responsible for reproductive isolation does not appear to work atleast in Minuca (Thurman, 1982). Thurman (1985) inferred that body structures and reproductive armature reflect ecological adaptation rather than phylogenetic affinity. Hence, classification based on certain morphological characters as diagnostic traits leads to confusion. von Hagen (1976) preferred "to avoid the clumsy subgeneric or even generic splitting and to adhere to the familiar plain use of *Uca*". Jones and George (1982) refrained from commenting on the unfortunate situation and added handedness also as an additional tool useful in arriving at a better taxonomic system. The biochemical studies like enzyme analysis (Selander *et al*, 1971) have revealed some geographic variations in *Uca*. Albrecht and von Hagen (1981) produced biochemical evidence (differential electrophoretic) in support of the views of Crane (1975) on relationships and phylogeny ; hence, the taxonomic system proposed by Crane (1975) is followed in this work as it appears to best suited.

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ON A NEW RECORD AND REDESCRIPTION OF *MACROBRACHIUM NOVAEHOLLANDIAE* FROM INDIAN WATERS (DECAPODA, PALAEMONIDAE)

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INTRODUCTION

Macrobrachium novaehollandiae is a medium sized prawn which was considered as exhibiting isolate distribution, having been recorded only from the Australian region (Holthuis, 1950). During a survey of the palaemonid prawns of the south-west coast of India, specimens belonging to the above species were obtained. Since a few major variations have been noticed in these forms a brief redescription of the species is attempted.

SYSTEMATIC ACCOUNT

Macrobrachium novaehollandiae (De Man)

1882. *Palaemon ornatus* : of Haswell, *Catal. Austr. Crust.* : 196 (non Olivier, 1811).
1908. *Palaemon* (*Eupalaemon*) *novae-hollandiae* De Man, *Ann. Mag. nat. Hist.* (8) 1 : 363-370, pl. 16.
1835. *Palaemon* (*Parapalaemon*) *aemulus* : Boone, *Bull, Vanderbilt mar. Mus.* 6 : 157, pl. 40 (non Nobili, 1906).
1950. *Macrobrachium novaehollandiae* Holthuis, *Siboga Exped.* 39 (a9) : 155-156.

Material : Three adult specimens of *M. novaehollandie* were collected from Paravur Lake, Quilon District, Kerala, India during September, 1982.

Measuremets (mm) of a male specimen of 87 mm in Total length : Carapace length-23, length of rostrum-17, length of telson-12.5. First chelate leg—Ischium (i)-6.5, merus (m) -9.5, carpus (c) -12, propodus (p) -5, dactylus (d) -2.5

Second chelate leg-i-14, m-17, c-32, p-40, d-13. First non-chelate leg-i-6, m-12, c-6.5, p-10.5, d-3.5. Second non-chelate leg-i-5.5, m-11, c-7, p-11, d-3.5. Third non-chelate leg-i-6.5, m-11, c-6.5, p-11, d-3.5

Description : Rostrum long, slender, extending as far as the distal end of the antennal scale ; basal crest not elevated ; distal end of rostrum curved upwards ; upper margin with 9 teeth ; first three teeth behind the orbit ; the first dorsal tooth situated at about the anterior 1/4 the length of the carapace ; second tooth slightly separated

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from the first ; 2nd to 7th teeth equidistantly spaced ; 8th tooth separated from the 7th by a distinct gap, 9th tooth closer to 8th. Ventral margin with four teeth ; 1st ventral tooth almost at the level of the 6th dorsal tooth ; 2nd between 6th and 7th dorsal teeth ; 3rd almost at the level of the 7th dorsal todth ; 4th behind the level of the 8th dorsal tooth. The rostral formula of the species is 9/4 of which first 3 teeth are post-orbital (Fig. 1a).

Carapace smooth ; antennal and hepatic spines characteristic of the genus present ; the latter situated behind an below the level of the former (Fig. 1a).

Abdomen glabrous ; pleurae of 1st to 3rd typical ; that os 4th and 5th backwardly directed and that of 6th spinous (Fig. 1b).

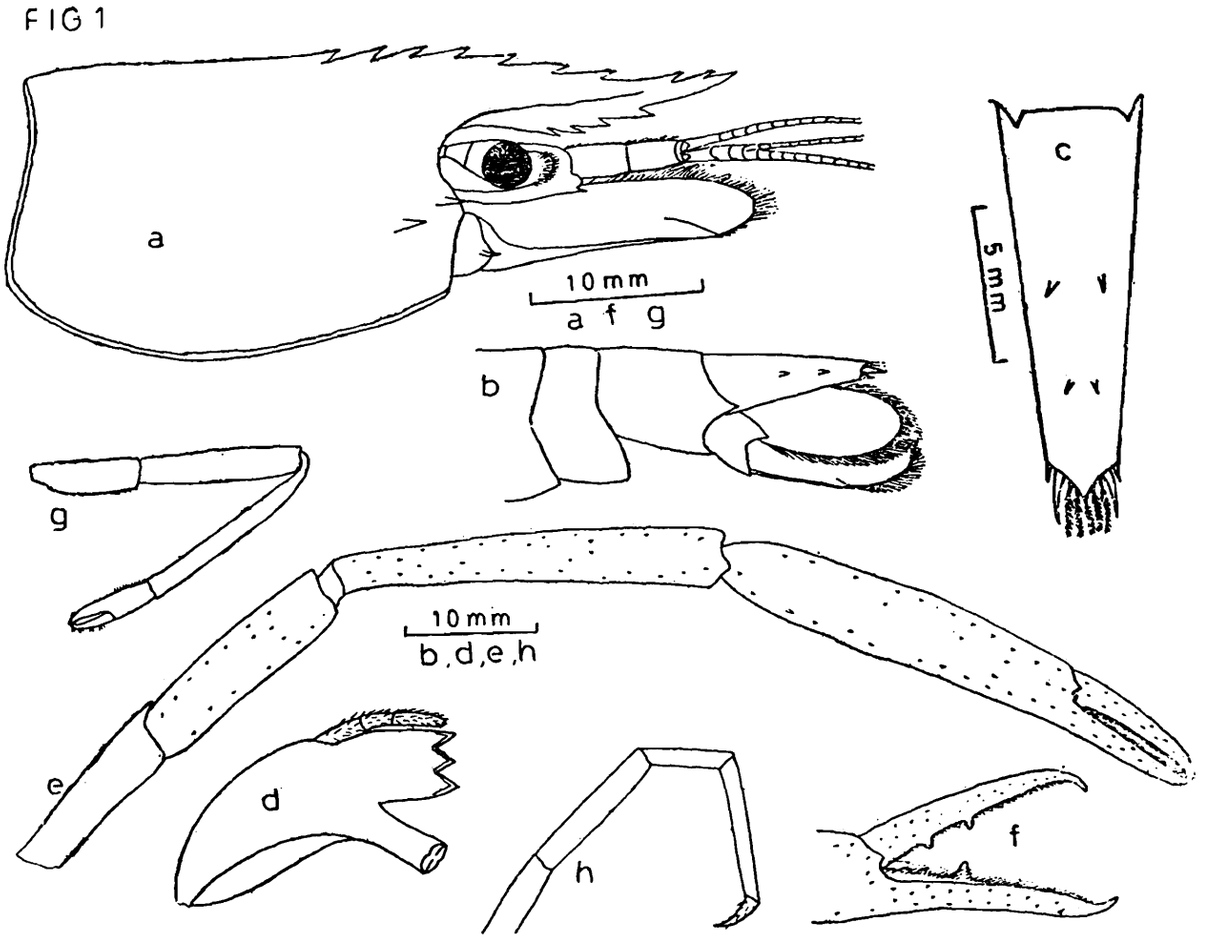

Fig. 1. *Macrobrachium novaehollandiae ;* a—Caphalothorax ; b—posterior abdomen ; c—Telson entire ; d—mandible ; e—second chelate leg ; f—part of 2nd chela showing denticle on the cutting edges of the fingers ; g—first chelate leg ; h—first non-chelate leg.

Telson robust ; posterior end of telson extends beyond the outer spine of the exopod of the uropod. The dorsal surface with two pairs of spines ; the proximal pair

situated slightly above the midway along the length of telson ; the distal pair above the midway between the first pair and tip of telson. Posterior end of telson bears two pairs of spines ; the outer pair smaller and immovable ; inner pair longer and movable, overreaches the tip of telson. A few plumose setae present in between the movable spines (Fig. 1c).

Antennules typical ; three segments of the peduncle in the ratio 7.5 : 3 : 3.5. Antennae typical. Mandibles with the apophysis about 11/2 times as long as the incisor process ; incisor process tridentate ; mandibular palp three segmented ; first segment smaller than the third segment ; middle segment smallest and the third segment longest (Fig. 1d). First maxillae, second maxillae, first to third maxllipeds typical. Third maxillipeds with endopod reaching beyond the tip of the antennal flagellar peduncle.

First pair of chelate legs typical ; ischium longer then propodus, dactylus ; but shorter than merus, carpus. Merus shorter than carpus, reaches the level of the distal end of the antennal flagellar peduncle ; carpus reaches the level of the distal end of the antennal scale ; plam equal to fingers (Fig. 1g).

Second chelate legs robust, equal sized ; ischium flat and smaller than merus, carpus and propodus ; but slightly longer than dactylus. Merus smaller than carpus, propodus ; distal end of merus reaches almost to the level of the antennal scale. Carpus shorter than the chela and slightly longer than palm but almost equal to the combined length of ishium and merus. Palm swollen ; dactylus about 1/2 the length of propodus, proximal part of the cutting edge with two denticles ; fixed finger with one prominent denticle and two smaller denricles present between the prominent denticle and the proximal part of the finger. A few short setae present on the cutting edges of the fingers (Figs. 1e & f).

Three pairs of non-chelate peraeopods simple ; ischium shorter than carpus ; merus equal to propodus or slightly longer ; dactylus simple (Fig. 1 h).

Pleopods and uropods typical.

Remarks : *M. novaehollandiae* is recorded for the first time from India. The species has been recorded only from the Australian region (from Australia and New Caledonia) (Holthuis, 1950). With this report, the distribution of the species has been Scientific name *Palaemon ornatus* Olivier, 1811 by Haswell (1882).

De Man (1908) has extensively described a new species *Palaemon* (*Eupalaemon*) *novaehollandiae* from Sydney, New South Wales. In recording this, De Man pointed out that the species recorded by Haswell does not belong to *P. ornatus* Olivier but a new species described by him as *P.* (*E.*) *novaehollandiae.* In the revision of the subfamily Palaemoninae, Holthuis (1950) has agreed to the above suggestion. In his own words ".....as pointed out by De Man (1908) the specimens mentioned by Haswell under the name *Palaemon ornatus* do not belong to that species (= *Macrobrachium lar*), but are in

reality *M. novaehollandiae*". In retaining the scientific name Holthuis (1950) writes" .....as the present species, as far as I can find, has not been described as new before 1908, the name *novaehollandiae* proposed by De Man, in case that the species might prove to be distinct from *Palaemon danae*, must be used". *Palaemon ornatus* Olivier, 1811 has been synonomysed with *Macrobrachium lar* (Fabricius, 1798).

The specimens studied here agree with the detailed descriptions of De Man (1908). A few differences exhibited by the present specimens on comparison with the original descriptions of De Man (1908) are given in Table I.

Table 1

A comparison of different characters of *M. novaehollandiae* from Sydney (based on De Man, 1908) and that from Kerala (present description)

Characters	Sydney	Kerala
1. Nature of rostrum	Reaches to the midway between the tip of the antennal scale and that of the spine at the far end of the outer margin	Reaches up to the tip of the antennal scale
2. No. of dorsal rostral teeth	10, of which 3 post-oribtal	9, of which 3 post-orbital
3. Nature of 2nd to 8th dorsal rostral teeth	2nd to 8th dorsal rostral teeth are equidistantly spaced	2nd to 7th dorsal rostral teeth are equidistantly spaced
4. Relation between merus and antennal scale (1st chela)	Merus projects 2/3 length beyond the antennal scale	Merus ends at the level of the tip of the antennal scale
5. Nature of 2nd Chela	Chela slender	Chela slightly swollen
6. Relation between chela and carpus	Chela 1/4 the length longer than carpus	Chela 1/5 the length longer than carpus
7. Width of palm and carpus	Width of palm equal to carpus	Width of palm greater than carpus and swollen

This report of the species from India proves beyond doubt that it is a clear case of discontinuous distribution.

Summary

M. novaehollandiae is a medium sized prawn considered as exhibiting an isolated distribution in the Australian region. A few specimens were recorded from Indian

waters for the first time. A redescription of the species is given because of a few major differences noted. With this report this species has to be considered as exhibiting a case of discontinuous distribution.

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