

**STUDIES ON THE FISH FAUNA OF UTTAR PRADESH TERAI 3.
NOTES ON THE DISTRIBUTION AND ECOLOGY OF *BALITORA
BRUCEI* GRAY (HOMALOPTERIDAE)**

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INTRODUCTION

Balitora brucei Gray, a homalopterid fish, is remarkably adapted to torrential streams and has so far been recorded from Burma, Meghalaya, Darjiling (West Bengal) and Bihar (Hora, 1920, 1932; Silas, 1952; Mohan et al., 1977; Jayaram, 1981. Recently, a 53 well preserved specimens of this species have been collected from Gola river below Jamrani, nearly 10 Kms. east of Kathgodam in Nainital district. The stream flows along the base of hills but the flow of water is tremendous. The water flows very fast through stony boulders on which these fishes cling very strongly. The impact of the flowing water is so heavy that it is difficult for a person to stand in the bed of the stream. The representatives of this species get dislodge from the rocks only when the latter are moved with a jerk. The dislodged fishes get washed into the hand-net placed just behind the moved rock. The living fish were kept on the wet palm of a hand and even when the hand was moved upside down, the clinging fish did not fall down and remained sticking to the palm. The head and body of the fish are greatly depressed and the paired fins are highly expanded and fan-like. There is no sucker on the chest or the fins but the skin of this area secretes a strongly adherent mucous substance. The remarkable adaptation of this fish to torrential streams has been described by Hora (1922 a, 1922 b, 1927, 1930, 1932). The present material from Gola river is far superior in number and quality of preservation than that studied by Hora (op. cit.) and Silas (op. cit.). Some of the salient characters of this species are studied in this material and are mentioned below.

Balitora brucei Gray

1832. *Balitora brucei* Gray, *Ill. Indian Zool.*, 1, pl. 88, fig.

1920. *Balitora brucei* : Hora, *Rec. Indian, Mus.*, 19 :197, fig.1.

B.III, D.II-III/8, P.VIII-X/10-12, V.II-III/9, A.II-III/5, C. 17-19; Lat.1. 67-72, Lat.tr. 9-11/8-11.

Material examined : 53 examples (52-102 mm total length), below dam site, Jamrani Bandh, Gola river, district Nainital, Coll. Raj Tilak, 20-22.2.85.

The head and body are greatly depressed and the ventral side is flattened. The length of head is contained 5.85-6.36 times in total length and 4.82-5.17 times in standard length of body. The dorsal side of head and body are arched and dome shaped. The ventral side of body and entire head region are scaleless. The eyes are small and situated on upper

part of the domb. The diameter of eye is contained 6.33-8.25 times in length of head, 2.66-3.50 times in interorbital width and 4.0-4.5 times in length of snout. The interorbital width is contained 2.2-2.4 times and length of snout 1.58-1.8 times in length of head. The snout is covered with small and sharp tubercles. The snout is trenchant. The rostrum in front of the mouth is separated by a groove which extends round the angles of the mouth. The rostrum has a median and two lateral lobes. The gill openings extend ventrally for a short distance in front of the pectoral fins. The depth of the body is contained 10.0-13.25 times in total length and 8.11-10.75 times in standard length. There are three pairs of thick short barbels. The paired fins are greatly expanded and bear more than one unbranched rays on the anterior side. The pectoral fin is pedunculate and much expanded; they do not reach the ventral fins. The lower lobe of the caudal fin is much longer than the upper. The least height of the caudal peduncle is contained 2.88-3.71 times in its length.

The long preserved specimens studied by Hora (1920) and subsequently by Silas (1952) had lost all natural colouration. Hence, no description of the colouration of the body of this species is available in literature except of the figure of Gray (1832). The colouration of the body and fins in the present nicely preserved fresh material is given below for future reference.

The dorsal side of head and body are dark in colour. On the head, the dark colouration is broken into many small dark blotches with intervening light and dark spaces, giving the appearance of almost of a reticulation. From the posterior end of the head upto the upper part of the base of the caudal fin, there are series of large dark blotches, of which 3 are present before the dorsal fin, one at the origin of the dorsal fin, another one at the base of the middle dorsal encircled by a light area. The lateral side of the body are irregularly blotched and reticulated with dark and light areas.

The dorsal fin bears 3-4 dark cross bands. The dorsal side of the pectoral and ventral fins bear 2-3 band each of the dark spots. The anal fin bear one dark cross band. There are 4 dark cross bands on the caudal fin. The ventral side of the body upto the base of the anal fin is immaculate yellow. The area behind the anal fin is dark in colour which is invariably broken into small blotches. The colouration of this species is quite characteristic and differs from all species in these waters.

Distribution : Uttar Pradesh, Bihar, West Bengal, Meghalaya and Burma.

ZOOGEOGRAPHICAL REMARKS

Tilak (in press a and 1990) has already pointed out the zoogeographical occurrence of *Conta conta* (Family : Sisoridae), *Chandramara chandramara* (Family : Bagridae) and *Acanthopthalmus pangia* (Family : Cobitidae) in Uttar Pradesh Terai. These species have been recorded from Uttar Pradesh Terai for the first time; they were earlier known only from eastern India. Similarly, Tilak and Husain (1975, 1978, 1980) have also reported the occurrence of eastern Himalayan fish forms in Uttar Pradesh (*Laguvia*

ribeiroi kapuri Tilak & Husain, *Leidocephalus annandalei* Chaudhuri, *Glyptothorax saisii* Jenkins etc.). *Balitora brucei* Gray is still another species which is recorded here from Uttar Pradesh for the first time and its earlier records have been only from Bihar and eastern parts of of Himalaya. The occurrence of a large number of eastern Indian fish forms in Uttar Pradesh is zoogeographically important.

Hora (1932) studied the material of *Balitora brucei* in the collections of Zoological Survey of India and British Museum and came to a conclusion that there were more than one subspecies. The specimens from Khasi Hills (Meghalaya) and Darjiling (North Bengal) belong to *Balitora brucei brucei* Gray (forma typica). The material from Meekalan, Meetan and Chittagong hills belonged to *B. brucei burmanicus* Hora. A species collected from Megha stream at Burma-Siam border and housed in British Museum belonged to *B. brucei melanosoma* Hora, because of its dark colouration. Hora (1941) named another sub-species, *B. brucei mysorensis* Hora, based on a single specimen collected from Sivasamudram, Mysore state. These four subspecies were recognised as independent forms by Silas (1952) but Menon et al. (1977) have merged *burmanicus* with *brucei* and raised *mysorensis* to the level of a species; they made no mention of *melanosoma*. Jayaram (1981) has followed the classification of Menon et al. (op. cit.). *B. maculata* Gray is already a separate species known from Darjiling hills. So, there are now three species of *Balitora* known from India viz. *B. brucei* Gray, *B. maculata* Gray and *B. mysorensis* Hora.

SUMMARY

Balitora brucei Gray (Family Homalopteridae), which is highly adapted to torrential streams, has been so far recorded from Burma, Meghalaya, West Bengal and Bihar. Recently, a good series of this species comprising 53 examples have been collected from Gola river between Jamrani and Kathgodam, district Nainital, Uttar Pradesh. The ecology of this species in this river has been studied. The colouration of the species was not described earlier and this has been done in this paper based on freshly preserved material. The present record of *Balitora brucei* from Uttar Pradesh Terai extends the range of distribution of this species further westwards along the base of Himalaya; this is zoogeographically important.

ACKNOWLEDGEMENT

The author feels grateful to the Director, Zoological Survey of India, Calcutta for encouragement.

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THE GRYLLOIDEA (ORTHOPTERA) OF TRIPURA, INDIA

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INTRODUCTION

Chopard (1969) studied the Grylloid fauna of India and adjacent countries but probably he did not have any material from Tripura. This particular part of India has remained unexplored so far as its Grylloid fauna is concerned. Recently some collections of Grylloidea were made by Dr. V.C. Agarwal and party (1969, 1972 and 1973) and one of the authors (M.S. Shishodia) of Zoological Survey of India. Most of the present collections were made from cultivated fields, thick forests, grasses, foliage, fallen or cut trees, understones; others from light traps operated in or near the base of foot hills. The material has been studied by us and it comprises altogether 19 species and one subspecies, distributed over 11 genera and five families of Grylloidea. The present paper adds one new species of Trigonidiidae, remaining all the species are new records for Tripura. The type specimens of the new species are deposited in the Zoological Survey of India.

It is certain, however, that many new species remain to be discovered from this virgin zone and further collection in the region, will enrich the known fauna.

Family GRYLLOTALPIDAE

1. *Gryllotalpa africana* Beauvois

1805. *Gryllotalpa africana* Beauvois, *Ins. Afr. Amer.*, : 229.

1869. *Gryllotalpa fossor* Scudder, *Mem. Peabody Ac. Sc.*, 1 : 21.

1969. *Gryllotalpa fossor*, Chopard, *Fauna of India, Orth.*, 2 *Grylloidea* : 8.

Material examined : Ampoi, 17. i. 1971, V.C. Agarwal (1 ♂); Teliamura (Forest Rest House), 10. xi. 1974, M.S. Shishodia (1 ♀); Teliamura (Golabari), 11. xi. 1974, M.S. Shishodia (1 ♀); Teliamura (Korilong), 13. xi. 1974, M.S. Shishodia (1 ♂).

Remarks : Restricted to tropical Asia and Africa. This species is very common in India.

2. *Gryllotalpa hirsuta* Burmeister

1838. *Gryllotalpa hirsuta* Burmeister, *Handb. Ent.*, 11 : 739.

1969. *Gryllotalpa hirsuta*, Chopard, *Fauna of India, Orth.*, 2 *Grylloidea* : 12.

Material examined : Kumarghat, 26. xii. 1972, V.C. Agarwal (1 ♀).

Remarks : The female specimen from Tripura agrees with the description given by

Chopard (1931, 1969). The species is being reported for the first time from India. It has been known earlier from Malaya, Sumatra, Java, and Borneo.

Family GRYLLIDAE

3. *Modicogryllus confirmatus* (Walker)

1859. *Acheta confirmata* Walker, *Ann. nat. Hist.*, (3) 4 : 221.

1969. *Modicogryllus confirmatus*, Chopard, *Fauna of India, Orth.*, 2 *Grylloidea* : 58.

1964. *Modicogryllus confirmatus*, Randall, *Can. Ent.*, 96 : 1584.

Material examined : Kumarghat, 29. xii. 1972, V.C. Agarwal (1 ♂); Ambassa, 1. i. 1973, V.C. Agarwal (1 ♂); Udaipur (Garjee), 7. xi. 1974, M. S. Shishodia (1 ♂); Teliamura (Forest Rest House), 10-12. xi. 1974, M. S. Shishodia (2 ♀♀).

Remarks : Chopard (1969) has described the species in detail. Recently Randell (1964) studied the male genitalia. The above male specimens agree well with the published description. A well distributed species in India and is also reported from Nepal, Bangladesh, Burma, Malaya, Thailand, Philippines and Israel.

4. *Modicogryllus* sp.

Material examined : Udaipur (Garjee), 7. xi. 1974, M. S. Shishodia (1 ♀).

Remarks : In the absence of male specimens it has not been possible to fix the specific identity.

5. *Loxoblemmus detectus* (Serville)

1839. *Platyblemmus detectus* Serville, *Ins. Orth.*, : 356.

1969. *Loxoblemmus detectus*, Chopard, *Fauna of India, Orth.*, 2 *Grylloidea* : 123.

Material examined : Teliamura (Bramachara), 10. xi. 1974, M.S. Shishodia (1 ♂); Teliamura (Kunjmura), 14. xi. 1974, M.S. Shishodia (1 ♀); Ambassa (Forest Rest House), 16. xi. 1974, M.S. Shishodia (1 ♀); Manu (Jamir Chera), 25. xi. 1974, M.S. Shishodia (1 ♂).

Remarks : The description by Chopard (1969) is comprehensive. Specimens before us agree well with the description of Chopard but differ in having, much longer labial palpi. Bhowmik (1969) reported that mirror in *L. detectus* is not divided but here the mirror is divided as referred by Chopard (1969).

The species is well distributed in northern and eastern India. It has also been reported from Sri Lanka, Malaya and Java.

6 a. *Loxoblemmus equestris* Saussure

1877. *Loxoblemmus equestris* Saussure, *Mem. Soc. Geneva*, 25 : 252.

1969. *Loxoblemmus equestris*, Chopard, *Fauna of India, Orth.*, 2 *Grylloidea* : 122.

Material examined : Teliamura (Forest Rest House), 11. xi. 1974, M. S. Shishodia

(1 ♂); Udaipur (Garjee), 4. xi. 1974, M. S. Shishodia (1 ♂).

Remarks : The above specimens agree with the description of Chopard (1969). A well distributed species in India. Also known from China, Japan, Burma, Malaya, Celebes and Sri Lanka. Captured at light.

6 b. *Loxoblemmus equestris manipurensis* Bhowmik

1969. *Loxoblemmus equestris* Var. *manipurensis* Bhowmik, *Zool. Anz.*, 182 : 150.

Material examined : Udaipur (Garjee Rest House), 4. xi. 1974, M. S. Shishodia (1 ♂ and 3 ♀♀); Teliamura (Bramachara), 10. xi. 1974, M. S. Shishodia (1 ♀); Ambassa (Forest Rest House), 16. xi. and 19. xi. 1974, M. S. Shishodia (1 ♂ and 1 ♀).

Remarks : The above specimens agree with the description of the variety described by Bhowmik (1969) from Manipur. Captured at light. It is raised to subspecies level.

7. *Loxoblemmus* sp.

Material examined : Teliamura (Bramachara), 10. xi. 1974, M. S. Shishodiag, (1 ♀).

Remarks : Black in colour, brachypterous. In the absence of male it is not possible to identify upto specific level.

8. *Pteronemobius indicus* (Walker)

1869. *Nemobius indicus* Walker, *Cat. Derm. Salt. Brit. Mus.*, 1 : 58.

1969. *Pteronemobius indicus*, Chopard, *Fauna of India, Orth.*, 2 *Grylloidea* : 159.

Material examined : Udaipur (Garjee Rest House), 4. xi. 1974, M. S. Shishodia (2 ♀♀); Teliamura (Forest Rest House), 10. xi. 1974, M. S. Shishodia (2 ♂♂); Ambassa (Forest Rest House), 16, 19-20. xi. 1974, M. S. Shishodia (1 ♀ and 2 ♂♂).

Remarks : *Pteronemobius indicus* is a widely distributed species in the Oriental region. From India, Chopard (1969) has reported this species from Bombay, Madras, Coimbatore and Assam(Ledo); Tandon and Shishodia (1972) from Assam (North Lakhimpur) and Arunachal Pradesh (Siang and Kambang). Most of the specimens were caught at light.

9. *Pteronemobius concolor* (Walker)

1871. *Eneoptera concolor* Walker, *Cat. Derm. Salt. Brit. Mus.*, 5 *Suppl.* : 10.

1969. *Pteronemobius concolor*, Chopard, *Fauna of India, Orth.*, 2 *Grylloidea* : 160.

Material examined : Udaipur (Garjee Forest House), 4. xi. 1974, M. S. Shishodia (1 ♂ and 5 ♀♀); Teliamura (Forest Rest House), 16, 19. xi. 1974, M.S. Shishodia (4 ♂♂ and 2 ♀♀); Manu, 23. xi. 1974, M. S. Shishodia (1 ♂).

Remarks : Specimens from Tripura agree with the description of Chopard (1969),

but differ in being comparatively darker. A widely distributed species in Tropical Asia; from India it is reported from Assam, West Bengal, Orissa, Tamilnadu, Maharashtra and Great Nicobar Island. Specimens were collected at light.

10. *Pteronemobius taprobanensis* (Walker)

1869. *Trigonidium taprobanensis* Walker, *Cat. Derm. Salt. Brit. Mus.*, 1 : 102.

1969. *Pteronemobius taprobanensis*, Chopard, *Fauna of India, Orth.*, 2 *Grylloidea* : 163.

Material examined : Agartala (Dak Bunglow), 11. xi. 1969, V C. Agarwal (1♂); Agartala (Forest Rest House), 31. x. 1974, M. S. Shishodia (1♀); Udaipur, Garjee (Forest Rest House), 4. xi. 1974 (1♂ and 2♀♀); Teliamura (Forest Rest House), 10-11. xi. 1974, M. S. Shishodia (5♂♂ and 5♀♀); and 14. xi. 1974, M. S. Shishodia (2♀♀); Ambassa (Forest Rest House), 16, 19. xi. 1974, M. S. Shishodia (2♂♂); Ambassa (Garo basti), 21. xi. 1974, M. S. Shishodia (1♂).

Remarks : It is a very widely distributed species in India and Indo-Malayan subregion. Tandon and Shishodia (1972) found the species in Arunachal Pradesh on dry river beds and on vegetation. Present series of specimens were collected from grasses and at light.

11. *Pteronemobius fascipes* (Walker)

1869. *Eneoptera fascipes* Walker, *Cat. Derm. Salt. Brit. Mus.*, 1 : 67.

1969. *Pteronemobius fascipes*, Chopard, *Fauna of India, Orth.*, 2 *Grylloidea* : 164.

Material examined : Agartala (Chandmari), 10. xi. 1969, V C. Agarwal (1♂); Ampy, 17. i. 1971, V. C. Agarwal (1♀); Agartala (M.B.B. College campus), 1. xi. 1974, M. S. Shishodia (1 ♀).

Remarks : A well distributed species in India, Sri Lanka, Malaya, Singapore, Java and Burma. Tandon and Shishodia (1972) found the species on dry river beds, wild vegetation and under the falled log of wood in Arunachal Pradesh. The specimens from Tripura were mostly collected at light and from grasses.

12. *Pteronemobius novarae* (Saussure)

1877. *Nemobius novarae* Saussure, *Mem. Soc. Geneve*, 25 : 83.

1969. *Pteronemobius novarae*, Chopard, *Fauna of India, Orth.*, 2 *Grylloidea* : 162.

Material examined : Ambassa, 1. i. 1973, V C. Agarwal (1♀), at light.

Remarks : A single female from Tripura agree well with the description given by Chopard (1969), but differs in being smaller in size and in colouration. Previously known in India from Madhya Pradesh. It is recorded for the first time from north eastern India. It has also been reported from Thailand, Malaya and Java.

Family OECANTHIDAE

13. *Oecanthus indicus* Saussure

1878. *Oecanthus indicus* Saussure, *Mem. Soc. Geneve*, 25 : 454.

1969. *Oecanthus indicus*, Chopard, *Fauna of India, Orth.*, 2 *Grylloidea* : 267.

Material examined : Fatik Roy, 29. xii. 1972, V. C. Agarwal (1 ♀).

Remarks : Previously recorded in India from Maharashtra, Bihar, Arunachal Pradesh, Karnataka, Tamilnadu, Kerala and Andaman Islands. Also known from China, Japan, Malaya, Philippines and Sri Lanka.

Family TRIGONIDIIDAE

14. *Homoeoxipha lycoides* (Walker)

1869. *Phyllopalpus lycoides* Walker, *Cat. Derm. Salt. Brit. Mus.*, 1 : 71.

1969. *Homoeoxipha lycoides*, Chopard, *Fauna of India, Orth.*, 2 *Grylloidea* : 275.

Material examined : Udaipur (Garjee Rest House), 6. xi. 1974, M. S. Shishodia (2 ♂♂ and 1 ♀) at light; Manu (Dhumachera), 24. xi. 1974, M. S. Shishodia (1 ♂).

Remarks : The specimens from Tripura agree with the description of Chopard (1969), but differ in having anterior and middle femora blackish and in the shape of anterior margin of pronotum. A widely distributed species in the Indo-Australian region; it has been reported earlier from India in Bihar, Assam, Arunachal Pradesh, Tamilnadu and Karnataka (Mysore).

15. *Anaxipha tripuraensis* sp. nov.

Male : Size small. Head of small size, yellowish brown, without ornamentation, convex above, a little wider than cephalic margin of pronotum; occiput, cheeks light brown; mandibles, labium with brown tinge; maxillary palps pale yellow; 5th joint of palpi triangular; antennae yellow; eyes almost rounded, protruding; frontal rostrum a little narrow than first antennal segment.

Thorax : Pronotum slightly constricted in front; anterior margin weakly convex; posterior margin straight; disc convex with few setae on head; lateral lobes concolorous, with feebly sinuated inferior margin; anterior angles rounded. Legs yellowish, pubescent; anterior femora perforated on both sides; posterior femora moderately thick with three spines on each margin. Elytra reaching almost the apex of abdomen, very pale yellow, almost transparent; elytral mirror almost twice as long as wide; lateral field almost transparent with three veins.

Abdomen : Visible segments yellow; cerci long, pale brown; genitalia as figured (figs. 1 & 2).

Measurements (in mm) : Length of body without wings, 6.00; length with wings, 10.00; length of pronotum, 1.00; length of posterior femora, 4.00; length of elytra, 4.00.

Female : Differs from male in general colouration in being rufous. Head brownish. Disc of pronotum with a fine yellow median line; posterior dorsal margin of pronotum with row of fine hairs. Elytra extending upto the apex of abdomen, weakly convex; dorsal field light brown with 4 straight veins. Ovipositor distinctly curved upwards; apical valves occupying half the total length, margin finely denticulated.

Measurements (in mm) : Length of body without wings, 5.5; Length of body with wings, 10.00; Length of pronotum, 1.5; Length of posterior femora, 4.00; Length of elytra, 4.00; Ovipositor, 2.00.

Material : Holotype, 1 ♂; Tripura : Teliamura (Forest Rest House), 10.xi.1974, M.S. Shishodia (Z.S.I Reg. No. 7424/H5).

Remarks : This species comes closer to *Anaxipha longipennis* (Serville), but differs in having elytral mirror twice as long as wide, female elytra with 4 veins in the dorsal field, maxillary palpi (5th segment) and in the shape of male genitalia.

16. *Cyrtoxiphoides* sp.

Material examined : Ambassa, 16.xi.1974, M. S. Shishodia (1♀).

Remarks : In the absence of male specimen it is not possible to fix the identity of the species. The genus is being recorded for the first time from Indian limits. Previously recorded from Tropical Africa, Australia and Sri Lanka.

17 a. *Trigonidium cicindeloides* Rambur

1839. *Trigonidium cicindeloides* Rambur, *Fauna Andal.*, 2 : 39.

1925. *Trigonidium cicindeloides*, Chopard, *Ann. Mag. Nat. Hist.*, (9) 15 : 525.

1969. *Trigonidium cicindeloides*, Chopard, *Fauna of India, Orth.*, 2 *Grylloidea* : 304.

Material examined : Ambassa, 4.i.1973, V.C. Agarwal (1♂ & 1♀), 16.xi.1974, M.S. Shishodia (1♂ and 1♀); Agartala (M.B.B. College Campus), 1.xi.1974 M.S. Shishodia (1♂ and 1♀); Udaipur (Garjee), 5.xi.1974, M.S. Shishodia, (1♂ and 4♀♀), 6.xi.1974, M.S. Shishodia (1♀), 7.xi.1974, M.S. Shishodia (3♂♂ and ♀); Fatik Roy, 29.xii.1972, V.C. Agarwal (8♂♂ and 6♀♀); Teliamura, (Bramachara), 10.xi.1974, M.S. Shishodia (3♂♂); Manu (Mainama), 23.xi.1974, M.S. Shishodia (4♂♂ and 7♀♀).

Remarks : The specimens from Tripura agree well with the description but some specimens are chestnut brown instead of black.

A well distributed species from South Europe to South Asia and all over Africa. In India, it was so far recorded from Bihar, Arunachal Pradesh, West Bengal and Andaman Islands. The specimens were collected from grasses under the trees.

17 b. *Trigonidium humberianum* (Saussure)

1878. *Homoeoxiphus humberianum* Saussure, *Mem. Soc. Geneve.*, 25 : 468.

1969. *Trigonidium humberianum*, Chopard, *Fauna of India, Orth.* 2 *Grylloidea* : 305.

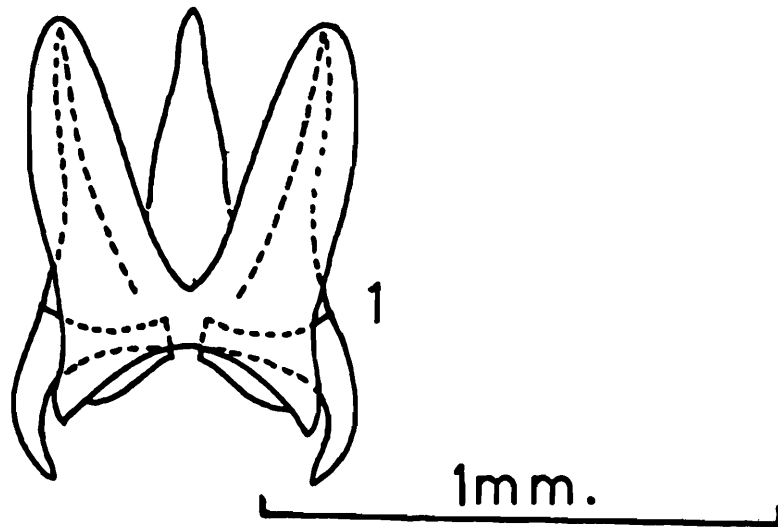


Fig. 1. Dorsal view of ♂ genitalia of *Anaxipha tripuraensis*.

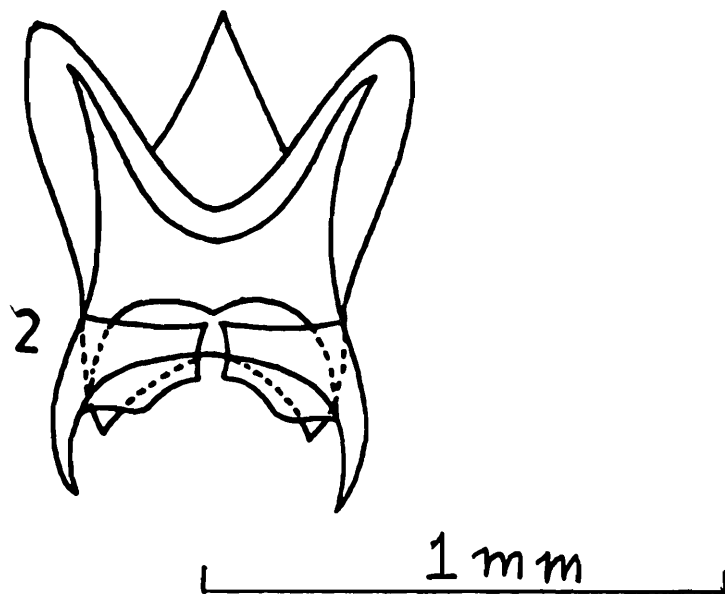


Fig. 2. Ventral view of ♀ genitalia of *Anaxipha tripuraensis*.

Material examined : Manu (Chailengta), 23.xii.1972, V. C. Agarwal (1 ♂), Fatik Roy, 29.xii.1972, V C. Agarwal (2 ♂♂ and 2 ♀♀); Agartala, 31.x.1974, M.S. Shishodia (2 ♂♂); Ambassa, 16.xi.1974, M.S. Shishodia (2 ♀♀, 2♂♂).

Remarks : The specimens from Tripura agree well with Chopard (1969) description but differ slightly in colouration of pronotum. A very widely distributed species in the Oriental region; from India it was so far reported from maharashtra, Bihar, Assam, Orissa, Tamil Nadu and Kerala.

Family ENEOPTERIDAE

18. *Madasumma* sp.

Material examined : Ambassa (Harinchara), 19.xi.1974, M.S. Shishodia (1♀).

Remarks : In the absence of male it has not been possible to fix the identity of the species.

19. *Euscyrthus hemelytrus* (Haan)

1842. *Gryllus (Eneoptera) hemelytrus* Haan, *Temminck Verhandel, Orth.* : 231.

1969. *Euscyrthus hemelytrus*, Chopard, *Fauna of India Orth. 2 Grylloidea* : 392.

Material examined : Udaipur (Garjee), 4.xi.1974, M.S. Shishodia (5 ♀♀), 8.xi.1974, M.S. Shishodia (1 ♂); Agartala (Bhangshala), 2.xi.1974, M.S. Shishodia (1 ♂ and 1 ♀); Teliamura (Bramachara), 10.xi.1974, M.S. Shishodia (1 ♀); Ambassa (Garo Basti), 2.xi.1974, M.S. Shishodia (1 ♂ and 1 ♀).

Remarks : The specimens from Tripura agree well with description of Chopara (1969), but differ in size and colour. A wide spread species in the Oriental region and was so far reported from West Bengal and Assam in India. It is also known from Australia.

SUMMARY

The present paper deals with the Grylloidea from Tripura, India. The collection comprises 19 species. *Anaxipha tripuraensis* is new to Science. *Gryllotalpá hirsuta*. Burmeister is a new record from India and the remaining are of interest from the point of geographical distribution. All are new records from Tripura. Notes on distribution of each species are also given.

ACKNOWLEDGEMENTS

We are grateful to the Director, Zoological Survey of India, for his constant encouragement and interest in this work.

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APHID (*MICROMYZUS KALIMPONGINSIS*) - ANT (*PHEIDOLE SMYTHIESI*) INTERRELATIONSHIP - A PRELIMINARY STUDY

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INTRODUCTION

Associations in general and mutualism in particular, result from usually reciprocal benefits, achieved by the interactions between two or more species. These benefits are often in the form of food, protection or locomotion. It is known that some species of ants interact in such a way with a variety of Hemipteran and Homopteran insects, particularly aphids and coccids (Herzig, 1938, Nixon, 1951 and Way, 1963). That ants feed on the honeydew produced by aphids is well documented. Moreover these ants may alter the life-table parameters of the aphids (El-Ziady, 1960; El-Ziady and Kennedy, 1956), or may influence aphid feeding upon the plants (Banks, 1958). It is also recorded that the presence of ants increase the fitness of aphids and thereby decrease the impact of predators (Banks, 1962; Burns, 1973 and Bradley, 1973).

The rate of excretion by an aphid may be conveniently estimated by multiplying the frequency with the average volume of the droplet excreted during a given time period (Auclair, 1958). Such a quantitative determination of honeydew excretion constitutes a most valuable tool in aphid physiology and is gaining impetus in microbiological research. It may be used in the studies of the rates of aphid feeding, food, assimilation and growth, in nutritional experiments involving food balance and nitrogen economy and in assessing the degree of resistance by the host plants. The species, variety, part and growth stage of the host plant fed upon, may influence honeydew by aphids, tended by ants, has been shown to increase considerably by the former (Banks, *et. al.*, 1958; Herzig, 1937; Mittler, 1958).

From very early times, deposits of honeydew on or near plants have attracted much interest because of their high sugar content. Studies have demonstrated that fresh honeydew is usually a complex mixture of a large variety of chemical compounds, including several sugars, amino-acids and amides, organic acids, alcohols, auxins, salts etc. (Auclair, 1959).

The association of ants, with aphids and related forms, has been worked since the turn of the century, and has been reviewed by Jones, (1929), Herzig, (1937), Nixon (1951), and Wellenstein (1952). An interesting analysis of this association has been presented by Kloft (1959, 1960). Way (1963) has reviewed the mutualism between ants and honeydew-producing Homoptera. The major emphasis has been laid on the beneficial effects derived out of such a mutualistic relationship by aphids. The influence

of ant-tending, upon aphid growth, population dynamics, protection from predators, and honeydew production has been widely studied (Nixon, 1951; Way 1963). However, the benefits derived by the ants in this relationship has been largely overlooked, probably because of the fact that it was thought basic, that the only benefit to the ants would be the honeydew produced by the aphids, which they utilise as their food, ants being obligate honeydew feeders. Way (1953, 1954a, b) showed the ant *Oecophylla longinata* (Latr) tending on coccid, *Saissetia zenzibarensis* Williams, could exist only at relatively low population levels in absence of the coccids. Pontin (1978) has shown that aphids supply enough food for the tending ants, making foraging and preying on other insects for food supply unnecessary, thus offering an energy-economy for food collection.

Keeping the above in view, the aim of this investigation was to substantiate the existing knowledge of the relationship between aphids and ants on the following aspects.

- a) to find out the population fluctuations of the aphids as influenced by tending ants.
- b) to see the level, or numbers of ants tending each aphid colony through a time period.
- c) to find out the amount of honeydew removed by the ants tending the aphid colonies.
- d) to see the levels of some biochemicals in the honeydew through the study period.

MATERIALS AND METHODS

Study site

The study was situated in the Umpling area of Shillong (25°34'N and 90°56'E), Khasi Hills district of Meghalaya.

The host plant, *Hedychium coronarium* (Zingiberaceae) is an ornamental plant found in and around Shillong. It has fragrant white or yellow flowers. The plant is seen to proliferate vegetatively from rhizomes shooting forth its aerial parts during monsoons. After the monsoon is over, the plant simply wilts and dies off leaving the underground rhizomes dormant throughout the dry winter periods. This indicates the transitory nature of this monsoonal plant with high conductive efficiency of the essential physiological sap to support the dense population of aphids.

The aphids, *Micromyzus kalimponginsis* (Basu 1967), colonise this plant. These aphids were seen to be distributed along the main veins on the underside of the young and maturing leaves. During the time of flowering, these aphids aggregate on the flowers and flower-buds.

The ants, *Pheidole smythiesi* Forel tend these aphids. They offer protection for these aphids and were also seen to clear the aphid colonies of plant and other debris, thereby

increasing the surface area of the leaves or flowers for aphid feeding. The ants also helped to keep wandering aphids within the colony. In return the ants were provided with the "Honeydew" by the aphids.

Population Analysis

Population counts were made without disturbing the aphid colony nor removal of plant parts keeping in mind the ultimate aim of project. Density of the aphids, together with the tending ants in the experiment site was estimated by counting them on seven stalks and flowers. (At the start of the experiment, plants were in bloom).

On each sampling day, 20 ants tending the aphids were collected. The tending ants were to be used subsequently for the biochemical analysis indicative of our indirect measurement of honeydew. At the same time control ants, which had not attended the aphid colonies, were also collected.

Sampling was done in triplicate, fortnightly throughout the study period for three months.

Ants returning from tending aphid colonies, have markedly distended abdomens. The increase in weight between tending ants, with distended abdomen, full of honeydew and those which have not tended the aphids and having normal size gave a good indication of the amount of honeydew removed from the aphids (Dixon, 1970).

Extraction Technique

For extraction of the honeydew component from the tending and control ant abdomen, the Trichloro Acetic Acid method was followed. Tris-HCl buffer was prepared by dissolving 0.012 M of Tris (Mol. Wt. 121.14) in 100 ml. of distilled water. Then concentrated HCl was added to make the pH of the buffer 7.2 to 7.4.

Twenty tending ant abdomens (average 3.8 mg.) from each collection were taken and homogenised in 1 ml. of the above Tris HCl buffer. For control, 20 ant abdomens (2.1 mg.) were taken to homogenate in 1 ml. of Tris HCl buffer.

To the homogenate 1 ml. of 10% TCA (Trichloro Acetic Acid) was added, mixed and kept at 0°C for 30 minutes. The solution was then centrifuged at 4000 rpm for about 30 minutes. The supernatant was collected.

To the residue, 1 ml. of 5% TCA was added. The aliquot was centrifuged for another 10 minutes at 4000 rpm. The resultant supernatant was pooled with the previous one. With this extract, estimation of carbohydrates and Amino-acids after standard methods.

OBSERVATION AND RESULTS

Aphid-population dynamics

The population counts at the start of the experiment totalled 463 aphids in the 7 stalks, i.e. 66/stalk. this number decreased to 440, average 62/stalk at the next sampling

date. The population reached a peak subsequently, totalling 2766 individuals i.e. 395/stalk. This then took a downward trend though not very low, numbering 1506 individuals i.e. 215/stalk, which at the next sampling, reached 181 aphids and finally the lowest of 110 aphids, both average 26/stalk and 15/stalk respectively (Fig. 1 and Table 1).

Number of tending ants

The corresponding ants tending the aphids were seen to follow a similar pattern, the rise and fall in ant numbers corresponding to the aphid population fluctuations though at a much lower level of magnitude. Initially the total number of ants tending the aphids were found to be 48 (7/stalk), which fell to 22 (3/stalk), and then rose to 79 ants or 11/stalk, which again fell to 27 ants (4/stalk). At the next sampling date the ants totalled 7, or 1/stalk, which was the lowest in the study period. The numbers rose to 13 at the last sampling date (2/stalk) (Fig. 1 and Table 2).

Thus, the two populations were seen to be highly correlated ($r = 0.82$, the aphids showing a positive response to ant tending, significant at $p < 0.01$ level).

Ant biomass and honeydew weights

The weight of the ants tending the aphids did not show any consistent pattern. On the first sampling date, the average weight was seen to be 0.29 mg., which rose to 0.33 mg. It then fell to 0.27 mg. It rose once again to 0.32 mg., only to fall to 0.29 mg. and rise to 0.32 mg. in the subsequent period (Table 3).

The difference between these two weights, at each sampling date, gives a measure of the honeydew uptake by the ants. The honeydew uptake was seen to be inversely related to the aphid and ant population levels, for nearly the whole period of investigation, except in the last two sampling dates, when the honeydew weight and the population structure showed a direct relationship to some measure. At the initial sampling date the honeydew measured was 0.206 mg. which rose to 0.244 mg. then fell to a low level of 0.180 mg., which was incidentally the lowest during the study period. At the next sampling date, the level rose to 0.230 mg., then dropped to 0.200 mg. and finally rose slightly to 0.210 mg. at the last sampling (Table 3).

Biochemical analysis of the tending ant abdomen

Sugars : The sugar content in the tending ants (expressed in mg/mg abdomen tissue), was 0.076 mg. initially. This level rose to 0.109 mg. at the next sampling date, (the highest for the study period), then fell subsequently to 0.065 mg. Subsequently it showed a slight rise (0.073 mg.), and then had a decreasing trend for the rest of the study period (0.047 mg. and 0.041 for the last two sampling dates).

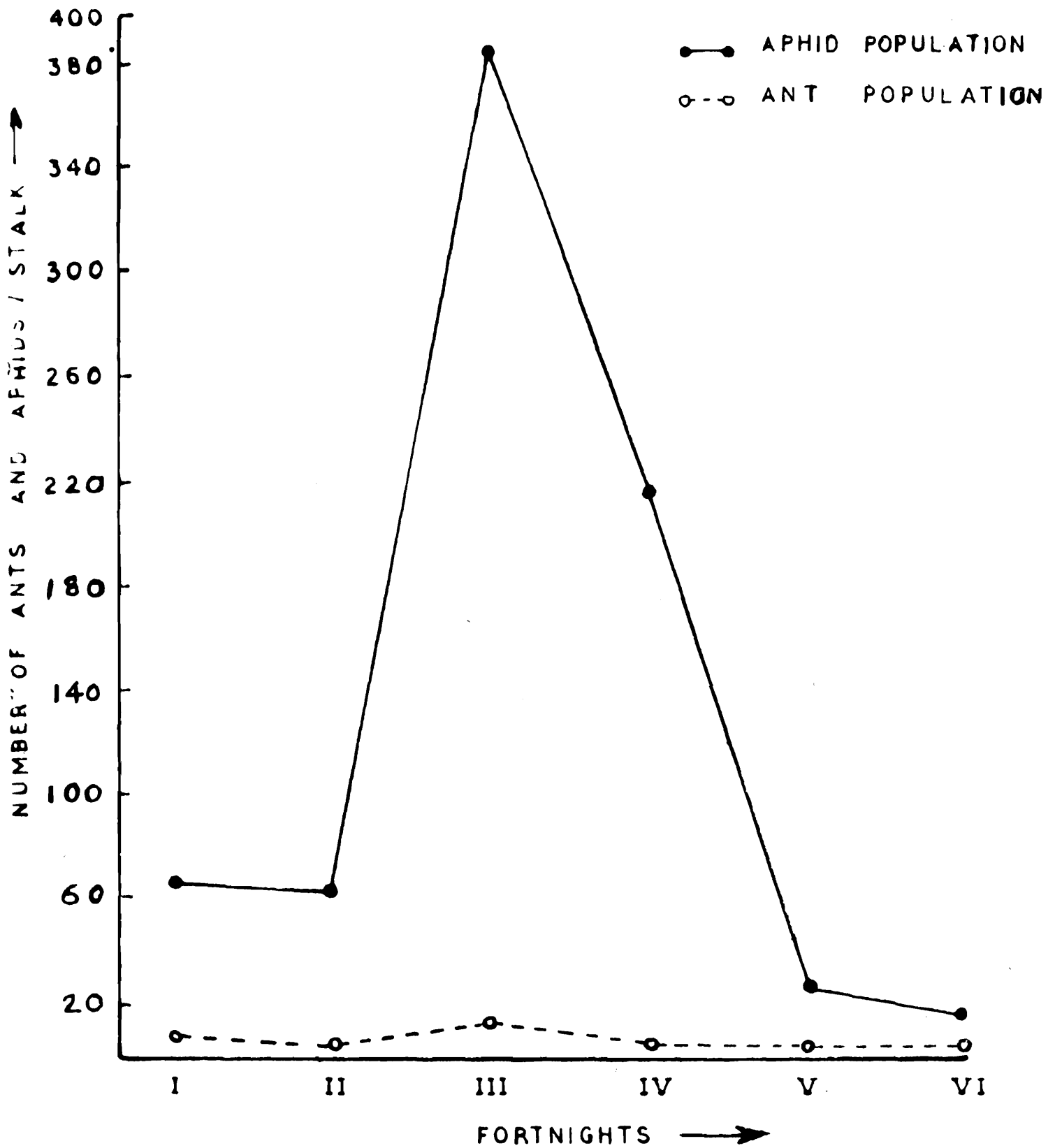


FIG.1

Fig. 1. Aphid - Ant population dynamics.

Table - 1. POPULATION DATA OF APHIDS

Fortnight	Stalk or leaf number							Total	Average
	1	2	3	4	5	6	7		
I	26	12	43	53	155	116	58	463	66
II	11	2	20	63	135	49	160	440	62
III	480	510	406	240	360	430	340	2766	395
IV	180	240	206	140	430	310	—	1506	215
V	21	—	15	32	40	43	—	181	26
VI	—	—	5	12	93	—	—	110	15

Table - 2. POPULATION DATA OF ANTS

Fortnight	Stalk or leaf number							Total	Average
	1	2	3	4	5	6	7		
I	4	2	6	5	12	13	6	48	7
II	—	1	2	4	7	4	4	22	3
III	15	26	9	5	7	10	7	79	11
IV	4	5	3	5	10	—	—	27	4
V	—	—	1	—	4	2	—	7	1
VI	—	—	—	3	10	—	—	13	2

Table - 3. WEIGHT OF ANTS AND THE RELATIVE CONTENT OF HONEYDEW

Fortnight	Tending Ants		Control Ants		Difference of weight between a and b (mg)	Honeydew content (% Body weight)
	Total weight (mg)	Average weight (mg) (a)	Total weight (mg)	Average weight (mg) (b)		
I	13.92	0.29	0.84	0.084	0.206	710.3%
II	7.22	0.33	0.86	0.086	0.244	73.94%
III	21.04	0.27	0.87	0.087	0.183	67.78%
IV	8.56	0.32	0.87	0.087	0.233	72.81%
V	2.02	0.29	0.59	0.098	0.192	66.21%
VI	4.22	0.32	0.43	0.107	0.213	66.56%

Table – 4. CARBOHYDRATE (TOTAL SUGAR) CONCENTRATION

Fortnight	Sugar concentration mg/20 ant abdomens	Sugar concentration mg/20 ant abdomens	Sugar concentration mg/ Total ant	Sugar concentration mg/mg
I	0.288	0.0144	0.6912	0.076
II	0.414	0.0207	0.4554	0.109
III	0.246	0.0123	0.9717	0.065
IV	0.276	0.0138	0.3726	0.073
V	0.180	0.0090	0.0630	0.047
VI	0.156	0.0078	0.1014	0.041
Control	0.096	0.0048	0.2400	0.046

Table – 5. TOTAL AMINO ACID CONCENTRATION

Fortnight	Amino Acid Conc. mg/20 ant abdomens	Amino Acid Conc. mg/20 ant abdomen	Amino Acid Conc. mg/ Total ant	Amino Acid Conc. mg/mg
I	0.039	0.00195	0.0936	0.0103
II	0.096	0.00480	0.1.56	0.0252
III	0.087	0.00435	0.3436	0.0229
IV	0.159	0.00795	0.2146	0.0412
V	0.243	0.01215	0.0851	0.0639
VI	0.073	0.00360	0.0478	0.0189
Control	0.033	0.00165	0.0825	0.0157

The total amount of sugar taken by the ants was 0.69 mg. at the first sampling date. This amount showed a slight decrease at the next sampling (0.46 mg.), which is more because of the decrease in ant numbers, rather than of a reduction in sugar content. This figure reached a peak thereafter (0.97 mg.), when the sugar removed by the ants was seen to be the highest. Subsequently it showed a decline with 0.37 mg. being removed at the next date. The lowest amount of sugar removed was on the next sampling date, when only 0.063 mg. of sugar was seen to have been removed by the ants. The ant numbers, incidently were also lowest at this date (total of 7 tending ants). On the last sampling date, the amount of sugar removed rose to 0.10 mg. when considered on a total weight basis, the sugar concentration followed the same pattern (Table 4).

Amino-acid : Amino acid concentration in the tending ant abdomen (expressed as mg/mg abdomen tissue), at the first sample date was 0.0103 mg. Thereafter, the amino acid concentration showed an upward trend, recording 0.0252 mg. at the second sampling fell slightly to 0.0229 mg., but increased again to 0.0412 mg. reaching a

peak on the fifth sampling date at 0.0639 mg. Then the level fell drastically, on the last date to 0.0189 mg.

The total amount of amino acids, removed by the ants, was 0.0936 mg on the first day. This, then, rose to 0.1056 mg. on the second day. On the third day, the amount removed was maximum (0.3436 mg.). Thereafter, the amount of amino acids removed, declined to 0.2146 on the third day and 0.0851 on the fourth, inspite of the concentration (mg/mg) being the highest for the whole study period on that date. This was because of the fall in the ants number (total of 7 tending ants). The amount removed on the last day was the lowest (0.0468 mg.), because of the concurrent decrease in amino acid content (0.0189 mg/mg), and the ant number (1/stalk) (Table 5).

DISCUSSION

Mutualistic interactions, resulting in a beneficial effect on both the interacting populations, is an evolutionary adaptation, in order to increase the fitness of both the species, in the face of increasing environmental stress. Aphid-ant associations form no exception to this general rule, and the relationship between these two interacting organisms have evolved to such a degree, that in some cases the relationships have become obligatory.

The present investigation showed that all the colonies of *Micromyzus kalimpengensis* Basu, were tended by ants of the species *Pheidole smythiesi* (Formicidae) only. The aphid population showed a positive correlation to tending ants ($r = 0.82$, $p < 0.01$), even though the numbers of tending ants oscillated at a very low magnitude. The present findings conform to those of earlier workers, such as Muir (1959), Way (1963), Banks (1962), Burns (1973) and Bradly (1973). It is possible that the presence of the ants helped to decrease (or probably, completely removed), the predatory pressure, so that the aphids had no decimation in number due to predators, or parasites.

Honeydew secretion, number of tending ants and aphid populations showed no correlation contrary to expectations. However, since the honeydew measurements were indirect, it is possible that all the honeydew secreted by the aphids were not taken up by the ants, and thus, a strong correlation between these parameters could not be found.

The seasonal fluctuation of honeydew uptake by the tending ants showed an inverse relationship both with the aphid and ant numbers towards the middle of the study period. (i) One reason could be as shown by Herzig (1973), and Mittler (1958) that honeydew secretion of aphids, attended by ants, reveals a decrease in the average droplet volume. (ii) The other could be due to the host plant which had matured by that time; and host plant age has been shown to effect the honeydew secretion (Auclair, 1958; 1959). This is probably the explanation for the lowering of the honeydew excretion when both ant and aphid numbers were more. (iii) The last reason could be attributed to the equidistribution of the honeydew secreted at low levels in relation to the tending ants.

Aphid colonies are a major source of carbohydrate and protein for the ants tending them (Schmidt, 1952). Further, as the colonies provide a steady source of food, foraging by the ants is reduced and this helps in economising energy in the latter (Pontin, 1978). In this study, though comparisons between ants foraging for food, with and without aphid colonies, were not investigated, hence their energy expenditure for food foraging could not be found. However, it has been seen that the ants removed honeydew on an average of 69.72% of their body weight, indicating their extent of dependence on the aphid colonies.

The biochemical analysis of the honeydew removed, showed that the sugar content in tending ant abdomen was significantly higher than in control ants ($t = 2.35$, $p < 0.1$) except on one occasion. However, the number of ants tending the aphid colonies and the sugar content in their abdomen were both low in the last two dates in comparison to other tending ants on earlier occasions. It is tempting to attribute the decrease in ant numbers to the decrease in sugar content, but more data on this is necessary before a clear relationship can be established. An interesting observation however lies in the fact that the sugars removed (indirect measurement of honeydew secretion) is larger as the tending ants increase in their population number. It is probably not farfetched to say that tending ants take advantage of the synchronizing size in aphid numbers to remove and probably store honeydew for use even when aphid population decreases or is totally absent.

Amino acid concentration, again, shows no relation with ant numbers and when the ant numbers were lowest, the amino acid concentration was highest; but this was not consistent throughout. Therefore, sugars, rather than amino acids seem to have a stronger relationship with ant numbers which suggests that ants tend the aphid colonies more for their sugar requirements than for amino acids. It would be worthwhile to investigate this aspect in more detail. However, a similar analysis as for sugar removal could be attributed here indicating a possibility of an equal amount of sugars and amino acid in honeydew.

The study, when considered in totality, suggests that the aphid populations show positive response to ant tending, regardless of the magnitude (or numbers) of the latter. The presence of ants, even in low numbers, seem to be beneficial to the aphids. On the other hand, the study revealed that the ants get a steady supply of sugars and amino acids from the honeydew, which reduces the need for foraging for food.

A study, incorporating energy expenditure of the ants for food foraging, with, and without aphid colonies should be interesting and would provide an insight into the adaptive strategy of the ants, as also the energy benefits to the ants resulting from such associations.

SUMMARY

The present study was undertaken to identify the inherent mechanism in aphid-ant

association. The results revealed a synchrony between the populations of aphids, and ants tending them. The elution of sugars and amino acids of the honeydew in such tending ant abdomens though did not change significantly over the study period, did however, keep in line with the tending ant population number. These and other indications and the implications of such association has been discussed.

ACKNOWLEDGEMENT

The authors are grateful to the Head, Department of Zoology, North-Eastern Hill University and the Director, Zoological Survey of India, Calcutta for providing the necessary facilities.

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**ON A COLLECTION OF FROGS AND TOADS FROM
PERIYAR WILDLIFE SANCTUARY**

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INTRODUCTION

Assessment of the faunal wealth of Conservation areas, particularly wildlife sanctuaries, is an essential prelude for proper management because in a complex ecosystem like this, there exist a multitude of interactions between the various components like the predators, prey, parasites, micro-organisms and the vegetation. With a view to study the various invertebrate and lower vertebrate fauna, survey and collections were undertaken in the Periyar Wildlife Sanctuary (Thekkady). The present paper is the outcome of these studies.

Faunistic surveys were carried out both in the accessible and remote areas within the Sanctuary from 9.2.1981 to 10.3.1981 in three relays led by Dr. Koshy Mathew, Dr. R. S. Pillai and Shri K. Ramachandra Rao. A total number of 329 examples of frogs and toads were collected which include a few tailed juveniles also.

The study has yielded 14 species of Amphibia falling under 3 families and 6 genera which, considering the short duration of surveys and period of the year, is fairly rich. Further surveys in the more remote localities and collections in other seasons of the year shall undoubtedly enhance the amphibian wealth of the sanctuary. Caecilians which are not represented in the present collection should also be available.

References which give descriptions of the species are indicated below each species.

ACKNOWLEDGEMENT

The authors are thankful to the Director, Zoological Survey of India, Calcutta, for all help and encouragement.

LIST OF SPECIES

Class AMPHIBIA

Order ANURA

Family BUFONIDAE

Genus (1) *Bufo* Laurenti

1. *Bufo melanostictus* Schneider

Family RHACOPHORIDAE

Genus (2) *Rhacophorus* Kuhl

2. *Rhacophorus lateralis* BoulengerGenus (3) *Philautus* Gistel3. *Philautus nasutus* (Günther)4. *Philautus beddomi* (Günther)5. *Philautus variabilis* (Günther)

Family RANIDAE

Genus (4) *Nyctibatrachus* Boulenger6. *Nyctibatrachus major* BoulengerGenus (5) *Micrixalus* Boulenger7. *Micrixalus fuscus* Boulenger8. *Micrixalus gadgili* Pillai & PattabiramanGenus (6) *Rana* Linnaeus9. *Rana cyanophlyctis* Schneider10. *Rana limnocharis* Boie11. *Rana keralensis* Dubois12. *Rana beddomii* (Günther)13. *Rana temporalis* (Günther)14. *Rana curtipes* Jerdon

SYSTEMATIC ACCOUNT

1. *Bufo melanostictus* Schneider1890. *Bufo melanostictus*, Boulenger, Fauna Brit. India : 505.1963. *Bufo melanostictus*, Daniel, J. Bombay nat. Hist. Soc. : 435.

Material : (i) 4 exs. Periyar Wildlife Sanctuary, Coll. R. S. Pillai, 14.x.1975. (ii) 1 ex. East Cheriyakanam. Coll. Koshy Mathew, 17.ii.1981. (iii) 2 exs. East of boat landing. Coll. Koshy Mathew, 21.ii.1981.

The largest example measures 50.5 mm in head and body.

Distribution : Oriental region and Malaysia.

2. *Rhacophorus lateralis* Boulenger1890. *Rhacophorus lateralis* : Boulenger, Fauna Brit. India : 473.

Material : (i) 1 ex. Opposite to TNEB office. Coll. Koshy Mathew, 22.ii.1981.

A single example measuring 21.5 mm from vent to snout agrees well with the available description of the species. In the preserved state purplish above. Dorsum and head with dark spots.

Distribution : Malabar.

3. *Philautus nasutus* (Günther)

1882. *Ixalus nasutus*, Boulenger, Cat. Batr. Sal. Brit. Mus. : 100.

1957. *Philautus nasutus*, Kirtisinghe, Amph. Ceylon : 73.

Material : (i) 3 exs. Poonamavu, Coll. Koshy Mathew, 13.ii.1981. (ii) 1 ex. Cheriya kanam, Coll. Koshy Mathew, 15.ii.1981. (iii) 6 exs. Karadi Kavala, Coll. Koshy Mathew, 20.ii.1981. (iv) 4 exs. Mullayaru, Coll. Koshy Mathew, 23.ii.1981. (v) 2 exs. N.E. side of Eadapalayam I.B., coll. R.S. Pillai, 2.iii.1981. (vi) 4 exs. Thambiranthuruthu, Coll. R.S. Pillai, 3.iii.1981. (vii) 3 exs. 2 Km. West of Manakavala I.B., Coll. K.R. Rao, 7.iii.1981. (viii) 2 exs. Valiyathuruthu, Coll. K.R. Rao, 8.iii.1981.

25 examples are available from different localities. Largest examples measures about 23 mm and smallest 14 mm.

Light brownish in preserved state with a median vertebral line. Supra-tympanic fold prominent. Tibio-tarsal articulation reaches the eye.

Distribution : Sri Lanka and Southern India.

4. *Philautus beddomii* (Günther)

1882. *Ixalus beddomii*, Boulenger, Cat. Batr. Sal. Brit. Mus. : 101.

1890. *Ixalus beddomii*, Boulenger, Fauna Brit. India : 486.

Material : (i) 1 ex. East Cheriya kanam, Coll. Koshy Mathew, 17.ii.1981. (ii) 2 exs. Karadi Kavala, Coll. Koshy Mathew, 20.ii.1981. (iii) 1 ex. 3 Km. West of Eadapalayam I.B., Coll. Koshy Mathew, 21.ii.1981. (iv) 2 exs. Mullayaru, Coll. Koshy Mathew, 23.ii.1981.

The largest one in the six examples measures 20 mm from snout to vent. Snout rounded. Nostril nearer to snout than eye. Toes less than half-webbed.

Distribution : South Kerala and Anaimalai Hills.

5. *Philautus variabilis* (Günther)

1890. *Ixalus variabilis*, Boulenger, Fauna Brit.India : 487.

1984b. *Philautus variabilis*, Inger. *et al.* J. Bombay nat. Hist. Soc. : 555.

Material : (i) 1 ex. East Cheriya kanam, Coll. Koshy Mathew, 17.ii.1981.

Only a single example measuring about 13 mm from tip of snout to vent is available which agrees well with published description of the species.

Distribution : Sri Lanka, Southern India.

6. *Nyctibatrachus major* Boulenger

1978. *Nyctibatrachus major*, Pillai, Bull. zool. Surv. India : 136.

Material : (i) 3 exs. Karadi Kavala, Coll. R.S. Pillai, 20.ii.1981. (ii) 1 ex. East of boat landing. 21.ii.1981.

The largest example measures 33.5 mm in total length.

Distribution Southern India.

7. *Micrixalus fuscus* Boulenger

1882. *Ixalus fuscus*, Boulenger, Cat. Batr. Sal. Brit. Mus. : 96.

Material : (i) 1 ex. Karadi Kavala, Coll. Koshy Mathew, 20.ii.1981.

Total length from snout to vent 25 mm. Small minute tubercles present on flanks. Tibio-tarsal articulation reaching eyes. Sub-articular tubercles not prominent. Dorsally light brown in colour.

Distribution : Throughout India.

8. *Micrixalus gadgili* Pillai & Pattabiraman

Material : (i) 1 ex. Anjuruli, Coll. Koshy Mathew, 13.ii.1981. (ii) 13 exs. Mullayaru, Coll. Koshy Mathew, 23.ii.1981.

All the examples agree well with the description of the species.

Distribution : Known hitherto only from the type locality viz. Sabarigiri Forest, Kerala.

9. *Rana cyanophlyctis* Schneider

1920. *Rana cyanophlyctis*, Boulenger, Rec. Indian Mus: 12.

Material : (i) 1 ex. Kokkarakandam, Coll. Koshy Mathew, 12.ii.1981. (ii) 1 ex. Anjuruli, Coll. Koshy Mathew, 13.ii.1981 (iii) 1 ex. Anjuruli, Coll. Koshy Mathew, 14.ii.1981. (iv) 3 exs. Cheriya kanam, Coll. Koshy Mathew, 15.ii.1981.

Totally 6 examples examined, the largest being 40 mm from Anjuruli.

Distribution : Throughout India.

10. *Rana limnocharis* Boie

1920. *Rana limnocharis*, Boulenger, Rec. Indian Mus : 28.

Material : (i) 2 exs. Nellikkampatii, Coll. Koshy Mathew, 11.ii.1981. (ii) 3 exs. Kokkara Kandam, Coll. Koshy Mathew, 12.ii.1981. (iii) 16 exs. Poonamavu, Coll. Koshy Mathew, 13.ii.1981. (iv) 3 exs. Cheriyanam, Coll. Koshy Mathew, 15.ii.1981. (v) 19 exs. Sethayana Odai, Coll. Koshy Mathew, 18.ii.1981. (vi) 5 exs. Mana Kavala, Coll. Koshy Mathew, 19.ii.1981. (vii) 3 exs. East to boat landing. Coll. Koshy Mathew, 21.ii.1981. (viii) 8 exs. Opposite to Periyar house, Coll. Koshy Mathew, 24.ii.1981. (ix) 11 exs. 1 1/2 Km. West of Edapalayam I.B., Coll. R.S. Pillai, 27.ii.1981. (x) 2 exs. 2 Km. south of Edapalayam I.B. coll. R.S. Pillai, 28.ii.1981. (xi) 6 exs. 2 Km. N.E. side of Edapalayam I.B. Coll. R.S. Pillai, 2.iii.1981. (xii) 11 exs. Thambiran thuruthu, Coll. R.S. Pillai, 3.iii.1981. (xiii) 2 exs. 1 Km South of Manakavala, Coll. K.R. Rao, 6.iii.1981. (xiv) 3 exs. 2 Km West of Manakavala, Coll. K.R. Rao, 7.iii.1981. (XV) 21 exs. Valiyathuruthu, Coll. K.R. Rao, 8.iii.1981.

As many as 115 examples are available from 15 different localities, the largest example being 43.5 mm. All the examples agree well with published descriptions.

Distribution : Eastern Asia from Pakistan to Japan.

11. *Rana keralensis* Dubois

1920. *Rana verrucosa*, Boulenger, Rec. Indian Mus. : 26.

1984. *Rana keralensis*, Inger *et al.* J. Bombay nat. Hist. Soc. : 426.

Material : (i) 3 exs. Nellikkampatti, Coll. Koshy Mathew, 11.ii.1981. (ii) 4 exs. East of boat landing, Coll. Koshy Mathew, 16.ii.1981. (iii) 5 exs. Karadi kavala, Coll. Koshy Mathew, 17.ii.1981. (iv) 5 exs. Karadi kavala, Coll. Koshy Mathew, 20.ii.1981. (v) 4 exs. East of boat landing, Coll. Koshy Mathew, 21.ii.1981. (vi) 8 exs. 2 km. N.E. side of Edapalayam IB. Coll. R.S. Pillai, 2.iii.1981. (vii) 1 ex. 1/2 Km. South of Edapalayam IB Coll. K.R. Rao, 4.iii.1981.

30 examples are available from different localities, the largest one measuring 52.5 mm from snout to vent.

Distribution : Hills of Malabar, Nilgiris and Travancore.

12. *Rana beddomii* (Günther)

1920. *Rana beddomi*, Boulenger, Rec. Indian Mus : 114.

Material : (i) 1 ex. Kokkara Kandam, coll. Koshy Mathew, 12.ii.1981. (ii) 4 exs. Poonamavu, Coll. Koshy Mathew, 13.ii.1981. (iii) 18 exs. Karadi Kavala. Coll. Koshy Mathew, 20.ii.1981. (iv) 1 ex. East of boat landing. Coll. Koshy Mathew, 21.ii.1981. (v) 10 exs. Mullayaru, Coll. Koshy Mathew, 23.ii.1981. (vi) 2 exs. N.E. side of Edapalayam IB, Coll. R.S. Pillai, 2.iii.1981.

36 examples from eight localities were collected, the largest measures 34.5 mm in total length.

Brown above with indistinct uniform darker spots.

Distribution : Forest of Southern India.

13. *Rana temporalis* (Günther)

1920. *Rana temporalis*, Eoulenger, Rec. Indian Mus. : 159.

Material : (i) 9 exs. Kokkara Kandam, Coll. Koshy Mathew, 12.ii.1981. (ii) 1 ex. Cheriya kanam, Coll. Koshy Mathew, 15.ii.1981. (iii) 3 ex. East of boat landing, Coll. Koshy Mathew, 16.ii.1981. (iv) 7 exs. East Cheriya kanam, Coll. Koshy Mathew, 17.ii.1981. (v) 1 ex. Karadi Kavala, Coll. Koshy Mathew, 20.ii.1981. (vi) 2 exs. East to boat landing, Coll. Koshy Mathew, 21.ii.1981. (vii) 3 exs. Mullayaru, Coll. Koshy Mathew, 23.ii.1981. (viii) 1 ex. 2 Km. West of Manakavala IB, Coll. K.R. Rao, 7.iii.1981.

The largest out of 27 exs. measures 46 mm from snout to vent.

Distribution : Malabar and Sri Lanka.

14. *Rana curtipes* Jerdon

1920. *Rana curtipes*, Boulenger, Rec. Indian Mus : 131.

Material : (i) 9 exs. East of boat landing. Coll. Koshy Mathew, 16.ii.1981. (ii) 1 ex. East Cheriya kanam, Coll. Koshy Mathew, 17.ii.1981. (iii) 7 exs. Sethayana Odai, Coll. Koshy Mathew, 18.ii.1981. (iv) 1 ex. Mullayaru, Coll. Koshy Mathew, 23.ii.1981. (v) 3 exs. 1 1/2 Km of Edapalayam IB. Coll. R.S. Pillai, 27.ii.1981. (vi) 5 exs. 2 Km. South of Edapalayam, Coll. R.S. Pillai, 28.ii.1981. (vii) 7 exs. 3 Km. west of Edapalayam IB Coll., R.S. Pillai, 1.iii.1981. (viii) 1 ex. Thambiranthuruthu, Coll. R.S. Pillai, 3.iii.1981. (ix) 2 exs. 1/2 Km. south of Edapalayam IB. Coll. R.S. Pillai, 4.iii.1981 (x) 12 exs. 1 Km south of Manakavala IB, Coll. K.R. Rao, 6.iii.1981. (xi) 4 exs. 2 Km. west of Manakavala IB. 7.iii.1981. (xii) 3 exs. Valiyathuruthu, Coll. K.R. Rao, 8.iii.1981.

Many out of the 55 examples with tiny tail are juveniles. The largest example in the collection measures 63 mm from snout to vent.

Distribution : Hills of Malabar from Canara to Travancore.

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**LEPEOPHTHEIRUS KRISHNAI, A NEW PISCICOLOUS
COPEPOD FROM THE PULICAT LAKE**

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INTRODUCTION

While examining some fish species from the Pulicat Lake, as a part of a detailed study on their biology (Kaliyamurthy, 1982), a caligoid copepod was found parasitic on *Siganus canaliculatus* (Park). This copepod is described here as a new species.

DESCRIPTION OF THE SPECIES

Family CALIGIDAE

Genus *Lepeophtheirus* Nordmann

Lepeophtheirus krishnai sp. nov.

(Fig. A – L)

Material examined : Three females and two juveniles collected from the inner opercles of *Siganus canaliculatus* caught from the Pulicat Lake. Holotype, female, will be deposited in the Indian Museum, Calcutta.

Etymology : This species was named after Dr. N. Krishnā Pillai, Professor (Emeritus), Department of Aquatic Sciences, University of Kerala, Trivandrum, in honour of his contributions to the knowledge of copepods parasitic on Indian marine fishes.

Female : The carapace is longer than broad with the anterior part slightly narrowing (Fig. A). The posterior sinuses are narrow and shallow and the postero-median lobe is very broad. The frontal plates are of moderate size with narrow flange, and the membranous flange of carapace is relatively narrower. The genital segment is wider than long, and its posterior corners are broadly rounded and bulging backwards. The abdomen is short. The caudal ramus is more or less rectangular with three long and three short setae (Fig. L) and its inner margin at the posterior end is setose.

The basal segment of antennule is stout and triangular; the distal segment short (Fig. B). The third segment of antenna is sharply curved at the tip with a short seta (Fig. C). The claw of the maxillule is slightly curved. The first maxilla is bifid. Distal segment of the second maxilla is slender and long, with two setae, outer one long and winged; the short inner one pectinate (Fig. D). The basal segment of the maxilliped is not very stout, and the distal segment is slightly curved (Fig. E). The sternal fork has a broad base and a tapering distal part (Fig. F); rami apically narrow and diverging.

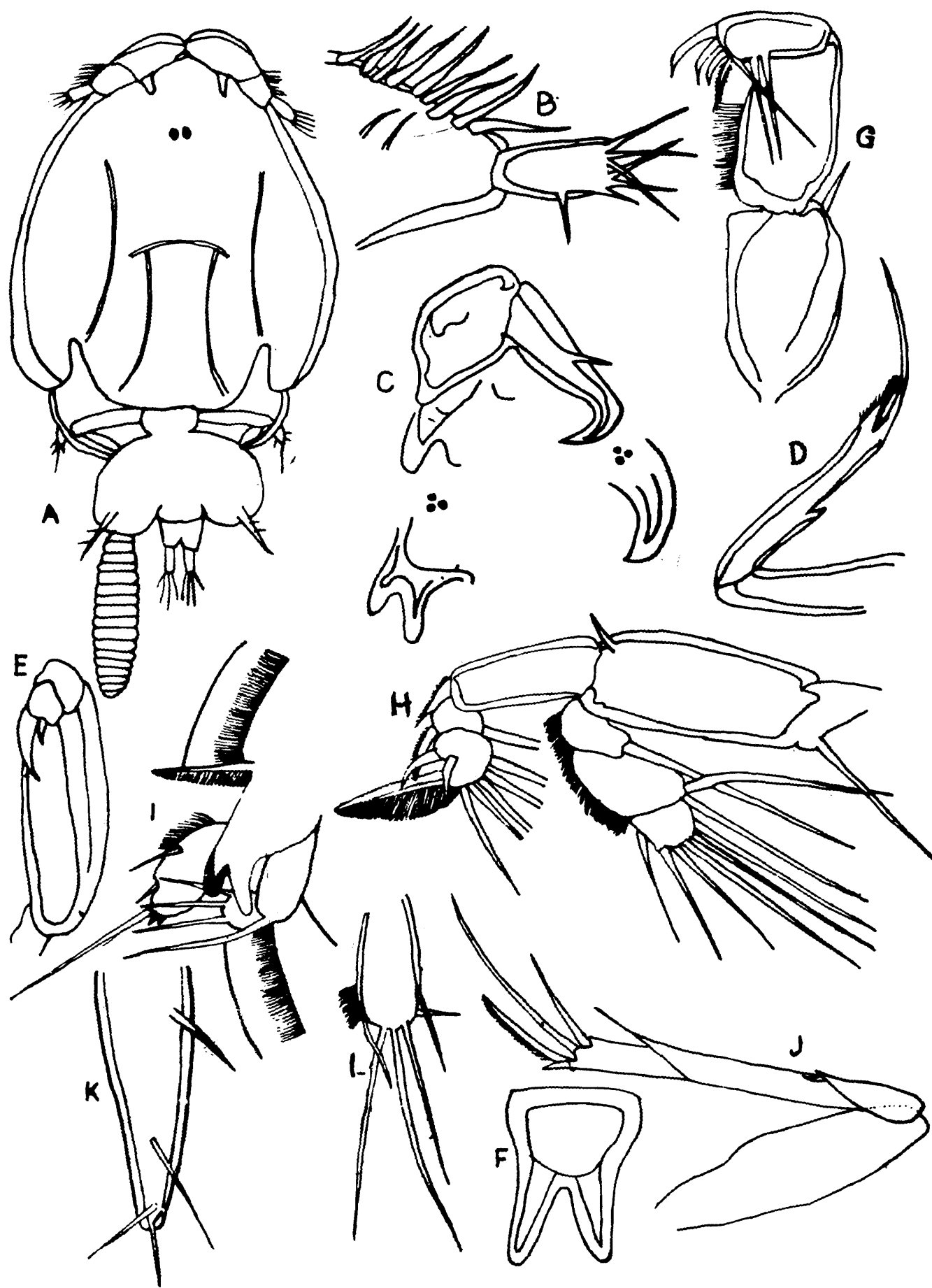


Fig. 1. *Lepeoptheirus krishnai* sp. nov. A. Carapace; B. Antennule; C. Antenna; D. Mascilla; E. Mascilliped; F. Sternal fork; G. Distal segment of first leg; H. Basipod; I. A pron of third leg; L. Caudal ramus.

The distal segment of the first leg has three strong curved claws, a short seta and three long stout setae along the inner margin (Fig. G). The basipod of the second leg is narrow and long (Fig. H). The outer border of the endopod segments has spinules. Apron of third leg is well developed, and the claw at the base of the exopod is bifid and curved inward (Fig. I). Exopod segments have very short spine like setae, the apical one is very long and slender, the fourth with three long slender claws (Fig. J). Fifth leg is a short process carrying four setae (Fig. K). The egg strings are uniseriate, short and oblong.

Total length : 1.96 mm.

Male : Unknown.

DISCUSSION

The genus *Lepeophtheirus* comprised of many species in which fifth leg is well developed like the present species. The shape of the cephalothorax of the present species is very characteristic and has a superficial resemblance to that of *L. spinifer*. *L. krishnai* sp. nov. can be distinguished from it by the shape of the genital segment and the fifth leg. The extreme development of fifth leg is an important character of the genus *Dentigryps* Wilson and hence Lewis (1964) suggested the transfer of all the species of *Lepeophtheirus* with well developed fifth leg to *Dentigryps*. But Pillai (1966) felt it natural to sink *Dentigryps* in the Synonymy of *Lepeophtheirus*. *L. krishnai* sp. nov. has a very short egg string, a feature comparable to that of *L. gonistii*.

The present species can be easily distinguished from all other species of *Lepeophtheirus* by a combination of many characters such as the shape of the cephalothorax, genital segment, postoral process, tip of the first leg and the process at the base of the exopod of the third leg.

SUMMARY

A new caligoid copepod, *Lepeophtheirus krishnai*, from the gills of *Siganus canaliculatus* of the Pulicat Lake, east coast of India is described. This species can be distinguished from all the known species by the shape of the cephalothorax, genital segment, postoral process, tip of the first leg and the process at the base of the exopod of the third leg.

ACKNOWLEDGEMENTS

The author is grateful to Dr. A.V Natarajan, Director, Central Inland Fisheries Research Institute, for his interest and encouragement. He is thankful to Dr. R. Cressey, Curator, Smithsonian Institution, Washington, U.S.A. and Dr. N. Krishna Pillai, Professor (Retired), Department of Aquatic Biology and Fisheries, Kerala University, Trivandrum, for their kind help and suggestions in the identification of the parasite.

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ON THE FISH FAUNA OF LADAKH WITH NOTES ON ZOOGEOGRAPHY

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INTRODUCTION

Steindachner (1966) was the first worker to report on the fishes of Ladakh, collected by Dr. Stoliczka and described three new genera of Schizothoracinae viz. *Schizopygopsis* from Henle, *Diptychus* from Leh and *Ptychobarbus* from Henle together with three new species of the genus *Noemacheilus* viz. *N. tenuicauda* from Henle, *N. stoliczkae* from Tso Morari, Rupshu and *N. microps* from Leh. Subsequently, these species of fishes were included in the Catalogue of the fishes of the British Museum by Guenther (1868) who described *Noemacheilus ladacensis* from head waters of the Indus river in Ladakh. Day (1876-1877) described *Exostoma stoliczkae* from Leh and *Noemacheilus gracilis* from head waters of the Indus river; he also recorded *Schizothorax richardsonii* (= *Oreinus sinuatus*), *Schizothoraichthys esocinus*, *Ptychobarbus conirostris*, *Schizopygopsis stoliczkae*, *Diptychus maculatus* and *Noemacheilus stoliczkae* from Ladakh. Zugmayer (1909, 1910) described two species, *Schizothorax ladacensis* Zugmayer and *S. montanus* Zugmayer from Indus river near Leh but no reference to these species appear to have been made by subsequent workers on the Ladakh fishes. It is not possible to study and check up the exact systematic position of the fishes described by Zugmayer (1909, 1910) des to lack of material of these species and, therefore, these taxa are being included here in the fauna of Ladakh. As and when material of these species is available, the systematic status of these species will be decided in future; these species are very closely related to *Schizothorax richardsonii* (Gray). Hora (1922) recorded *N. ladacensis*, *N. stoliczkae*, *N. tenuicauda*, *N. microps* definitely from localities within Ladakh. Subsequently, Hora and Mukerji (1935) worked out the collection of fishes obtained by Mr. J.A. Sillem as member of Netherlands Karakoram Expedition (1929-1930) and reported the presence of *Schizothoraichthys esocinus*, *Schizopygopsis stoliczkae*, *Diptychus maculatus*, *Ptychobarbus conirostris*, *Noemacheilus stoliczkae*, *N. gracilis* and *N. tenuicauda* from the Indus river system in Ladakh. Hora (1936) and Mukerji (1936) worked out the collections of fishes made from Ladakh during Yale North India Expedition (1932) and reported seven species of the genus *Noemacheilus* of which three were new to science (viz. *N. stoliczkae* Steindachner, *N. gracilis* Day, *N. microps* (Steindachner), *N. tenuicauda* (Steindachner), *N. dettrai* Hora, *N. hutchinsoni* Hora and *N. panguri* Hora). In addition to these species, they also recoded six species of Schizothoracinae (viz. *Schizothoraichthys (Racoma) labiatus* (McClelland), *S. (Schizothoraichthys) esocinus*

(Heckel), *Schizothorax richardsonii* (Gray), *Schizopygopsis stoliczkae* Steindachner, *Diptychus maculatus* Steindachner and *Ptychobarbus conirostris* Steindachner) and one species of a Sisorid (*Glyptosternum reticulatum* McClelland). Talwar (1978) has recently described *Gymnocypris biswasi* Talwar and recorded *S. stoliczkae*, *N. deterrai*, *N. ladacensis* and *N. panguri* from Ladakh.

The fishes described by Heckel (1838) and Silas (1978) were from the Kashmir Valley and not from Ladakh although some species of this Valley are distributed in Ladakh also as can be seen from the list of fishes reported from Ladakh. The list of fishes of Kashmir drawn up by Das (1965) is a compilation from earlier literature and does not clearly indicate species exclusively found in Ladakh. Talwar (1978) drew up a list of fishes from Ladakh comprising 26 species of which at least 9 species (*S. curvifrons*, *S. hugelii*, *S. longipinnis*, *S. nasus*, *S. niger*, *S. micropogon*, *S. planifrons*, *S. progsastus* and *N. yarkandensis*) were never definitely reported from any locality in Ladakh nor did this author study them in his collection although these species existed in the surrounding area such as the Kashmir Valley and the Pamir mountains. The existence of these species in Ladakh is, therefore, neither supported by literature nor by the material studied by Talwar (1978). The works of Das *et al.* (1964), Das and Nath (1965), Das and Subla (1966) and Saxena (1968) are not based on actual collection of fishes from Ladakh. Thus, through a review of literature on the fishes of Ladakh together with the study of the material collected by the present author from this area during 1977, it is now possible to enumerate 22 species of fishes actually recorded from Ladakh area of Jammu & Kashmir. Among these, two species of the genus *Noemacheilus* (*N. drassensis* and *N. shehensis*) are described here as new species. *Schizothorax micropogon* is recorded from Ladakh definitely for the first time.

SYSTEMATIC LIST

Order SILURIFORMES

Family SISORIDAE

1. *Exostoma stoliczkae* Day
2. *Glyptosternum reticulatum* (McClelland)

Order CYPRINIFORMES

Family CYPRINIDAE

Sub-family SCHIZOTHORACINAE

3. *Diptychus maculatus* Steindachner
4. *Gymnocypris biswasi* Talwar
5. *Ptychobarbus conirostris* Steindachner
6. *Schizopygopsis stoliczkae* Steindachner
7. *Schizothorax richardsonii* (Gray)

8. *Schizothoraichthys (Racoma) labiatus* (McClelland)
9. *Schizothoraichthys (Schizothoraichthys) esocinus* (Heckel)
10. *Schizothorax ladacensis* Zugmayer
11. *Schizothorax montanus* Zugmayer
12. *Schizothoraichthys (Schizothoraichthys) micropogon* (Heckel)

Family COBITIDAE

13. *Noemacheilus deterrai* Hora
14. *Noemacheilus drassensis* sp. nov.
15. *Noemacheilus gracilis* Day
16. *Noemacheilus hutchinsoni* Hora
17. *Noemacheilus ladacensis* Guenther
18. *Noemacheilus microps* (Steindachner)
19. *Noemacheilus panguri* Hora
20. *Noemacheilus shehensis*, sp. nov.
21. *Noemacheilus stoliczkae* (Steindachner)
22. *Noemacheilus tenuicauda* (Steindachner)

SYSTEMATIC NOTES

Systematic notes on some of the important species in the present collection are given below. The two new species of the genus *Noemacheilus* are also described here along with figures.

Schizothorax richardsonii (Gray)

1832. *Cyprinus richardsonii* Gray, III. *Indian Zool.*, pt. 10, pl.14, Fig. 2 (Type-locality : not mentioned)
1838. *Schizothorax palgiostomus, sinuatus* Heckel, *Fische aus Caschmir* p.16, pl.1 (Type-locality : Kashmir).
1971. *Schizothorax richardsonii* : Menon, *Rec. zool. Surv. India*, 63(1-4), p.203.
1978. *Schizothorax skarduensis* Mirza and Awan, *Biologia*, 24, pp. 199-203.

Material examined (i) 1 ex. (180 mm. total length), Suru river, Kargil, Ladakh, 2.9.1977, coll. R. Tilak (ii) 8 Exs. (107-198 mm. total length), Sheh Canal, Ladakh, 10.9.1977, Coll. R. Tilak.

Remarks This species has a characteristic transverse and hard papillated strip at the chin, behind which the labial fold is continuous. It can be distinguished from *S. kumaonensis*, the other species of this genus reported from Kumaon Himalaya (Uttar Pradesh), in the longer head whose length is contained from 4.05-5.05 times in the standard length (Versus 4.85-5.76 times). The sexes are distinctly separate; the male bears tubercles on the snout while the female has a smooth snout. Mirza and Awan (1978) have described a new specie *S. skarduensis* from Pakistan; the only point of

difference of this species with *S. richardsonii* is the longer barbels. The length of barbels is a highly variable character in this species. The shape and structure of the papillated strip at the chin are of intermediate nature between those of *Schizothorax* and *Schizothoraichthys*. Specimen of this kind are usually met with and are due to hybridization (Tilak, 1987).

S. richardsonii is a highly versatile species as far as its adjustment to the various ecological conditions at different altitudes is concerned. This is the only species which is distributed in all streams of Himalaya between 700-3500 mts.

Distribution : Throughout Himalaya including Ladakh; Afghanistan.

***Schizothoraichthys (Racoma) labiatus* (McClelland)**

1842. *Racoma labiatus* McClelland, *Calcutta J. nat. Hist.*, 2, p. 578, pl. XV, Fig. I
(Type-locality : Kunar River near Jallabad, Afghanistan).

1936. *Schizothorax labiatus* : Mukerji, *Men. Conn. Acad. Sci., Letter*, 10, p. 333.

Material examined : 1 ex. (193 mm. total length) Sheh canal, Ladakh, 12.9.1977, Coll. R. Tilak.

Remarks : The characteristic feature of this species is the presence of trilobed lower lip which has a continuous labial fold. The strip of hard papillated structure at the chin is absent. The intermediate lobe of the lower lip may be well developed or small. There are four barbels, the last ray of the dorsal fin is bony, posteriorly serrated, the pharyngeal teeth triserial (5-4-3/3-4-5) etc. The species was reported for the first time by Mukerji (1936). The present material is the second collection of the species from Ladakh. It is found in rapid running waters.

Distribution : Ladakh and Kashmir Valley (J. & K.) : Afghanistan.

***Schizothoraichthys (Schizothoraichthys) micropogon* (Heckel)**

1838. *Schizothorax micropogon* Heckel, *Fische aus Caschmir*, p.41, pl. viii, Fig. 1
(Type-locality: Kashmir).

1936 *Schizothorax micropogon* : Mukerji, *Mem. Conn. Acad. Sci., Letters*, 10, p. 343.

Material examined : 1 ex. (141 mm. total length), Sheh canal, Ladakh, 8.9.1977. Coll. R. Tilak.

Remarks : In size, this is the smallest species among schizothoracids and is sexually mature at 141 mm. total length. The lower lip has an interrupted sub-labial groove. The scales along the anal sheath are small and not bigger than those of the rest of the body.

This species is being definitely reported for the first time from Ladakh.

Distribution : Ladakh and Kashmir Valley (J. & K.).

***Schizothoraichthys (Schizothoraichthys) esocinus* (Heckel)**

1838. *Schizothorax esocinus* Heckel, *Fische aus Caschimir*, p.48, pl. ix (Type-locality : Kashmir).

1936. *Schizothorax esocinus* : Mukerji, *Mem. Conn. Acad. Sci., letters*, 10, p. 335.

Material examined : (i) 2 exs. (148-170 mm. total length), Sheh Canal, Ladakh, 5.9.1977, Coll. R. Tilak (ii) 1 ex. (168 mm. total length), Irrigation Canal, Sheh, Ladakh, 7.9.1977, Coll. R. Tilak; (iii) 6 exs. (69-170 mm. total length), Sheh Canal, Ladakh, 8-13.9.1977, Coll. R. Tilak (iv) 1 ex. (64 mm. total length), Indus river near Chuglamsar, 3 Kms. east of Leh, Ladakh, 11.9.1977, Coll. R. Tilak.

Remarks : This species distinguishes itself from all other species of this genus in possessing a deep cleft of the mouth. The body bears dark irregular spots. The lower labial fold is interrupted in the middle. Mukerji (1936) has indicated that *S. punctatus* Day is synonymous with this species.

Distribution : Ladakh and Kashmir Valley (J. & K.) : Afghanistan.

***Diptychus maculatus* Steindachner**

1866. *Diptychus maculatus* Steindachner, *Verh. zool.-bot. Ges. Wien XVI*, p. 788, pl. 13, Fig. 5 (Type-locality : Tibet, 11200 ft.)

1936. *Diptychus maculatu* : Mukerji, *Mem. Conn. Acad. Sci., Letters*, 10.p.354.

Material examined : (i) 1 ex. (163 mm. total length), Suru river, Tilichchi Village near Kargil, 3.9.1977, Coll. R. Tilak (ii) 32 exs. (46-92 mm. total length), Suru river near Andoo Village, Kargil, Ladakh, 4.9.1977, Coll. R. Tilak (iii) 7 exs. (168-210 mm. total length) Dumkhar nullah, nearly 20 Kms. west of Khalsi, Ladakh, 16.9.1977, Coll.R. Tilak (iv) 1 ex. (227 mm. total length) Tribhuchan Nullah, 4 Kms. from Drass, Ladakh, 18.9.1977, Coll. R.Tilak (v) 3 exs. (147-182 mm. total length), Drass Nullah Drass, Ladaky, 18.9.1977, Coll. R. Tilak.

Remarks : This species is characterised by the presence of an inferior mouth with a sharp horny covering on the lower jaw, 2 maxillary barbels, scales on the body present only above the lateral line, pharyngeal teeth in 2 rows (4-3/3-4) and the last undivided ray of the dorsal fin soft and unserrated.

Distribution : Chandra Bhaga river in Lahaul & Spiti Valley, Himachal Pradesh and Indus river and its tributaries in Ladakh; Tibet, Nepal, Karakash and Yarkand rivers of Central Asia.

***Ptychobarbus conirostris* Steindachner**

1866. *Ptychnobarbus conirostris* Steindachner, *Verh. zool.-bot., Ges. Wien, XVI*, p.790, pl. 17, Fig. 4 (Type-locality : Ladakh, 15200 ft.).

1936. *Ptychobarbus conirostris* : Mukerji, *Mem. Conn. Acad. Sci., Letters*, X, pp. 356-359.

Material examined : (i) 14 exs. (98-176 mm. total length), Irrigation Canal at Sheh, nearly 12 Kms. east of Leh, Ladakh, 8.9.1977, Coll. R. Tilak (ii) 8 exs. (99-172 mm.

total length), same locality as at No. i, 10.9.1977, Coll. R. Tilak (iii) 1 ex. (164 mm. total length), Indus river Chuglamsar, 7 Kms. east of Leh, 11.9.1977, Coll. R. Tilak (iv) 17 exs. (162-192 mm. total length), Indus river near Khalsi, Ladakh, 15.9.1977, Coll. R. Tilak (v) 2 exs. (190-198 mm. total length), Indus river, 2 Kms. upstream from Khalsi, Ladakh, 16.9.1977, Coll. R. Tilak.

Remarks : This species is characterised by the presence of a subterminal mouth, last undivided ray of the dorsal fin soft and unserrated, body completely scaled, only 2 maxillary barbels present, pharyngeal teeth in 2 rows (4-3/3-4) and the body uniformly spotted.

Distribution : Head waters of Indus river, Gompo and Nubra Valley, Ladakh; Tibet.

Schizopygopsis stoliczkae Steindachner

1866. *Schizopygopsis stoliczkae* Steindachner, *Verh. zool.-bot., Ges. Wien*, XVI, p. 785, pl. 16, Fig. 2 (Type-locality : Ladakh).

1936. *Schizopygopsis stoliczkae* : Mukerji, *Mem. Conn. Acad. Sci., Letters*, 10, p. 351.

Material examined (i) 1 ex. (178 mm. total length), Irrigation Canal, nearly 12 Kms. east of Leh, Ladakh, 7.9.1977, Coll. R. Tilak (ii) 176 exs. (58-188 mm. total length), Sheh, Ladakh, 8.9.1977, Coll. R. Tilak (iii) 5 exs. (63-120 mm. total length), Sheh, 10.9.1977, Coll. R. Tilak (iv) 2 exs. (141-167 mm. total length), Indus river near Gomak Village, Ladakh, 11.9.1977, Coll. R. Tilak (v) 3 exs. (134-167 mm. total length), Indus river near Chuglamsar Village, 7 Kms. east of Leh, Ladakh, 11.9.1977, Coll. R. Tilak.

Remarks : The absence of scales on the body except along the Lateral line and a shoulder patch, barbels absent, pharyngeal teeth in 2 rows (4 or 3-3/33 or 4), the last undivided ray of the dorsal fin bony and serrated and the inferior mouth with a sharp horny covering on the lower jaw.

Distribution : From Badakshan and the Pamirs to the eastern Himalaya including the upper reaches of the Oxus, the Indus, the Sutlej and Brahmaputra rivers.

Noemacheilus drassensis, sp. nov.

B. III, D. III-IV/7, P. I/10-11, V. I/7, A. III-IV/5, C. 15.

It is an elongated form with the head and body slightly depressed. The dorsal profile is arched between the base of the dorsal fin and the snout, and it slopes down to the base of the caudal fin. The head is moderately long and bluntly pointed. The length of head is contained from 5.87-6.0 times in total length and 4.90-5.12 times in standard length. The width of head is contained 1.43-1.66 times and its height 1.65-1.77 times in its length. The eye is almost in the middle of head but in many specimens, it is slightly in the anterior half of head. The diameter of eye is contained 6.32-6.6 times in head length, 2.8-2.85 times in length of snout and 1.6-1.8 times interorbital width. The eyes are not visible from the ventral side of head.

The mouth opening is crescentic and transverse. It is bordered by fleshy lips which are continuous at the corners of the mouth. The lower lip is interrupted in the middle where two small median lobes are formed. The lower lip is reflected backwardly so that a shovel-shaped part of the lower jaw is left naked. The lips are striated.

The outer rostral barbels are the longest. The outer rostral and the maxillary barbels are nearly equal to 2 diameters of eye. The body is devoid of scales. The lateral line is incomplete it runs upto the end of the dorsal fin and thereafter it becomes faint and completely obliterated above and behind the anal fin.

The depth of body is maximum opposite the middle of the pectoral fin and is contained 7.68-9.3 times in total length and 6.56-7.8 times in standard length. The caudal peduncle is not whip-like as in many other high altitude species of *Noemacheilus*. The height of caudal peduncle is contained 2.05-2.08 times in its length.

The dorsal fin originates slightly behind the origin of the ventral fin and is nearer the caudal base than the tip of the snout. The distance between the anterior origin of the dorsal fin and the base of the caudal fin, when carried forward, falls on the nostrils. The longest ray of the dorsal fin is contained 1.32-1.45 times and the length of its base 1.66-1.97 times in length of head. The tip of the dorsal fin is almost cut square. The pectoral fins are broad and the edge is pointed in the middle. The 4th branched ray of the pectoral fin is longest and forms the tip of the fin; its length is contained from 1.19-1.23 times in head length., The 3rd and 4th branched rays of the ventral fin are the longest and reach upto the tip of the fin. The 2nd and the 3rd branched rays of the anal fin reach upto its tip and their length is contained 1.5-1.6 times in length of head. The ventral fins do not reach the anal opening and the anal fin extends only half-way to the base of the caudal fin. The caudal fin is emarginate. The 3rd and 4th branched rays of the caudal fin form the tips of each of the two lobes of the fin. The unbranched rays of both the lobes of caudal are shorter and do not reach tip of the fin. The length of the caudal fin is contained 1.0-1.14 times in length of head.

Sexual dimorphism : There is a marked sexual dimorphism in this species; it is of a similar nature as described in *N. tibetanus* and other species of the genus *Noemacheilus* of high altitude areas (Hora, 1922). In the male, there is a slit-like deep groove in front of the eye. The groove extends between anterior border of eye and base of outer rostral barbels and marks off a fleshy appendage. The skin of the appendage and some portion of the cheek below it are roughened by the presence of minute tubercles. Similar tubercles are present on the dorsal side of the branched rays of the pectoral fin. These rays of the pectoral fin are thickened and bony.

In the female, the groove between the eye and the thickening of the pectoral rays, and covering of the tubercles on both these structures are absent.

Colour : The body bears irregular colour markings which form a reticulum in the anterior half of the body while they take the shape of irregular vertical bands behind the dorsal fin. There are 10-11 dark saddle-shaped bands on the back. The 4-5 bands on the

back, behind the dorsal fin, are more prominent than those present in the area anterior to the dorsal fin. The ventral and lateral sides of the head bear reticulations of dark colour. The ventral sides of head and body are pale olivaceous in colour. There are 3 dark bands at the base of the dorsal fin. There are 3-4 rows of dark spots on the dorsal fin. There are a few rows of dark spots on the pectoral fin. The ventral and anal fins are normally yellowish but in some specimens, 1-2 dark spots are present on the middle rays of these fins. There are 3-4 irregular rows of dark spots on the caudal fin. There is a vertical dark band at the base of the caudal fin.

Distribution Drass, Ladakh (J. & K.).

Holotype : F. NRS/ZSI-1206, 1 example (106 mm. total length) *male*, a stream near Drass (Ladakh, J. & K.), 19.9.1977, Coll. R. Tilak.

Paratype : F. NRS/ZSI-1207, 7 examples *male* and 11 examples *female* (43-97 total length), locality data same as that of the Holotype.

Relationships : *N. drassensis*, sp. nov. is a small sized fish which lives under stones in a small stream near Drass by the side of Srinagar-Leh highway. Since Drass has been recorded as the second coldest place in the world, the streams near about this place remain under a heavy cover of snow for major part of the year and the present species is adapted to live under harsh conditions.

This species is close to *N. microps* Steindachner but differs from it in many features. Steindachner (1866) described *N. microps* from headwaters of Indus river at an altitude of 16000 ft. above sea level. Günther (1867) considered *N. microps* near to *N. rupecola* (McClelland) while Day (1878) doubtfully synonymised it with *N. rupecola*. Hora and Mukerji (1935) studied 57 examples of *N. microps* from Karakash river at Alinazar Kurgan and remarked that this small-sized fish has small eyes. The characters in which the present species differs from *N. microps* are the following.

1. *N. drassensis* has a deeper body than that of *N. microps* the depth of body is contained 7.68-9.3 times in total length in the new species whereas the same dimension is 9.0-12.0 times in *N. microps*.

2. The eyes are larger in *N. drassensis*, being 6.32-6.6 times in head length against 7.0-7.5 times in *N. microps*.

3. The postdorsal distance, when carried forward, falls on the nostrils in *N. drassensis* whereas in *N. microps*, it falls behind the eye.

4. The colour pattern is different in both species.

Noemacheilus shehensis, sp. nov.

B. III, D. III/7-8, P.I./11-12, V II/8, A. III/5, C. 16.

It is an elongated and robust-looking fish with the anterior part of the body slightly depressed while the posterior part being compressed with a long tail. The tip of the snout is broadly pointed. The length of head is contained 4.41-4.96 times in total length

and 3.76-4.23 times in standard length. The width of head is contained from 1.68-2.06 times in the length of head. The eye is situated partly in the anterior half of head and is nearer the tip of snout than the opercular margin. They are not visible from the ventral side of head. The diameter of eye is contained from 4.87-6.33 times in the length of head, from 2.06-2.55 times in length of snout and 1.17-1.73 times in the interorbital width. The mouth is crescentic and transverse; it is situated on the ventral side somewhat behind the tip of the snout and is encircled by fleshy lips. The lips are continuous at the corners of the mouth. The lower lip is interrupted in the middle by a deep symphyseal furrow. On either side of the furrow, a small lobe of the lip is formed. The lips are striated and cover the jaws completely. The barbels are short and thick. The maxillary and outer rostral barbels are either as long as or slightly smaller than the eye while the inner rostral barbels are smaller and not more than $\frac{3}{4}$ th of eye diameter.

The deepest part of the body is somewhere between the head and the base of the dorsal fin. The maximum depth of body is contained from 6.97-9.4 times in total length and 5.84-8.0 times in standard length. The lateral line is incomplete and extends on the body upto a point opposite $\frac{1}{3}$ rd length of the pectoral fin. The head and body are without scales.

The caudal peduncle is thin and narrow; its height is more than the diameter of eye and is contained from 2.87-4.07 times in its length.

The dorsal fin is inserted opposite the ventral fin and its origin is equidistant between the base of the caudal fin and the nostrils. The longest ray of the dorsal fin is almost equal to that of the pectoral fin and is much smaller than the head. The longest ray of the dorsal fin is contained from 1.62-1.85 times and the length of the base of the dorsal fin 1.30-1.56 times in head length. The last undivided ray of the dorsal fin is much smaller than the 1st branched ray of the same fin. The upper edge of the dorsal fin is truncate or slightly crenulate. The pectoral fin is broad and pointed in the middle; the 3rd and 4th branched rays form the tip of this fin. It is smaller than the head and is separated from the ventral fin by a distance equal to its own length. The ventral fin is smaller than the pectoral fin. The ventrals almost extend upto the anal opening or fall short of it by a small distance. They do not extend upto the anal fin which does not reach the base of the caudal fin. The longest ray of the anal fin is contained from 1.87-2.25 times in head length. The caudal fin is longer than all other fins of the body but smaller than the head. The length of the caudal fin is contained from 1.30-1.54 times in head length. The posterior border of the caudal fin is concave and both the lobes of this fin are of equal extent.

Swim-bladder The swim-bladder is divided into two parts : (1) the anterior part, consisting of two rounded lateral chambers, enclosed in bony capsules and connected to each other through a small transverse tube, (2) a large posterior part, lying free in the abdominal cavity and connected with the transverse tube by another short tube. A small tube connects the anterior part of the bladder with the oesophagus. The posterior part of

the bladder is uniformly smooth without any constriction and represents a single chamber which extends upto the posterior end of the body cavity. The length of the posterior chamber is contained from 3.0-3.4 times in the total length of the fish. The bony capsules around the anterior chambers of the swim-bladder lie just above the bases of the pectoral fins and deep beneath the skin without giving any external indication of their presence.

Colouration In spirit preserved specimens, the ground colour of the body is pale-olivaceous. The dorsal and lateral sides of the head bear reticulations of dark colour. The dorsal and lateral sides of the body are generally dark coloured and bear somewhat irregular, wavy and vertical bands of different lengths. Some of the bands run across the mid-dorsal side of the body like a saddle. The bands do not extend lower than $\frac{3}{4}$ th part of the side of the body. The dorsal, pectoral and caudal fins bear 3-4 cross series of spots. The base of the caudal fin bears a cross series of dark spots. The ventral and anal fins bear a dark cross band on each. The membrane inbetween the last undivided and the first divided rays of the anal fin bear an elongated dark mark.

Sexual dimorphism : The sexes in this species can be easily distinguished in the following characters: (1) In the male, there is an elongated fleshy pad between the end of the maxillary and the anterior edge of the orbit. The pad is separated from the skin of the cheek by a groove on the ventral edge of the pad. The pad is absent in the female. (2) The barbels are somewhat longer in the males than in the female specimens. (3) In the male, a fleshy genital papilla with a terminal male genital pore is present behind the anal aperture. In the female specimens, no genital papilla is present and the female genital opening is wide and opens just behind the anal aperture. The testes are elongated and flattened yellowish white bodies with a somewhat wavy margin. The male ducts from the two testes unite medially and open jointly at the male genital pore. In the female, the ovaries are massive structures; the ovaries of the two sides are fused with each other through nearly $\frac{2}{3}$ rd of their posterior part. The common oviduct opens at the female genital pore. The ovaries contain ova of various stages of maturity even in specimens at 110 mm. total length.

Bionomics The narrow and whip-like tail in this species indicates that it is adapted to live in fast currents of water and can swim fastly. But the presence of an extensive swim-bladder in the abdominal cavity indicates that it has lake-dwelling habit. This species was collected from a side channel of the Indus river entering fish-rearing tanks where water is almost stationary and moves at a very slow pace. The environment of the fish provides both fast running water as well as stationary tank-water with very slight movement.

The gut contents of a large number of specimens were studied; the food of this species consists completely of insect larvae (dipterous) although some sand particles or rarely a shelled crustacean has also been seen. The gut length is nearly $\frac{4}{5}$ th of the total length of the fish and suggests animal feeding habit. It is a bottom feeder.

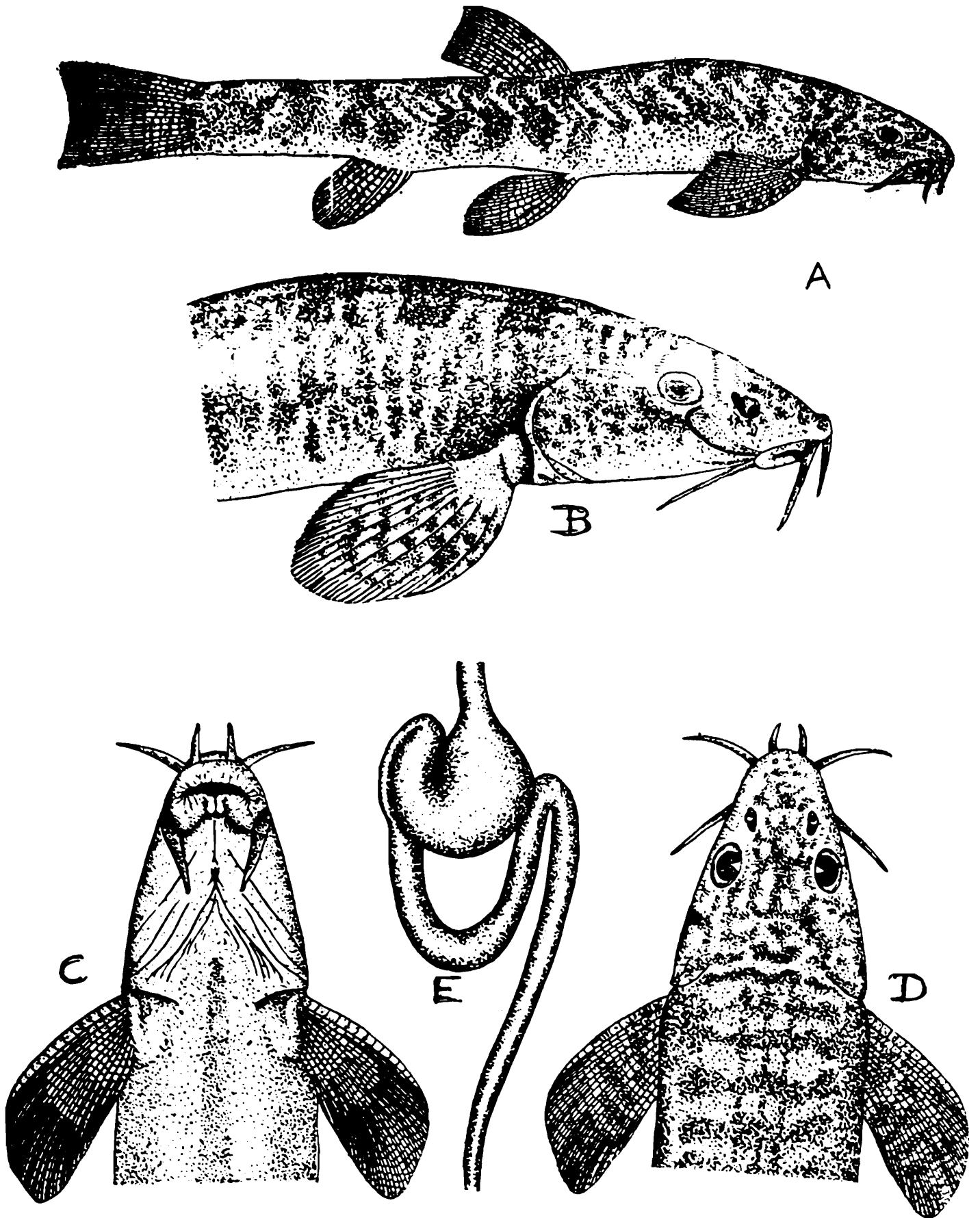


Fig. 1. (A) *Noemacheilus drassensis*, sp.nov. - lateral view; (B) Head and anterior part of body - lateral view; (C) Ventral aspect of head and anterior part of body; (D) Dorsal aspect of head and anterior part of body; (E) The gut.

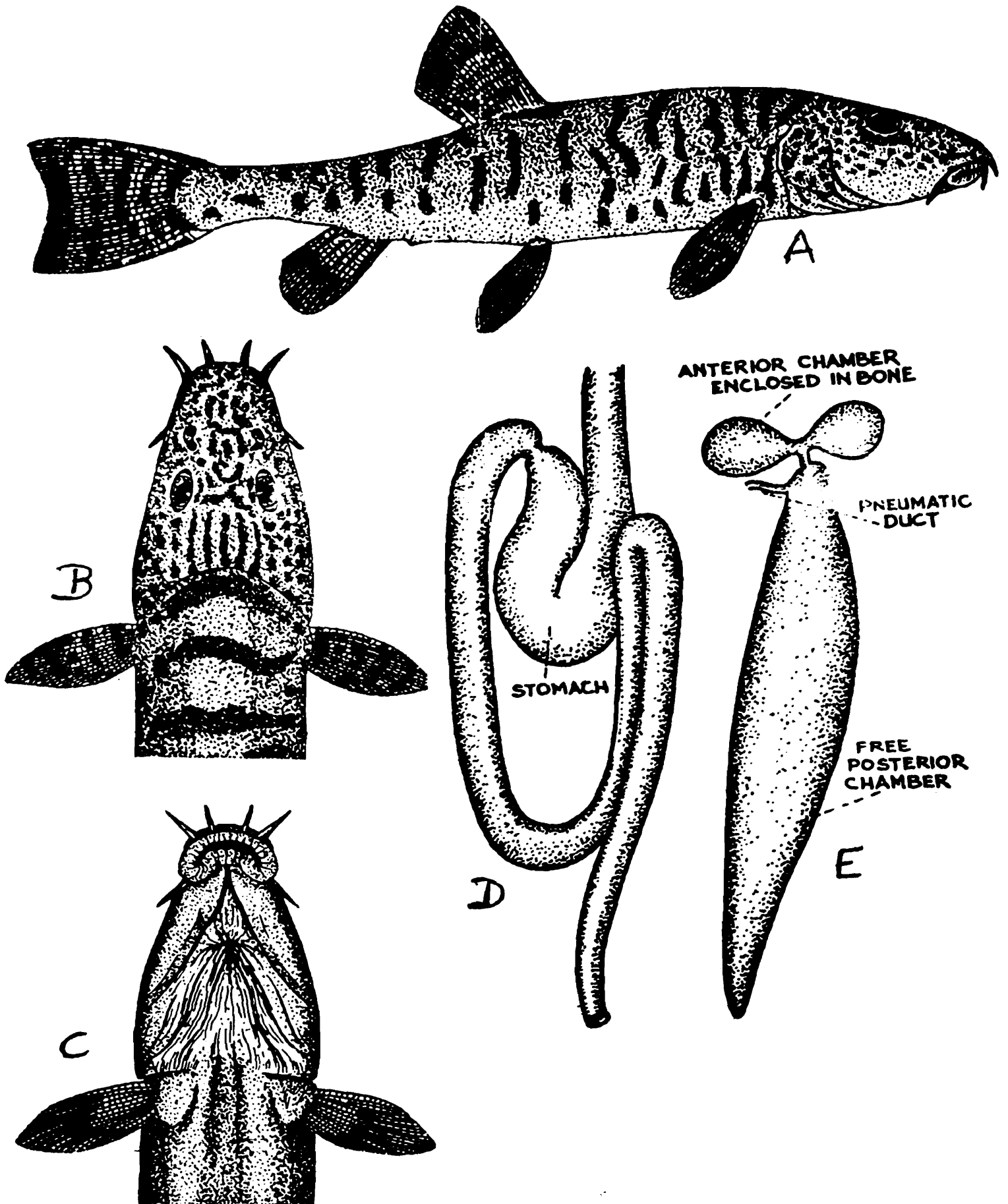


Fig. 2. (A) *Noemacheilus shehensis*, sp. nov. - lateral view; (B) Dorsal view of head and anterior part of body; (C) Ventral view of head and anterior part of body; (D) Gut; (E) Swim-bladder.

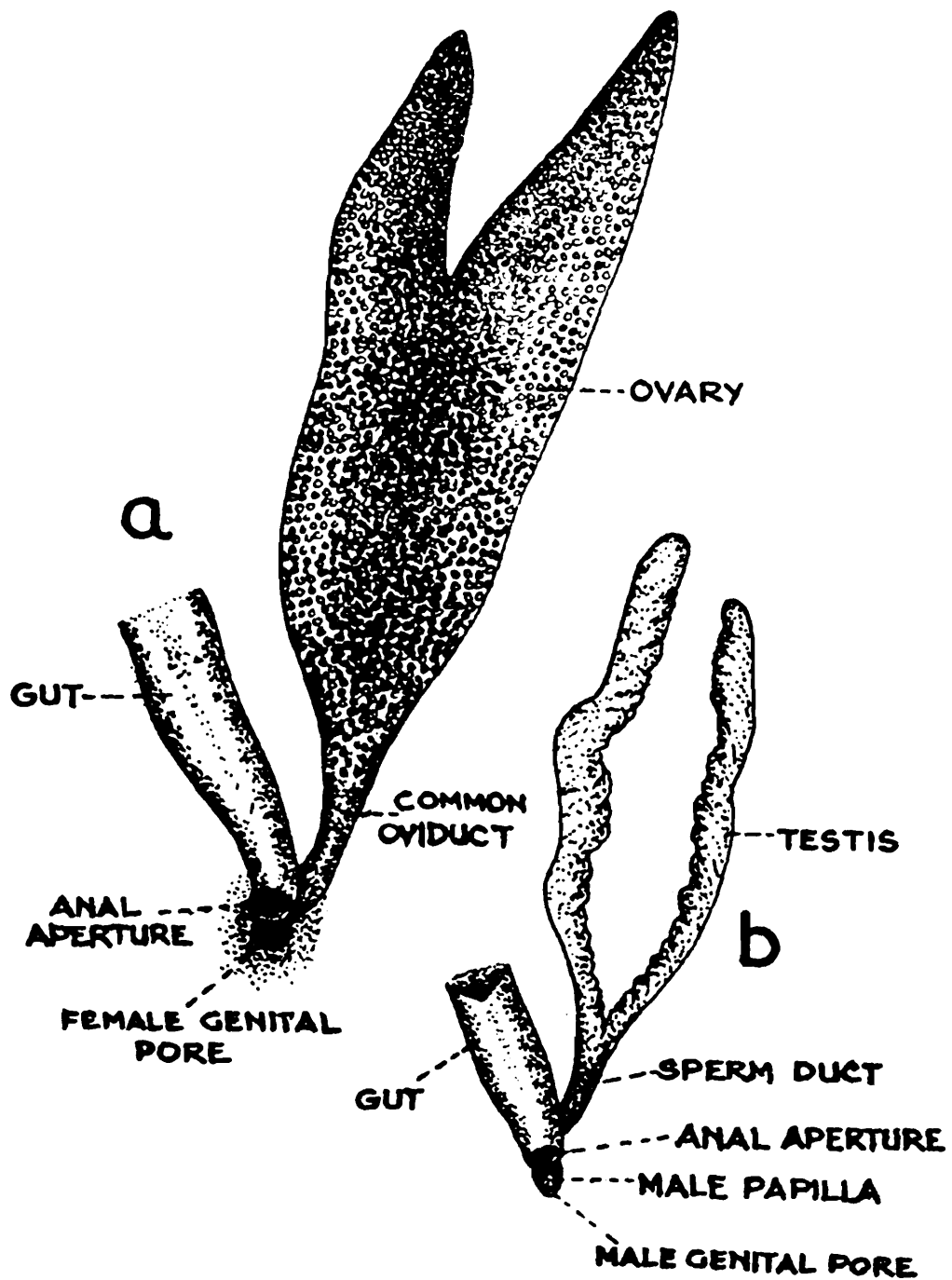


Fig. 3. (A) Female gonads and related structures of *N. shehensis*; (B) Male gonads and related structures of *N. shehensis*.

Relationships : In the possession of an extensive posterior part of the swim-bladder in the abdominal cavity (Diplophysid type), this species falls under a group of species comprising *N. hutjertjuonsis* Rendahl, *N. stewarti* Hora, *N. panguri* Hora, *N. deterrai* Hora, *N. hutchinsoni* Hora etc. The three latter species are described by Hora (1936) from Ladakh and the present species differs from them all in its specific colouration of the body and the morphometric measurements.

Holotype : I example (132 mm. total length) Regd. No. NRS/ZSI-1208, Irrigation canal at Sheh, nearly 12 Kms. east of Leh (Ladakh), 8.9.1977, Coll. R. Tilak.

Paratypes : 4 examples (81-133 mm. total length), Regd. No. NRS/ZSI-1209 (Locality data same as that of holotype). : 25 examples (55-150 mm. total length), Regd. No. NRS/ZSI-1210, Irrigation canal at Sheh, nearly 12 Kms. east of Leh (Ladakh), 10.9.1977, Coll. R. Tilak.

Noemacheilus stoliczkae (Steindachner)

1866. *Cobitis stoliczkae* Steindachner, *Verh. zool.-bot. Ges. wien*, XVI, p. 793, pl. xiv, Fig. 2 (Type-locality : Tso Murari, Rupshu, Ladakh).

1936. *Noemacheilus stoliczkae*: Mukerji, *Mem. Conn. Acad. Sci., Letters*, 10, p. 306.

Material : (i) 1 ex. (113 mm. total length), a stream at Sheh, nearly 12 Kms. east of Leh, Ladakh, 8.9.1977, Coll. R. Tilak.

Remarks : This species is much allied to *N. tenuicauda* but can be distinguished in the height of the caudal peduncle being contained from 3.4-4.0 times in its length. A very wide interpretation has so far been given to this species which is also widely distributed. It feeds on dipterous and caddis-fly larvae.

Distribution : Ladakh; Central Asia.

Noemacheilus tenuicauda (Steindachner)

1866. *Cobitis tenuicauda* Steindachner, *Verh. zool. -bot. Ges. Wien*, XVI, p. 792, pl. XVII, fig. 3 (Type-locality : Hanle, Ladakh).

1936. *Noemacheilus tenuicauda*: Hora, *Mem. Conn. Acad. Sci., Letter*, 10, p. 311.

Material : (i) 10 exs. (59-113 mm. total length), a stream at Sheh, nearly 12 Kms. east of Leh, Ladakh, 8.9.1977, Coll. R. Tilak.

Remarks : This species is characterised by the following characters: (1) The ventral fins extend posteriorly beyond the anal opening. (2) The swim-bladder has two anterior lateral chambers only: the posterior chamber is absent. (3) The eyes are situated in the middle of the head and the snout is almost equal in length to the post-orbital part of head. (4) The anterior origin of the dorsal fin is nearer to the base of the caudal fin than the tip of the snout. The distance between the anterior origin of the dorsal and the base of the caudal fin, when carried forward, falls on the nostrils. (5) The height of the caudal peduncle lies 4.88-5.0 times in its own length.

This species is distinguished from *N. stoliczkae* in its narrower caudal peduncle.

Distribution : Ladakh.

ZOOGEOGRAPHIC REMARKS

The cyprinid, the cobitid and the silurid fishes so far recorded from Ladakh are essentially palaeartic in origin and are specialised in many ways. Tilak (in press) has already indicated that the palaeartic cyprinids of the subfamily Schizothoracinae have entered the Indian origin through the northern side across the Himalaya during the late Pleistocene era. This hypothesis is in line with the Pamir-Kashmir theory enunciated by Das (1965, 1966) and Das and Subla (1964, 1970). Hora's Satpura Hypothesis (Hora, 1937; 1944; 1949; 1953; Menon, 1951; 1954; 1978; Silas, 1952) explained the distribution of fresh-water fishes through the eastern gate via Assam, Satpura range and then along the Western Ghats to peninsular India. According to that observation, the fresh-water fishes of India originated mainly in southern China and Malaya, and spread westwards. This invasion from the East apparently began in the lower Eocene as soon as the terrestrial connection between India and other parts of Asia was established. Tilak and Husain (1978), based on the distribution of some of the fresh-water fishes of Indo-gangetic plains, suggested a revision of Hora's Satpura Hypothesis and explained the entry of fishes towards West along the base of Himalaya in Indo-gangetic plains. The pattern of distribution of Schizothoracinae, siluriform and cobitid fauna, allied to those of Ladakh forms, into Kashmir Valley and the Indian region along southern face of Himalaya has neither been explained on the basis of Hora's Hypothesis nor the modification suggested for that Hypothesis by Tilak and Husain (1978).

Based on the biogeographical theory, proposed by Henning (1966) and Brundin (1975), Novacek and Marshall (1976) opined that South America was most likely the area of origin of Ostariophysan fishes. Contrary to this explanation, Briggs (1979) suggested that the Oriental region was the center of evolutionary radiation for the Ostariophysan and other advanced groups of primary fresh-water fishes; this suggestion corroborates Hora's Satpura Hypothesis, modification of Hora's Hypothesis by Tilak and Husain (1978) and the present hypothesis of a northern entry for Schizothoracinae. The evolution of Schizothoracid fishes is a recent event than the evolution of the family Cyprinidae as a whole.

The existence of *Glyptosternum reticulatum* (McClelland), species of the genera *Schizothorax* and *Schizothoraichthys* in Ladakh on the one hand and Kashmir and Poonch Valleys on the other (Silas, 1960; Das, 1965; Sharma and Sharma, 1974; Talwar, 1978; Nath, 1981, Tilak, in press) indicates that the drainage of these areas was contiguous with one another before the rise of Himalaya and these fishes moved freely in these areas. After the uplift of Himalaya, the major stock of these fishes got cut off from these Valleys because of the eruption of very high ranges, causing disruption of the common drainage of the two areas (Tilak, in press). The existence of a larger number of genera and species of Schizothoracids and some specialised siluridus in

Ladakh indicates that this area has been the parental home of these fishes. This belief is further strengthened on the basis of the present day distribution of *Diptychus maculatus*, particularly in Ladkakh on the one side and Lahaul Valley (Himachal Pradesh) on the other (Tilak, 1976: and in press). This supports the fact that the drainage of Chandra-Bhaga river (Chenab) in Lahaul Valley was at one time connected with that of Ladakh. The introduction of *Glyptosternum*, *Schizothorax* and *Schizothoraichthys* into the drainage system on the southern face of Himalaya probably took place from Kashmir through the Poonch Valley into the Chenab drainage and further into other river systems along Himalaya. Since the introduction of *Schizothorax* and *Schizothoraichthys* into the drainage system along the southern face of Himalaya is a subsequent event, these fishes had to cross through the water-ways of very low altitudes (nearly 600 mts.) where they lived for hundreds of years before they gradually started ascending into the rivers along southern side of Himalaya. *Glyptosternum* did not find an opportunity to move further along with Schizothoracid fishes and remained limited upto the Chenab drainage; this happened probably because of the peculiar mode of living of this fish which remains clinging to rocks near the bottom of water. Since living in torrential streams of higher oxygen contents has been the inherent quality of schizothoracids, they again started invasion of the higher reaches of Himalayan streams during the recent era but so far they have not achieved those altitudes at which their parental stock lived in Kashmir or Ladakh; this can be clearly seen from the present-day distribution of these fishes in Himalayan rivers which drain into the Indo-gangetic plains. Even the same species, such as *Schizothorax richardsonii*, which thrives comfortably at an altitude of 4000 mts. and higher in Ladakh, is not found in the streams and rivers on the southern side of Himalaya at altitudes higher than 1500 mts or so. These series of events in the distribution of silurids and schizothoracids clearly indicate that the dispersal of Central-Asiatic fishes took place through the northern gate via the Kashmir and Poonch Valleys towards the East along Himalaya.

SUMMARY

On the basis of a collection of fishes from various localities in Ladakh together with the reports published by other workers, a list of 22 species of fishes so far recorded from this region has been presented here. Among these, there are two new species of the genus *Noemacheilus* which have been described and figured here for the first time. Taxonomic notes on important species included in this list have been added. Since the fish fauna recorded and studied here is totally palaeartic, it has a great zoogeographic significance and when compared with the fauna of Kashmir and the rivers on the southern face of Himalaya, supports the view that the palaeartic fishes entered the Indian region through the northern route via the Kashmir and Poonch Valleys. The evidence for such a hypothesis is clearly presented by the Schizothoracid fishes which have a peculiar pattern of distribution.

ACKNOWLEDGEMENT

The author feels grateful to the Director, Zoological Survey of India, Calcutta for his continuous encouragement and award of facilities to work in the department. He is thankful to Director of Fisheries, Govt. of Jammu & Kashmir, Srinagar and members of staff of that department for their help in various ways.

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**SARCOPHAGID FLIES (DIPTERA : SARCOPHAGIDAE) FROM
TAMIL NADU AND KERALA, INDIA**

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INTRODUCTION .

Sarcophagid flies comprising eleven species under five genera collected by the author from different parts of Tamil Nadu and Kerala are recorded here.

SYSTEMATIC ACCOUNT

Subfamily	SARCOPHAGINAE
Tribe	SARCOPHAGINI
Subtribe	PARASARCOPHAGINA

1. *Parasarcophaga* (s.str.) *albiceps* (Meigen)

1825. *Sarcophaga albiceps* Meigen, *System. Besch.*, 5 : 22.

1982. *Parasarcophaga* (s.str.) *albiceps* (Meigen) : Nandi, *Rec. zool. Surv. India*, 80 : 118.

Material 2 ♂♂, Tamil Nadu : Mariner beach, 25.x.1985; 2 ♂♂, Madras Zoo Garden, 25.x.1985; 2 ♂♂, St. Thomas Road, 26.x.1985; 5 ♂♂, Tambram, 26.x.1985; 1 ♂, Kerala : Palghat, 82 m., 28.x.1985; 8 ♂♂, Walayar Forest, 100m., 28.x.1985; 3 ♂♂, Tamil Nadu : Coonoor, 1,700m., 29.x.1985; 1 ♂, Coimbatore, 150 m., 30.x.1985; 1 ♂, Kerala : Cochin, 1.xi.1985; 6 ♂♂, Periyar Lake, 1000m., 2.xi.1985; 14 ♂♂, Kumilly, 1,020m., 2.xi.1985; 2 ♂♂, Panthanpuzha, 200m., 3.xi.1985; 3 ♂♂, Kovalam, 4.xi.1985; 2 ♂♂, Tamil Nadu : Kodaikanal, 2,300m., 7.xi.1985; 1 ♂, Madurai, 133m., 8.xi.1985.

2. *Parasarcophaga* (s.str.) *knabi* (Parker)

1917. *Sarcophaga knabi* Parker, *Proc. U.S. natn. Mus.*, 54 : 96.

1982. *Parasarcophaga* (s.str.) *knabi* (Parker) : Nandi, *Rec. zool. Surv. India*, 80 : 118.

Material : 2 ♂♂, Tamil Nadu : St. Thomas Road, 26.x.1985, 1 ♂, Tambram, 26.x.1985; 1 ♂, Kerala Palghat, 82m., 28.x.1985; 4 ♂♂, Walayar Forest, 100m., 28.x.1985; 1 ♂, Tamil Nadu : Coonoor, 1,700m., 29.x.1985; 2 ♂♂, Ooty, 2,204 m., 29.x.1985; 3 ♂♂, Tamil Nadu : Marudamalai, 150m., 30.x.1985; 6 ♂♂, Coimbatore,

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150m., 30.x.1985; 1 ♂, Kerala : Coochin, 1.x.1985; 2 ♂♂, Ernakulam, 1.xi.1985; 7 ♂♂, Periyar Lake, 1,000 m., 2.xi.1985; 6 ♂♂, Kumilly, 1,020 m., 2.xi.1985; 3 ♂♂, Panthanpuzha, 200m., 3.xi.1985; 1 ♂, Kovalam, 4.xi.1985; 2 ♂♂, Tamil Nadu : Madurai, 133m., 8.xi.1985; 1 ♂, Rameswaram, 9.xi.1985; 1 ♂, Pamban, 9.xi.1985.

3. *Parasarcophaga* (s.str.) *hirtipes* (Wiedemann)

1830. *Sarcophaga hirtipes* Wiedemann. *Ausser. Zweifl. Ins.*, 2 : 661.

1979. *Parasarcophaga* (s.str.) *hirtipes* (Wiedeman) : Nandi, *Oriental Ins.*, 13(1-2) : 189.

Material 1 ♂, Tamil Nadu : Mariner Beach; 25.x.1985; 1 ♂, Madras Zoo Garden, 25.x.1985; 2 ♂♂, St. Thomas Road, 26.x.1985; 1 ♂, Kerala : Palghat, 82m., 28.x.1985; 1 ♂, Walayar Forest, 100m., 28.x.1985; 1 ♂, Ernakulum, 1.xi.1985; 1 ♂, Kumilly, 1,200 m., 2.xi.1985; 12 ♂♂, Tamil Nadu : Madurai, 133 m., 8.xi.1985; 1 ♂, Rameswaram, 9.xi.1985.

This species is recorded for the first time from Kerala.

4. *Parasarcophaga* (s.str.) *orchidea* (Böttcher)

1913. *Sarcopagga orchidea* Böttcher, *Ann. Hist. Mus. Nat. Hung.*, 11 : 375.

1982. *Parasarcophaga* (s.str.) *orchidea* (Böttcher) : Nandi, *Rec. zool. Surv. India*, 80 : 119.

Material : 2 ♂♂, Tamil Nadu : Mariner Beach 25.x.1985; 7 ♂♂, Madras Zoo Garden, 25.x.1985; 3 ♂♂, St. Thomas Road; 26.x.1985; 3 ♂♂, Tambaram, 26.x.1985; 4 ♂♂, Kerala : Palghat, 82m., 28.x.1985; 7 ♂♂, Walayar Forest, 100m., 28.x.1985; 4 ♂♂, Tamil Nadu : Marudamalai, 150m., 30.x.1985; 7 ♂♂, Coimbatore, 150m., 30.x.1985; 2 ♂♂, Kerala : Coochin, 1.xi.1985; 2 ♂♂, Ernakulam, 1.xi.1985; 6 ♂♂, Periyar Lake, 1,000m., 2.xi.1985; 4 ♂♂, Kumilly, 1,020m., 2.xi.1985; 1 ♂, Kovalam, 4.xi.1985; 1 ♂, Tamil Nadu : Madurai, 133m., 8.xi.1985; 3 ♂♂, Tirumalaya, 8.xi.1985.

5. *Parasarcophaga* (*Liopygia*) *ruficornis* (Fabricius)

1794. *Musca ruficornis* Fabricius, *Ent. Syst.*, 4 : 314.

1982. *Parasarcophaga* (*Liopygia*) *ruficornis* (Fabricius) : Nandi, *Rec. zool. Surv. India*, 80 : 119.

Material : 3 ♂♂, Tamil Nadu : Ooty, 2,204m., 29.x.1985; 1 ♂, Kerala : Kovalam, 4.xi.1985; 7 ♂♂, Tamil Nadu : Madurai, 133m., 8.xi.1985; 5 ♂♂, Pamban, 9.xi.1985.

This is recorded for the first time from Kerala.

6. *Parasarcophaga* (*Liosarcophaga*) *dux* (Thomson)

1868. *Sarcophaga dux* Thomson, *Kongl. Se ven. Freg. Eugen. Resa.*, P. 534.

1982. *Parasarcophaga* (*Liosarcophaga*) *dux* (Thomson) : Nandi, *Rec. zool. Surv. India*, 80 : 119.

Material : 1 ♂, Tamil Nadu : Tambram, 26.x.1985; 1 ♂, Ooty, 2,204m., 29.x.1985; 9 ♂♂, Rameswaram, 9.xi.1985; 2 ♂♂, Pamban, 9.xi.1985.

It is recorded for the first time from Kerala.

Subtribe HARPAGOPHALLINA

7. *Iranihindia futilis* (Senior-White)

1924. *Sarcophaga futilis* Senior-White, *Rec. Indian Mus.*, 26(3) : 246.

1982. *Iranihindia futilis* (Senior-White) : Nandi, *Rec. zool. Surv. India*, 80 : 118.

Material : 3 ♂♂, Tamil Nadu : Madras Zoo Garden, 25.x.1985; 1 ♂, Kerala : Walayar Forest, 100m., 28.x.1985; 2 ♂♂, Tamil Nadu : Marudamalai, 150m., 30.x.1985; 1 ♂, Coimbatore 150m., 30.x.1985; 1 ♂, Kerala : Ernakulam, 1.xi.1985; 1 ♂, Tamil Nadu : Mudurai, 133 m., 8.xi.1985.

This species is recorded for the first time from Tamil Nadu and Kerala.

Subtribe SARCOSOLOMONINA

8. *Sarcosolomonina (Parkerimyia) nathani* Lopes and Kano

1969. *Sarcosolomonina (Parkerimyia) nathani* Lopes and Kano, *Pacif. Ins.*, 11(1) : 184.

1976. *Sarcosolomonina (Parkerimyia) nathani* : Nandi, *Oriental Ins.*, 10(1) : 12.

Material : 1 ♂, Tamil Nadu : Coonoor, 1,700m., 29.x.1985.

This is the first record of this species from Tamil Nadu.

Subtribe SENIORWHITEINA

9. *Seniorwhitea krameri* (Böettcher)

1912. *Sarcophaga krameri* Böettcher, *Ent. Mitt.*, 1 : 166.

1982. *Seniorwhitea krameri* (Böettcher) : Nandi, *Rec. zool. Surv. India*, 79 : 460.

Material : 1 ♂, Kerala : Walayar Forest, 100m., 28.x.1985; 1 ♂, Tamil Nadu : Marudamalai, 150m., 30.x.1985.

It is recorded for the first time from Tamil Nadu and Kerala.

Subtribe HARPAGOPHALLINA

10. *Thyrsocnema (Pseudothyrsocnema) longistylata* Shinonaga and Lopes.

1924. *Sarcophaga crinita* Senior-White, *Rec. Indian Mus.*, 26(3) : 245.

1975. *Thyrsocnema (Pseudothyrsocnema) longistylata*, Shinonaga and Lopes, *Pacif. Ins.*, 16(4) : 459.

1979. *Thyrsocnema (Pseudothyrsocnema) longistylata* Shinonaga and Lopes : Nandi, *Oriental Ins.*, 13(1-2) : 194.

Material : 1 ♂, Kerala : Palghat, 82m., 28.x.1985.

Recorded for the first time from Kerala.

11. *Thyrsocnema (Pseudothyrsocnema) indica* Shinonaga and Lopes.

1924. *Sarcophaga caudagali* Senior-White, *Rec. Indian Mus.*, 26(3) : 227.

1975. *Thyrsocnema (Pseudothyrsocnema) indica*, Shinonaga and Lopes, *Pacif. Ins.* 16(4) : 459.

Material : 1 ♂, Tamil Nadu : Coonoor, 1,700m., 29.x.1985.

SUMMARY

Of eleven species of Sarcophagid flies, *Iranihindia futilis* (Senior-White), *Seniorwhitea krameri* (Boettchu) are recorded for the first time from Tamil Nadu, and *Parassarcophaga (s.str.) hirtipes* (Wiedemann), *Parasarcophaga (Liopygia) ruficornis* (Fabricius), *Parasarcophaga (Liosarcophaga) dux* (Thomson), *Iranihindia futilis* (Senior-White), *Seniorwhitea krameri* (Böettcher) and *Thyrsocnema (Pseudothyrsocnema) longistylata* Shinonaga and Lopes from Kerala.

ACKNOWLEDGEMENTS

The author is grateful to the Officer-in-Charge, Krishnanagar Govt. College, for laboratory facilities. The author is thankful to the Director, Zoological Survey of India, Calcutta, for the opportunity to work on this group under Collaborative Research Project and Contractual Services of the Zoological Survey of India. Financial help to the author by the said organisation is also duly acknowledged.

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**AN ADDITION TO THE ARANEID FAUNA (ARANEAE :
ARACHNIDA) OF INDIA**

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INTRODUCTION

Most of us know well about the cob-webs and their dwellers in the houses and the precise architectural orb-web, some of which are finely decorated in the hedges, fields and other vegetations made by the spiders. These orb weavers are belonging to the family Araneidae (= Argiopidae). Some informations are available on Indian araneid forms along with other groups of spiders from the works of the previous workers viz., Stoliczka (1869), Simon (1889), Thorell (1895), Pocock (1900), Narayan (1915), Gravely (1921), Sherriffs (1928, 29), Caporiacco (1934, 35) and Dyal (1935). Recently Sinha (1951) and Tikader (1963-82) have described a number of new species of spiders belonging to different families including Araneidae. During recent years Tikadar and Bal (1981) and Patel (1975) have described several new species of spiders of this family.

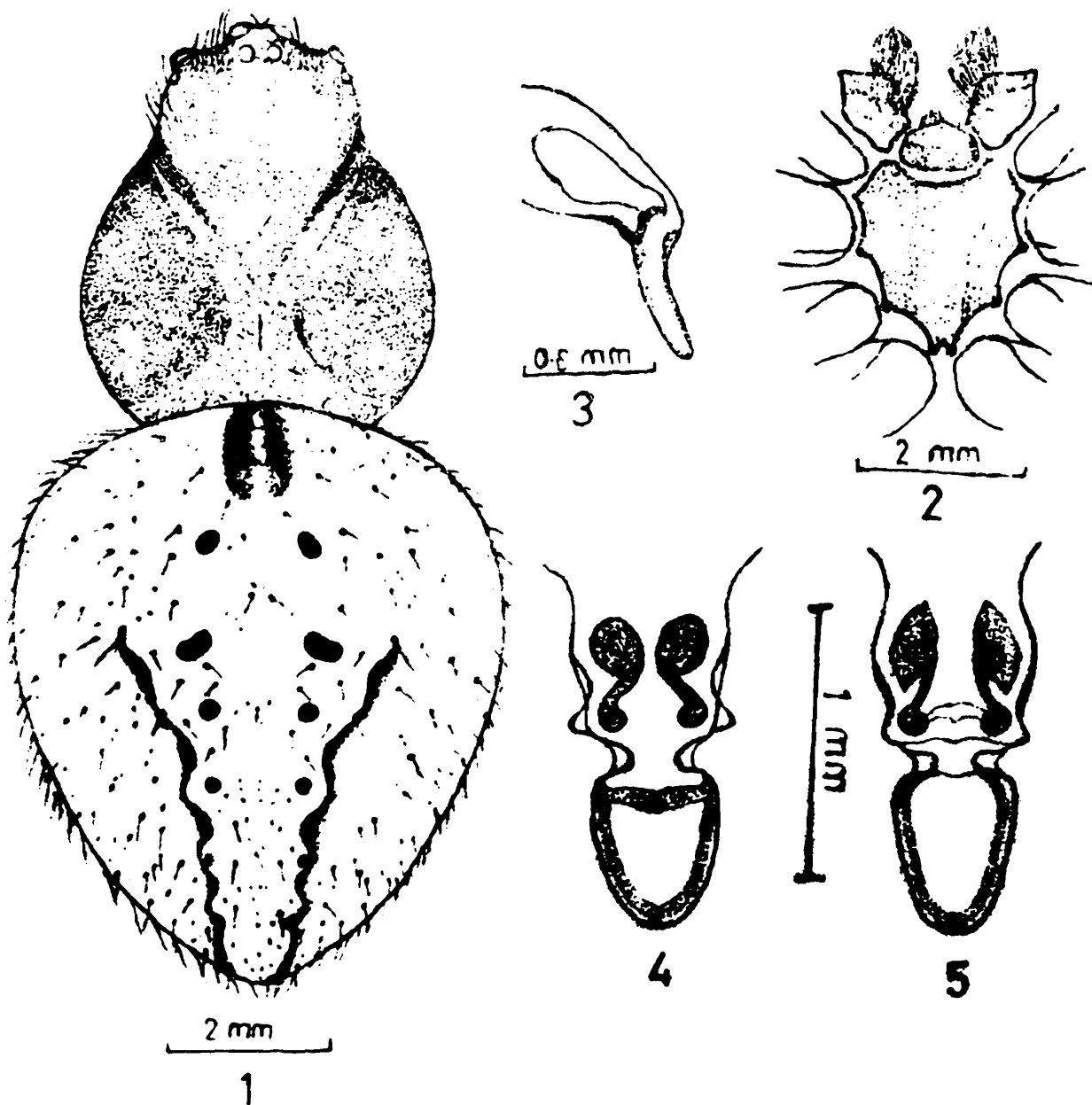
Recently Tikader (1982) have revised the family Araneidae from India and described with illustrations 101 species of spiders including six new species in his creditable work in the Fauna of India, Spiders : Araneae: Vol. II: Part-1. Unfortunately, *Larinia tyloridia* Patel (1975) from Gujarat is skipped off by him in his revisionary work. Caporiacco's collection from Karakorum includes *Araneus cucurbitinus* Clerck, *Meta menardii* (Latr.), *Cyclosa kashmirica* Cap., *A. altitudinum* Cap., *A. angulatus* Clerck, *A. pontii* Cap., *A. redii* Scopoli, *A. obscurissimus* Cap., *A. carbonarius* (C. L. Koch) and *Zygeilla decemnotata* Clerck. Out of ten species only *A. cucurbitinus* is included by Tikader (1982) in his fauna and the redescription and illustrations of it are given based on one specimen collected by him from Shillong, Meghalaya as it is the only species collected by Caporiacco from Karakorum falling within the Indian territory.

During the course of our studies on spiders from Bhavnagar, Gujarat, we came across two new species, one each of the genera *Neoscona* Simon and *Zygeilla* F.O.P. Camb. which are described and illustrated herewith. *L. tyloridia* Patel is also redescribed and its internal genitalia and male palp are illustrated.

The type specimens will be deposited in the National Collections of Zoological Survey of India, Calcutta, in due course of time.

Neoscona murthyi sp. nov.
(Figs. 1-5)

General : Cephalothorax and legs yellowish, abdomen dark brown with greyish patches. Total length 11.50 mm. Carapace 5.02 mm long, 4.30 mm wide; abdomen 7.00 mm long, 6.00 wide.



Figs. 1-5. *Neoscona murthyi* sp. nov. 1. Dorsal view, female; 2. Sternum, labium and maxilla; 3. Epigyne, lateral view; 4. Epigyne, ventral view; 5. Internal genitalia.

Cephalothorax : Carapace longer than wide, narrower in front, light brown in colour, clothed with hairs. Cephalic region high separated from the thorax by a distinct cervical groove. Thoracic region dark brown on the margin and lighter in colour in the centre, provided with a depression in the centre. Eyes in two rows; both rows recurved, posterior row more recurved than anterior; anterior medians larger than the posterior medians, lateral eyes close to each other and situated on a tubercle. Ocular quad longer than wide, wider in front than behind. Sternum heart shaped pointed behind, light brown in colour with some silvery spots, clothed with hairs. Labium wider than long, brown with pale distal end and with few hairs on the distal margin. Maxillae broad, brown, with scopulae. Sternum, labium and maxillae as in Fig. 2. Chelicerae strong, dark brown with three teeth on both the margins, provided with distinct boss. Legs long and strong yellowish with distinct bands on distal ends of trochanter, patella, tibia and metatarsus, clothed with numerous spines and hairs. Leg formula 1-2-4-3.

Abdomen : Subtriangular, longer than wide, broadest at anterior end and tapering behind, clothed with long hairs. Dorsum of abdomen with white and greyish brown patches and markings as in Fig. 1. Five pairs of sigilla arranged mid-dorsally on the dorsum, the second being the largest and bean shaped. Ventral side dirty brown. Epigynal scape with constriction at the lower portion as in Figs. 3 and 4. Internal genitalia as in Fig. 5.

Holotype : 1 ♀, in spirit, University Campus, Bhavnagar, Dist. Bhavnagar, Gujarat, 28.xii, 1983, Coll. T. S. Reddy.

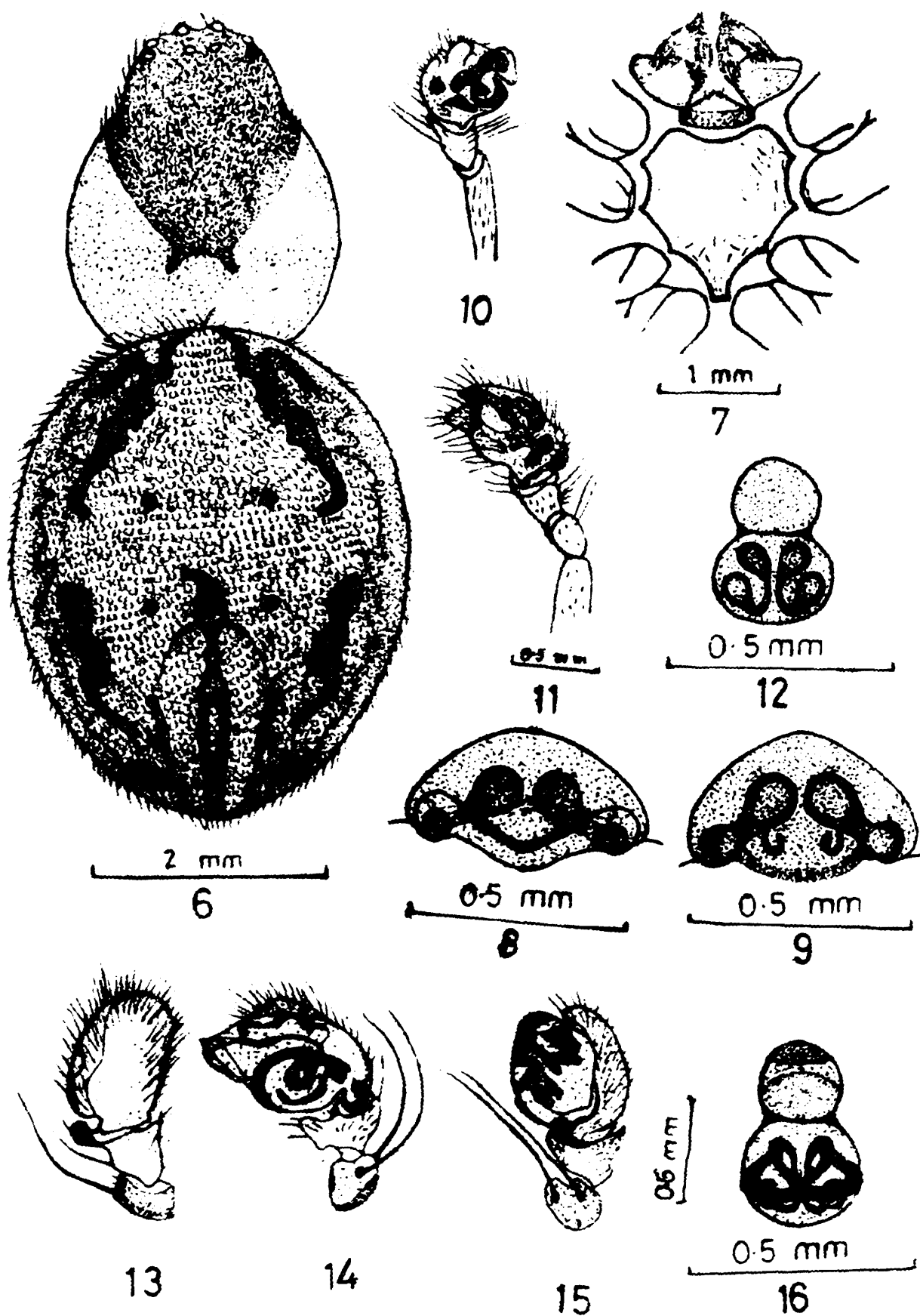
Distribution : Known from type-locality only.

Remarks : This species resembles to *Neoscona mukerjei* Tikader but it differs as follows : (i) Cephalic region is not provided with conspicuous 'V' shaped dark brown patch as in *N. mukerjei*. (ii) Structures of epigyne and internal genitalia are also different.

It also resembles to *N. rumpfi* Thorell but differs as follows : (i) Only five pairs of sigilla are present instead of six pairs as in *N. rumpfi*. (ii) Structures of epigyne and internal genitalia also differs.

***Zygeilla shivui* sp. nov.**
(Figs. 6-11)

General : Cephalic region blackish brown, thoracic region yellow, legs yellowish with some black patches, abdomen whitish with light brown and some black markings forming a folium. Total length 7.37 mm. Carapace 2.95 mm long, 2.54 mm wide; abdomen 4.67 mm long, 3.77 mm wide.



Figs. 6-11. *Zygeilla shivui* sp. nov. 6. Dorsal view, female; 7. Sternum, labium and maxilla; 8. Epigyne; 9. Internal genitalia; 10. Left male palp, ventral view; 11. Left male palp, outer view. Fig. 12-16. *Larinia tyloridia* Patel; 12. Internal genitalia; 13. Left male palp, dorsal view; 14. Left male palp, ventral view; 15. Left male palp, outer view; 16. Epigyne.

Cephalothorax : Carapace longer than wide, narrowing in front, cephalic region more darker than thoracic region with few hairs. Thoracic region wider in the middle with a depression in the centre and outer margin bordered with a raddish line. Eyes in two rows, both rows recurved; anterior medians larger than the posterior medians, posterior medians pearly white, laterals contiguous and situated on a tubercle, posterior laterals slightly smaller than anterior laterals. Ocular quad wider in front than behind (Fig. 6). Sternum heart shaped, pointed behind, yellowish brown without markings, clothed with fine long hairs. Labium wider than long. Maxillae broad, pale brownish yellow, provided with distinct scopulae at the distal end. Sternum, labium and maxillae as in Fig. 7. Chelicerae strong, blackish, three retromarginal and four promarginal teeth, second being the largest of promargin. Legs long, strong, clothed with hairs and spines. Tibia I and II with 4 to 5 prolateral spines, femora I and II with nine dorsal spines, distal end of all femora and tibia with dark brown patches on dorsal side. Leg formula 1-2-4-3.

Abdomen : Oval, longer than wide, without humps, clothed with hairs. Dorsum with a distinct folium with four pairs of sigillae as in Fig. 6. Ventral side with white pigmentation in between epigastric furrow and spinnerets and provided with four pairs of reddish spots. Transverse dark lines are present across the ventral side. Epigyne without scape, having semicircular openings as in Fig. 8. Internal genitalia as in Fig. 9.

Male : Male is same in resemblance but little smaller than the female. Total length 6.72 mm. Carapace 3.11 mm long, 2.62 wide; abdomen 3.85 mm long, 2.78 mm wide.

Holotype : 1 ♀, in spirit, Gaurishankar lake, Bhavnagar, Dist. Bhavnagar, Gujarat, 23.ix. 1983. Coll. T. S. Reddy; *allotype* 5 ♂♂, and *paratype* 9 ♀♀, in spirit, data same as holotype.

Remarks : This species resembles to *Zygeilla melanocrania* (Thorell) and *Z. indica* Tikader and Bal (1980) but differs from both of them in the colouration of cephalothorax and the pattern of folium on the dorsum. It also differs from them in the structures of epigyne and internal genitalia. Male palp also differs from that of the male palp of *Z. indica*.

***Larinia tyloridia* Patel**
(Figs. 12-16)

Material examined : 1 ♂, Gaurishankar lake, Bhavnagar, 28. ix. 1983. 2 ♀♀, Victoria Park, Bhavnagar, Dist. Bhavnagar, 4.ix.1983. Coll. T. S. Reddy.

General : Body yellowish brown. Total length 7.87 mm. Carapace 3.33 mm long, 1.62 mm wide; abdomen 4.55 mm long, 2.15 mm wide.

Cephalothorax : Longer than wide, narrower anteriorly, clothed with fine hairs. Cephalic region high with a median brown longitudinal band from the posterior median eyes just up to the fovea. Eyes pearly white, both rows of eyes slightly recurved,

laterals contiguous, laterals and posterior medians encircled in black markings. Ocular quad longer than wide, narrowing posteriorly. Sternum oblong, pointed behind and truncated anteriorly, brown with a dark margin and light coloured longitudinal band in the middle. Lambium as long as wide. Maxillae scopulate with dark margin. Cheliceras with strong curved fange, fang groove with three teeth each on both margins. Legs yellow, long, clothed with hairs and spines. Femora I with two dorsal, two apical and two prolateral spines; patella I and II with two dorsal and two lateral spines on both sides but no ventral spines; metatarsi I and II longer than that of the III and IV; tarsi of all legs with two claws; femora I with 12 to 13 and II with 11 ventral black spots. Leg formula 1-2-4-3.

Abdomen Yellowish with white patches, acuminate, clothed with white pubescence and few spines. Anterior end projecting into a tubercle like prominence and posterior end pointed behind. Spinnerets just below the posterior end. Anterior end of abdomen overlapping the posterior region of cephalothorax in front. A mid-dorsal longitudinal white band from anterior end to posterior end and four lateral dark striations on each side extending upto the ventral side. Ventral side with a broad, brown, longitudinal band from epigastric fold to spinnerets, interrupted by white patches in the anterior half and two small circular yellow dots posteriorly. Structure of internal genitalia and epigyne as in Figs. 12 and 16 respectively.

Male : Little smaller and similar in colour to the female, but the cephalothorax seems to be darker in colour. Total length 5.63 mm. Carapace 2.43 mm long, 1.71 mm wide; abdomen 3.21 mm long 1.54 mm wide. The palps are also dark in colour as that of cephalothorax. Patella of male with two long spines on apical region; paracymbium having a hook like structure. Chelicerae with four promarginal and three retromarginal teeth. Structure of male palp as in Figs. 13 to 15 is illustrated herewith as it is described for the first time.

Distribution : Mogari, Dist. Kheda; Bhavnagar, Dist. Bhavnagar, Gujarat.

SUMMARY

Two new species of spiders *Neoscona murthyi* and *Zygeilla shivui* are described and illustrated, another spider *Larinia tyloridia* Patel is redescribed with its illustrated internal genitalia and male palp in this paper from Gujarat, India.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the laboratory facilities and encouragement from Prof. K. B. Tipnis, Principal, Sir P. P. Institute of Science, Bhavnagar. They are also thankful to Dr. B. K. Tikader, Director, Zoological Survey of India, Calcutta for confirmation of the specimens and his valuable inspiration.

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STUDIES OF SOME GIANT CRAB SPIDERS OF THE FAMILY HETEROPODIDAE FROM INDIA. PART II.

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INTRODUCTION

The spiders of the family Heteropodidae are known as Giant Crab spiders, which we had described in our previous paper with the Systematic studies of the Genus *Heteropoda* Latreilly, *Olios* Walckenaer, *Sparielenus* Simon the remaining genera are going to be described in this paper are *Tarania* Simon, *Panaretus* Simon, *polystes* L. Koch. *Thelcticopis* Karsch. All studies have been made on the basis of type or authenticated identified specimens which were described by Simon, Pocock & Gravely are received from Museum National d'Histoire Naturelle, Paris, British Museum (Natural History) London & National collection of Zoological Survey of India, Calcutta.

The validity of family name, and General taxonomic *Characters* of spiders with special reference to the family are discussed in our previous paper. This paper deals key to the genera of the family Heteropodidae with Systematic study of remaining genera.

Family HETEROPODIDAE (Giant Crab-spiders)

- 1873. Heteropodidae, Thorell, *Nova Act. Reg. Soc. Sci. Upsaliae* (3) 7 : 606.
- 1895. Heteropodidae, Thorell, *Descriptive catalogue of the spiders of Burma* : 265.
- 1897. Sparassidae, Simon, *Hist. Nat. Araignees*, 2(1) : 48.
- 1912. Ensparassidae, Jarvi, *Ann. Acad. Sci. Fenn.*, 4(1) : 1-131.
- 1931. Ensparassidae, Gravely, *Rec. Indian Mus.*, 33(3) : 237.
- 1935. Sparassidae, Dyal, *Bull. Zool. Punjab Univ.*, 1 : 204.
- 1942. Heteropodidae, Comstock, *The Spider book*, : 564.
- 1951. Heteropodidae, Bonnet, *Biblio. Araneorum* 2(3) : 2202.
- 1954. Eusparassidae, Roewer, *Kat. der Araneae*, 2(A) : 671.
- 1973. Heteropodidae, Patel and Patel, *Orient. Insects*, 7(1) : 127-132.
- 1973. Heteropodidae, Platnick and Levi, *Bull. Brit. Arach. Soc.* 2(8) : 166-167.
- 1977. Heteropodidae, Tikader, *Rec. zool. Surv. India*, 72 : 177-184.

Characters : Cephalothorax broader than long is general except a few, its convexity and thickness varying with genera, thoracic groove longitudinal. Eyes variable in size in different genera, eight in number and are placed in two rows; medians forming a quadrangle. Cheliceral fang furrow armed with teeth. Sternum heart shaped, pointed behind. Legs laterigrade, powerful, spinny, tarsi and metatarsi with thick scopulae on the ventral side; apex of metatarsus with soft trilobate membrane, tarsi with 2 toothed

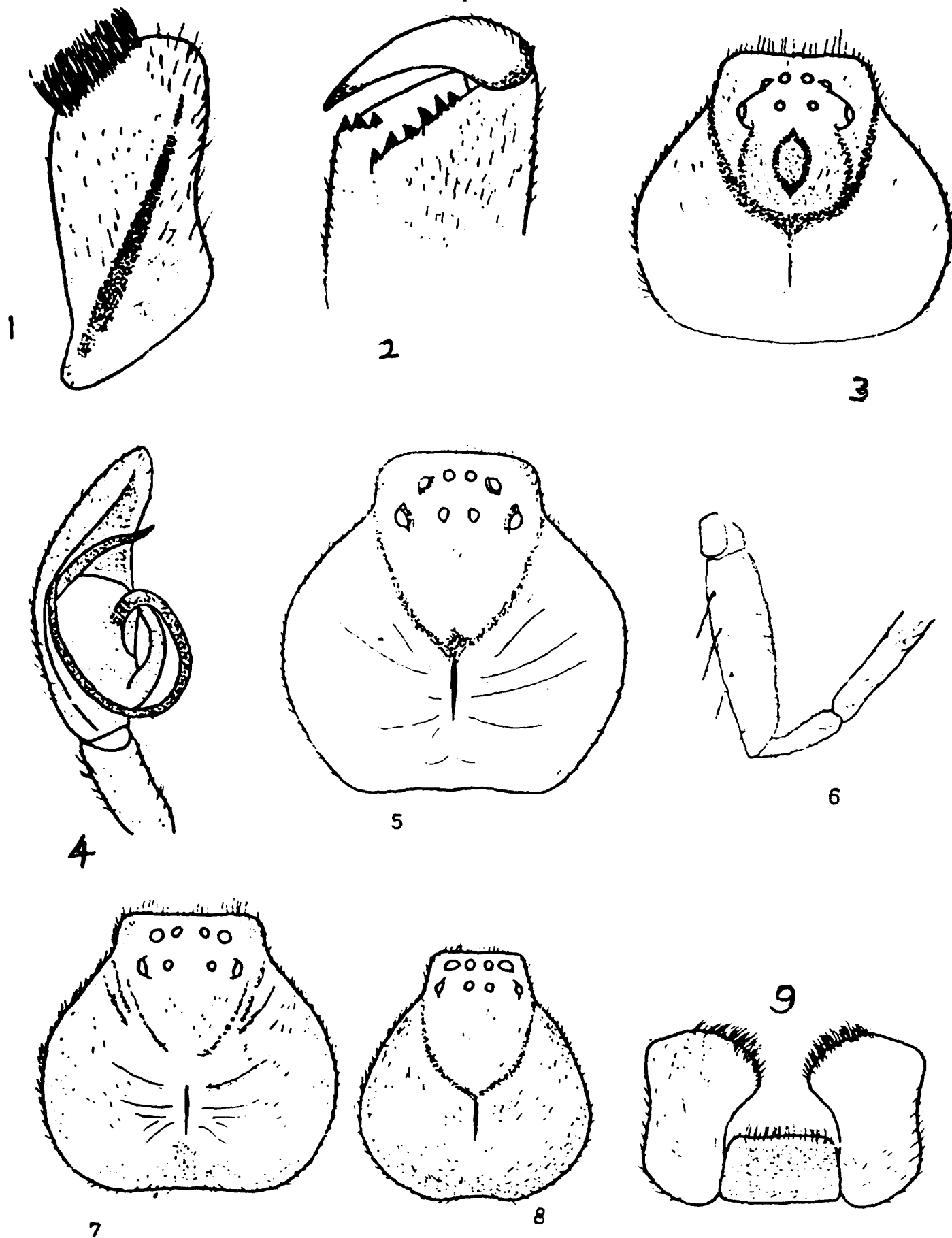
claws. Abdomen variable in size and shape, colulus absent, 3 pairs of spinnerets. Epigynum provide with paired lateral lobes, often these are accompanied with a median piece. Spiders are generally larger in size, do not make webs, female carry large cocoon beneath her body.

Type-genus *Heteropoda* Latreille.

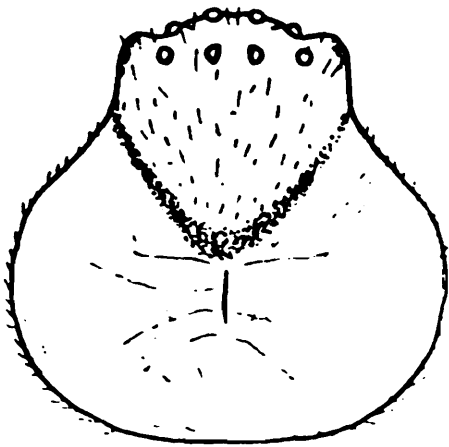
Distribution : Tropical and sub-tropical parts of the world.

Key to the Genera of the Family HETEROPODIDAE

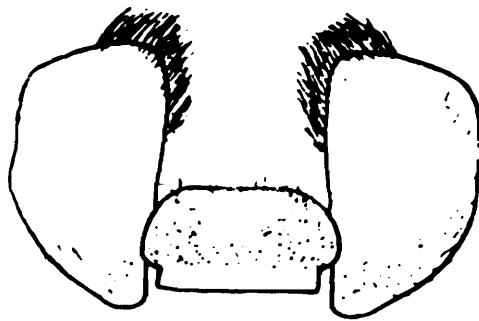
1. Posterior row or eyes recurved; lateral eyes prominent.....2
 Posterior row of eyes straight or procurved; lateral eyes not prominent and may be sessile.....5
2. Maxillae with distinct midlongitudinal crest (Fig. 1); ocular quad squarish; inner margin of fang furrow armed with 5-6 teeth (Fig. 2).....
*Spariolenus*
 Maxilla not crested; ocular quad not squarish; inner margin of fang furrow with less number of teeth.....3
3. Anterior row of eyes slightly procurved and much shorter than the posterior eye row (Fig. 3); cephalic part of carapace much elevated and provided with a median depression (Fig. 3); embolus of male palp encircles wholly the genital bulb (Fig. 4).....*Torania*
 Anterior row of eyes straight or procurved and more or less equally lengthed to the posterior eye row; cephalic part of carapace not elevated and without any median depression; embolus of male palp otherwise ...4
4. Ocular quad twice longer than wide and seems parallel sided; cephalic part separated from thoracic part by a distinct semicircular depression; femra provided with very long fringed bristles underneath.....
*Pandercetes*
 Ocular quad less than twice longer than wide and narrow in front than behind (Fig. 5); cephalic part slightly depressed in front; femora not provided with fringed bristles (Figs. 6)..... *Heteropoda*
5. Cephalothorax larger than broad and much higher posteriorly; eye region smaller; anterior lateral eyes more than twice than anterior medians (Fig. 7); eyes of anterior row close to each other (Fig. 7).....
*Panaretus*
 Cephalothorax otherwise and not much higher posteriorly; eye region not smaller, anterior lateral eyes otherwise; eyes of anterior row not close to each other.....6



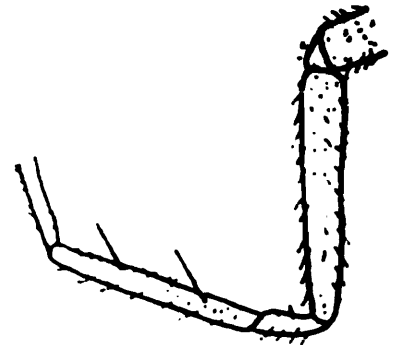
Figs. 1-9. 1. Ventral view of left maxilla of *Spariolenus*. 2. Inner view of left chelicera of *Spariolenus*. 3. Dorsal view of carapace of *Torania*. 4. Ventral view of eight male palp of *Torania*. 5. Dorsal view of carapace of *Heteropoda*. 6. Lateral view of left leg I of *Heteropoda*. 7. Dorsal view of carapace of *Panaretus*. 8. Dorsal view of carapace of *Palystes*. 9. Ventral view of labium and maxillae of *Palystes*.



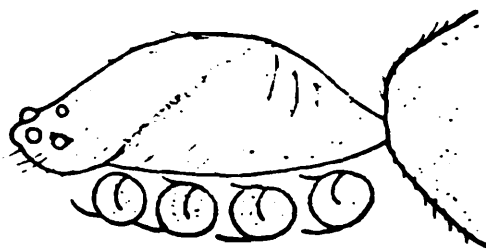
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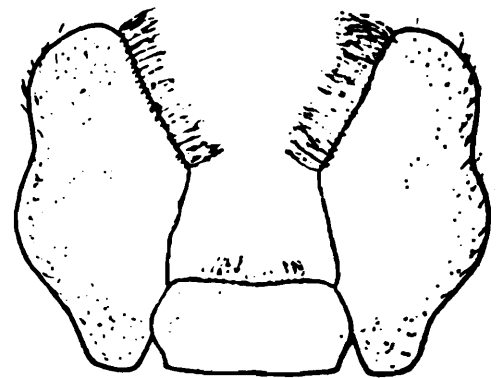
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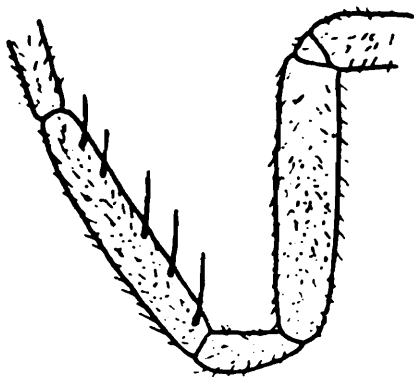
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16

Figs. 10-16. 10. Dorsal view of carapace of *Olios*. 11. Ventral view of labium and maxillae of *Olios*. 12. Lateral view of right leg I of *Olios*. 13. Lateral view of cephalothorax of *Thelcticopis*. 14. Ventral view of labium and maxillae of *Thelcticopis*. 15. Lateral view of left leg I of *Thelcticopis*. 16. Ventral view of spinnerets of *Thelcticopis*.

6. Carapace narrow anteriorly and convex posteriorly but abruptly sloping down; anterior lateral eyes much larger than anterior medians (Fig. 8); labium truncated at the apex (Fig. 10).....*Palyates*
 Carapace not narrow anteriorly and posteriorly otherwise; anterior lateral eyes smaller than anterior medians; labium not truncated at the apex....7
7. Cephalic part of carapace remarkably higher than the thoracic part (Fig. 10); labium rounded at the apex (Fig. 11); tibia 1 armed with 2 pairs of inferior spines (Fig. 12); spinnerets without any membranous stalk and without chitinous ring*Olios*
 Cephalothorax longitudinally convex (Fig. 13); labium truncated at the apex (Fig. 14); tibia I armed with 5-7 pairs of inferior spines (Fig. 15); spinnerets supported on a membranous stalk and strengthened by a hairy chitinous ring (Fig. 16).....*Thalcticopis*

Genus *Torania* Simon

1886. *Torania*, Simon, *Act. Soc. Linn. Bord.*, 40 : 143.
 1897. *Torania*, Simon, *Hist. Nat. Araign.*, 2 : 33.
 1899. *Torania*, Pocock, *Proc. zool. Soc. Lonc.*, : 874.
 1902. *Torania*, Waterhouse, *Index zoolgicus, London, 1902* : 421.
 1928. *Torania*, Petrunkevitch, *Trans. Connect. Acad. Arts Sci.*, 29 : 159.
 1931. *Torania*, Gravely, *Rec. Indian Mus.*, 33(3) : 246.
 1938. *Torania*, Gerhardt & Kastner, *Echte Spinner* : 629.

Characters : Cephalothorax slightly longer than wide; cephalic part much elevated than the thoracic part and may be provided with distinct mid longitudinal depression. Both anterior and posterior rows of eyes slightly recurved; anterior row of eyes much shorter than the posterior row; posterior lateral eyes much on prominent stalks; ocular quad narrow in front than behind. Second pair of legs robust and largest of all. Epigynum consists of three piece of sclerites united in front. Palpal organ furnished with slender embolus encircled the posterior part of the genital bulb.

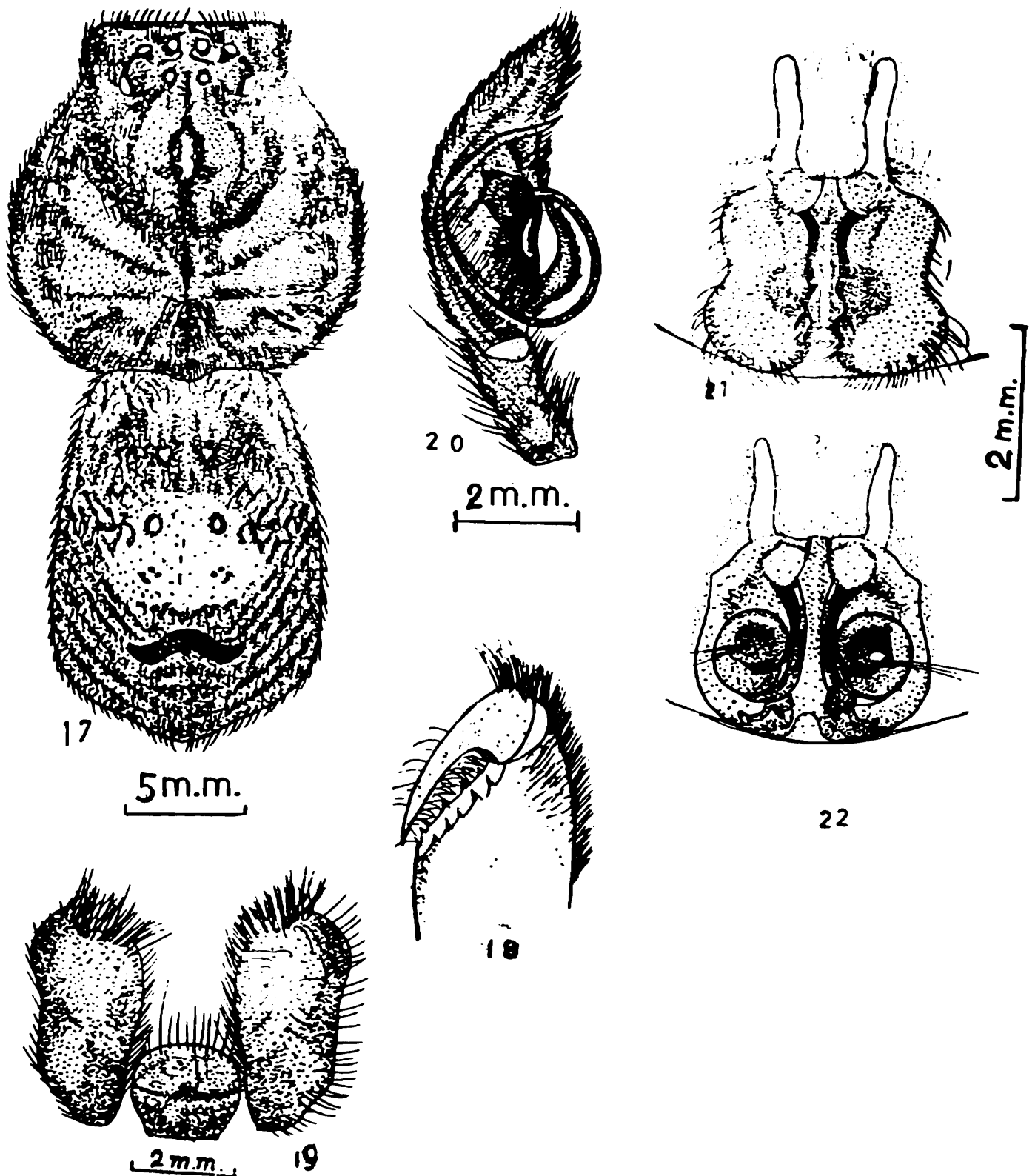
Type-species : *Torania gloriosa* Simon.

Distribution : India, Indo-China, Java, Sumatra, Africa.

Torania gloriosa Simon
 (Figs. 17 - 22)

1880. *Torania gloriosa*, Simon, *Act. Soc. Idnn. Bord.*, 34 : 257.
 1904. *Torania gloriosa*, Simon, *Miss. Pavia Indochina, Arachn.*, 3 : 285.
 1931. *Torania gloriosa*, Gravely, *Rec. Indian Mus.*, 33(3) : 246.
 1954. *Torania gloriosa*, Roewer, *Kat. der Araneae*, 2(A) : 725.

General : Cephalothorax and legs dark brown, abdomen yellowish. Total length 30.20 mm.; carapace 15.20 mm. long, 15.00 mm. wide, abdomen 15.10 mm. long, 11.00 mm. wide.



Figs. 17-22. *Torania gloriosa* Simon 17. Dorsal view of female, legs omitted. 18. Inner view of left chelicera showing arrangements of teeth. 19. Ventral view of labium and maxillae. 20. Ventral view of right male palp. 21. Epigynum, ventral view. 22. Internal genitalia, dorsal view.

Cephalothorax : Nearly as long as wide, robust in structure, covered with large hairs, cephalic part much elevated with a circular ridge like appearance and a cephalic depression at the centre as in text-fig. 17; thoracic part distinctly lower than cephalic part and provided with a mid-longitudinal fovea as in text-fig.17. Anterior row of eyes smaller than the posterior row as in text-fig. 17; anterior row nearly straight and eyes are subequal; posterior row of eyes distinctly recurved, posterior medians are much smaller than posterior laterals; posterior lateral eyes are placed on prominent stalks as in text-fig. 17. Ocular quad narrow anteriorly. Clypeus very broad. Chelicera robust and strong, dark brownish, outer and inner margins of fang furrow armed with 6 and 5 small teeth respectively as in text-fig. 18. Labium brownish, nearly as long as wide. Sternum oval shaped, dark brown. Legs very powerful and long, 2nd pairs of leg longest nearly 60 mm. in length, metatarsi and tarsi provided with thick ventral scopulae. Male palp with long slender embolus encircling the posterior part of the genital bulb as in text-fig. 20.

Abdomen : Roughly pentagonal, comparatively smaller than cephalothorax, clothed with large hair. Dorsum of abdomen provided with 2 pairs of sigilla and at the posterior 2/3rd end dark brown mark present as in text-fig. 17. Epigynum with a pair of lateral lobes and median piece, lateral lobes united at the anterior end as in text-fig.21. Internal genitalia as in text-fig. 22.

Distribution : India : Silcuri, Cachar, Assam, Indochina, Malaysia, Indonesia.

Remarks : Description and illustrations are based on the basis of one paratype female and a male received from the B.M.(N.H.), London, Regd. No. 1860.15. One female specimen received from the M.N.H.S., Paris, Regd. No. 7849 was also studied.

Genus *Pandercetes* L. Koch

- 1875. *Pandercetes* Koch, L. *Arachn. Austral.*, : 739.
- 1880. *Pandercetes*, Simon, *Act. Soc. linn. Bord.*, 34 : 227.
- 1897 *Pandercetes*, Simon, *Hist. nat. Araign.*, 2 : 56.
- 1900. *Pandercetes*, Pocock, *Fauna Brit. India, Arachn.*, : 254.
- 1903. *Pandercetes*, Hogg, *Proc. Zool. Soc. Lond.*, 1902 (2) : 419
- 1912. *Pandercetes* : Jarvi, *Ann. Acad. Sci. Fenn.*, (A) 4(1) : 72.
- 1931 *Pandercetes* : Gravely, *Rec. Indian Mus.*, 33(3) : 221-222.
- 1928. *Pandercetes* : Petrunkevitch, *Trans. Connect. Acad. arts Sci.*, 29 : 158.
- 1954. *Pandercetes* : Roewer, *Kat. der Araneae*, 2(a) : 722.

Characters Cephalothorax not much longer than wide, cephalic part differs from thoracic part by a semicircular depression and distinct thoracic furrow present. Anterior row of eyes straight and eyes narrowly and equally separated from each other; posterior row of eyes recurved; lateral eyes larger than medians; ocular quad twice longer than wide and slightly narrow in front than behind; anterior median eyes slightly bigger than posterior median eyes slightly bigger than posterior medians. Inner margin of fang furrow armed with four teeth of equal size, may be the last one smaller. Legs are in very great length; femora provided with very long fringed bristles underneath.

Distribution : India, Sri Lanka, Burma, Malacca, New Guinea, Malayasia, Australia.

Remarks : This genus is only recorded by a single species *Pandercetes calatus* Pocock from India description of which is given in the *Fauna of British India*, Arachnida, P. 265 by Pocock. But since we have not got any Type of identified specimen we could not included it in this work.

Genus *Panaretus* Simon

1880. *Panaretus* Simon, *Act. Soc. linn. Bord.*, 34 : 259.

1902. *Panaretus* : Waterhouse, *Index Zoologicus*, London. 1902 : 264.

1928. *Panaretus* : Petrunkevitch, *Trans. Connect. Acad. arts Sci.*, 29 : 158.

1931. *Panaretus* : Gravely, *Rec. Indian Mus.*, 33(3) : 247.

1935. *Panaretus* : Gitlay, *Mus. roy. hist. nat. Belg.*, 11(20) : 14.

Characters : Cephalothorax more longer than broad and much higher posteriorly. Eye region is smaller; anterior row of eyes in a straight line and eyes close to each other; anterior median eyes more than twice smaller than anterior laterals; posterior row of eyes slightly procurved and eyes are equidistinct from one another; four median eyes subequally; ocular quad longer than broad and narrower anteriorly. Legs more slender.

Type-species : *Panaretus ignichelis* Simon.

Distribution : Java, Sumatra, Indo-China.

Key to the species of the genus *Panaretus* Simon

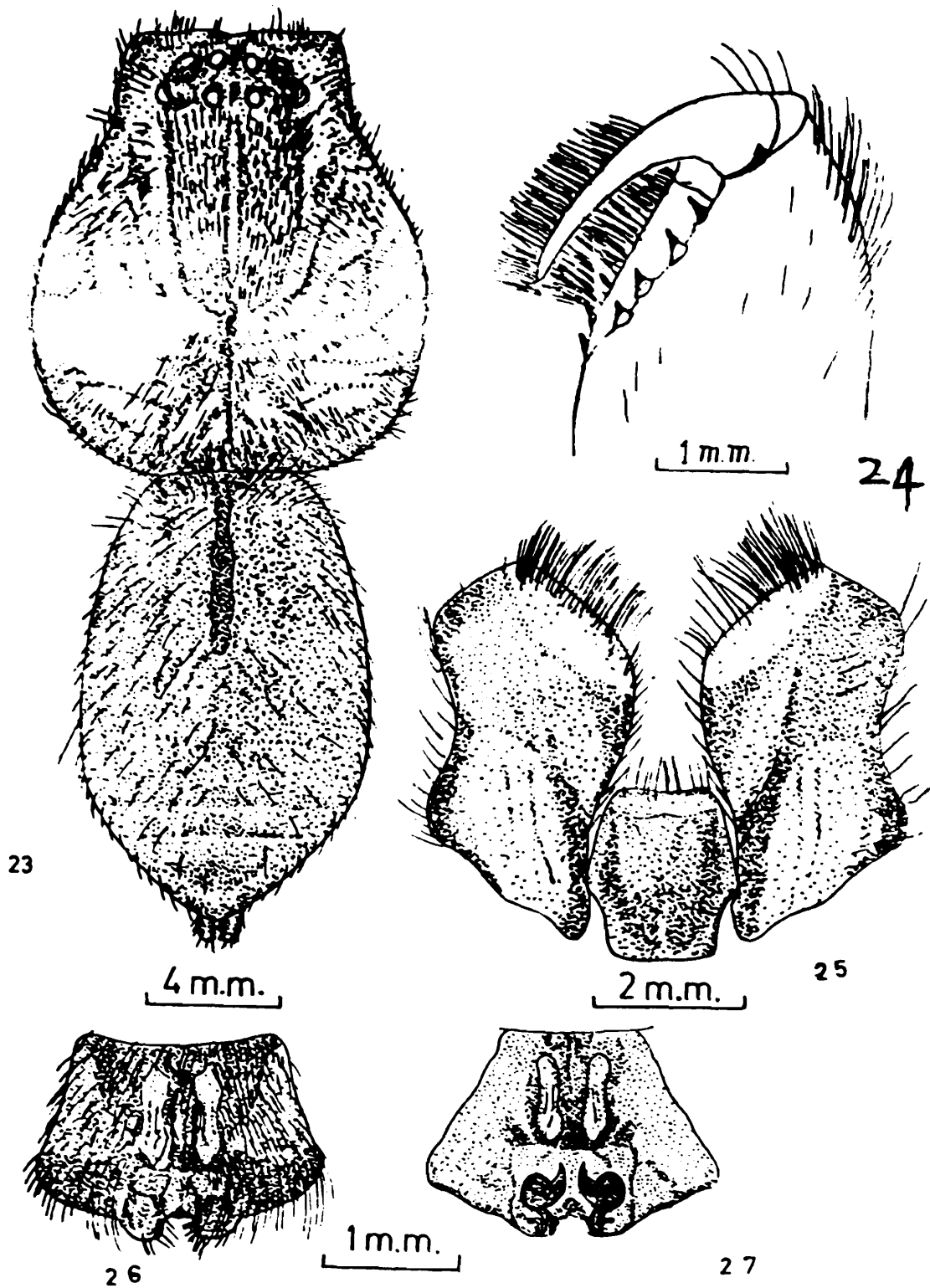
1. Cephalic region of carapace elevated than thoracic region and covered with large hairs (Fig. 23); ocular region subterminal on the carapace (Fig. 23); anterior row of eyes slightly recurved; sternum heart shaped; inner margin of fang furrow armed with 4 teeth (Fig. 24); labium longer than wide (Fig. 25); posterior pair of spinnerets enormously longer than the anterior pair; lateral lobes of epigynum short and not distinctly separated along their length (Fig. 26).....*nirounensis*
Cephalic region of carapace distinctly more elevated than thoracic region and not covered with large hairs (Fig. 28); ocular region terminal on the carapace (Fig. 28); anterior row of eyes straight; sternum oval in shape; inner margin of fang furrow armed with 5 teeth (Fig. 29); labium wider than long (Fig. 30); posterior pair of spinnerets normal in size and slightly longer than the anterior pair; lateral lobes of epigynum much longer and distinctly separated along their length (Fig. 31).....
.....*ignichelis*

Panaretus nirounensis Simon (Figs. 23-27)

1903. *Panaretus nirounensis* Simon, *Ann. Soc. Ent. France*, 72 : 304.

1931. *Panaretus nirounensis*, Gravely, *Rec. Indian Mus.*, 33(3) : 247.

1954. *Panaretus nirounensis*, Roewer, *Kat. der Araneae*, 2(A) : 721.



Figs. 23-27. *Panaretus nirouensis* Simon 23. Dorsal view of female, legs omitted. 24. Inner view of left chelicera showing arrangements of legs. 25. Ventral view of labium and maxillae. 26. Epigynum, ventral view. 27. Internal genitalia, dorsal view.

General Cephalothorax dark brownish, legs brownish and abdomen dark brown. Total length 26.50. Carapace 12.40 mm. long, 11.20 mm. wide; abdomen 12.80 mm. long, 8.35 mm. wide.

Cephalothorax : Longer than wide, cephalic region covered with large hairs and more elevated than thoracic region, thoracic furrow longitudinal as in text-fig. 23. Anterior row of eyes shorter than the posterior row; both anterior and posterior rows of eyes are slightly recurved as in text-fig. 23. Posterior laterals are placed on prominent stalks. Ocular quad slightly narrow anteriorly. Labium longer than wide, dark brown as in text-fig. 25. Sternum heart shaped. Chelicerae very strong, stout, dark brown, outer margin with 2 and inner margin with 4 teeth on the fang furrow as in text-fig. 24. Legs long, less spiny, with thin scopulae on the ventral side.

Abdomen : Oval, dorsum having with a mid-longitudinal strip like mark on the anterior half of the abdomen as in text-fig. 23. Ventral side with or pair of white U-shaped mark. Posterior pair of spinnerets much longer. Epigynum provided with a pair of short lateral lobes, leaving a cavity in between at the centre as in text-fig. 26. Internal genitalia show coma shaped spermathecae as in text-fig. 27.

Distribution : India : Darjeeling, West Bengal, Sumatra.

Remarks : Description and illustrations have been prepared on the basis of an identified female specimen, received from the M.N.H.N., Paris, Regd. No. 22179.

***Panaretus ignichelis* Simon**
(Figs. 28-32)

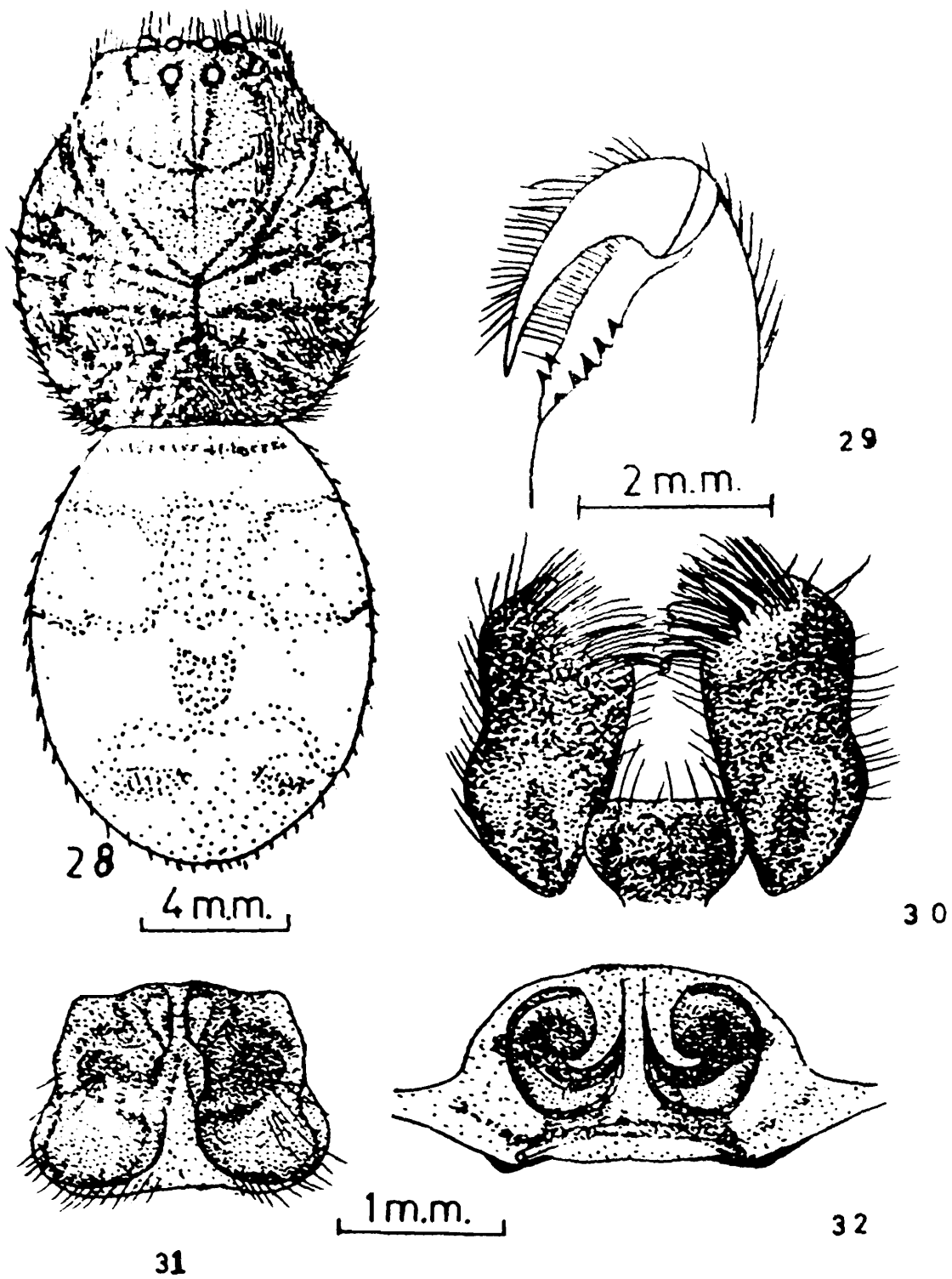
1880. *Panaretus ignichelis* Simon, *Act. Soc. Linn. Bord.*, 34 : 201.

1897 *Panaretus ignichelis*, Simon, *Hist. Nat. Araisn.*, 2(1) : 54.

1954. *Panaretus ignichelis*, Roewer, *Kat. der Araneae*, 1(A) : 721.

General : Cephalothorax and legs brownish, abdomen yellowish with brown dots. Total length 22.00 mm. Carapace 10.60 mm. long, 9.50 mm. wide; abdomen 11.80 mm long, 9.40 mm. wide.

Cephalothorax : Longer than wide much thick, covered with large and small hairs, cephalic part much elevated than thoracic part, thoracic furrow longitudinal and distincts as in text-fig. 28. Ocular region at the apex of cephalic part. Anterior row of eyes nearly straight; posterior row slightly recurved and eyes are equidistinct from one another; median eyes are subequal in size, ocular quad slightly narrow in front than behind, posterior lateral eyes are on prominent stalks as in text-fig. 28. Clypeus wider than the anterior medians. Chelicerae moderately strong, dark brown, outer and inner margins of fang furrow armed with 2 and 5 teeth as in text-fig. 29. Labium wider than long as in text-fig. 30. Sternum oval shaped, dark brownish in colour. Legs are slightly more slender and laterigrade, thick white scopulae on the ventral side of metatarsi and tarsi.



Figs. 28-32. *Panaretus ignichelis* Simon 28. Dorsal view of female, legs omitted. 29. Inner view of left chelicera showing arrangements of teeth. 30. Ventral view of labium and maxillae. 31. Epigynum, ventral view. 32. Internal genitalia, dorsal view.

Abdomen : Oval with anteriorly truncated, dorsum with brown dots at over as in text-fig. 28. Epigynum with paired lateral lobes separated along the length with a median cavity at the middle as in text-fig. 31. Internal genitalia shows semicircular ducts as in text-fig. 32.

Distribution : Indochina, Java, Borneo. Gravely recorded and described 2 known species collected from Darjeeling and Harmutti, India. Though *Panaretus ignichelis* not reported from India but it may be available in this subcontinent. As we had received the Type female specimen from the M.N.H.N., Paris, we have described it in this work.

Remarks : Illustrations and descriptions are prepared on the female Type specimen received from M.N.H.N., Paris, Regd. No. 1568.

Genus *Palystes* L. Koch

- 1875 *Palystes* Koch, L. *Arachn. Austral.*, : 701.
 1880. *Palystes*, Simon, *Act. Soc. Linn. Bord.*, 34 : 262.
 1882. *Palystes*, Scudder, *Bull. U. S. Nat. Mus.*, 19 : 231.
 1897. *Palystes*, Simon, *Hist. Nat. Araign.*, 2 : 65.
 1900. *Palystes*, Pocock, *Fauna Brit. India, Arachn.*, : 265.
 1935. *Palystes*, Dyal, *Bull. Zool. Panjab Univ.*, 1 : 210.

Characters : Carapace narrow anteriorly and longer and posteriorly convex and abruptly sloping down. Anterior row of eyes straight or a bit procurved, anterior lateral eyes much larger than medians; posterior row of eyes also straight and subequal, posterior laterals not prominent. Labium broader than long and truncated at the apex. Clypeus low. First leg longer than second.

Type-species : *Palystes castaneus* (Latreille)

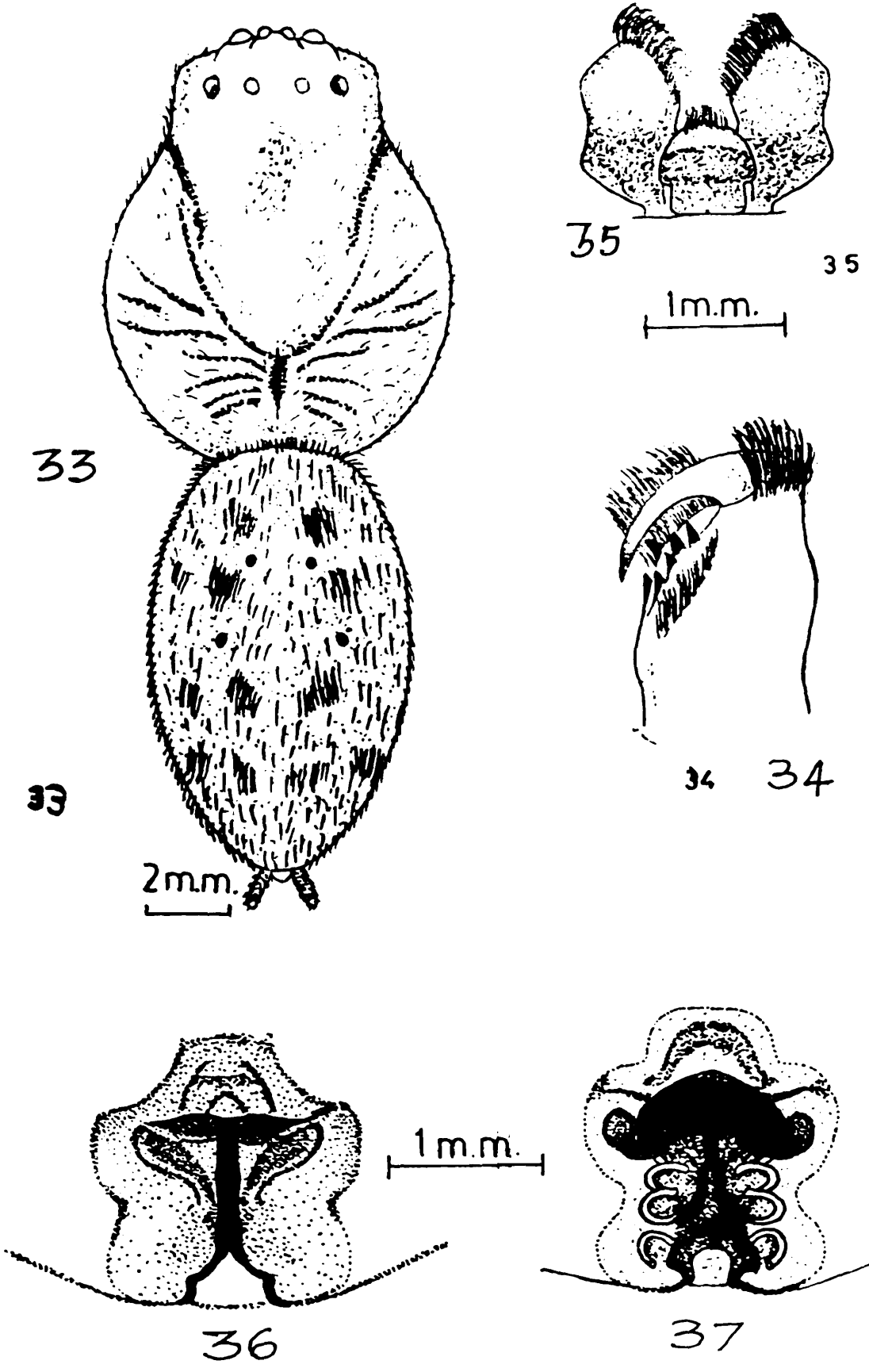
Distribution : Tropical Africa, India to Australia.

Key to the species of the genus *Palystes* L. Koch

1. Anterior lateral eyes nearly twice larger than anterior medians (Fig. 33); dorsum of abdomen provided with patches of long erected hairs (Fig. 33); epigynum with lateral lobes contracted midlongitudinally throughout their length (Fig. 36)*kochi*
- Anterior lateral eyes one and half times larger than anterior medians (Fig. 38); posterior row of eyes slightly procurved (Fig. 38); posterior row of eyes slightly procurved (Fig. 38); dorsum of abdomen not provided with patches of long erected hairs (Fig. 38); epigynum having with a V-shaped sclerite in between the lateral lobes (Fig. 42)*flavidus*

Palystes kochi Simon (Figs. 33-37)

1880. *Palystes kochi* Simon, *Act. Soc. Linn. Bord.*, 34 : 265.
 1887. *Palystes kochi* : Simon, *J. Asiat. Soc. Bengal*, 56(2) : 103.



Figs. 33-37. *Palystes kochi* Simon 33. Dorsal view of female, legs omitted. 34. Inner view of left chelicera showing arrangements of teeth. 35. Ventral view of labium and maxillae. 36. Epigynum, ventral view. 37. Internal genitalia, dorsal view.

1890. *Palystes melamychins* : Thorell, *Ann. Mus. Civ. Genova*, **30** : 53.
 1895. *Palystes kochi* : Thorell, *Descript. catal. Spid. Burma*, : 268.
 1900. *Palystes kochi* : Pocock, *Fauna Brit. India, Arachn.*, : 265.
 1931. *Palystes kochi* : Gravely, *Rec. Indian Mus.*, **33**(3) : 259.
 1954. *Palystes kochi* : Roewer, *Kat. der Araneae*, **2**(A) : 728.

General : Cephalothorax reddish brown, legs dark brownish, abdomen yellow in colour. Total length 20.30 mm; carapace 10.35 mm. long, 8.45 mm. wide; abdomen 9.90 mm. long, 6.20 mm. wide.

Cephalothorax : Longer than wide, carapace convex and covered with fine hairs; cephalic part elevated than thoracic part but not separated by grooves; cephalic part lighter in colour than thoracic part; longitudinal thoracic fovea as in text-fig. 33. Anterior row of eyes slightly procurved as seen from in front; anterior lateral eyes nearly twice the anterior medians; posterior row of eyes straight as seen from above as in text-fig. 33; eyes of posterior row equally spaced; ocular quad longer than wide and narrow in front than behind. Clypeus narrow. Sternum heart shaped, flat, brownish, antero-median ridge present at the edge. Maxilla thick and convex, provided with dense scopulae. Labium nearly as long as wide, brownish, apex thick and obtuse, lateral notch on each side as in text-fig. 35. Chelicera strong and stout, dark brownish in colour, armed with 2 and 4 teeth on outer and inner margin of fang furrow respectively as in text-fig. 34. Legs long and strong, spiny, dark brownish in colour.

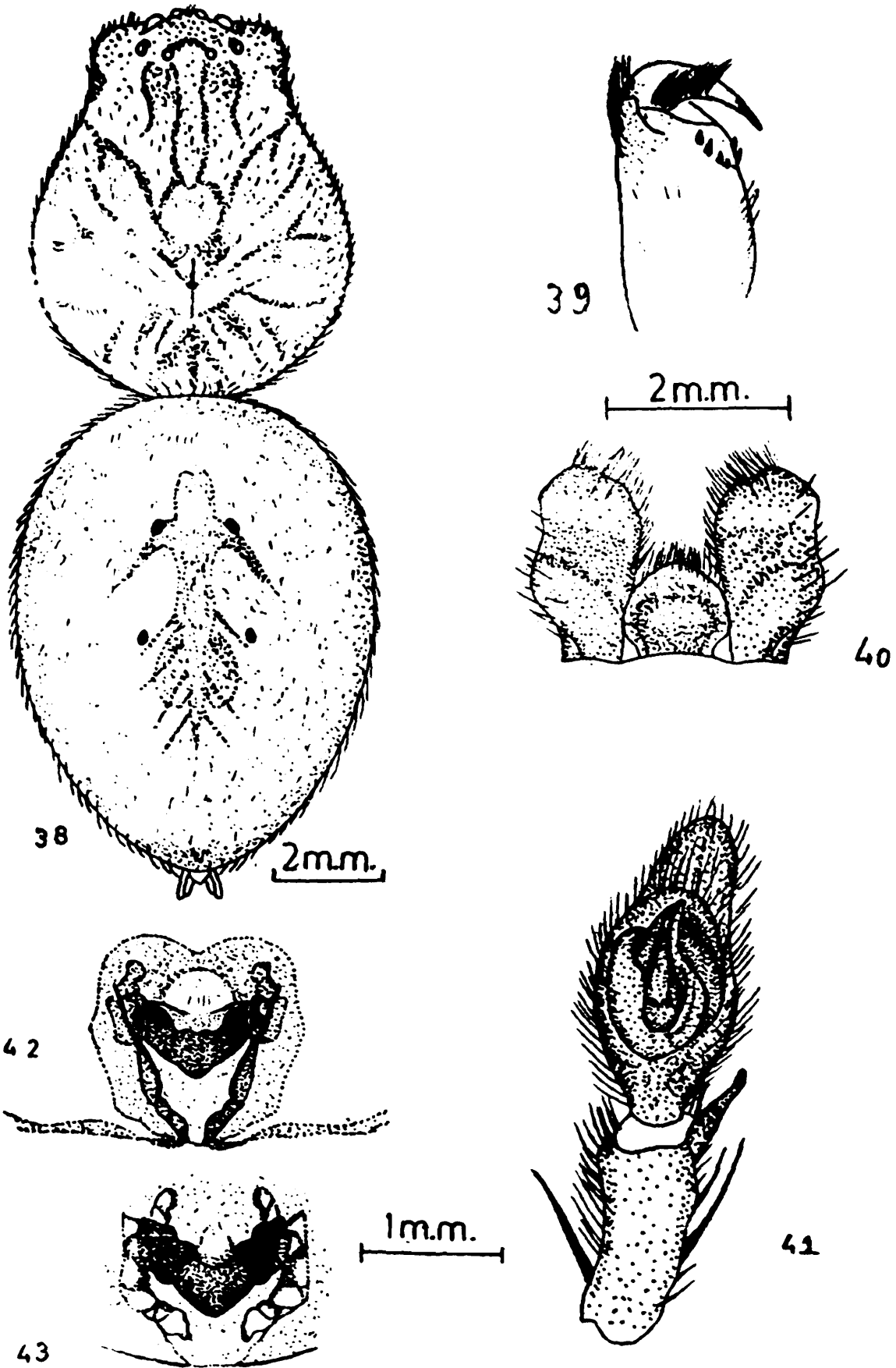
Abdomen : Oval, yellowish, dorsum provided with two pairs of sigilla and patches of long erected hairs as in text-fig. 33. Ventral side having with a pair of midlongitudinal lines. Epigynum highly sclerotised and the lateral lobes are in contact throughout their length midlongitudinally leaving a narrow transverse cavity in front of them as in text-fig. 36. Internal genitalia complicated, fertilization tube spiral in structure as in text-fig. 37.

Distribution : India : Assam, Burma : Rangoon, Tenasserim. Sumatra, Malaysia.

Remarks : Description and illustrations based on the female specimen which was received from the National Collection of Z.S.I., Calcutta, Regd. No. 8580/9. This specimen of Calcutta was wrongly identified as *Heteropoda venatoia*. After comparing this specimen with the authenticated identified specimen of M.N.H.N., Paris, Regd. No. 1133, B.No. 1741 found it is *Palystes kochi*.

***Palystes flavidus* Simon**
(Figs. 38-43)

1896. *Palystes flavidus* : Simon, *Ann. Soc. Ent. France*, **65** : 489.
 1900. *Palystes flavidus* : Pocock, *Fauna Brit. India, Arachn.*, : 256.
 1931. *Palystes flavidus* : Gravely, *Rec. Indian Mus.*, **33**(3) : 258.
 1935. *Palystes flavidus* : Dyal, *Bull. Zool. Panjab Univ.*, **1** : 210.
 1954. *Palystes flavidus* : Roewer, *Kat. der Araneae*, **2**(A) : 727.



Figs. 38-43. *Palystes flavidus* Simon 38. Dorsal view of female, legs omitted. 39. Inner view of right chelicera showing arrangements of teeth. 40. Ventral view of labium and maxillae. 41. Ventral view of right male palp. 42. Epigynum, ventral view. 43. Internal genitalia, dorsal view.

General : Cephalothorax yellowish in colour, legs yellowish with faint brownish lint, abdomen pale yellowish. Total length 15.80 mm. long, 5.90 mm. wide; abdomen 9.80 mm. long, 6.75 mm. wide.

Cephalothorax : Longer than wide, cephalic part slightly and not distinctly elevated from the thoracic part; carapace covered with fine hairs; thoracic furrow longitudinal as in text-fig. 38. Anterior row of eyes procurved as seen from in front, anterior lateral eyes one and half times larger than the anterior medians as in text-fig. 38; posterior row of eyes slightly procurved as seen from above; ocular quad much narrower anteriorly than behind. Clypeus narrow. Sternum heart shaped, anteriorly concave, yellowish in colour. Maxillae longer in shape, yellowish in colour. Labium longer than wide, pale yellowish, obtuse at the apex as in text-fig. 40. Chelicera moderately strong, armed with 2 and 4 teeth outer margins and inner margin of fang furrow respectively as in text-fig. 39. Legs long and strong, spiny, yellowish in colour, covered with white hairs. Male palp as in text-fig. 41.

Abdomen : Oval, yellowish, dorsum as in text-fig. 38 and provided with 2 pairs of sigilla. Epigynum provided with a V-shaped sclerite in between the lateral lobes as in text-fig. 41. Internal genitalia as in text-fig. 43.

Distribution : India : Trichinopoly, Remnod, Tamil Nadu, Barkuda Island, Chilka Lake, Ganjam, Orissa; Serampore, Calcutta, Tollygunga, Kalimpong, West Bengal; Allahabad, U.P.; Sripur, Saran, Bihar; Eastern Himalayas.

Remarks : Description and illustrations are based on the authenticated identified female and male specimen received from the National Collection of Z.S.I., Calcutta, Reg. No. 1783/18. One female identified specimen of Simon, collected from Trichinopoly, Madras, also been studied which was received from the M.N.H.N., Paris, Regd. No. 10907.

Genus *Thelcticipis* Karsch

- 1884. *Thelcticipis* Karsch, *Sitz. ber. Ges. Naturw. Marburg*, : 65.
- 1897. *Thelcticipis* : Pocock, *Abh. senck. naturf. Ges.*, 23 : 621.
- 1898. *Thelcticipis* : Simon, *Hist. Nat. Araig.*, 2 : 205.
- 1900. *Thelcticipis* : Pocock, *Fauna Brit. India, Arachn.*, : 270.
- 1931. *Thelcticipis* : Gravely, *Rec. Indian Mus.*, 33(3).
- 1935. *Thelcticipis* : Dyal, *Bull. Zool. Panjab Univ.*, 1 : 211.
- 1938. *Thelcticipis* : Sherrifs, *Hong-Kong Nat.*, 8(3-4) : 183.

Characters : Cephalothorax longer than broad thick, anteriorly broad and longitudinally convex. Posterior row of eyes procurved; lateral eyes sessile; anterior median eyes larger than anterior laterals; ocular quad more or less squarish. Legs short, less laterigrade; first leg longer than second or may be equal; tibia I armed with 5-7 pairs

of inferior spines. Spinnerets supported on a membranous stalk and strengthened by a hairy chitinous ring.

Type-species : *Thelcticopis severa* (L.Koch).

Distribution : Burma, Thailand, Sri Lanka Solomon islands.

***Thelcticopis canescens* Simon**
(Figs. 44-49)

1887. *Thelcticopis canescens* Simon, *J. Asiat. Soc. Bengal*, 56(2) : 103.

1895. *Thelcticopis birmanica* : Thorell, *Descrip. Catal. Spider Burma.*, : 274.

1900. *Thelcticopis canescens* : Pocock, *Fauna Brit. India, Arachn.*, : 271.

1931. *Thelcticopis canescens* : Gravely, *Rec. India, Mus.*, 32(3) : 245.

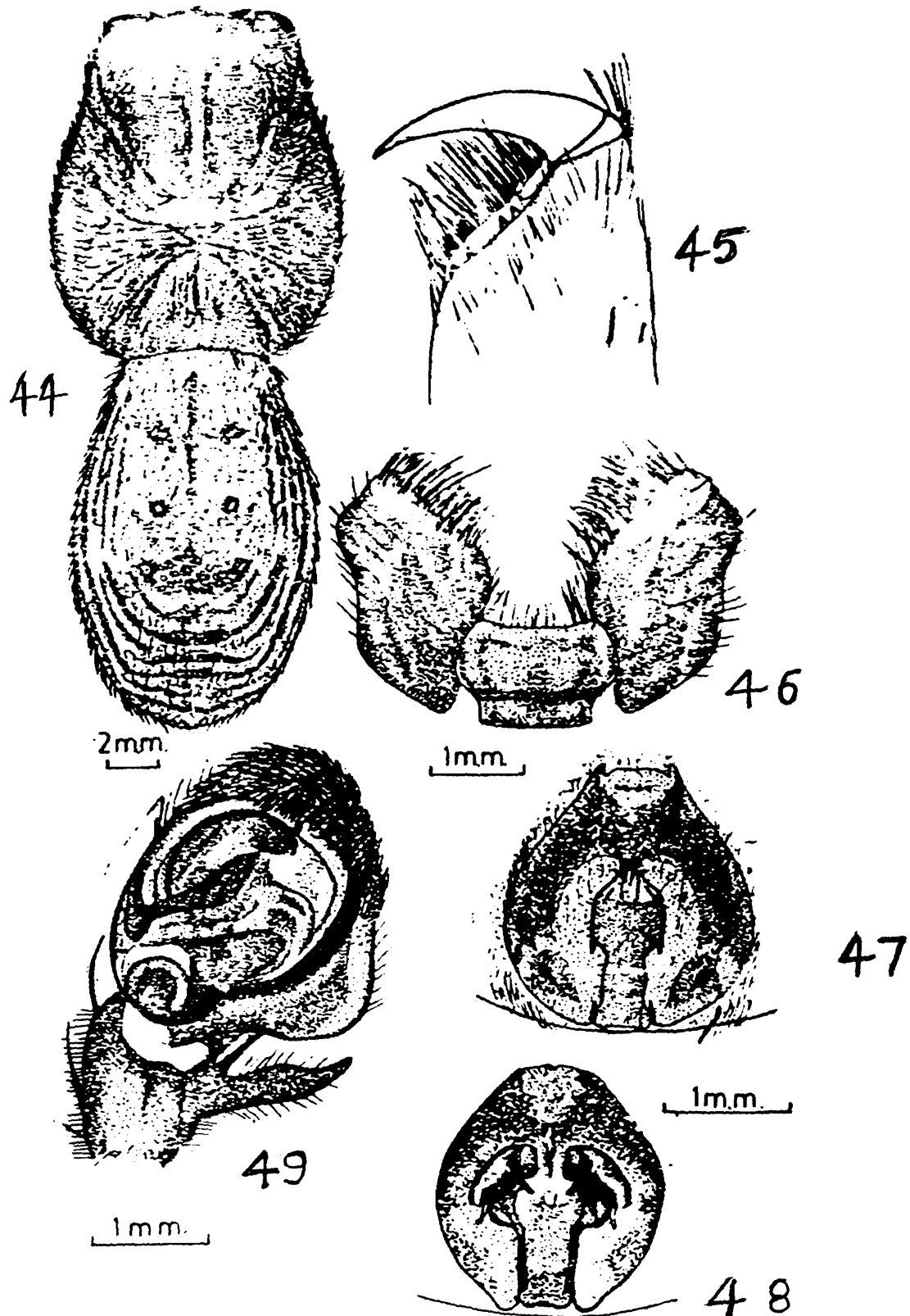
General : Cephalothorax reddish brown, legs brownish in colour, abdomen greyish yellow with some earthen coloured markings. Total length 28.90 mm.; carapace 14.50 mm. long, 11.40 mm. wide; abdomen 15.20 mm. long, 9.60 mm. wide.

Cephalothorax : Longer than wide, cephalic part exceedingly high and convex, thoracic part sloping down towards the periphery, covered with large hairs and pubescence, thoracic fovea indistinct. Anterior row of eyes slightly procurved as seen from in front, anterior laterals smaller than anterior medians, anterior medians are largest of all as in text-fig. 44; posterior row of eyes also slightly procurved, posterior laterals are far away from the posterior medians as in text-fig. 44; ocular quad narrow anteriorly than behind as in fig. 44. Sternum heart shaped, concave anteriorly, reddish brown in colour. Maxilla wider distally, provided with thick scopulae. Labium wider than long dark brown in colour, having with a horizontal ridge as in text-fig. 46. Chelicera robust and very strong, dark brownish in colour, outer margin of fang furrow armed with 2 large teeth and inner margin armed with 4 small teeth as in text-fig. 45. Legs not very long but strong and stout, covered with hairs, metatarsi and tarsi with thick leg scopulae on the ventral side. Male palp as in text-fig. 49.

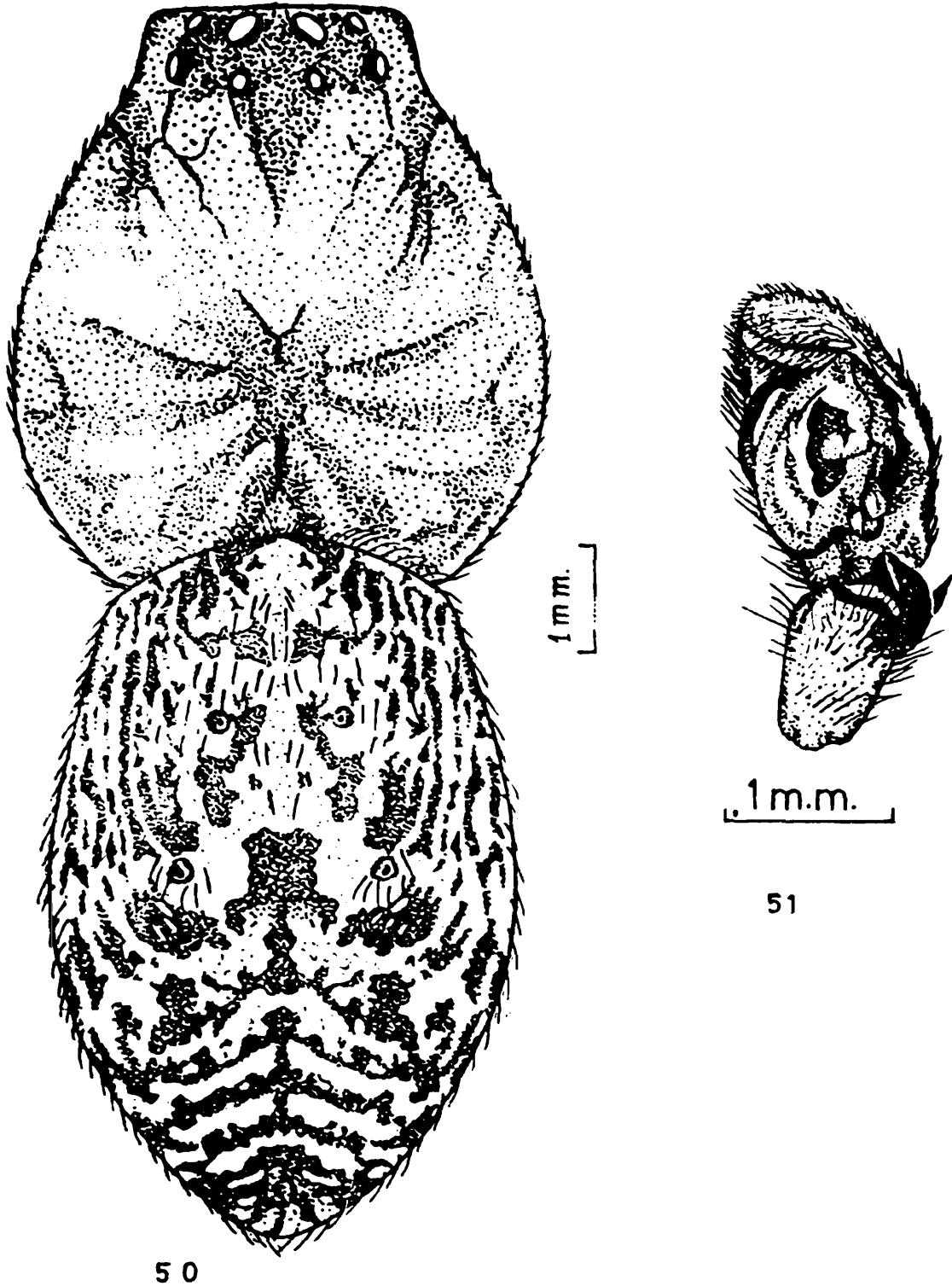
Abdomen : Barrel shaped, covered with hairs. Dorsum of abdomen provided with 3 pairs of sigilla and earthen coloured linear markings as in text-fig. 44. Ventral side having with a pair of mid-longitudinal white lines, and a single white line on each side. Epigynum heavily sclerotised, lateral lobes fused anteriorly and median piece narrow at the middle as in text-fig. 47. Internal genitalia as in text-fig. 48.

Distribution India : Andaman & Nicobar Islands. Burma : Tavoy, Tenasserim. Thailand.

Remarks Description and illustrations are based on the female specimen collected by Dr. B. K. Tikader from Andaman which was received from unidentified collection of Z.S.I., Calcutta, Regd. No. Nil. We also had received one authentically identified male specimen from M.N.H.S., Paris, Regd. No. 8587. The male palp is given in Fig. 49.



Figs. 44-49. *Thectocipis canescense* Simon 44. Dorsal view of female, legs omitted. 45. Inner view of left chelicera showing arrangements of teeth. 46. Ventral view of labium and maxillae. 47. Epigynum, ventral view. 48. Internal genitalia, dorsal view. 49. Ventral view of right male palp.



Figs. 50-51. *Thelcticopis maindroni* Simon 50. Dorsal view of male, legs omitted. 51. Ventral view of right male palp.

***Thelcticoois maindroni* Simon**
(Figs. 50-51)

1906. *Thelcticopis maindroni* Simon, *Ann. Soc. Ent. France*, 75 : 295.

1931. *Thelcticopis maindroni* : Gravely, *Rec. Indian Mus.*, 33(3) : 217.

1954. *Thelcticopis maindroni* : Roewer, *Kat. der Araneae*, 2(A) : 686.

General : Cephalothorax and legs yellowish, abdomen yellowish with brownish markings. Total length 12.25 mm., carapace 6.00 mm. long, 5.25 mm. wide; abdomen 7.00 mm. long, 4.65 mm. wide.

Cephalothorax : Slightly longer than wide, cephalic region higher than the thoracic region, longitudinal thoracic furrow present as in text-fig. 50. Anterior row of eyes nearly straight, anterior medians largest and oval in shape and obliquely placed as in text-fig. 50; posterior row of eyes procurved and eyes are equally placed from each other. Ocular quad squarish as in text-fig. 50. Male palp simple type, conductor distinct at the anterior end, paracymbium bifurcated as in text-fig. 51.

Abdomen : Roughly barrel shaped, dorsum provided with 2 pairs of sigilla and dark brown patches as in text-fig. 51.

Distribution : This species is reported so far from its Type-specimen is the only example of this species, the description and illustrations are based on the Male Type Specimen received from the M.N.H.N., Paris, Regd. No. 17289.

ACKNOWLEDGEMENTS

We expressing the appreciation to many scientists who have contributed loans of Type-specimens of heteropodid spiders. Mr. F. R. Wanless and Dr. P. D. Hillyard, of Arachnida Section, British Museum (Natural History), London, for sending the Type-specimens and authenticated identified specimens of Thorell and Pocock; Prof. Max Vachon and Dr. H. Hubert, of Museum National d'Histoire Naturelle, Paris, for providing the Type-specimens and identified specimens of Simon; Dr. N. I. Platnick, American Museum of Natural History, New York, U.S.A., for sending some valuable literatures on heteropodis.

We are thankful to Dr. B. S. Lamba, Joint Director, Dr. R. H. Kamble, Scientist 'B', Western Regional Station, Pune, for providing us necessary facilities to carry out this Research work and to Dr. Animesh Bal, Scientist 'B', Zoological Survey of India, Calcutta, for going through the manuscript.

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