FOUR NEW SPECIES OF PLATYGASTERID PARASITES HYMENOPTERA OF GALL MIDGES FROM INDIA[1]

By S. N. Rao, M.Sc., F.R.E.S., *U. P. Government Research Fellow, School of Entomology, St. John's College, Agra.*

This paper contains descriptions of four new species of Platygasteridae (Serphoidea), parasitic on gall midges (Itonididae : Diptera) from India. The holo-and allotypes are deposited in the collections of the Zoological Survey of India, Indian Museum, Calcutta and the paratypes are in the collections of the School of Entomology, St. John's College, Agra. I am indebted to Prof. M. S. Mani for guidance.

Platygaster salvadorae, sp. nov.

Male.—Head black, very sparsely and finely pubescent; viewed from above (Text-fig. 4*a*) strongly transverse, nearly as wide as thorax, breadth two and a half times the median length, ocellar region transversely and slightly irregularly striate, interocellar space twice the ocellocular, twice the front ocellar, vertex very slightly convex, transversely striate, striae not very irregular, margined, occiput transversely striate ; viewed from above broadly oval, frons not pubescent, very closely and finely punctate, face very finely and closely punctate, very slightly convex, clypeus not discrete, slightly convex, mandibles bidentate, the teeth with blunt and slightly darker and unequal tips, reddish-brown, eyes naked, inner orbital borders parallel, labial palpi short, uniarticulate, maxillary palpi biarticulate, long, antenna (Text-fig. 1*c* & *g*) inserted much below the middle of face, very close to the mouth, with ten segments, dark reddish-brown, fairly hairy, scape long, nearly three and a half times as long as broad at its broadest region, slightly narrowed at the extremities, longer than the three following segments combined, without a lamellate expansion, pedicel wider apically than at base, length nearly one and two-thirds the width at the widest region, first funicular segment nearly half the length of the pedicel, second segment longer than the first, very slightly longer but stouter than the pedicel, third and fourth segments equal to each other, nearly cylindrical, nearly twice as long as thick, very slightly longer than the pedicel, fifth, sixth and seventh segments nearly equal in all proportions, terminal segment longer than the penultimate, uniformly broad up to the apical one fourth, tapering to a blunt tip toward the apex, length a little over three and a half times the width, club of fifth to tenth segments ; viewed from side oval, height one and a half times the thickness, gena short, transversely striate, one-fourth the length of the eye, temples one-fourth the width of the eye in the middle.

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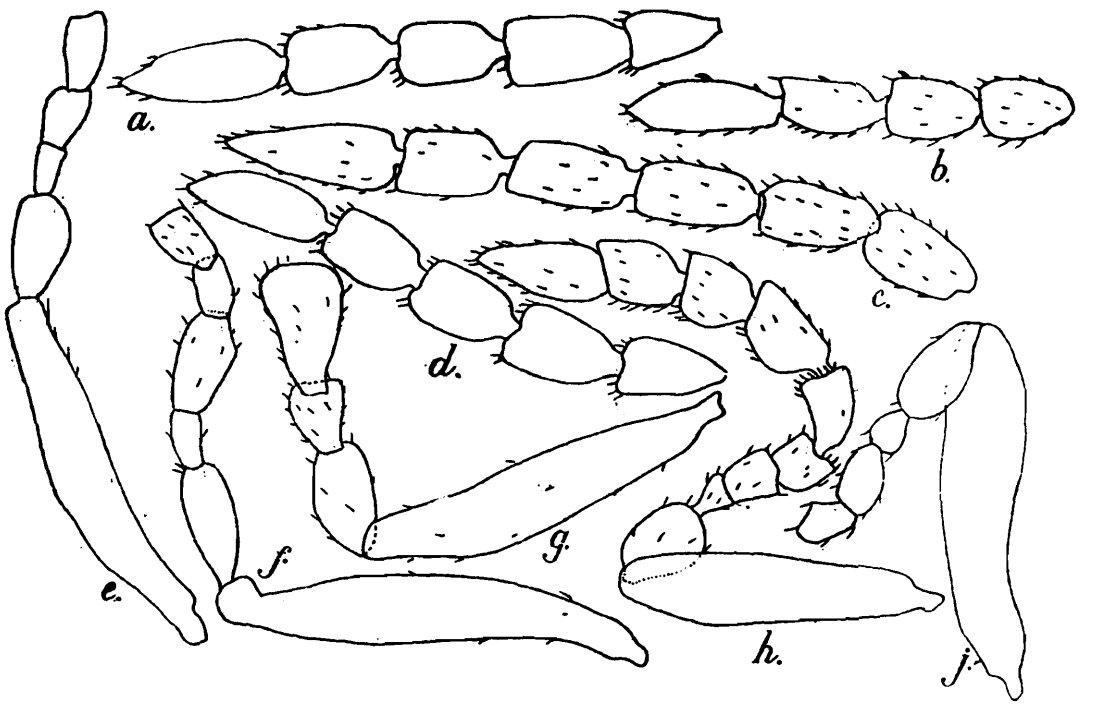
Thorax black, raised much above the level of the head, shiny, pronotum shiny, sparsely setose, mesonotum rugulose, without pubescence or setae, slightly convex, scutellum strongly convex, very prominent, semicircular, rugulose, propodeum produced in the form of a hood. Wings pubescent, without veins, fore wing a little over two and a half times as long as broad, with a very short marginal fringe, hind wing with two frenal hooks, with a marginal fringe of about one-fourth the thickness of the wing, rest of the details as in the figure (Text-fig. 3*a*). Legs short, tarsi five-segmented, coxae brownish-black, trochanters brownish-yellow, femur darker than trochanters, brownish-black, tibiae slightly darker than the yellowish-brown first four tarsi, fifth tarsal segment darker than the rest; coxa of the front leg shorter than both the trochanters combined, femur a little over twice or twice the length of the trochanters, broadest in the middle, tibia slender but slightly



Text-fig. 1.—*a. Polygnotus ramachandrai*, sp. nov., terminal five antennal segments of ♂; *b. Proleptacis fici*, sp. nov., terminal four antennal segments of ♀; *c. Platygaster salvadorae*, sp. nov., terminal six antennal segments of ♂; *d. Polygnotus ramachandrai*, sp. nov., terminal five antennal segments of ♀; *e. Polygnotus ramachandrai*, sp. nov., first five antennal segments of ♂; *f. Proleptacis fici*, sp. nov., first six antennal segments of ♀; *g. Platygaster salvadorae*, sp. nov., first four antennal segments of ♂; *h. Platygaster salvadorae*, sp. nov., antenna of ♀; *j. Polygnotus ramachandrai*, sp. nov., first five antennal segments of ♀.

longer than the femur, nearly half the length of the rest of the tarsi combined, twice the length of the second tarsal segment, terminal tarsal segment longer than the penultimate. Claw stout, evenly curved, dark brown, simple, shorter than the empodium. Abdomen with six tergites, dark brown to black, first tergite much shorter than the second, the latter three-fourths the length of the abdomen, three and a half times as long as the first, rest of the tergites much shortened.

Length 0·55 mm.

Female.—Head black, very sparsely pubescent on the gena only, without any projection between the antennae; viewed from above strongly transverse, twice as wide as the thorax, breadth a little less

than two and a half times the median length, ocellar region irregularly and transversely striate, interocellar space thrice the ocellocular, twice the front ocellar, vertex slightly convex, transversely rather shallowly striate, margined, occiput transversely striate ; viewed from front nearly circular, frons very finely pubescent, rather rugulose, shiny, face very finely pubescent, very shallowly and closely punctate, slightly convex, clypeus not discrete, slightly convex, sparsely hairy, mandibles reddish-brown, bidentate, the teeth with blunt and unequal tips, eyes naked, inner orbital borders parallel, labial palpi short, uniarticulate, mandibular palpi biarticulate, long, antenna with ten segments, inserted very close to the mouth, darker than in ♂, sparsely hairy, rest of the details as in the figure (Text-fig. 1*h*) ; viewed from side oval, height a little over one and half times the thickness, gena short, sparsely pubescent, one-fourth the length of the eye, temples one-fourth the width of the eye in the middle.

Thorax black, shiny, raised much above the level of the head, pronotum and mesonotum shiny, rugulose, without pubescence, convex, mesopleura with a cluster of hairs in the middle posteriorly, scutellum semicircular, prominent, convex, rugulose, propodeum fairly pubescent. Wings as in ♂. Legs similar but slightly longer than those of the ♂. Abdomen with six tergites, dark-brown to black, fuciform, first tergite much shorter than the second, the latter occupying the major length of the abdomen, nearly four times the length of the first, rest of the segments much shortened. Ovipositor concealed.

Length 0·6 mm.

Holotype.—1 ♂ and *Allotype.*—1 ♀ dissected and mounted on slide Nos. $\frac{1935}{H3.}$ & $\frac{1936}{H3.}$. "Reared from gall No. 168 on stem of *Salvadora persica* Linn. S. N. Rao Coll. Agra, 27. iii. 1950".

Host.—*Thomasiniana salvadorae* Rao.

The relationship of this species to the other two known Indian species is given in the following key, modified from Mani[1].

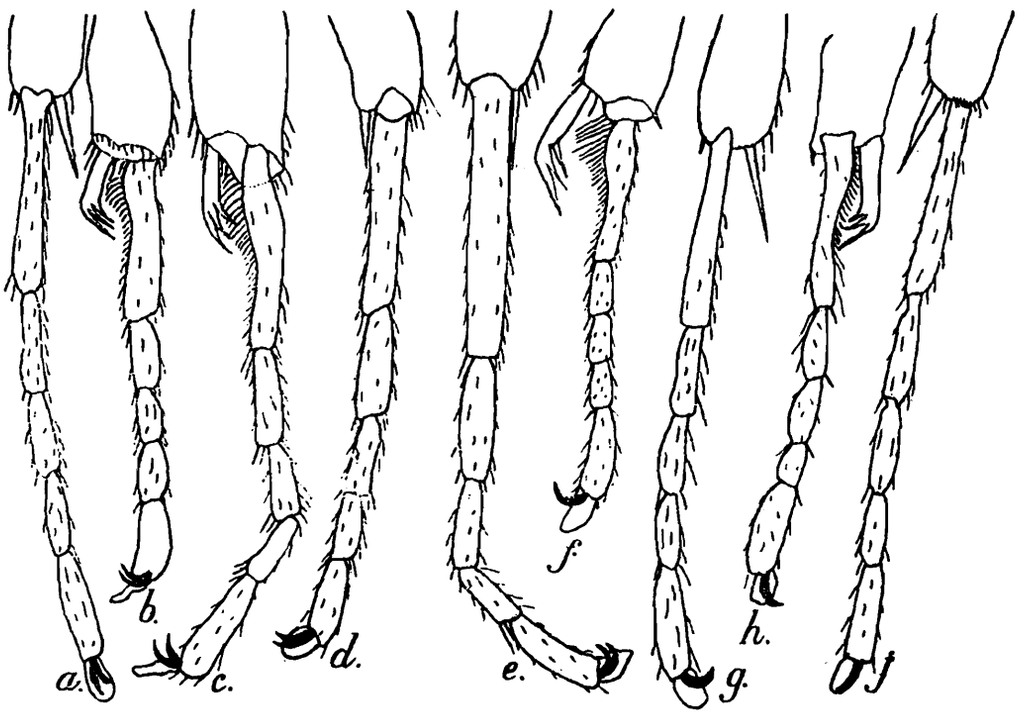
1. Scutellum somewhat elongate ; fourth antennal segment of the ♀ twice as long as thick, longer than fifth ; club absent .. .. *tibialis* Kieffer.
   Scutellum not elongate ; fourth antennal segment not as above ; club present 2
2. Legs uniformly yellow ; scutellum strongly transverse ; wings with very long marginal cilia : body brown .. .. .. *oryzae* Cameron.
   Legs brownish-black, yellowish-brown in parts ; scutellum semicircular ; wings with very short marginal fringe ; body black .. *salvadorae*, sp. nov.

Proleptacis fici, sp. nov.

Female.—Head black, slightly wider than thorax, transverse ; viewed from above roughly rectangular (Text-fig. 4*d*), breadth a little over one and a half times the median length, ocellar region shiny, leathery, slightly convex, interocellar space twice the front ocellar, posterior ocelli very close to the eyes, vertex convex, leathery, margined, occiput excavate ; viewed from front nearly circular, frons leathery, shiny, not pubescent, slightly convex, face leathery, not pubescent, nearly

[1]Mani, M. S., *Cat. Ind. Ins.* XXVI, p. 34 (1941).

deplanate, clypeus not discrete, very sparsely hairy, slightly convex, mandibles reddish-brown, stout, bidentate, with blunt and unequal tips, eyes naked, inner orbital borders nearly parallel, maxillary palpi biarticulate, labial palpi uniarticulate, antenna inserted much below the middle of face, very close to the mouth, with ten segments, brown, fairly hairy, scape long, longer than the four following segments combined, not lamellate, club of four segments, rest of the details as in figures (Text-fig. 1*b* & *f*); viewed from side oval, height a little over twice the thickness, gena long, nearly half the length of the eye, temples short, half the width of the eye in the middle.



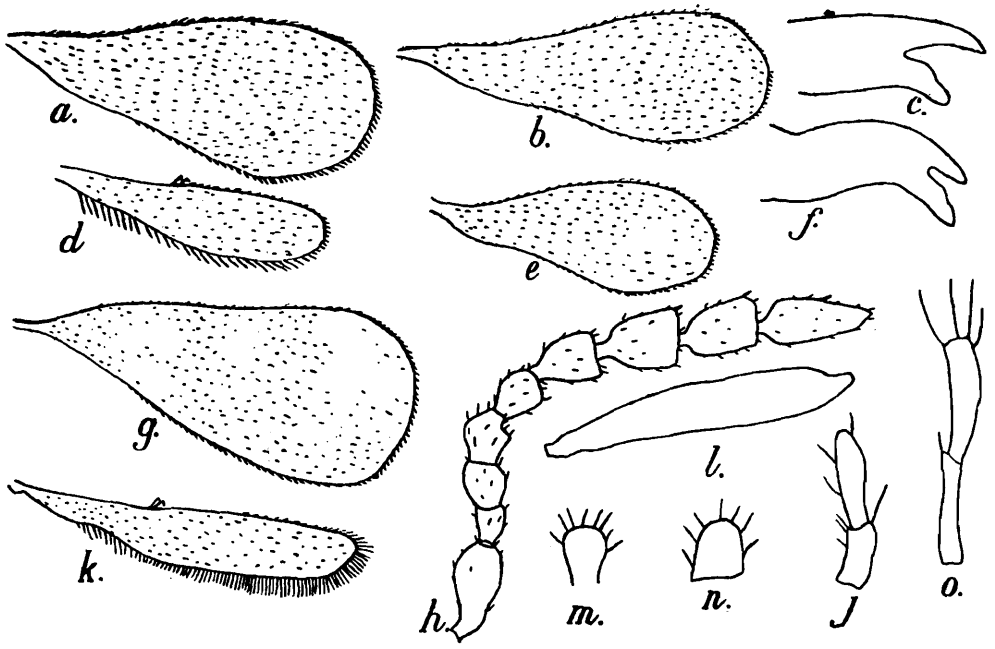
TEXT-FIG. 2.—*a. Polygnotus ramachandrai,* sp. nov., tip of hind tibia and tarsi of ♂ : *b. Platygaster salvadorae,* sp. nov., tip of fore tibia and tarsi of ♀ ; *c. Platygaster salvadorae,* sp. nov., tip of fore tibia and tarsi of ♂ ; *d. Platygaster salvadorae,* sp. nov , tip of hind tibia and tarsi of ♀ ; *e. Platygaster salvadorae,* sp. nov., tip of hind tibia and tarsi of ♂ ; *f. Proleptacis fici,* sp. nov., tip of fore tibia and tarsi of ♀ ; *g. Proleptacis fici,* sp. nov., tip of hind tibia and tarsi of ♀ ; *h. Polygnotus ramachandrai,* sp. nov., tip of fore tibia and tarsi of ♀ ; *j. Polygnotus ramachandrai,* sp. nov., tip of hind tibia and tarsi of ♀.

Thorax black, not compressed laterally, slightly raised above the level of the head, pronotum shiny, mesonotum shiny, closely punctate, parapsidal furrows indistinct, slightly convex, without pubescence, with a cluster of hairs posteriorly, scutellum convex, large, sparsely hairy, with one thorn posteriorly, much shorter than the mesonotum, without a nipple, propodeum with a hood-like elevation, wings pubescent without veins, fore wing two and a half times as long as broad, with a marked marginal fringe, hind wing with two frenal hooks, with a marginal fringe of about one-third the width of the wing, rest of the details as in figure (Text-fig. 3*g*). Legs short, tarsi five segmented, coxae dark brownish-black, trochanters brownish-yellow, femora brown, tibiae slightly lighter than the femur, first four tarsal segments brownish-yellow, terminal tarsal segment darker than the rest, fore coxa nearly equal to the length of the two trocahnters combined, femur twice the length of the trochanters, broad in the middle, tapering towards the

extremities, tibia as long as but slender than femur, with a trifid apical spur, first tarsal segment longest, shorter than the rest of the tarsal segments combined, but equal to the length of the three following segments, terminal segment longer than the penultimate, claw pale yellow, evenly curved, rather stout, simple, shorter than empodium. Abdomen with six tergites, dark brown to black, first tergite much shorter than the second, the latter nearly three-fourths the length of the abdomen, rest of the tergites much shortened, ovipositor concealed.

Length 1·1 mm. *Holotype.*—1 ♀ dissected and mounted on slide No. $\frac{1937}{H3}$. "Reared from gall No. 264 on leaf of *Ficus glomerata* Roxb. S. N. Rao Coll. Agra, 21. iv. 50"

Host.—*Dyodiplosis fici* Rao



Text-fig. 3.—*a. Platygaster salvadorae*, sp. nov., fore wing of ♀; *b. Polygnotus ramachandrai*, sp. nov., fore wing of ♂; *c. Platygaster salvadorae*, sp. nov., mandible of ♀; *d. Platygaster salvadorae*, sp. nov., hind wing of ♀; *e. Proleptacis oryzae*, sp. nov., fore wing of ♀; *f. Proleptacis oryzae*, sp. nov., mandible of ♀; *g. Proleptacis fici*, sp. nov., fore wing of♀; *h. Proleptacis oryzae*, sp. nov., antenna except the scape of ♀; *j. Proleptacis oryzae*, sp. nov., maxillary palpi of ♀; *k. Proleptacis fici*, sp. nov., hind wing of ♀. *l. Proleptacis oryzae*, sp. nov. scape of antenna of ♀; *m. Platygastec salvadorae*, sp. nov., labial palpi of ♂; *n. Proletacis oryzac* sp. nov. Labiral palpi of ♀; *o. platygaster salvadorae* sp. nov. maxillary palpi ♂.

This is the first record of the genus from India. This species differs from the two known species from the world in the proportions of the antennal and palpal segments, the lighter colour of the legs and in the hind tibial spur being three-fourths the metatarsus.

Proleptacis oryzae, sp. nov.

Female.—Head dark brown, very sparsely pubescent; viewed from above (Text-fig. 4*e*) transverse, slightly wider than thorax, breadth twice the median length, ocellar region slightly convex, transversely and

slightly irregularly striate, interocellar space nearly twice the ocellocular, one and a half times the front ocellar, vertex very slightly convex, margined, transversely striate, slightly deplanate; viewed from front nearly circular, frons shiny, not pubescent, smooth, very slightly convex, face nearly deplanate, sparsely pubescent, closely minutely and shallowly punctate, clypeus discrete, convex, sparsely pubescent, mandibles reddish-brown, bidentate, stout, with the teeth unequal and blunt at tip, eyes naked, inner orbital borders sub-parallel, labial palpi short, uniarticulate, nearly cylindrical, (Text-fig. 3*n*), maxillary palpi (Text-fig. 3*j*) biarticulate, long; antenna inserted much below the middle of face, very close to the mouth, with ten segments, scape yellow, very long, longer than the following five segments combined, eight times as long as thick, broadest at the apical three-fourths, pedicel and the following few segments pale brown, club segments brown, pedicel wider apically than at base, length a little over twice the breadth, one-fourth the length of the scape, first funicilar segment much shorter and slender, a little over one-third the length of the pedicel, wider at apex than at base, length a little greater than the width at apex, second segment subcylindrical, slightly wider at apex, length one and a half times the width at apex, third segment subglobose, length a little less than one and one-third the width, fourth segment nearly equal to but slightly slender than the preceding, club of four segments, all except the first club segment with a lateral spine, rest of the details as in the figures (Text-fig. 3*h* & *l*); viewed from side oval, height twice the breadth, gena short, one-fourth the length of the eye, temples large, half the width of the eye, transversely striate.

Thorax brown to dark brown, slightly raised above the level of head and abdomen, laterally compressed, without parapsidal furrows, mesonotum large, convex, longitudinally striate, propleura leathery, shiny, scutellum strongly convex, smaller than mesonotum, roughly triangular, with rounded corners, sparsely hairy, with one posterior thorn, propodeum thickly hairy. Wings finely pubescent, without any venation, fore wing with a very small marginal fringe, two and a half times as long as broad, hind wing narrow, long, with a marginal fringe of about one-third the width of the wing. Legs uniformly yellowish-brown, front legs shorter than the hind ones, tarsi five segmented, fore coxa as long as broad, narrowed toward the apex, trochanters slightly longer than coxa, femur twice as long as the trochanters, widest in the middle, tips tapering, a little over thrice as long as thick, tibia slender, wider at apex, very little shorter than the femur, with a trifid apical spur, first tarsal segment longest of all, nearly seven times as long as thick, second segment two-fifths the first, and two and a half times its own thickness, third segment slightly stouter than the second, terminal segment nearly twice the length of the penultimate claw pale yellow, evenly curved, stout, shorter and nearly equal to the empodium. Abdomen dark brown, nearly fusiform, with six tergites, first tergite much shorter, second occupying nearly half the length of the abdomen, rest of the tergites much shrotened, ovipositor concealed.

Length 0·75 mm.

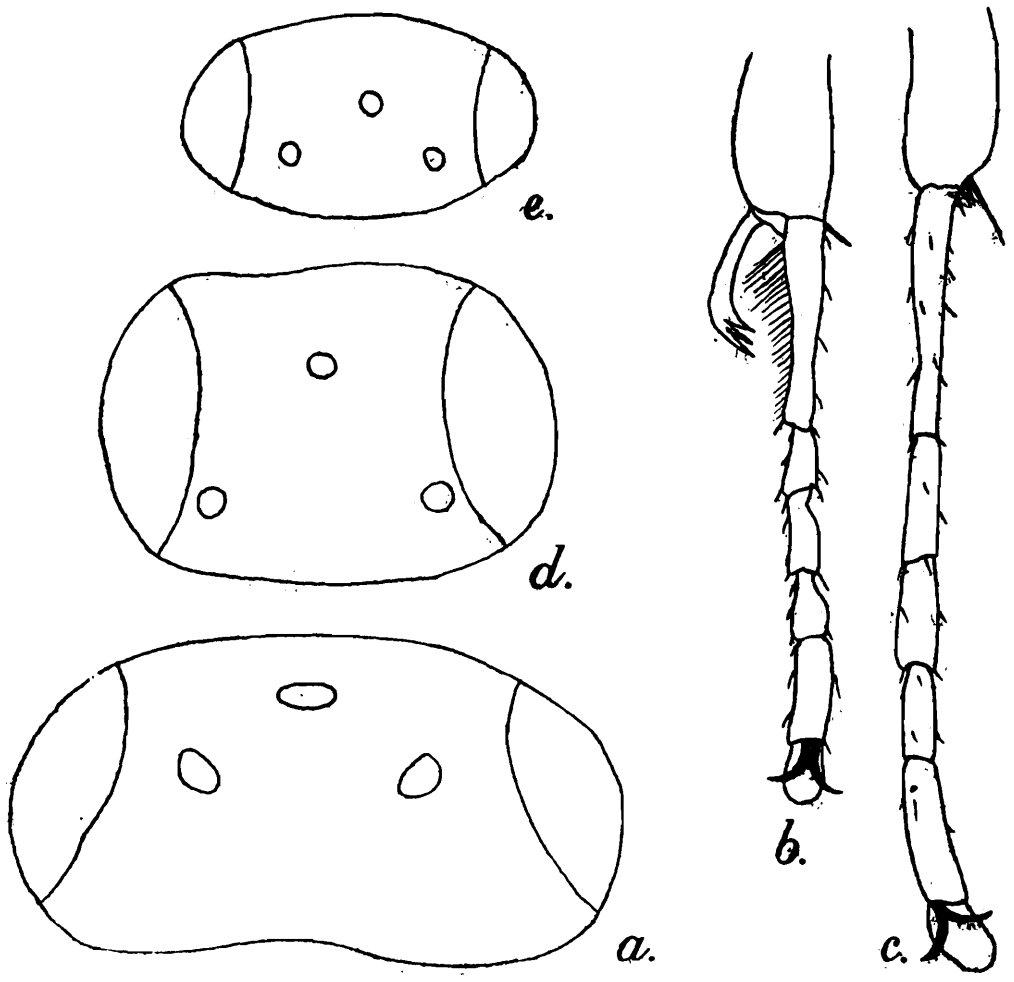
Male.—Similar in all essential characters to the ♀ except for the smaller size, slender legs, narrower abdomen and paler antenna.

Length 0·69 mm.

Host.—*Pachydiplosis oryzae* Mani.

Holotype.—1 ♀ and *Allotype.*—1 ♂ dissected and mounted on slide Nos. $\frac{1938}{H3}$ & $\frac{1938}{H3}$ "Central Rice Research Institute, Cuttack, PAR.-V on grubs of *Pachydiplosis oryzae* Mani, P. Israel Coll. 24. ix. 49"

This species is described from specimens received for identification from Mr. P. Israel, Entomologist, Central Rice Research Institute, Cuttack.



TEXT-FIG. 4.—*a. Platygaster salvadorae*, sp. nov., head seen from above of ♂; *b. Proleptacis oryzae*, sp. nov.,tip of fore tibia and tarsi of ♂; *e. Proleptacis oryzae*, sp. nov., tip of hind tibia and tarsi, of ♀; *d. Proleptacis fici*, sp. nov., head seen from above of ♀; *e. Proleptacis oryzae*, sp. nov. head seen from above of ♀.

This species is distinguished from *P. fici* Rao by the following characters: body brown; posterior ocelli away from the eye; clypeus discrete; antenna yellow; thorax slightly compressed laterally; legs uniformly yellowish-brown; second abdominal tergite only half the length of the abdomen.

This is the first record of the genus from India.

Polygnotus ramachandrai, sp. nov.

Male.—Head dark brown; viewed from above transverse, nearly as wide as the thorax, breadth one and a half times the median length, ocellar region very closely and minutely punctate, ocelli not very prominent, interoceller space a little less than the ocellocular, four times the front ocellar, vertex convex, transversely shallowly striate, margined, occiput excavate; viewed from front nearly circular, frons not pubescent, nearly smooth and shiny, clypeus indistinctly discrete, slightly convex, mandible reddish-brown, unidentate, long, pointed, eyes, naked, innerorbital borders subparallel, labial palpi long, uniarticulate, maxillary palpi biarticulate, antenna inserted much below the middle of face, very close to the mouth, with ten segments, yellowish-brown, very sparsely hairy, scape long, nearly five and a half times as long as the breadth at the broadest region, extremities slightly narrowed than the middle region, longer than the four following segments combined pedicel subcylindrical, nearly twice as long as broad, two-fifths the length of the scape, first funicular segment half the pedicel, much slender twice as long as broad, broader apically than at base, second segment shorter but stouter than the preceding, one and a half times as long as broad, rest of the details as in figures (Text-fig. 1*a* & *e*); viewed from side oval, height one and three-fourths the thickness, gena short, nearly one-fourth the length of the eye, temples one-fourth the width of the eye in the middle.

Thorax dark brown, on a level with the rest of the body, shiny, pronotum shiny, parapsidal furrows wanting, mesonotum shiny, very closely and minutely punctate, very slightly deplanate, scutellum strongly convex, semicircular, rounded posteriorly, without a thorn, smaller than mesonotum, very sparsely hairy. Wings pubescent, without veins, fore wing two and a half times as long as broad, without any marginal fringe. Legs yellowish-brown, throughout, long, tarsi five segmented, fore legs shorter than the hind ones, fore coxa nearly rounded, trochanters equal in length to the coxa, femur a little over two and a half times the length of the trochanters combined, lanceolate, thrice as long as thick, tibia three-fourths the femur, slender, nearly thrice as long as thick at the distal region, with an apical trifid spur, tarsi five articulate, first tarsal segment longest of all, a little less than the following three segments combined, nearly six times as long as thick, penultimate segment shortest of all, terminal segment twice the length of the penultimate, claw simple, evenly curved, light yellow, shorter than the empodium. Abdomen with six tergites, not very long, brown, first tergite much shorter than the second, the latter occupying nearly three-fourths the length of the abdomen, rest of the tergites much shortened.

Length 0·79 mm.

Female.—As in ♂ in all essential characters, except for the stout legs, antennae and abdomen and very slightly darker and larger body.

Length 0·82 mm.

Holotype.—1 ♂ and *Allotype.*—1 ♀ dissected and mounted on slide Nos. $\frac{1940}{H3}$ & $\frac{1941}{H3}$. "Parasites from gall on *Andropogon schoenanthus*, Y. R. Rao Coll. Coimbatore, 5. xii. 1916."

This species is described from specimens received for identification by Prof. Mani from Rao Bahadur Y. Ramachandra Rao in 1930. I associate the name of the collector with this species. Ramakrishna Ayyar[1] recorded an unnamed species of *Polygnotus* as parasitic on *Pachydiplosis oryzae* Mani in South India. This is the first species of the genus to be described from India.

[1] Ramakrishna Ayyar, T. V. *Bull. Ent. Res.* XVIII p. 76 (1927).

ON THE DISTRIBUTION OF THE GENUS *AMEMBOA* ESAKI (HEMIPTERA: HETEROPTERA), WITH THE DESCRIPTION OF A NEW SPECIES.

By K. S. PRADHAN, M.Sc., *Assistant Zoologist, Zoological Survey of India, Calcutta.*

(Plate V.)

Esaki[1] erected the genus *Amemboa* and described the species *A. fumi* on the specimens collected from northern Formosa. One year later, the species was reported by him as common in mountainous streams throughout Formosa, and its distribution was extended to northern Mindanao, Philippine, and Sumatra. He described one more new species, *viz.*, *Amemboa horvathi*[2] on two female specimens from Annam and pointed out that the genus *Amemboa* belongs to the Halobatinae and has some resemblances with *Onychotrechus* Kirk. Two years later, he[3] tabulated the structural characters which could be successfully employed for separating the genera *Onychotrechus* and *Amemboa* from each other and rightly suggested that *Onychotrechus kumari* Distant[4] and *Onychotrechus lyra* Paiva[5] are the species actually belonging to the genus *Amemboa*, although the judgment about the latter species was based only on the figure and not on the examination of the type-specimen. *Amemboa kumari* (Distant) was recorded from Travancore ; Maddathoray, Western base of Western Ghats, and *Amemboa lyra* (Paiva) from Taunggya valley, Yawnghwe State *ca.* 3500 ft., Southern Shan States, Burma. The type and cotype specimens of *Onychotrechus lyra* Paiva [=*Amemboa lyra* (Paiva)] present in the Zoological Survey of India have now been examined and the structural characters evidently indicate that the specimens definitely belong to the genus *Amemboa*. The antennae and the intermediate legs of the type (Reg. No. 7124/H_1) are mutilated but other structural characters, *viz.*, rostrum, posterior legs, etc. are exactly as in *Amemboa*. The cotype specimens preserved in spirit are, however, intact and fully conform to the structural characters of the genus *Amemboa*. Lundblad[6] described *Amemboa javanica* from Java, raising the number of known species of *Amemboa* to five as follows :

Amemboa fumi Esaki.—Formosa, Philippine, Mindanao and Sumatra.

Amemboa horvathi Esaki.—Annam, Indo-China.

Amemboa kumari (Distant).—W base of the Western Ghats, Travancore.

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[1] Esaki, T., *Philipp. Jour. Sci.* XXVI, pp. 62-64, pl. II, figs. 22-29 (1925).
[2] Esaki, T., *Ann. Hist.-Nat. Mus. Hung.* XXIII, pp. 120-122, fig. 2 (1926)
[3] Esaki, T., *Ann. Mag. Nat. Hist.* (10) II, p. 508 (1928).
[4] Distant, W. L., *Faun. Brit. Ind. Rhyn.* V, pp. 147, 148 (1910).
[5] Paiva, C. A., *Rec. Ind. Mus.* XIV, pp. 24, 25 (1918).
[6] Lundblad, O., *Arch. Hydrobiol. Plankt.* XII (Supplement), pp. 405-408, tat. xii, fig. 130 (1934).

Amemboa lyra (Paiva).—Southern Shan States, Burma.

Amemboa javanica Lund.—Java.

Distribution.—It will be seen from the foregoing account that the genus *Amemboa* has been recorded in the east from Formosa, Mindanao, Philippine, Java, Sumatra, Indo-China and Southern Shan States, Burma (Text-fig. 1). In India it was first recorded by Distant under the name *Onychotrechus* from Travancore; Maddathoray, Western base of Western Ghats. It is now recorded from the Gandh Mardan Pervat, Orissa.

The discontinuous distribution of the Malayan fauna and flora into the Peninsular India and Ceylon has long attracted the attention of biologists. The close affinities of a number of Malayan forms with those inhabiting Ceylon and the Western Ghats in south India, and their absence in the northern part of India or in the intervening tracts have been, for a long time, puzzling zoologists interested in the science of Zoogeography. They are, however, agreed that this far-flung discontinuous distribution of closely allied forms can be accounted for only on the presumption that the distant areas were directly connected at some time in the earth's history, and the uniform physiography afforded continuity and facilitated migration. A number of theories have been advanced to explain the probable path of migration, and, of the possibilities suggested, the Satpura Trend hypothesis suggested by Dr. S. L. Hora provides a possible solution to this puzzling problem. According to this hypothesis the animals and plants spread over the continuous stretch of mountain ranges of the Tenasserim, Arakan, Assam Himalayas and Eastern Himalayas; and over the Garo-Rajmahal hills gap, which is of recent origin, into the Peninsular India over the ranges of the Vindhya-Satpura mountains, which some time back in the earth's history stretched continuously across the Peninsula and were higher than what they are now; and southwards over the Western Ghats down to Cape Comorin and Ceylon.

The present-day knowledge of the distribution of the genus *Amemboa* lends support to the Satpura Trend hypothesis as it strongly suggests the continuity of the Assam Himalayas with the Vindhya-Satpura chain of mountains at a time when this genus was widely distributed.

A systematic and extensive investigation of the insect fauna especially from the hill streams of the Vindhya, Satpura, and Aravalli mountains will further throw considerable light on the distribution of the genus and bridge the gap that exists at the present moment.

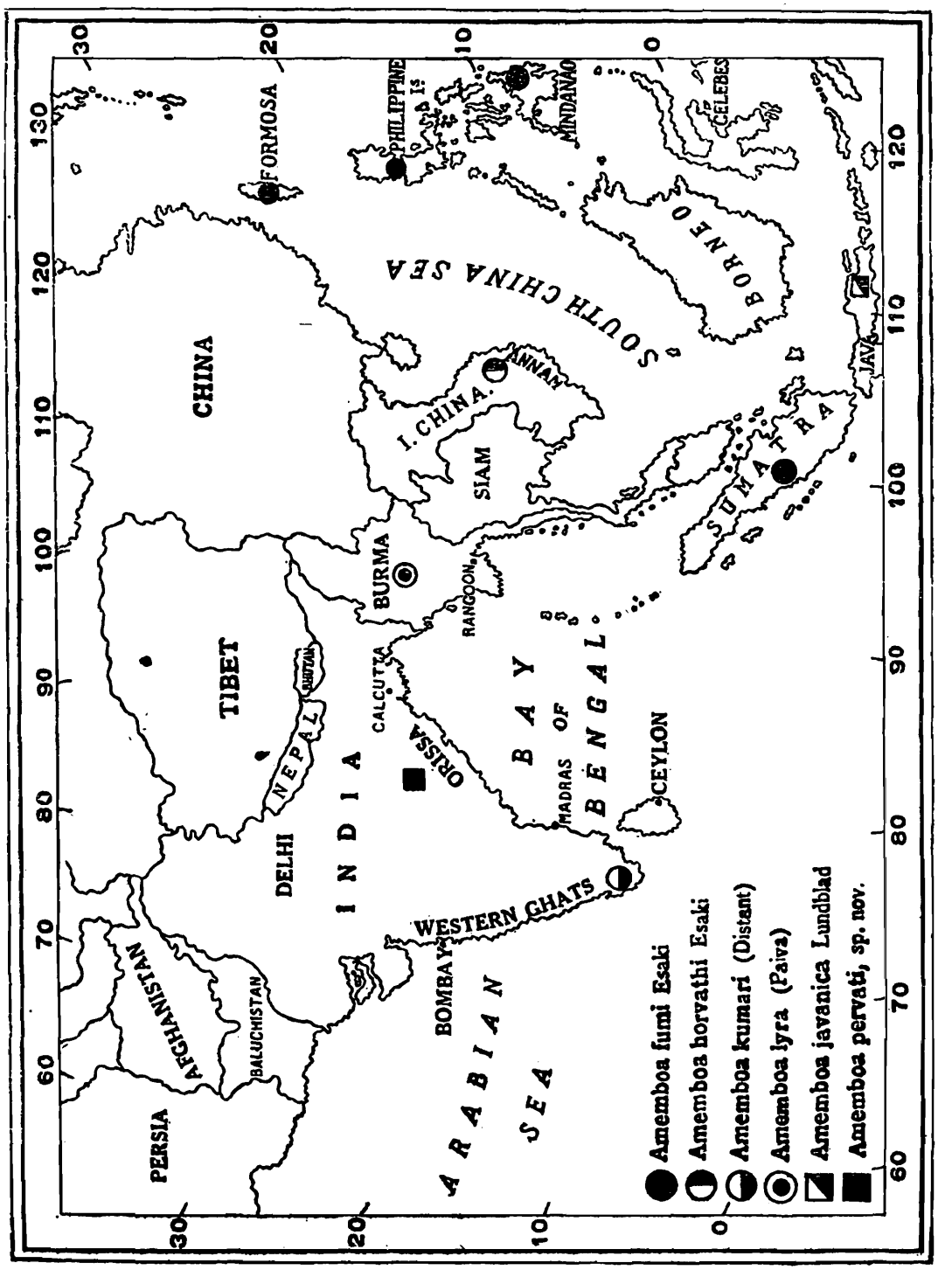
The new species dealt with in this paper is based on one male and two female specimens collected from Gandh Mardan Pervat, Orissa.

Amemboa pervati, sp. nov.

(Plate V, figs. 1-6.)

Head ochraceous; antenniferous tubercles, a short longitudinal mark extending upwards, a central somewhat triangular or V-shaped mark having its apex directed towards the vertex, a slightly curved longitudinal narrow spot extending from near the anterior end of the

inner margin of each eye backward and inward towards the middle line, black, in the female examples basal line of the triangular mark absent with the result that the central mark appears V-shaped (Plate V, fig. 3); rostrum pale ochraceous, long, extending beyond anterior coxae but not reaching upto the middle of mesosternum (Plate V, fig. 4), labrum and



TEXT-FIG. 1.—Outline map of India, Burma, Siam and Malay Archipelago, showing the geographical distribution of *Amemboa fumi* Esaki, *Amemboa horvathi* Esaki, *Amemboa Kumari* (Distant), *Amemboa lyra* (Paiva), *Amemboa javanica* Lund. and *Amemboa pervati*, sp. nov.

fourth joint shining black, second joint and a central longitudinal fascia to the third joint dark brownish; antenna with its first joint slightly curved and ochraceous, second, third and fourth joints dark fuscous,

first joint of antenna slightly longer than the third but considerably shorter than the fourth, second joint shortest, while the fourth longest, relative measurements of the antennal joints taken by the help of oculometer are as follows :

Sex.	Antennal joints. I	II	III	IV
Male ..	14	12	13	19
Female	14	11	13	19

Pronotum with its anterior margin black and with four discal and two lateral longitudinal black marks, of the four discal marks the central two broader than others ; mesonotum very large and ochraceous, its anterior margin, two central longitudinal spots wider in the anterior two-thirds of their length and narrower behind, another slightly curved narrow longitudinal stripe running on the outer side of each central longitudinal spot and connected with it approximately about the middle by a transverse somewhat curved fascia, rather inconspicuous in the male example (Plate V, fig. 1) but quite prominent in the female, a narrow more or less sigmoid fascia running from the outer end of the transverse fascia posteriorward, a lateral longitudinal stripe extending from the anterior end of mesonotum almost upto the broadly elongated spot a little above the intermediate coxae, a narrow transverse streak extending from the broadly elongate spot inward and meeting a somewhat irregular triangular spot, an elongated mark a little above the base of posterior coxae, black ; the space enclosed between the two central longitudinal spots of mesonotum testaceous in the anterior half and dark brownish in the posterior half.

Abdomen with a central or medial longitudinal series of ochraceous spots and a segmental series of transverse black spots on either side ; connexivum distinct and marked with a segmental series of black spots separated by ochraceous ones ; body beneath luteous, a transverse fascia at the posterior margin of prosternum between the anterior coxae, one lateral spot a little above the base of anterior legs, a central longitudinal mark on the prosternum in the posterior region (prominent in female but not in male), one broad central longitudinal spot extending approximately from the anterior end of mesothorax upto the tip of abdomen, one lateral stripe on either side in the thoracic region, one narrow longitudinal streak on the inner side at the base of intermediate coxae, black, the central longitudinal spot fuscous in the male and differs in shape from that of female in being conical in thoracic region with the apex of the cone directed anteriorward, the abdominal sternites light brownish-ochraceous.

Anterior femora and tibiae brownish-ochraceous, tarsi and apices of tibiae fuscous, femora of male not incrassate but distinctly notched (Plate V, fig. 6), a short pointed tooth-like structure composed of a number of short hair at the proximal and a short blunt tooth-like black elevation at the distal limit of the notch, a very short rounded dot-like subapical spot on the underside of the femur, black, tibiae in the basal region

narrower and appearing a little concave on the inner surface, anterior femora of female devoid of the notch and the tibiae of uniform thickness throughout, *i.e.*, not narrower in the basal region ; intermediate femur shorter than tibia and tarsus together, intermediate tarsus longer than a half of tibia, first tarsal segment longer than twice the second ; posterior tarsus about two-thirds of tibia and the first segment of posterior tarsus longer than the second ; intermediate and posterior legs brownish-ochraceous, apices of femora, tibiae and tarsi tinged with fuscous.

Three specimens, one male and two females, were collected from Sukhtel river, Gandh Mardan Pervat on 16th March 1946, and all the specimens are apterous.

Male specimen 3·2 mm. long and 1·1 mm. wide ; length and breadth of female specimen 3·7 mm. and 1·4 mm. respectively.

Type-specimens.—Holotype.—One male No. $\frac{6\,3\,6\,0}{H\,7}$, and *Paratypes :* two females No. $\frac{6\,3\,6\,1}{H\,7}$, *Zoological Survey of India.*

Locality.—Gandh Mardan Pervat, Harishanker, Patna State, Orissa.

Remarks.—The specimens of *A. pervati,* sp. nov. closely resemble those of *A. lyra* (Paiva) but can be easily distinguished thus :

Male anterior femur of *A. lyra* (Paiva) incrassate in the proximal region and provided with a comb of short, uniform, closely set brownish or blackish hairs on the inner side extending up to a little before the middle of its length ; the inner margin of femur between the distal end of the comb and the preapical process broadly concave.

Male anterior femur of *A. pervati* in the basal region not incrassate as in the former species and completely devoid of a comb of closely set hairs ; its inner margin only slightly and narrowly notched near the preapical process.

EXPLANATION OF PLATE.

FIG. 1.—Dorsal view of male *Amemboa pervati* : × 18⅓

FIG. 2.—Ventral view of male *Amemboa pervati* : × 18⅓.

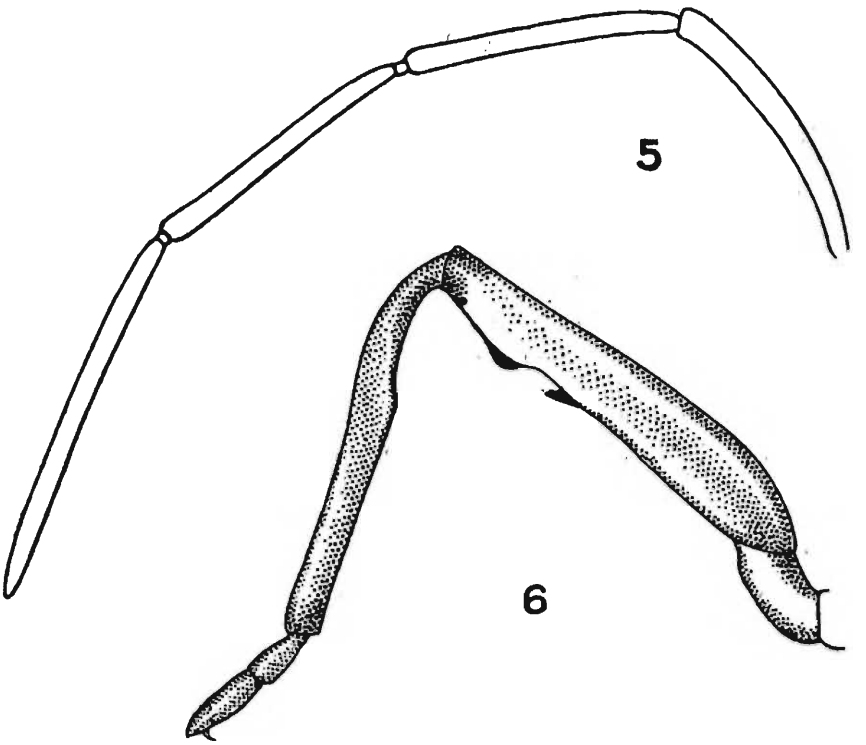
FIG. 3.—Dorsal view of female *Amemboa pervati* : × 18⅓.

FIG. 4.—Ventral view of female *Amemboa pervati* : × 18⅓.

FIG. 5.—Antenna of male *Amemboa pervati* : × 35.

FIG. 6.—Anterior leg of male *Amemboa pervati* : × 33⅓.

1



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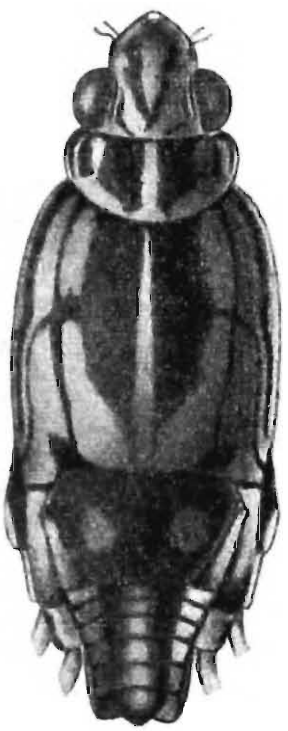

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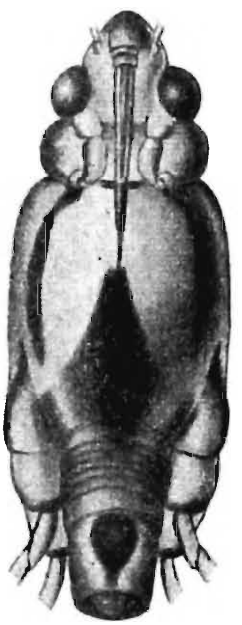

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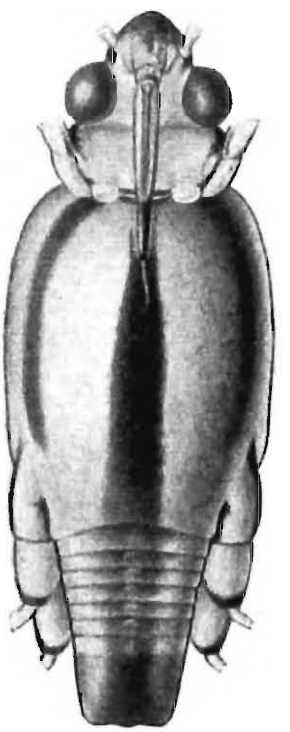


4

AMEMBOA PERVATI PRADHAN.

A NOTE ON *EPILACHNA OCELLATA* REDT. (COLEOPTERA: COCCINELLIDAE), WITH DESCRIPTIONS OF THREE SPECIES HITHERTO CONFUSED WITH IT.

By A. P. KAPUR, M.Sc., Ph.D. (London), D.I.C., *Zoological Survey of India, Calcutta.*

CONTENTS.

INTRODUCTION.

Recently, Dr. S. L. Hora, Director of this Survey, brought a number of examples of *Epilachna ocellata* Redtenbacher, which were found damaging potato plants in a field situated about one and a half miles on the road from Naggar to Manali (*ca.* 8,000 ft.; Kulu Sub-Division, Punjab, India) on the 15th June, 1950. On the average six beetles were found on a plant. The infestation was also observed in other fields further up on the above-mentioned road.

These observations are of special interest because hitherto no information was available on the host-plant of this member of the vast sub-family Epilachninae which is mostly herbivorous. Its attack on potato is of further interest owing to the importance of the crop in those tracts. I am grateful to Dr. Hora for permitting me to record his above-mentioned observations and for placing at my disposal the material for study. He has also been generous in affording me facilities for work.

Epilachna ocellata is of further interest from the point of view of systematics and geographical distribution. Redtenbacher[1] (*in* Hügel, 1944) first described it from Kashmir; six years later, in 1850, Mulsant[2] described *Epilachna oculea* from Nepal and considered it to be closely related to *ocellata*. Mulsant reported variations in the pronotal markings of *oculea* and named a variety as *retexta*. In 1874 Crotch[3] synonymized *oculea* with *ocellata* and observed that his material also showed considerable variation in the markings. Subsequent workers followed the synonmy proposed by Crotch and recorded the species from several

[1] Redtenbacher, L., (*in* Hügel) "Kaschmir und das Reich der Seik....." IV, pt. 2, pp. 497-564, 6 pls. (1844).

[2] Mulsant, E., *Ann. Soc. Agric. Lyon* (2) *III*, pp. 1-1104 (1850).

[3] Crotch, G.E., A revision of the coleopterous family coccinellidae, 311 pp. (1874).

other places in India. In 1895, Weise[1] recorded it from Barway (Bengal), while in 1924 Subramaniam[2] reported it (with a querry) from Coorg and Godavari in South India, and Beeson[3], in 1941, gave its distribution as Himalayas to South India. From these records it would appear that the species, besides being variable, is widely distributed in India. Recently, however, Dieke[4] (1947) stated that the long series of the species that he had examined from Kulu, and various places in Uttar Pradesh (U.P.)., were uniform. An examination, by the present writer, of the material placed under *E. ocellata* in the collection of the British Museum (Natural History), London, and in the Indian Museum (Zoological Survey of India), Calcutta, revealed that in fact three other, somewhat variable but superficially similar, species were involved. This fact apparently seems to have been responsible for some of the earlier records regarding its wider distribution and variability.

The material from South India belongs to two hitherto undescribed species and there is another new species from Manipur, Assam. *Epilachna ocellata* seems to be distributed in the Himalayas, between Kashmir and Darjiling (see map, text-fig. 4). The material from Nepal (type-locality for *oculea* Mulsant) agreed in description with the examples from the Western Himalayas, from where *ocellata* was first described; thus the earlier synonym proposed by Crotch remains unchanged.

II. DESCRIPTIONS OF THE SPECIES.

Epilachna ocellata Redtenbacher.

1844. *Epilachna ocellata*, Redtenbacher (*in* Hügel), "Kaschmir und das Reich der Siek", IV, pt. 2, pp. 497-564, 6 pls. (Type-locality : Kashmir).

1850. *Epilachna ocellata*, Mulsant, *Ann. Soc. Agric. Lyon* (2) III, pp. 792-793

1850. *Epilachna oculea*, Mulsant, *Ann. Soc. Agric. Lyon* (2) III, pp. 791-793 (Type-locality : Nepal).

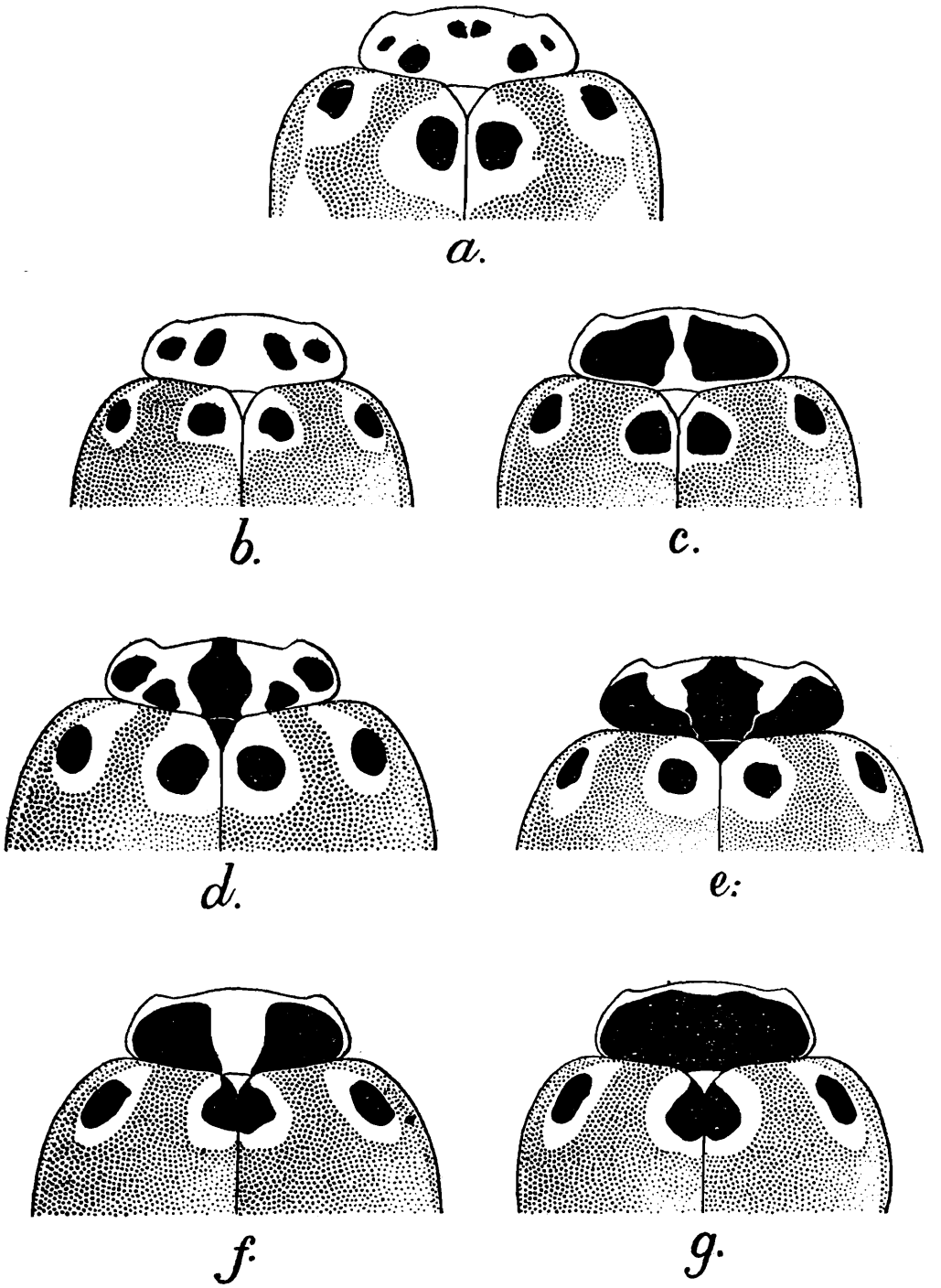
1874. *Epilachna ocellata*, Crotch, *A revision of the coleopterous family Coccinellidae*, p. 89.

1874. *Epilachna oculea*. Crotch, *A revision of the coleopterous family Coccinellidae*, p. 87 (Synonymized with *ocellata*).

Body shortly oval, convex, most so in the middle ; pubescence greyish except on the six black spots on elytron, where it is black. Head brown to dark brown with a piceous ill-defined marking on the vertex ; eyes black. Pronotum brown, with five black spots (Text-fig. 1, *d*) which are sometimes enlarged and fused ; when distinct these are arranged as follows : the largest spot situated in the middle, elongate, irregular in outline, extending from the base to the anterior margin and about as wide as one-fourth the width of pronotum. A pair of smaller spots situated obliquely on either side of the median spot, the proximal one of these spots usually smaller than the distal one, situated near the base and at equal distance from the posterior angle and the median spot ; the distal spot larger, subquadrate to oblong, situated in the middle

[1] Weise, J. *Jour. Ann. Soc. Ent. Belgique* XXXIX, pp. 120-146 (1895).
[2] Subramaiam, T. V. *Rep. Proc. fifth ent. Meetings, Pusa*, pp. 108-118 (1924).
[3] Beeson, C.F.C. "The Ecology and control of forest insects....." 1007 pp. (1941).
[4] Dieke, G. H. *Smitason. Miscell. Colin.* CVI, No. 15, 183 PP. (1947).

of and close to the lateral margin. In most cases the latter spot is much enlarged and almost touches the proximal spot. In extreme cases when all the spots are enlarged and fused (Text-fig. 1, *e*), the entire pronotum is black except for a brownish, narrow, irregular border along the anterior margin. Scutellum black throughout. Elytron with six black spots, each spot surrounded by brown to rather light brown ring



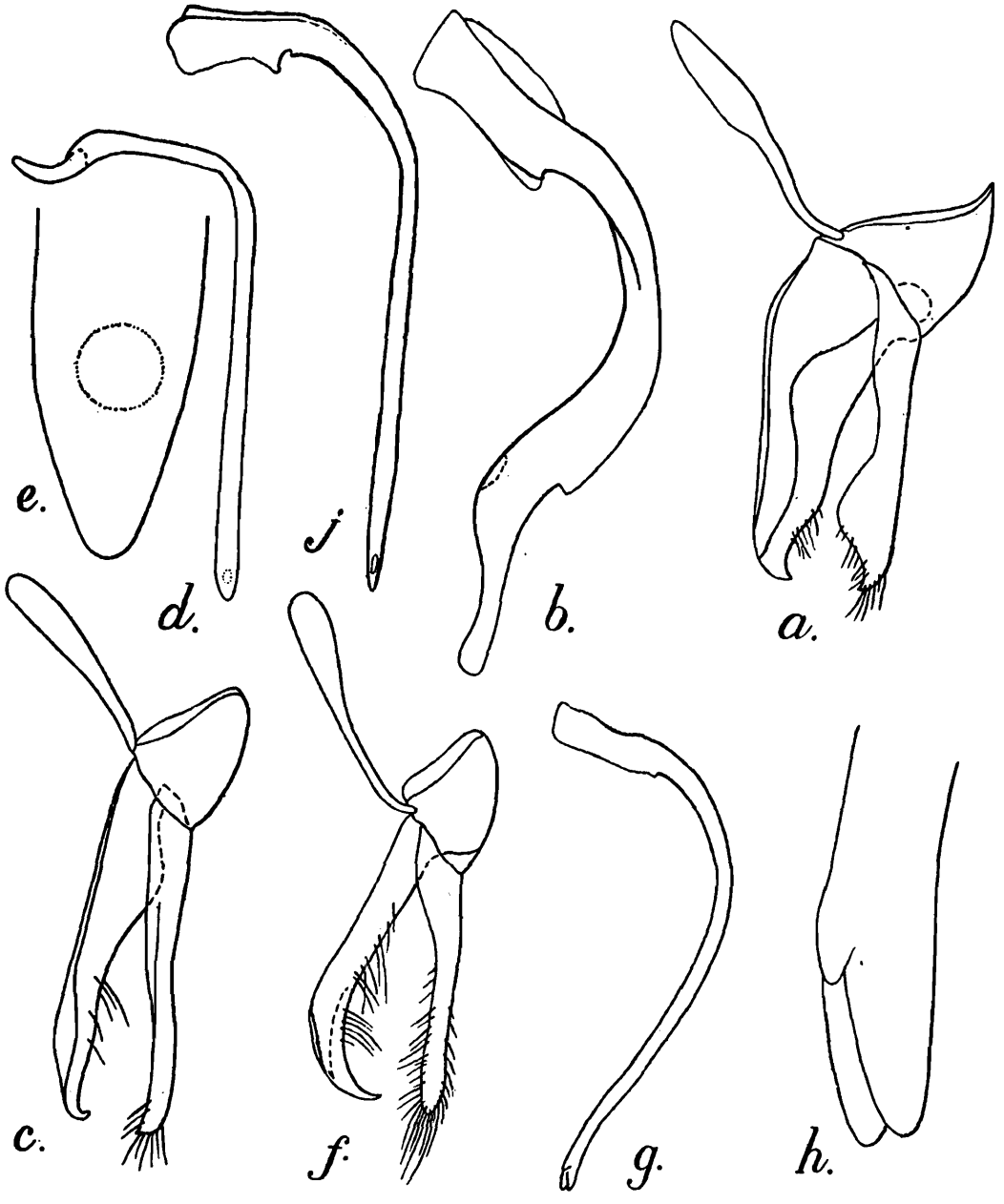
TEXT-FIG. 1.—Pronotum and the anterior part of elytra of: *a. Epilachna anita* sp. nov. *b-c. E. nana,* sp. nov.; *d-e. E. ocellata* Redt.; *f-g. E. manipurensis,* sp. nov.-(all figs.X 8).

of moderate width except for spot No. 4 (the spots are numbered according to their position on the right elytron, from left to right and from base to apex) which is produced laterally to reach the external margin and where the ring is left incomplete. The remaining area on the elytron dark brown to piceous. Elytral spots arranged as follows : No. 1 or scutellar

spot, small to moderately large, rounded, with the anteriormost margin at level with the apex of scutellum, slightly closer to the suture than to the base; spot No. 2 also rounded, usually moderately large and situated on the shoulder boil; spot No. 3 almost rounded to a little transverse oval, situated a little anterior to the middle of elytron, farther away from the suture than either spot 1 or 5. Spot No. 4 usually larger than No. 3, subrounded to quadrate, expanded laterally to reach the external margin and situated almost in the middle of the latter; spot 5 subrounded to transverse oval or subquadrate, slightly smaller than spot 3, situated at about three-fifths the length of elytron and as near the suture as spot No. 1. Spot No. 6 of about the same size as spot No. 2, subrounded to transverse oval, situated at about four-fifths the length of elytron and relatively closer to the external margin than to the suture. Underside usually dark brown to piceous except for the light brown mouth-parts, prothoracic epipleurae and prosternum, elytral epipleurae and legs, a light patch near lateral margins on each of the first four abdominal sternites and a similar patch in the middle of the apical margin of the fifth sternite. Sometimes trochanter and base of the femur and the median part of the elytral epipleuron piceous in colour.

Head minutely and fairly closely punctate; pubescence long and moderately close. Pronotum widely emarginate anteriorly, the anterior angles and lateral margins widely rounded and slightly elevated; punctation and pubescence similar to that on the head. Scutellum triangular, with the sides trifling longer than the base, apex pointed, punctation and pubescence similar to that on the head. Elytra with a less conspicuous shoulder-boil; shoulder angle widely rounded, external margin bordered but not raised to form a channel; apical angle rounded and not making a sharp point with the suture; punctures of two kinds, coarser punctures sparser and moderately impressed; finer punctures nearly as fine as those on the head or the pronotum but relatively sparser; pubescence similar to that on the pronotum. Underside with the abdominal lines complete, subterminal and subangulate; punctation on abdominal sternites rather coarser and more impressed than on the metasternum; pubescence relatively short and less dense than on the upper surface. Fifth sternite in the male slightly longer than the preceding sternite; the sixth with a distinct emargination at the apex. In the female, fifth sternite broadly and shallowly emarginate, the median apical part being mostly glabrous and very minutely and sparsely punctate; sixth segment split longitudinally into two except for the median basal part which is produced like an arch which remains covered by the fifth segment (Text-fig. 3, *b*). Male genitalia with the sipho (Text-fig. 2, *b*) rather thick in the middle, the proximal two-thirds bent nearly in semicircle, the distal one-third straight and almost vertical; siphonal capsule tubular, slightly constricted in the middle and with a thin chitinous flap on the upper surface; orifice at two-thirds the length of sipho on the underside. Basal plate (Text-fig. 2, *a*) relatively less developed; penis well developed, larger than most other species in the genus, widest in the basal one-third of the length, thereafter narrowed gradually towards the apex; seen from the side, there is a slight bend in the middle of the upper surface and another one, slightly more prominent, just before the apex; a few short setae present in the area just

before the latter bend ; basal one-third of penis is a wide and oblique tube through which the sipho passes, the tube is continued on the underside as an open, rather shallow and moderately wide channel which becomes narrow at the subapical bend where it ends ; paramera nearly as long as penis, spoon-shaped, with a deep emargination on the outer side just before the apex, the apical one-third of paramera with a row of moderately long setae. Female genitalia with the subgenital plates (IX sternite) (Text-fig. 3, *d*) weakly emarginate for the greater length of the inner margin, and of the apical one-third of the outer margin, stylus rather well developed, with five or six long setae at its apex ; tenth tergite subtruncate in the middle, slightly rounded at the sides.



TEXT-FIG. 2.—Male genitalia : *a*. side view of basal-plate, penis, paramera, etc. of *Epilachna ocellata* (X 27) ; *b*. sipho of the same (X27) ; *c*. penis, paramera, etc. of *E. manipurensis* (X 27) ; *d*. sipho of the same (X 27) ; *e*. apex of sipho of the same (X 200) ; *f*. penis, paramera, etc. of *E. nana* sp. nov. (X 27) ; *g*. sipho of the same (X 27) ; *h*. apex of sipho (X 200) ; *j*. sipho of *E. anita*, sp. nov. (X 27).

Length 6·0—7·2 mm ; width 5·6—6·0 mm.

Type-locality.—Kashmir, (for *E. oculea* Mulsant : Nepal).

Material examined.—Forty-two examples as follows :—Gharial, *ca.* 6000 ft., Murree Hills, Punjab (P.) 19th September 1928, (*H. S. Pruthi*) (5260/H4). Naggar (1½ miles from Naggar on the road from Naggar to Manali), 15th June 1950, feeding on potato leaves, (*S. L. Hora*) (7957/H4-7968/H4). Simla, Punjab (I), 7000—8000 ft., 7th May 1910, (*N. Annandale*) (5257/H4) ; Phagu, *ca.* 9000 ft., Simla Hills, 18—21st May 1916, (*N. Annandale and S. W. Kemp*), (5258/H4) ; Kufri, *ca.* 7,000 ft., Simla Hills, 1st October 1925, (*B. N. Chopra*) (5253/H4. 5255/H4, (5256/H4). Almora, Kumaon Hills, U. P., 5th-10th August 1911, (*C. Paiva*), (5259/H4). Thangiet, 6000 ft., Nepal, (*1949- British Museum Expedition*) ; Trisuli to Rasua, 8000 ft., Nepal, (*1949-B.M.E.*) ; Rasua, 8000 ft.. Nepal, *1949* -(*B.M.E.*). Sikkim, Eastern Himalayas (no further data available), (8888/7). Mungphu, Darjilling District, Bengal, (no further data available), (7955/H4-7956/H4).

Remarks.—The species is easily distinguishable from the other species described here by the large median pronotal spot which extends from the anterior to the basal margin, by the black scutellum, and by the position of the scutellar spots and the laterally extended spot No. 4 of the elytra which reaches the lateral margin. In the structure of the genitalia also *E. ocellata* is very distinct. In the female, the fifth segment has the arch-like prolongation ; the subgenital plates have characteristic outline and the styli on them are better developed than is the case in any other species. In the male also the penis and sipho are greatly developed. In these characters of the genitalia, *ocellata* resembles some of the species from North-East India and the East Indies, such as *Epilachna tertia* Dieke from Assam and *Epilachna enneasticta* Mulsant, from Java and Sumatra. Dieke, who had not seen a female example of *tertia* at the time of describing the species did not point out the above mentioned similarity in the structure of the fifth sternite of the female but in his arrangement of the species, *tertia* comes next to *ocellata*, presumably on the basis of male genital characters. He also drew attention to the resemblance in the genitalia of *ocellata* and *enneasticta* group. Korschefsky[1] in his catalogue listed *ocellata* in the group of palaearctic species though structurally it does not show affinity to any known species of that group. On the other hand, it is possible that the characters in which it resembles *tertia* or *enneasticta* might have evolved independently in the various species. In the present state of our knowledge, however, it would seem more appropriate to regard it as a species that has evolved from the Indo-Malayan group and has spread from the East to the West Himalayas.

Epilachna nana, sp. nov.

Body similar in outline to that of *E. ocellata*, slightly smaller ; pubescence also similar, being greyish except on the elytral spots where it is black. Head brown, without any piceous marking on the vertex, antennae and mouth-parts also brown, eyes black. Pronotum brown, testaceous at the anterior angles ; usually with four piceous to black spots, all arranged in a row on the transverse median line (Text-fig. 1, *b*) ; the outer spot roundish, the inner or the one nearer the centre often oblong, the distance between the two inner spots is more than that between the outer and inner spots on the same side ; sometimes the spots are enlarged and the two of the same side become confluent to form a large subquadrate

[1] Korschefsky, R., *Coccinellidae I, Coleopterorum catalogus*. ..(Junk Pub.) pars. 118, p. 24 (1931).

spot which almost touches the base of pronotum but it neither extends to the lateral and anterior margins nor to the median longitudinal line. Scutellum brown. Elytron with six black spots ; each spot including No. 4, surrounded by a brown to light brown ring of moderate width ; the remainder of the area rather piceous, dark brown or brown (in the last mentioned case the rings round the spots are lighter still). Arrangements of spots similar to that in *ocellata* except where indicated below. Spot No. 1 rounded, small to moderately large, nearer the base than is the case in *ocellata*, the front tangent of the spots passing through scutellum at two-thirds its altitude. Spot No. 2 of about the same size and shape as spot No. 1 ; spot No. 3 large, subrounded, a little wider than long; spot No. 4 equal in size or smaller than the preceding spot, surrounded all round by the brown ring and situated close to but not touching the lateral margin. Spot No. 5 subrounded, equal in size to spot No. 4 or a little smaller ; No. 6 spot more variable in size than the other spots, smaller or larger than spot No. 5 in different examples, rounded to transverse oval. Underside brown except for a pair of dark brown to piceous patches on the metasternum ; slightly dark brown patches also present on abdominal sternites in some examples ; legs brown throughout.

Head minutely and fairly closely punctate, the punctures rather impressed ; pubescence moderately long, fine and rather sparse. Pronotum similar in outline to that of *ocellata* except that the lateral margins are relatively less rounded ; punctation and pubescence similar to that on the head. Scutellum triangular, as in *ocellata*, punctation very fine and fairly close ; pubescence similar to that on the pronotum. Elytra similar in outline to those of *ocellata*, without a sharp point near the apex of the suture ; punctures of two kinds, coarser punctures sparse and moderately impressed , finer punctures relatively less impressed than those on the pronotum ; pubescence similar to that on the pronotum. Underside with the abdominal lines complete, subterminal and slightly angulate ; abdominal sternites with relatively coarser, closer and more impressed punctures than those on the metasternum ; pubescence uniform, relatively short, fine and sparser than that on the upper surface. Male with the fifth sternite slightly longer than the fourth ; the sixth distinctly emarginate at the apex. In the female the fifth sternite distinctly longer than the fourth ; the sixth completely split longitudinally into two (similar to those shown in Text-fig. 3, *a*). Male genitalia with the sipho relatively thin (Text-fig. 2, *g*), regularly and widely curved in the proximal half, straight distally ; siphonal capsule a little wider than the siphonal tube, nearly twice as long as wide ; apex of sipho with a v-shaped notch having a slight indication of a third projection near the base of the notch (Text-fig. 2, *h*). Basal plate moderately developed ; penis like a narrow tube, nearly one-tenth as wide as long, subparallel and straight for two-thirds its length, the distal one-third gradually curved upwards and narrowed towards the apex which is sharply pointed ; opening of the penis on the underside, elongate oval, situated at two-thirds its length, the median half of the upper surface with a number of moderately long setae. Paramera slightly narrowed and shorter than penis, rounded at the apex, their distal half with long setae which

are more numerous towards the apex. Female genitalia with the subgenital plates subquadrate (Text-fig. 3, *e*), each plate about two-thirds as wide as long, maximum width also at two-thirds its length, widely curved distally and at the apical margin ; inner margin notched near the base, the notch relatively shallow except in its distal part, the remainder of the inner margin straight ; stylus very small in comparison to that in *ocellata*, with two or three setae which are longer than the other setae on the plate ; tenth tergite subrounded.

Length 6·2 mm. ; width 5·0 mm.

Type-specimens.—Holotype : male, INDIA, Nilgiri Hills, (*G. F Hampson*); in the Zoological Survey of India, No. 3426/13 (entry in the register dated 18th March 1892).

Allotype : female, Nilgiri Hills, (*H. L. Andrewes*) ; in the British Museum.

Paratypes.—a male and two females ; Cochin State, Parambikulam, 1700—3200 ft., 16-24. IX. 1914, (*F. H. Gravely*), a female, in the Z. S. I., No. 5262/H4. Nilgiri Hills, (*G. F Hampson*), in the B. M.

Remarks.—The species is easily distinguished from *ocellata* by the markings on the pronotum, the brown scutellum, the position of the elytral spots No. 1 and 4 ; underside too is brown, as against black in *ocellata*. Both the male and female genitalia are very different in the two species as has been stated in the description. The shape of the male genitalia is very similar to that of *Epilachna boisduvali* Mulsant, although the penis is relatively narrower in *nana* and the apex of sipho slightly different in the two species. The female genitalia are, however, very different in the two species ; the subgenital plates in *boisduvali* being widest in the basal one-third of their length and without an emargination on the inner margin. The species *boisduvali* is widely distributed in Australia, the Philippine Islands, Fiji, Samoa, etc. ; its pronotum is usually without markings, and the elytral spots are without any kind of brown rings around them.

Epilachna anita, sp. nov.

Body similar to that of *E. nana* ; the pubescence also similar, being greyish except on the black elytral spots where it is dark brown. Head, antennae and mouth-parts brown ; eyes black. Pronotum (Text-fig. 1, *a*) brown with six black spots of relatively smaller size, arranged in three pairs as follows : a pair of median, subquadrate spots situated in the middle of the pronotum, one on either side of the median longitudinal line and usually narrowly separated from each other but sometimes becoming confluent to form a single transverse spot ; a lateral pair comprising a small and another relatively large spot situated in each half of the pronotum, the larger spot situated near the base and in the middle of the distance between the lateral margin and the median longitudinal line, the smaller spot situated a little anteriorly of the other spot and is about twice as far away from the median pair of spots as from the lateral margin. Scutellum brown. Elytron with six black spots, each surrounded by a ring of brown colour ; the remainder of the elytral

surface dark brown to piceous. The spots similar to and arranged as in *nana* except that these are relatively smaller and the brown rings surrounding them are proportionately wider. Besides, spot No. 1 is situated distinctly away from the apex of the scutellum. Underside with the coloration similar to that in *nana*.

Head minutely and fairly closely punctate, pubescence moderately long and close. Pronotum with the anterior angles widely rounded; the lateral margins only slightly so, almost subparallel; punctation moderately fine, impressed and close; pubescence similar to that on the head. Scutellum as in *E. nana*. Elytra also similar, but with a minute point at the place where the suture meets the apical margin; punctation as in *nana*, pubescence also similar but shorter. Underside with the abdominal lines complete, subterminal and subangulate; abdominal sternites similar in structure to those of *nana*. Male genitalia with the sipho moderately developed (Text-fig. 2, j), slightly narrowing towards the apex, the proximal one-third moderately curved, the rest almost straight, siphonal capsule distinctly wider than the tube, approximately twice as long as wide and slightly constricted in the middle, apex of the sipho rather flattened, pointed, with the orifice elongate oval and situated just before the tip. Basal plate moderately developed; penis as in Text-fig. 2, *c*, when seen in profile, appearing broad in the basal half and much narrowed distally, its underside is straight for three-fourths its length, bent upwards in the apical one-fourth and with the apex pointed and curved upwards in the forms of a hook; upper surface with a blade-like projection which is almost semicircular in outline, the subapical part slightly enlarged and curved on the upper surface and with a number of long setae usually formed into two groups; seen from below, the opening is elongate oval and narrowed at either end; paramera nearly as long as penis, slightly narrowed in the distal half, with distinct apical thorn pointing towards the penis, the apical one-fourth with long and dense setae along the margin.

Female not known.

Length 6·2 mm., width 5·0 mm.

Type specimens.—Holotype: male; INDIA, Nilgiri Hills, (*G. F Hampson*); in the British Museum.

Paratype: male; with the same data as the holotype; in the Zoological Survey of India No. 7969/H4. An additional specimen with the same data but without abdomen, in the B. M.

Remarks:—Superficially this species resembles *E. nana* more than any other species dealt with here, but it can be distinguished from *nana* by the position of the pronotal and elytral spots, as follows: the pronotal spots not in two pairs and not situated on the transverse median line as in *nana* but in three pairs and situated at different levels. The elytral spots No. 1 situated distinctly away from the apex of scutellum in *anita*, while in *nana* the front tangent of the No. 1 spots passes through the scutellum at two-thirds its length. The apex of elytra in *anita* with a minute point formed at the place where the suture meets the apical margin; it is smooth in *nana*. In the structure of the

genitalia the two species differ considerably. The species can be distinguished easily from most other species of the genus by the ocellations round the elytral spots and the structure of the genitalia.

Epilachna manipurensis, sp. nov.

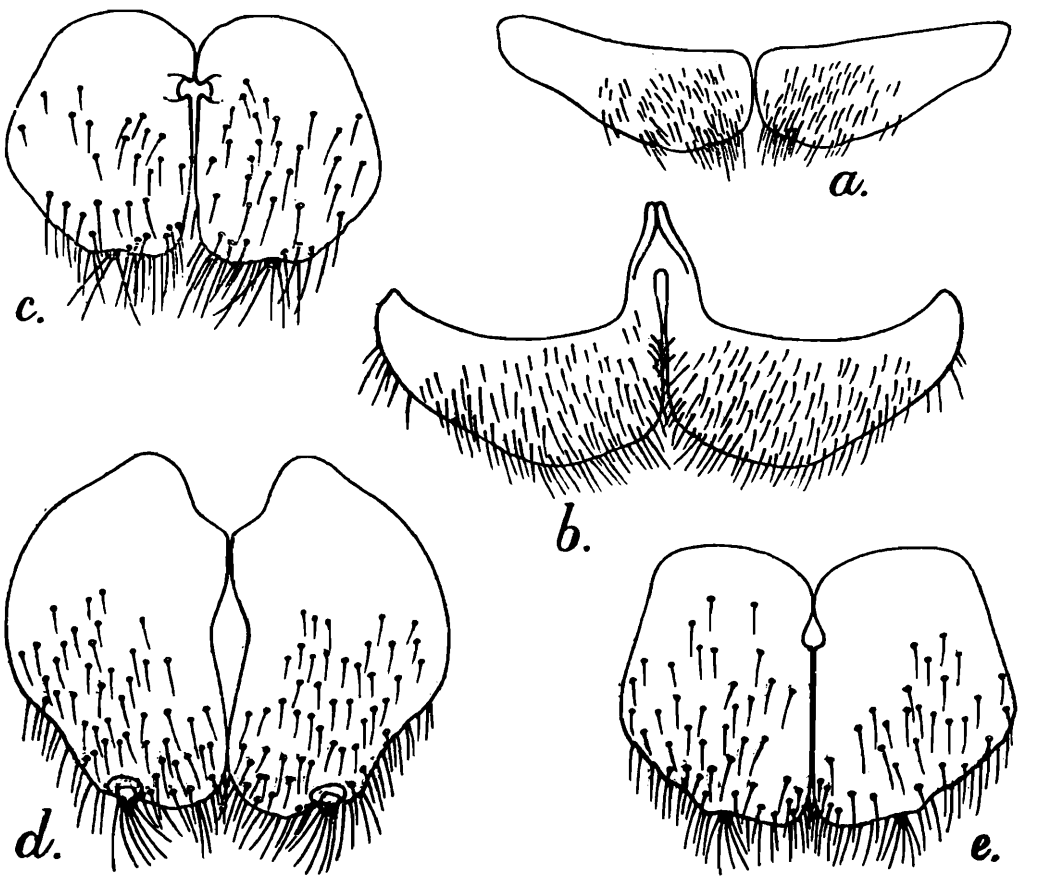
Body similar in outline to that of *E. ocellata* ; pubescence also of similar colour, *i.e.*, grey except on the black elytral spots where it is also black. Head brown or slightly darker, with a moderately large, black spot between the eyes (in holotype, male) or entirely black in the front (in female) ; antennae and mouth-parts brown, eyes black. Pronotum rather dark brown, with a pair of large, black spots ; each spot occupying lateral one-third of the pronotum except for the narrow border along the lateral and anterior margins. In another example (female) the pronotum is black except for the above-mentioned margins. Scutellum chestnut-brown. Elytra altogether with eleven black, rounded spots each of which is surrounded by light brown and moderately wide ring ; the scutellar spot common to both the elytra, extended towards and almost touching their base and surrounding the scutellum on the two sides. The remaining area on the elytra piceous. The other five spots on elytron placed as in *ocellata*. The shoulder spot or spot No. 2, rounded, moderately large ; spot No. 3 a little larger than spot No. 2, subrounded and slightly wider than long ; spot No. 4 slightly larger than No. 3, but not touching the lateral margin as is the case in *ocellata*. Spot No. 5 equal in size to No. 3 or somewhat smaller and rounded ; No. 6 also similar or a little smaller and transverse oval. Underside black except for the brown prothoracic and elytral epipleurae, the mesoepisternum and the greater part of the legs which usually have piceous femora.

Head with rather minute and fairly close punctation and moderately long and close pubescence. Pronotum more widely emarginate anteriorly than is the case in *ocellata*, anterior angles narrower, lateral margins less distinctly rounded, punctation and pubescence similar to that on the head. Scutellum very minutely and fairly closely punctate ; pubescence as on the pronotum. Elytra similar in form to that of *ocellata* but with a sharp point where the suture and the apical margin meet ; punctures of two kinds, the coarser ones relatively more numerous and less impressed than those in *ocellata* or any other fore-mentioned species, the other set of punctures finer than those on the pronotum ; pubescence similar to that on the latter. Underside with the abdominal lines complete, semicircular, reaching about two-thirds the length of the sternite ; punctation on the abdominal sternites slightly coarser than that on the pronotum, and much more so than the punctures on the metasternum ; pubescence relatively short and sparse. Sixth sternite in the male with a distinct emargination in the middle, in the female completely divided longitudinally into two (Text-fig. 3, *a*). Male genitalia with the sipho very narrow, obliquely bent at one-third its length, distally rather flattened (Text-fig. 2, *d*), the siphonal capsule indistinctly marked and for the most part only a little wider than the siphonal tube, apex moderately pointed, orifice rounded, situated a

little away from the apex. General outline of the remainder of the genitalia (Text-fig. 2, *c*) similar in outline to that of *anita* except that the blade on the upper surface of the penis is narrower and less strongly curved. Female with the subgenital plates (Text-fig. 3,c) similar to, though slightly smaller than those of *nana* but easily distinguishable from the latter by the shape of the emargination on the inner margin of the plate, the emargination being situated at one-fourth the length of the margin and resembling three-fourths of a circle in outline; stylus not quite so small as in *nana* but smaller than that in *ocellata*, usually with three distinctly long setae.

Length 6·5 mm.; width 5·0 mm.

Type-specimens.—*Holotype* : male ; INDIA, Assam, Manipur, (*Doherty*) in the British Museum (N. H.), London.

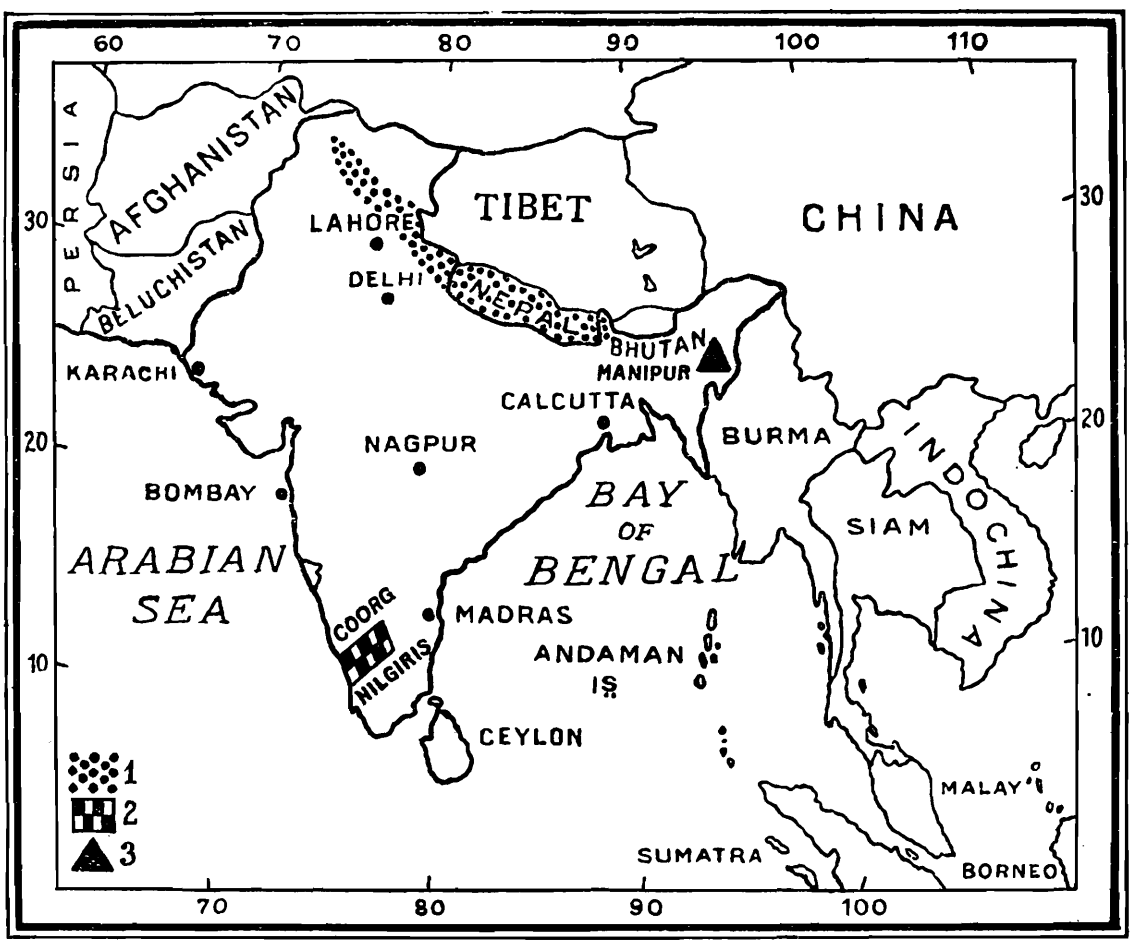


TEXT-FIG. 3.—*a*. sixth abdominal sternite of the female : *a. Epilachna manipurensis*, sp. nov. (X 34) ; *b*. the same of *E. ocellata* Redt. (X 34). *c*. subgenital plates (IX sternite) of *E. manipurensis* (X 54) ; *d*. the same of *E. ocellata* (X54) ; *e*. the same of *E. nana*, sp. nov. (X 54).

Allotype : female ; with the same data as the holotype, also in the B. M.

Remarks.—This species is easily distinguishable from the other species dealt with here by the position and shape of spot No. 1 on the elytra and by the shape of the sipho and the subgenital plates. It is further distinguishable from *ocellata* by the absence of the elongate median spot on the pronotum ; even when the pair of pronotal spots become enlarged to cover most of the pronotum, the absence of the median spot can be detected by the fact that the border along the anterior

margin remains brown. Spot No. 4 of the elytron does not reach the lateral margin as it does in *ocellata*. In the structure of genitalia the two species are very distinct (compare Text-fig. 2, *a* and *b*, with Text-fig. 2, *c*, *d*, *e* ; Text-fig 3, *b* and *d* with Text-fig. 3, *a* and *c*). From *nana* and *anita* also it is further distinguishable by the predominently black coloration on the underside, the position of the pronotal spots, and by the structure of the genitalia, as already stated in the description.



TEXT-FIG 4.—Map showing the distribution of: 1. *Epilachna ocellata* Redt.; 2. *E. nana*, sp. nov. and *E. anita*, sp. nov.; 3. *E. manipurensis*, sp. nov.

III.—KEY TO THE SPECIES.

The following key to the species dealt with in this paper is based on external characters only; structural differences such as those of genitalia though supporting the external characters have been avoided in the hope that it would be found more convenient to use the key without carrying out the dissections for the study of genitalia :—

1. The black scutellar spot (No. 1) away from the suture, surrounded all round by a light brown ring; not touching or forming a single spot with its opposite number on the other elytron .. . 2.
2. The black scutellar spot (No. 1) on the elytron touching the suture and forming a single spot with its opposite number, and enclosed by a single brown ring. (Text-fig. 1, *f*, *g*.) .. .. *manipurensis sp. nov.*

2. Scutellum black; spot No. 4 (near middle of external margin) of elytron produced laterally to reach the external margin; underside mostly black or piceous (Text-fig. 1, *d*, *e*) .. .. .. *ocellata* Redt.

Scutellum light brown; spot No. 4 not touching the external margin; underside mostly brown with only a pair of piceous spots on metasternum .. .. 3.

3. Pronotum with four spots arranged in a row on the transverse median line, without any spot in the middle of the said line; apex of suture smoothly meeting the apical margin of elytra, not forming a point where the two meet (Text-fig. 1 *b*. *c*) .. .. *nana*, sp. nov.

Pronotum with six spots, arranged in three pairs, never in a straight row on the transverse median line, elytra with the apex of suture forming a small point where it meets the apical margin (Text-fig. 1, *a*) .. *anita*, sp. nov.

DESCRIPTIONS OF GALL MIDGES (ITONIDIDAE : DIPTERA) FROM INDIA.*

By S. N. Rao, M.Sc., F.R.E.S., *U. P. Government Research Fellow, School of Entomology, St. John's College, Agra.*

This paper contains descriptions of one new genus and three new species. I have in addition included the redescription of an imperfectly described species.

I thank Prof. M. S. Mani for guidance and encouragement. My thanks are also due to Major Dr. M. L. Roonwal, Forest Entomologist, Forest Research Institute, Dehra Dun, for the specimen of *Cincticornia bivalviae*, sp. nov.

Subfamily Itonididinae.

Tribe Porricondylini.

Vanchidiplosis agraensis, sp. nov.

Female.—Length 1·5 mm. Brown. Eyes confluent above. Trophus bluntly and conically produced. Neck prominent. Antenna with 15 segments, sparsely setose, segments brown with two whorls of rather stout setae, with very short apical stems and gradually becoming shorter and slender towards the apex; scape cup-shaped, yellowish-brown, pedicel slightly darker, subcylindical; first flagellar segment fused with the second (Text-fig. 1*f*), a little over twice as long as thick, cylindrical; second segment as long as and as thick as the first; third segment as long as the second but slightly slender; fifth segment (Text-fig. 1*c*) shorter than the third and a little less than twice its own thicnkess; seventh segment (Text-fig. 1*g*) as long as the fifth but very slightly slender; ninth segment slightly shorter than the seventh but as thick as the latter; eleventh segment equal to the ninth; twelfth segment (Text-fig. 1*d*) as thick as and as long as the eleventh; terminal segment (Text-fig. 1*d*) shorter than the penultimate but with a short teat-like projection nearly one-third the length of the segment. Palpi (Text-fig. 1*h*) quadriarticulate, moderately setose; first segment nearly cylindrical, very slightly bulging in the middle, shortest of all segments, length a little less than twice the width in the middle; second segment cylindrical, nearly twice the length of the first and two and three-fourths its own thickness, slightly pointed distally; third segment shorter than the second, cylindrical, thrice as long as thick, ends slightly tapering; fourth segment cylindrical, very nearly equal to the third. Mesonotum brown. Scutellum and postscutellum brown. Abdomen brown. Halteres pale yellow. Wings (Text-fig. 1*a*) hyaline, neither too long

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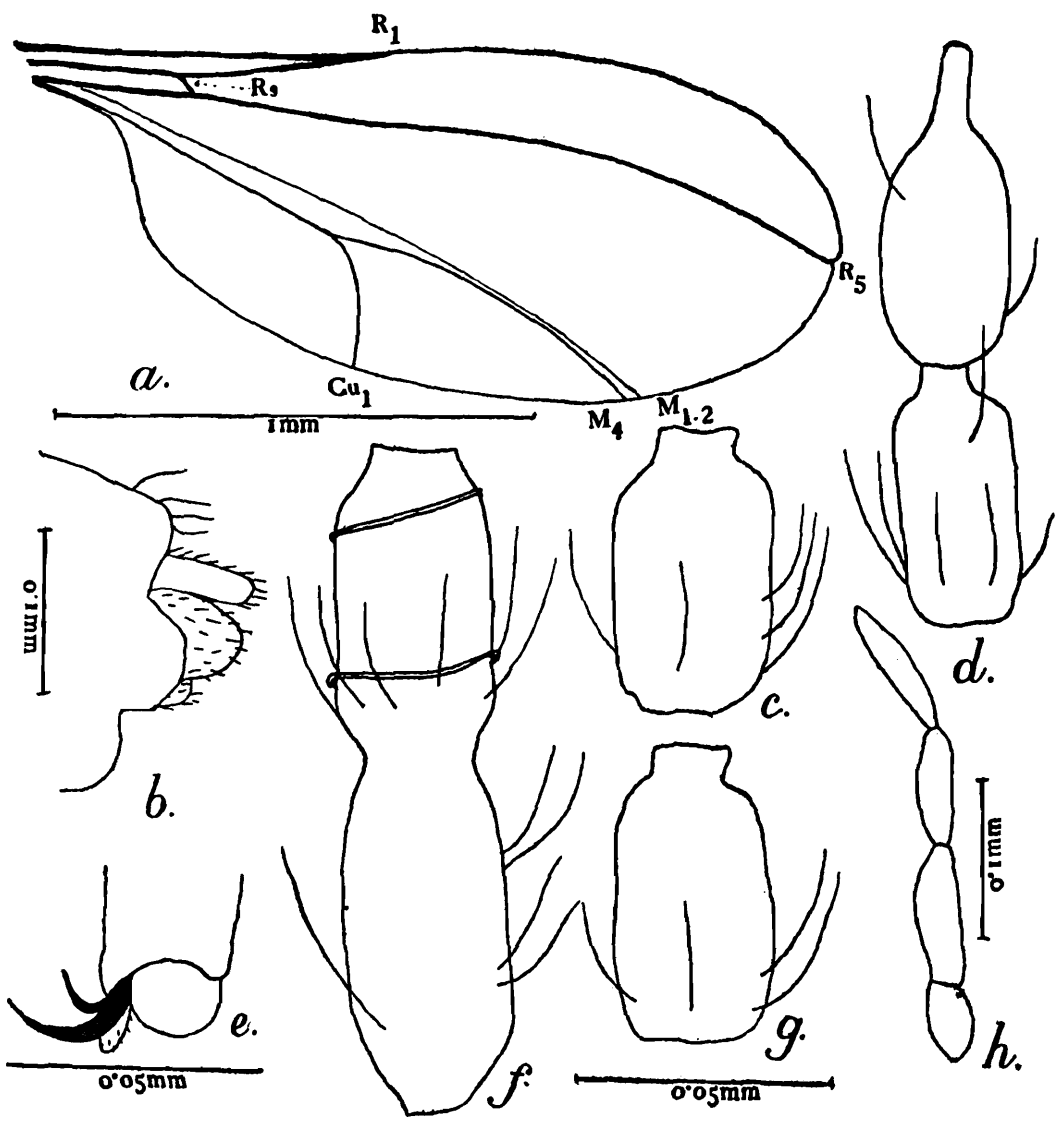
nor too broad, length a little over twice the width, with four long veins, Rs distinct and making an obtuse angle with costa, costa and R_1 covered with thick hairs, R_5 reaching the margin of the wing beyond apex, M_{1-2} simple, complete, distinct but faint, $Cu\text{-}M_4$ forked. Legs pale brown, thickly hairy, coxae brown and with characteristic thick hairs, metatarsus short, one-eighth the length of the second tarsal segment, slightly shorter than the terminal tarsal segment, second segment longest of all, longer than the two following segments combined, third segment nearly half the second, longer than the fourth, terminal segment slightly longer than the metatarsus. Claw (Text-fig. 1*e*) bifid, bent at almost right



TEXT-FIG. 1.—*Vanchidiplosis agraensis*, sp. nov., ♀.

a. wing; *b*. ovipositor; *c*. fifth flagellate antennal segment; *d*. terminal two antennal segments; *e*. bifid claw of hind leg, *f*. first two flagellate antenna segments; *g*. seventh flagellate antennal segment; *h*. palpus.

angles, slender, dark brown, empodium half the length of the claw. Ovipositor small (Text-fig. 1*b*), with nearly triangular terminal lobes, fairly hairy.

Holotype.—1 ♀ dissected on slide No. $\frac{2146}{H\,6}$ in the collections of the Zoological Survey of India, Calcutta. "At light, School of Entomology Laboratory, S. N. Rao Coll. Agra, 12.ix.1949."

This species is readily separated from *Vanchidiplosis vanchi* Nayar[1] by the different proportions of the palpal segments, terminal lobes of ovipositor being triangular and the lighter colour of legs and halteres.

Tribe Lasiopterini.

Neoprotoplonyx, gen. nov.

Eyes confluent above. Trophi short. Palpi quadriarticulate. Antenna with 18 segments in ♀, sgements cylindrical, sessile; first and second flagellate segments not fused. Wings neither too long nor too broad, hyaline, with three long veins; costa thickly and R_1 and R_5 sparsely hairy, the latter close to the costa and uniting with it a little beyond the middle of the wing, Cu-M_4 forked. Claws dentate on all legs. Ovipositor one-third the length of the abdomen, of the usual Lasiopteran type.

Genotype : *Neoprotoplonyx indica* sp. nov.

This genus runs very close to *Protoplonyx* Felt in Mani's[2] key to the Oriental genera but is readily distinguished from it by the dentate claw on all legs.

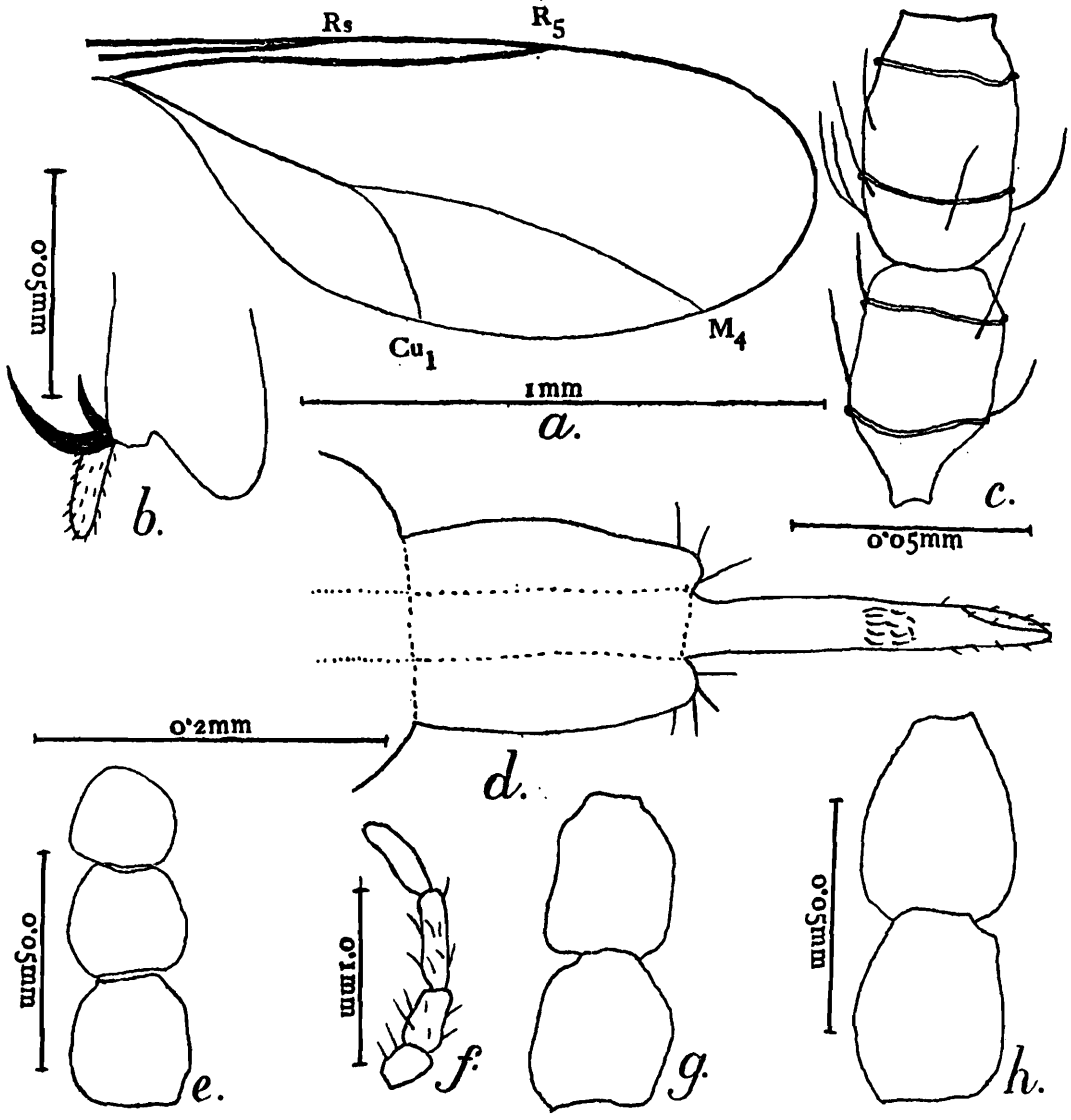
Neoprotoplonyx indica, sp. nov.

Female.—Length 1·13 mm. Brown. Eyes confluent above. Trophi not produced. Antenna brown, half the length of the body, with 18 segments, segments cylindrical, sessile, gradually becoming slender, shorter and somewhat transverse towards the apex, with a basal whorl of stout and moderately long setae reaching upto nearly half the length of the segment; scape cup-shaped, yellowish-brown, length one and one-third the width at apex; pedical subglobose, slightly darker than the scape, a little longer than wide; first flagellar segment (Text-fig. 2*c*) fused with the second, as long as the scape and one and one-third as long as its own thickness; second segment (Text-fig. 2*c*) equal in all proportions to the first; third segment very slightly shorter than the second; fifth segment (Text-fig. 2*h*) shorter than the third, very slightly longer than its own thickness; seventh segment as long as the fifth but slightly slender and very slightly narrower distally; ninth segment (Text-fig. 2*g*) a little shorter and slender than the seventh and a little longer than its own thickness, slightly narrowed distally; eleventh segment slightly shorter than the ninth, narrowed distally, length a little greater than its median thickness; thirteenth segment subglobose, narrowed distally, length a little less than its own thickness; fifteenth segment (Text-fig. 2*e*) subglobose, wider than long; terminal segment (Text-fig. 2*e*) uniformly wide upto the apical three-fourths and narrowed into a blunt knob distally, shorter than wide. Palpi (Text-fig. 2*f*) quadriarticulate, pale yellow, sparsely setose, first segment subcylindrical, shortest of all, a little longer than thick; second segment cylindrical, stouter and longer than the first, nearly twice as long as thick, very slightly narrowed distally; third

[1] Nayar, K. K., *Proc. Roy. Ent. Soc. London*, XVIII, p. 82 (1949).

[2] Mani, M. S., *Ind. Jour. Ent.*, VII, pp. 189-235 (1946).

segment longest of all, cylindrical, slender than the second, more than thrice as long as thick; fourth segment slender than the third, cylindrical, other proportions as in the third. Mesonotum dark brown. Scutellum and postscutellum lighter than mesonotum. Abdomen brown. Wings (Text-fig. 2*a*) hyaline, nearly two and two-thirds as long as wide, R. very close to the costa and uniting with the latter a little beyond the middle, costa densely and R_1 and R_5 sparsely hairy, M_{1-2} absent, Cu-M_4 forked, the fork reaching the wing margin a little beyond the middle. Halteres brownish-yellow basally and pale yellowish distally. Legs slender, long, sparsely hairy, yellowish-brown, metatarsus shorter than the fifth tarsal segment, nearly one-seventh the second tarsal segment, second tarsal segment longest of all, longer than the three following



Text-fig. 2.—*Neoprotoplonyx indica*, sp. nov., ♀.

a. wing; *b*. bifid claw of hind leg; *c*. first two flagellate antennal segments; *d*. ovipositor; *e*. terminal three antennal segments; *f*. palpus; *g*. ninth and tenth flagellate antennal segments; *h*. fifth and sixth flagellate antennal segments.

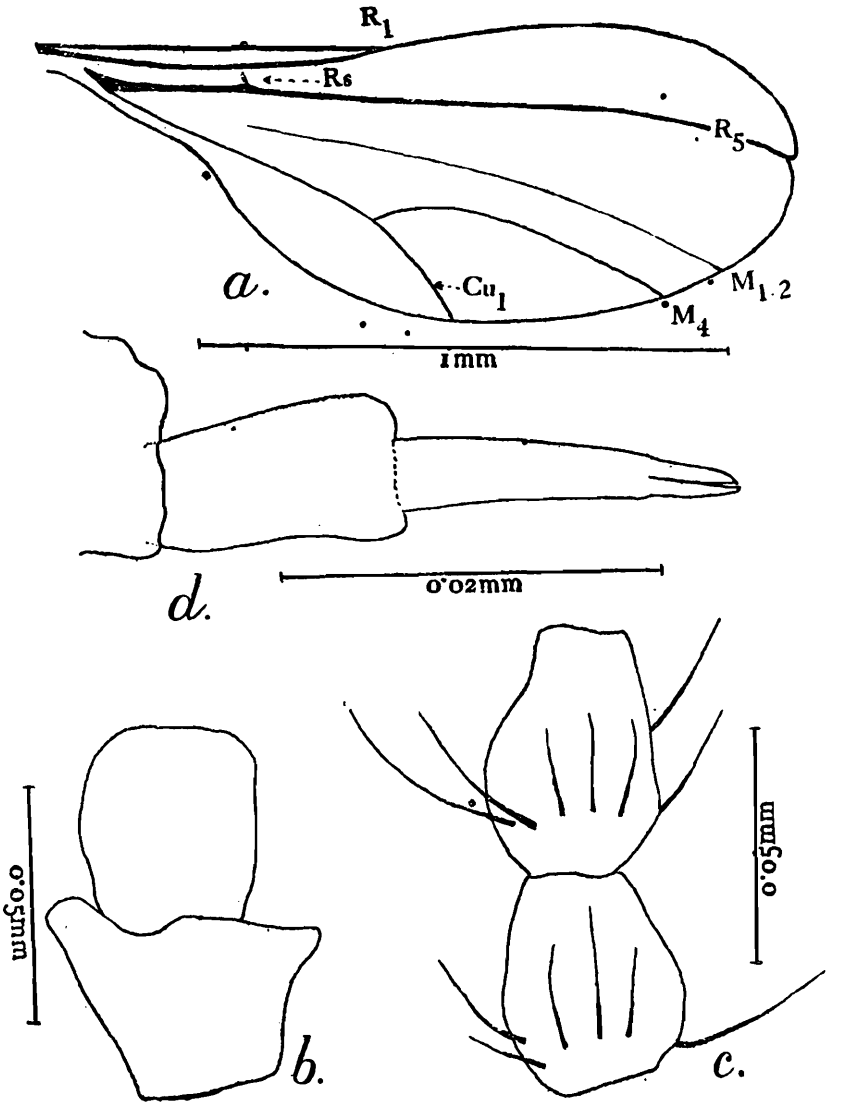
segments combined, third segment a little shorter than half the second, fourth two-thirds the third, terminal segment nearly three-fifths the penultimate. Claw (Text-fig. 2*b*) dark brown, evenly curved, not very slender, with a tooth at the base, empodium a little less than three-fourths the length of the claw. Ovipositor (Text-fig. 2*d*) yellowish-brown, one third the length of the body.

Holotype.—1 ♀ dissected on slide No. $\frac{2142}{H\ 6}$ in the collections of the Zoological Survey of India, Calcutta. At light, School of Entomology, Laboratory, St. John's College, S. N. Rao Coll. Agra, 12.ix. 1949"

Tribe Asphondylini.

Cincticornia bivalviae, sp. nov.

Female.—Length 1·52 mm. Yellowish-brown to brown. Eyes confluent above. Antenna short, light brown, half the length of the body, with 14 segments, segments short, sessile, gradually becoming



Text-fig. 3.—*Cincticornia bivalviae*, sp. nov., ♀.

a. wing; *b.* scape and pedicel; *c.* fifth and sixth flagellate antennal segments *d.* ovipositor.

shorter and slender towards the apex, with long scattered setae almost near the base of the segment and with two rows of circumfila; scape (Text-fig. 3*b*) widest at the apex, width at apex nearly one and a half times the length; pedicel (Text-fig. 3*b*) subcylindrical, very slightly narrowed towards the apex, length one and a half times the breadth; first flagellar segment cylindrical, nearly equal to the length of the scape

and pedicel combined, fused with the second, twice as long as thick, with a very short basal stem of one-sixth the length of the segment; second segment half the length of the first, slightly slender than the first; third segment slightly broader basally than at spex, nearly one and a half times as long as the median width; fifth segment (Text-fig. 3*c*) shorter than the third, subglobose, length a little greater than the width; sixth (Text-fig. 3*c*) and seventh segments equal in all proportions to the fifth; ninth segment nearly globose; tenth segment equal to the ninth; terminal two segments nearly equal in all proportions to each other. Palpi quadriarticulate, (shrunk) fairly hairy, light brown, first segment cylindrical, length a little less than one and a half times the thickness, second segment cylindrical, one and a half times the length of the first and a little over twice its own thickness, third segment slightly shorter than the second, fourth segment longer than the third, longest of all segments. Mesonotum brown. Scutellum and postscutellum lighter than mesonotum. Abomen yellowish-brown. Wings (Text-fig. 3*a*) hyaline, neither too long nor too broad, length a little over twice the breadth, costa thickly and R_1 sparsely covered with brown hairs, the latter uniting with costa a little before the middle of wing, Rs not very distinct, only in the form of a stump from R_1 and making a small angle and not uniformly pigmented throughout, R_5 reaching the margin of the wing a little beyond the apex, very sparsely covered with hairs, $M_{1\text{-}2}$ very faint, Cu-M_4 forked, the fork very faint. Halteres brown. Legs long, slender, brown, densely hairy, metatarsus nearly equal to the fifth tarsal segment, three-eighths the second tarsal segment, the latter longest of all, longer than the two following segments combined, distal two segments nearly equal to each other. Claw slender simple and bent nearly at right angles at the distal three-fourths, empodium shorter than claw. Ovipositor (Text-fig. 3*d*) long, exserted, nearly one-fourth the length of the body, not aciculate, with two small terminal lobes.

Holotype.—1 ♀ dissected on slide Nos. 3121 & 3122 in the collections of the Forest Research Institute, Dehra Dun. "Reared on 8.vi.1950, from gall No. 209 (Text-fig. 4) on leaflets of *Acacia catechu* Willd. by Dr R. N. Mathur, at the Forest Research Institute from material received from the Research Ranger, Shahapur, Thana Dist., Bombay."

This species is named after the nature of the bivalve gall No. 209 (Text-fig. 4) this midge produces. This gall was described by Mani as early as 1935 from material collected by him at Walayar (South India) in 1928. He did not however breed the midges.

This is the first record of the genus *Cincticornia* Felt from India.

Asphondylia pongamiae Felt.

1922. *Asphondylia pongamiae*, Felt, *Mem. Dept. Agric. India Ent. Ser.* VII, p. 24.

1934. *Asphondylia pongamiae*, Mani, *Rec. Ind. Mus.*, XXXVI, p. 415.

1948. *Asphondylia pongamiae*, Mani, *Jour. Roy. As. Soc. Bengal, Sci.*, XIV, p. 92.

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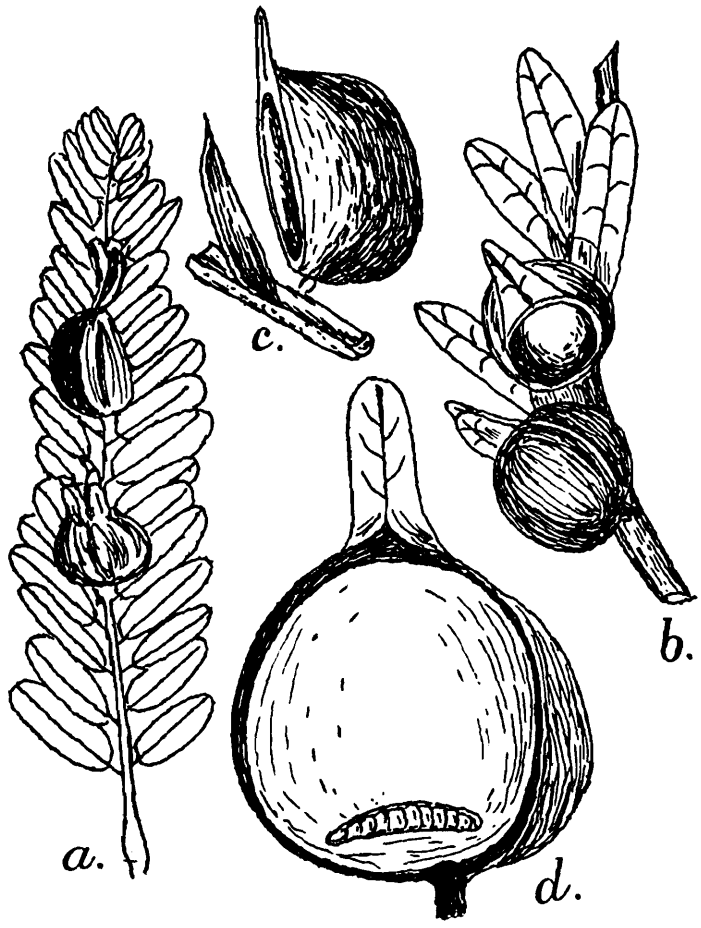
[1]Mani, M. S., *Rec. Ind. Mus.* XXXVII, p. 447 (1935); *Jour. R. Asiatic Soc. Bengal, Sci.*, XIV, p. 139 (1948).

I have before me 3 ♂♂ received for identification from the Government Entomologist, Bangalore, and causing gall No. 202 on *Pongamia glabra* Vent.

These midges differ from the original description by Felt (*loc. cit.*) in the following: length 3·5 mm. Fifth antennal segment (third flagellate) four and a half times as long as thick. First segment of palpi widest at apex, length one and a half times the width at apex. Third segment of palpi only a little longer than the second (15 : 17), cylindrical. Abdomen dark brown.



TEXT-FIG. 4.—Gall No. 209 by *Cincticornia bivalviae*, sp. nov. on *Acac ia catechu Willd* (after Mani.)

a. one pinna with the galls *in situ* (×3) ; *b*. two galls enlarged ; *c*. the gall with the valves open ; *d*. gall with the larva inside (×7½).

Tribe ITONIDIDININI-TRIFILA.

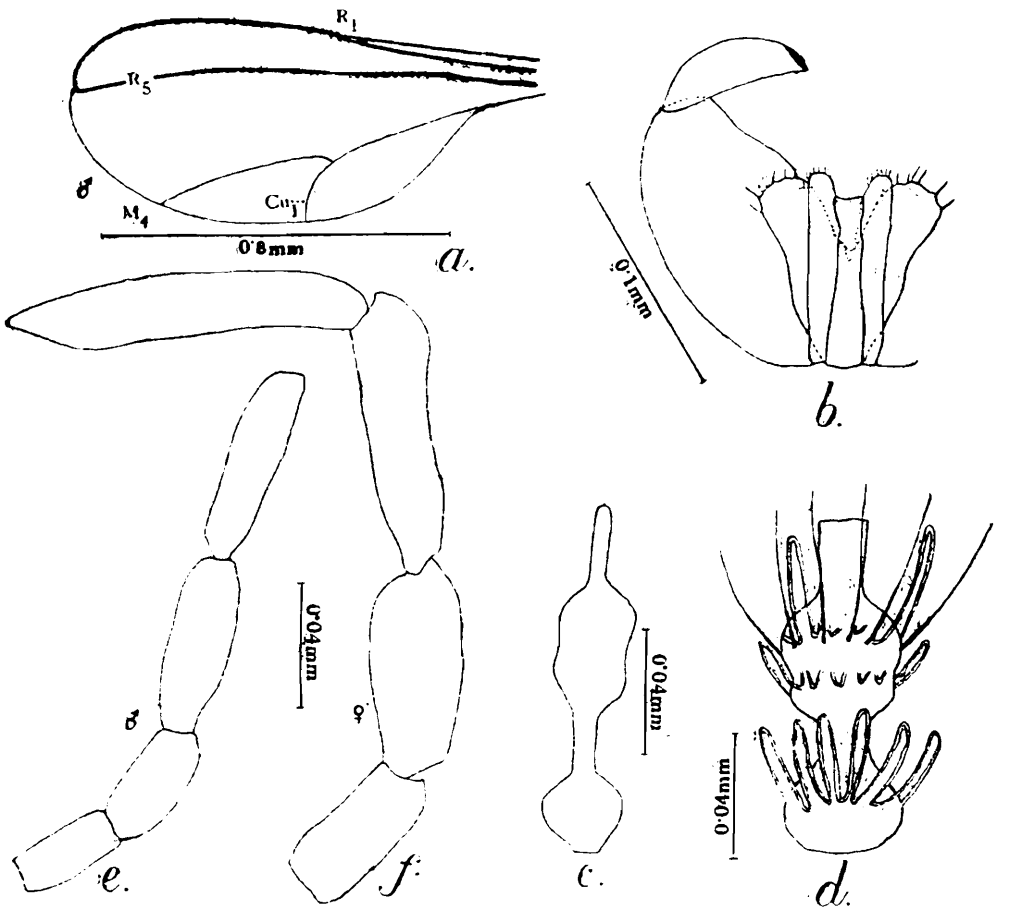
Aschistonyx crataevae (Mani).

1934. *Cecidomyiela crataevae*, Mani, *Rec. Ind. Mus.*, XXXVI, p. 428.

This species was originally described by Mani (*loc. cit.*) from specimens reared by him from leaf bud gall No. 171 on *Crataeva religiosa* Först. at Tanjore. At Prof. Mani's request, I re-examined his cotype specimens on slide No. 1033, kindly loaned by the Director, Zoological Survey of India, Calcutta and have also compared with them the midges reared by me. I find this species to belong to the genus *Aschistonyx* Rübsaamen and redescribe the ♂ and ♀ in detail.

Male.—Length 1·24 mm. Body light orange-red in live specimens, sparsely hairy. Eyes confluent above. Trophi not produced. Antenna light brown basally and paler distally, a little longer than body, with 14 segments, segments gradually becoming slender and the stems longer towards the apex, all segments binodose, apical nodes slightly constricted about the basal fourth, with three whorls of circumfila, loops of the basal and apical whorls being similar and equal to the length of the apical stems, the middle whorl slightly shorter, with two whorls of long setae, one on the basa of the basal and the second on the apical three-fourths of the apical enlargements; scape very light brown, broader than long, broadest at apex, width at apex one and a half times the length; pedicel subglobose, slightly darker than scape, length a little less than the median width; first flagellar segment fused with the second, with a very stem, stem nearly one-third the length of the basal enlargement and three-fifths as long as thick, basal enlargement nearly globose, a little less than one-third the length of the segment and as thick as long, basal stem as long as the basal stem, slightly slender and nearly one-fourth the length of the apical enlargement, apical enlargement subcylindical, slightly constricted a little below the middle, giving a false apparance of two sessile segments fused together, a little less than one-third the length of the segment and one and one-third as long as thick, apical stem one-sixth the length of the segment, a little less than half the length of the apical enlargement and slightly longer than broad; second segment as long as the first, basal enlargement globose, as long as and as thick as that of the first segment, basal stem as that of the first segment, apical enlargement longer than that of the first segment, one and two-fifths as long as thick, apical stem longer than that in the first segment, twice as long as thick, and a little less than one-fourth the length of the segment; third segment equal in all proportions to the second, very slightly slender than the second; fifth segment (Text-fig. 5*d*) as long as the third, but slender, basal enlargement wider than long, length seven-tenth the width and less than one-fourth the length of the segment, basal stem a little less than twice its own thickness, one-sixth the length of the segment and slightly shorther than half the apical enlargement, apical enlargement a little over one-third the length of the segment, slightly longer than thick, apical stem a little over twice as long as thick, more than half the length of the apical enlargement; seventh segment as long as the fifth but slender, basal enlargement wider than long, length three-fuorths the width, and one-fifth the length of the segment, basal stem as long as the basal enlargement, twice as long as thick, apical enlargement one-third the length of the segment, one and one-fourth as long as thick, apical stem four-fifths the apical enlargement and a little less than twice its own thickness; ninth segment equal in all proportions to the seventh; eleventh segment as long as the ninth but with slender stems, basal enlargement one-fifth the length of the segment and three-fourths its own thickness, basal stem as long as the basal enlargement and thrice its own thickness, apical enlargement a little less than one-third the length of the segment, nearly one and one-third as long as thick, apical stem very slightly shorter than the apical enlargement four times as

long as thick; terminal segment (Text-fig. 5*c*) very slightly longer than the penultimate, rest of the details as those of the eleventh. Palpi (Text-fig. 5*e*) quadriarticulate, pale yellow, finely and moderately setose, first segment cylindrical, slender than the second segment, twice as long as thick, second segment cylindrical, slightly stouter than the first, as long as the latter, a little over one and a half times as long as thick, third segment slender and longer than the second, cylindrical, a little less than twice as long as thick, fourth segment very slightly slender than the third, other proportions as in the latter. Mesonotum light brown. Scutellum and postscutellum lighter than mesonotum. Abdomen very light orange-red. Halteres pale brown basally and lighter distally. Wings (Text-fig. 5*a*) nearly two and a half times as long as broad, Rs wanting, with three long veins, costa sparsely hairy, R_1 uniting with costa before the middle of wing, R_5 reaching the wing margin at apex,



TEXT-FIG. 5.—*Aschistonyx crataevae* (Mani).

a. wing of ♂; fifth flagellate antennal segment; *e*. palpus of ♂; *f*. palpus of ♀. *b*. genitalia; *c*. terminal antennal segments of ♂; *d*.

M_{1+2} absent, Cu-M_4 forked. Legs long, slender, thickly hairy, light brown, metatarsus shorter than the fifth tarsal segment, nearly one-eighth the length of the second tarsal segment, the latter longest of all segments, longer than the three following segments combined, third segment less than half the length of the second, fourth segment shorter than the third terminal segment shorter than the fourth. Claw simple, slender, evenly curved, dark brown, empodium as long as the claw. Genitalia (Text-fig. 5*b*) light brown; basal clasp segment nearly cylindrical, twice as

long as broad, moderately hairy, without basal lobe; terminal clasp segment half the length of the basal clasp segment, nearly twice the thickness in the middle, gradually narrowed towards the apex, slightly curved and ending in a blunt tooth; dorsal plate not chitinized, bilobed, the margins of the lobes thickened laterally and produced into small projections apically, with rather stout setae; ventral plate nearly as long as the dorsal plate, much slender, deeply notched, with the tips of the lobes bluntly pointed, and covered with fine setae; style stout, broader at base than at apex, gradually narrowed distally and ending in an angulated tip, thrice as long as thick in the middle, slightly shorter than the dorsal plate and nearly half the length of the basal clasp segment.

Female.—Length 1·43 mm. Body light orange-red in live specimens, slightly darker than that of the ♂, sparsely hairy. Eyes confluent above. Trophi not produced. Antenna light brown, lighter towards the apex, slightly shorther than the body, with 14 segments, segments gradually becoming shorter and slender towards the apex, cylindrical, with very short apical stems, with two whorls of setae, the basal whorl long and almost reaching the tip of the segment, apical whorl rather short, circumfila in two rows; scape yellowish brown, cup-shaped, length equal to the width at apex; pedicel slightly darker than scape, subglobose, length nearly equal to the median thickness; first flagellar segment fused with the second, longest of all, with a short basal stem, length of stem two-thirds its own thickness, enlargement with a slight constriction in the middle, nearly five times as long as thick, apical stem equal in all proportions to the basal stem; second segment without the basal stem very slightly shorther than the first, rest of the details as in the first segment; third segment shorter than the second, nearly twice as long as thick, with an apical stem similar to that of the second segment; fifth segment shorter than the third, one and two-thirds as long as thick, with an apical stem of one-fifth the length of the segment; seventh segment equal in all proportions to the fifth; ninth segment slightly slender than the seventh, nearly twice as long as thick; eleventh segment as long as the ninth but slender, twice as long as thick; terminal segment slightly longer than the penultimate, length a little over twice the thickness, with an apical knob of almost half the length of the enlargement and two and a half times its own thickness. Palpi (Text-fig. 5*f*) finely and moderately setose, quadriarticulate, light brown, first segment cylindrical, nearly twice as long as thick, second segment cylindrical, slightly stouter but as long as the first, one and a half times as long as thick, third segment cylindrical, longer and slender than the second, twice as long as thick, fourth segment cylindrical, very slightly slender and slightly longer than the third, longest of all, a little over as long as thick. Mesonotum brown. Scutellum and postscullteum light brown. Abdomen light orange red. Halteres pale brownish basally and lighter distally. Wings hyaline nerly two and half times as long as broad. Rest of the details as in the wing of the ♂. Legs long, longer than those of the ♂, thickly hairy, light brown, metatarsus shorter than the fifth tarsal segment, a little over one-seventh the second tarsal segment, the latter longest of all, longer than the following three segments combined, third segment very slightly less than half the length of the

second tarsal segment, fourth segment shorter than the third, termina segment shorter than the fourth. Claw simple, slender, evenly curved, dark brown, empodium as long as the claw. Ovipositor of variable length, from half to one fourth the length of the body, exserted, with two elongately oval terminal lobes.

Redescribed from 1 ♂ and 1 ♀ dissected on slides and several ♂♂♀♀ in spirit in the collections of the School of Entomology St. John's College, Agra and from cotypes. " Reared from leaf-bud gall No. 171 on *Crataeva religiosa* Först. in the School of Entomology Laboratories, S. N. Rao Coll. Agra, 25/26.vii.1950. "

The pupal period in Agra is 5 days in July and in Madras Mani[1] recorded the same to be 3 days in July.

Spatholobomyia, nom. novum.

I propose this new name to *Heliodiplosis* Felt[2] [Genotype *Heliodiplosis spatholobi* Felt reared from the leaf gall on *Spatholobus gyrocarpus* (Wall.) Benth, from Philippines], which is preoccupied by *Heliodiplosis* Haeckel[3] (Radiolaria, Rhizopoda, Protozoa).

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[1]Mani, M. S., *Rec. Ind. Mus.*, XXXVI, p. 429 (1934).

[2]Felt, E. P., 1918. *Philip. Jour. Sci.* XIII, p. 291.

[3]Haeckel, E., 1887. *Rep. Voy. Challenger—Zool.* XVIII, p. 445.

ON A NEW SPECIES OF *APORORHYNCHUS* FROM THE WHITE SCAVENGER VULTURE *NEOPHRON PERCNOPTERUS* (LINN.) FROM INDIA.

By E. N. Das, *M.Sc., Department of Zoology, Vidarbha Mahavidyalaya, Amraoti (M. P.)*

[Plate VI.]

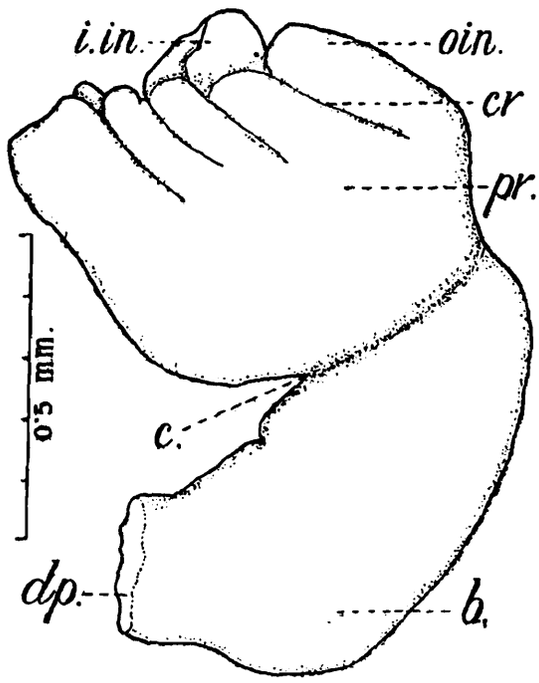
In describing a new species of an Acanthocephalan worm from a bird, *Hemignathus procerus*, Shipley (1897) created the genus *Arhynchus* literally meaning "without proboscis" In 1899, he proposed the name *Apororhynchus* for it on the ground that *Arhynchus* was preoccupied. A second species of this genus *Apororhynchus aculeatus*, was described by Meyer (1931) from the intestine of a bird, *Casicus cristatus*. I collected three specimens of a worm belonging to this genus from the intestine of the White Scavenger Vulture, *Neophron percnopterus*. All the three specimens are adult females. Since it was impossible to make out the details of the anatomy of the worm from specimens cleared in lactophenol, I cut sagittal sections of one of the three specimens and reconstructed a wax model, magnified 75 times. The specimens described below are remarkable in many ways and represent a new species of *Apororhynchus* for which I propose the name *Apororhynchus bivolucrus*, sp. nov.

Apororhynchus bivolucrus, sp. nov.

Diagnosis of the species.—Entire length of the parasite 1·4 mm.; length of proboscis 0·53 mm.; breadth of proboscis 0·70 mm.; maximum breadth of the body 0·46 mm.; breadth of the posterior end 0·25 mm. Proboscis marked off from the body by a deep constriction; proboscis divided into two involucres and an inner cone-like proboscis by means of deep cleavages; the colour of the parasite dark brown; giant nuclei measure 0·09 mm. × 0·05 mm.; Ovary, spherical, 0·13 mm. in diameter; giving rise directly to eggs, persisting throughout the maturity of the worm. Eggs oval, measuring 0·10 mm. × 0·06 mm. × 0·04 mm. Uterus very much elongated; vaginal gland and the horse-shoe shaped muscle present.

The worm (Text-fig. 1) is cylindrical in shape and round in cross section. It is curved on the dorsal side. In the living condition it was dark brown in colour and could be easily passed off as a faecal pellet. It measures 1·40 mm. in length and 0·70 mm. in maximum width in the region of the proboscis and 0·46 mm. in maximum width in the region of the body. The worm is divisible into two parts, an anterior representing the proboscis and a posterior representing the body. The proboscis (Text-fig. 1, *pr.*) is separated from the body by a deep constriction (Text-fig. 1, *c*) and the maximum width in this region is 0·38 mm. The posterior end is narrower than the rest of the body and measures 0·25 mm. in width.

The proboscis.—The proboscis (Text-fig. 2, *pr.*) measures 0·43 mm. in length and 0·70 mm. in breadth. It is devoid of hooks and spines. Externally it bears resemblance to an half opened flower. There are two involucres. The outer involucre (Text-fig. 2, *o. in.*) forms a complete cup. The anterior end of the cup is divided into clefts. One such cleft carrying on it a muscle mass is shown in Text-fig. 2, *p.* Dorsally the outer involucre is much thinner than it is on the ventral side. The thickness is 0·05 mm. on the dorsal and 0·18 mm. on the ventral side. The inner



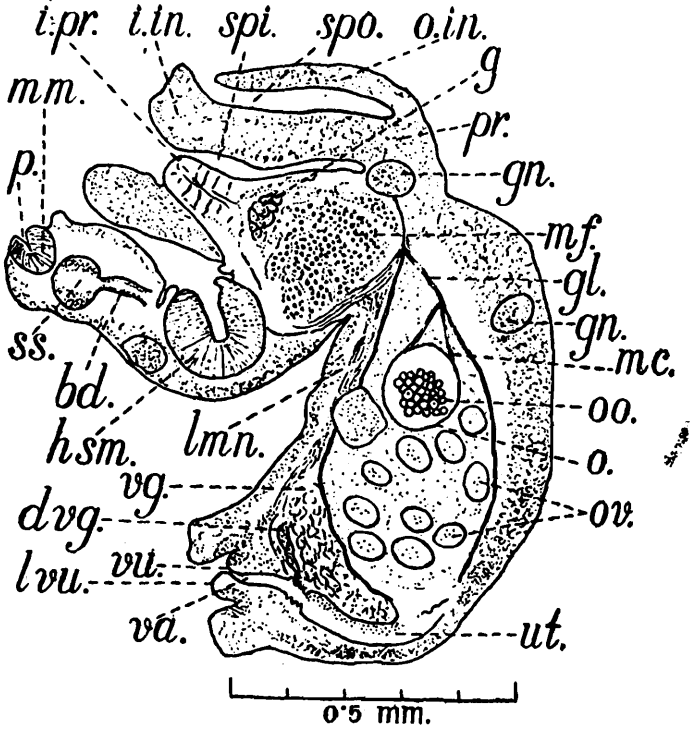
TEXT-FIG. 1.—*Apororhynchus bivolucrus*, sp. nov. Entire specimen.

b. body; *c.* constriction; *cr.* cleaves in the rim; *dp.* depression formed by the extension of the posterior wall of the body; *i.in.* inner involucre; *o.in.* outer involucre; *pr.* proboscis.

involucre (Text-fig. 2, *i. in.*) has a uniform thickness measuring 0·08 mm. but is incomplete on the ventral side. Its rim is also cleaved and the whole of it protrudes beyond the outer involucre, the protrusion being 0·06 mm. on the dorsal side. The inner involucre encloses within it a solid cone-like structure which could be called the inner proboscis (Text-fig. 2, *i. pr.*). It measures 0·45 mm. in length and 0·30 mm. in thickness at the base, it is a solid mass of muscles and in a sagittal section the muscle fibres are cut transversely. The nerve ganglion is situated half way between the apex and the base. The two involucres are not in contact with each other but they enclose a distinct space between them. In sagittal sections the space (Text-fig. 2, *spo.*) between the walls of the two involucres measures 0·30 mm. in length from anterior to posterior and 0·03 mm. in width. There is a similar space (Text-fig. 2, *sp. i.*) between the inner involucre and the inner cone-like proboscis and it measures 0·30 mm. in length and 0·01 mm. in width. The length of the space between the outer and the inner involucre is less than the length of the proboscis because at the base of the proboscis near the constriction, the involucres and the cone are all joined together. On the ventral side, in the region where the wall of the inner involucre is incomplete, there lies a horse-shoe shaped muscle (Text-fig. 2, *hsm.*), at the base of the cleft near

the constriction, wedged in between the base of the inner cone and the wall of the outer involucre. It measures 0·26 mm. in width and 0·40 mm. in length. It is seen to occur in five sections only each 20 μ in thickness. The muscle is situated at the base of the proboscis between the outer involucre and the inner cone and seems to regulate the size of the cleft or space between the outer involucre and the inner cone. It works in such a manner that either the wall of the involucre could be pushed out or the inner cone could be narrowed so as to widen the space between the outer involucre and the inner cone. It may also bring the wall of the outer involucre nearer to the inner cone thus reducing the space between the two. Probably this mechanism provides an adhesive organ in the absence of hooks. Probably it allows the contents of the intestine of the host to pass round in the clefts between the involucres and the inner cone so as to provide a larger absorptive surface. At the tip of the ventral wall of the outer involucre of the proboscis where a small portion of it is bifid, there is a similar but smaller muscle mass and it helps the portion of the bifid wall to work as a pincer (Text-fig. 2, *p.*).

Just below this muscle there is a spherical hollow cellular structure (Text-fig. 2, *ss.*), the lumen leading into a cellular duct (Text-fig. 2, *bd.*), which ends blindly. It is difficult to assign any particular function to this structure.



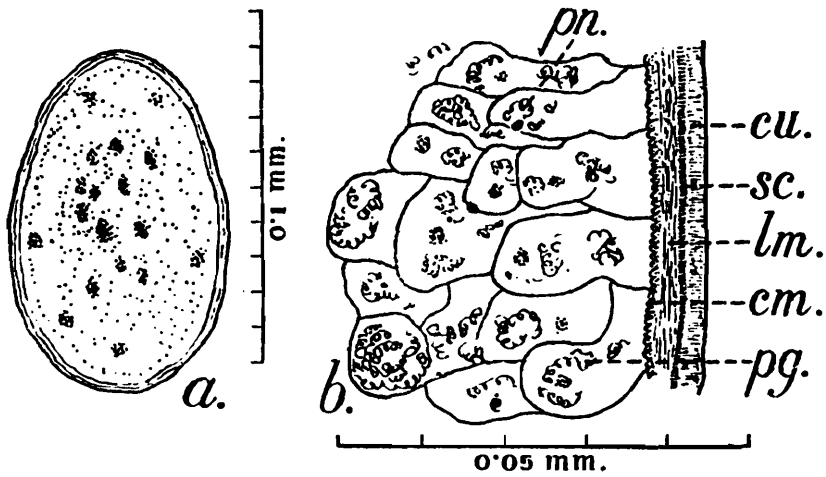
TEXT-FIG. 2.—*Apororhynchus bivolucrus*, sp. nov. Reconstruction of sagittal sections.

bd. blind duct ; *dvg.* duct of the vaginal gland ; *g.* ganglion ; *gl.* genital ligament ; *gn.* giant nuclei ; *hsm.* horse-shoe shaped muscle ; *i.in.* inner involucre ; *i.pr.* inner proboscis ; *lmn.* lemnisci ; *lvu.* lips of vulva ; *mc.* muscular connectives ; *mf.* muscle fibres ; *mm.* muscle mass ; *o.* ovary ; *o.in.* outer involucre ; *oo.* ova in the ovary ; *ov.* ova within the genital ligaments ; *p.* pincer ; *spo.* space in between the two involucres ; *spi.* space between the inner involucre and the inner proboscis ; *ss.* spherical structure ; *ut.* uterus ; *va.* vagina ; *vg.* vaginal gland ; *vu.* vulva.

The body.—The body (Text-fig. 1, *b.*) is sac-like in shape, and is markedly convex on the dorsal side, it is narrower in girth than the proboscis.

I could see faint annulations on the outer surface of the body in the living worms. The vulva is situated at the posterior end of the body and lies in a cup-like depression surrounded by the body wall.

The body wall.—The body wall is composed of a thin layer of cuticle (Text-fig. 3, *cu.*) forming the outer most layer. Inside this there is a thin layer of the fibrillar sub-cuticle (Text-fig. 3, *sc.*). Next to the sub-cuticle lies the muscular layer consisting of an outer layer of longitudinal muscle fibres (Text-fig. 3, *lm.*) and an inner layer of circular muscle fibres (Text-fig. 3, *cm.*). Parenchymatous cells (Text-fig. 3, *pn.*) laden with pigment (Text-fig. 3, *pg.*) occupy the deeper region of the body wall. The layer of the parenchyma is thicker on the dorsal side than on the ventral side. Giant nuclei (Text-fig. 2, *gn.*) measuring 0·09 mm. by 0·05 mm. are found scattered in the parenchyma. The musculature of the body wall is reinforced by strands running from the cone like inner proboscis to the body wall.



TEXT-FIG. 3.—*Apororhynchus bivolucrus*, sp. nov.

a. Mature ovum ; *b.* Longitudinal section of body wall ; *cm.* circular muscles ; *cu.* cuticle ; *lm.* longitudinal muscle ; *pg.* pigment ; *pn.* parenchyma ; *sc.* subcuticle.

The lemnisci.—The two elongated lemnisci (Text-fig. 2, *lmn.*) are fibrous. They originate from the base of the proboscis on the ventral side and run for more than half of the length of the body lying 80 μ to 100 μ apart from each other. Each measures 0·40 mm. long and 17 μ broad.

The genital organs.—The genital ligaments (Text-fig. 2, *gl.*) arise from the base of the proboscis, and diverge to enclose a saccular space within the body in which the genital organs lie. They consist of a single ovary and the eggs. The ovary (Text-fig. 2, *o.*) is a spherical structure, measuring 0·13 mm. in diameter. It lies towards the anterior end of the genital sac and is held in position by muscular connectives (Text-fig. 2, *mc.*) given off from the genital ligaments.

The mature egg (Text-fig. 2, *ov.* & Text-fig. 3, *a.*) is a typical acanthocephalan egg. It is oval in shape and measures 0·10 mm. by 0·06 mm. by 0·04 mm. It has three concentric membranes surrounding it.

The uterus (Text-fig. 2, *ut.*) is an elongated structure and lies on the dorsoposterior side between the genital space containing the eggs and the body wall. In many Acanthocephala, eggs pass into a short tube called the uterine bell and pass out into the cavity outside the bell if the eggs are not in the proper condition of maturity or pass into the uterus if they are mature. This arrangement does not obtain in this worm. The broad uterus is continuous with the posterior narrow portion which is the vaginal canal. It seems that eggs undergo maturity in the body cavity and thus pass into the bell *cum* uterus. The vaginal canal (Text-fig. 2, *va.*) is a much narrower duct than the uterus. Seen in a section, the inner wall of the vaginal canal is thrown into folds. The vagina opens out through the vulva (Text-fig. 2, *vu*), which is inclined towards the ventral side and is located in the centre of the cup like depression at the posterior end surrounded by the body wall.

The vaginal gland.—Between the posterior end of the genital sac and the uterus there is a glandular structure measuring 0·30 mm. by 0·10 mm. A small duct arises from the ventral side of this glandular structure and opens into the anterior end of the vagina. Owing to its close association with the vagina the duct is named as the vaginal duct (Text-fig. 2, *dvg.*) and the glandular structure as the vaginal gland (Text-fig. 2, *vg.*). Its function is presumably to secrete a substance and pour it in the vagina.

The nervous system.—The nervous system is composed of a large ganglion placed in the cone of the inner proboscis.

Systematic position and discussion.—The genus *Apororhynchus* is the only genus of the family Apororhynchidae. Only two species *Apororhynchus hemignathi* and *Apororhynchus aculeatus* are included in it. The peculiar morphological characters of the species have stimulated controversy regarding the exact systematic position of the family. Based on Shipley's (*op. cit.*) description of the species *Apororhynchus hemignathi*, Southwell and MacFie (1925) included the family Apororhynchidae in the Sub-order Neoechinorhynchidea, because of the presence of a subspherical proboscis and giant nuclei, both in the subcuticle and in the lemnisci. Thapar (1927) in his tentative classification of Acanthocephala erected a new order Apororhynchidea, consisting of one family, one genus and one species. He justified the creation of a new order on the ground that the form had neither hooks on the proboscis nor spines on the body, a character which makes it peculiar among Acanthocephala. Later Meyer (*op. cit.*) described a new form, in which he observed minute spines on the proboscis, but the general shape was almost the same as *Apororhynchus hemignathi.* He named the new species *Apororhynchus aculeatus.* In the classification which he proposed, Meyer reduced Thapar's Order Apororhynchidea to one of the six families in the order Archiacanthocephala, one of the two orders, he then created.

The characters of the family Apororhynchidae as given by Meyer (*op. cit.*) are as follows :—

(*a*) The proboscis is clearly globular without hooks but may have numerous spines ; (*b*) Lemnisci are long and finger like in shape ; (*c*) Absence of proboscis sheath ; (*d*) Presence of the giant nuclei both in the subcuticula and in the lemnisci.

The parasites belonging to this family are found in birds.

The characters of the form which is described in this paper conform to the characters of the family Apororhynchidae and consequently its only genus *Apororhynchus*. In shape it resembles the two known species though it is much smaller than any of them. The proboscis has no hooks. The proboscis sheath is absent. Giant nuclei are present in the body wall. The parasite was found in a bird.

Comparison with other species.—When compared with *Apororhynchus hemignathi* and *Apororhynchus aculeatus*, the only two species known, the new form is found to differ from them in many respects :

(1) It is a much smaller form than *Apororhynchus hemignathi* and *Apororhynchus aculeatus*, which measure 3·5 mm. and 4 mm. in length respectively. The new species measures only 1·4 mm. in length and 0·46 mm. in breadth in the region of the body and is 0·70 mm. broad in the region of proboscis.

(2) The body of the new species is much more curved than the other two species. In *Apororhynchus hemignathi* the body is divided into three regions : the proboscis, the collar and the trunk, whereas in *Apororhynchus aculeatus* the anterior part of the body is produced into a ridge which surrounds the base of the proboscis. In the new form there is neither the collar intervening between the proboscis and the trunk, nor the anterior region of the trunk produced into a ridge, but the proboscis is marked off from the body by means of a deep constriction, dividing the body only into two parts.

(3) The proboscis in *Apororhynchus hemignathi* has very small pits on its surface, in *Apororhynchus aculeatus*, it is split at the apex and is covered with very minute spines, but in the form under discussion the rim of the proboscis has clefts which go deep to the base dividing the proboscis into an external and an inner involucre enclosing a cone like inner proboscis.

(4) The lemnisci in *Apororhynchus aculeatus* are long, coiled and finger-like in *Apororhynchus hemignathi*, they are long and sac-like, whereas in the new form the lemnisci are fibrous.

(5) The ovary gives rise directly to eggs and not to egg masses as is found in the other two species. Besides it does not disintegrate when the worm attains full maturity, as is the case in the other two species.

(6) The uterus is very much elongated in the new form as compared with the other two species.

(7) The presence of the vaginal gland is known neither in *Apororhynchus hemignathi* nor in *Apororhynchus aculeatus*.

(8) The horse-shoe shaped muscles are also not found in the other two species.

This new species is a highly specialized form. The peculiar structure of the proboscis and the more developed musculature of the form are characters suitable for the environment in which it lives, as these parasites

are found in the intestine of a bird which feeds largely on human excrement, in which there is little of nourishment. With a well developed musculature the parasite can move in the intestine in the slow caterpillar-way of progression, and the cleavages in the proboscis increase the area of the absorptive surface to absorb maximum nourishment.

Acknowledgment.—I am greatly indebted to Dr. M. A. Moghe, Ph.D. (London), Professor of Zoology, Nagpur University, for his help and guidance at every step of my work. I am also grateful to Professor K. V. Varadpande, Head of the Biology Department, Vidarbha Mahavidyalaya, Amraoti for giving me various facilities to collect the material. Thanks are due to Dr. B. S. Chauhan, Zoological Survey of India, for helping me with certain relevant literature.

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EXPLANATION OF PLATE.

Apororhynchus bivolucrus, sp. nov.

FIG. 1.—A sagittal section of the entire specimen.

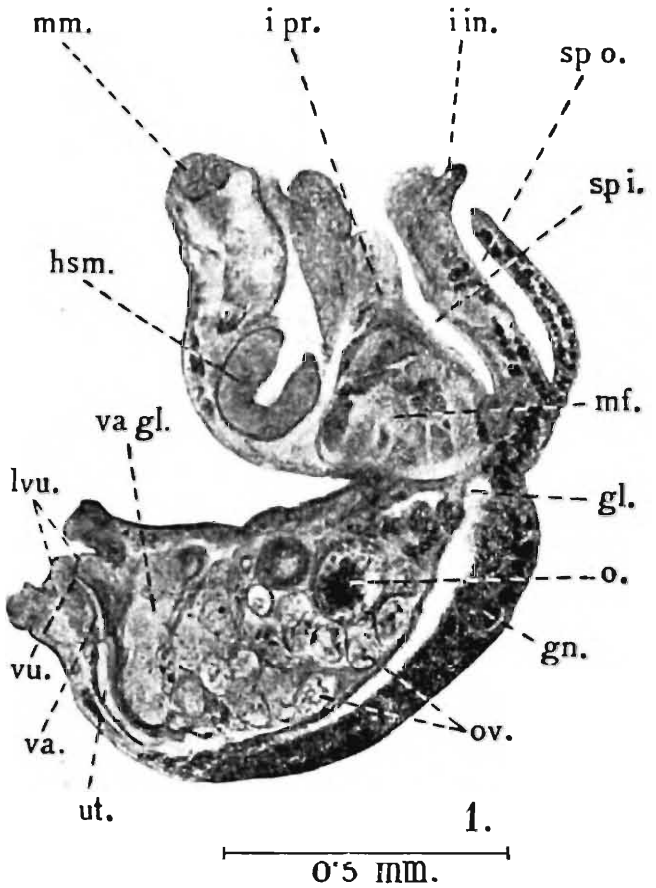
FIG. 2.—A sagittal section showing the lemnisci and the horse shoe-shaped muscle.

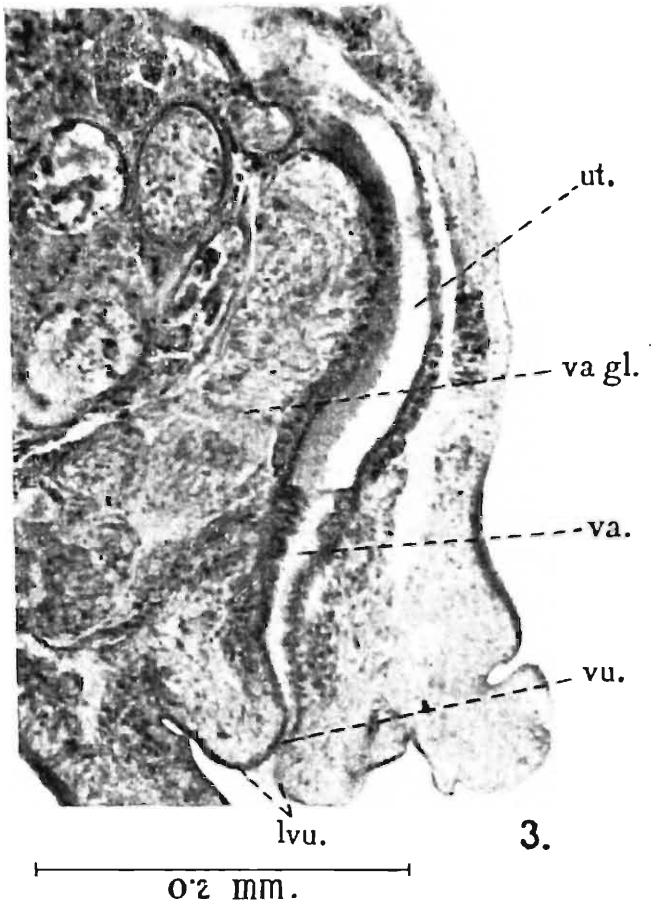
FIG. 3.—A sagittal section showing the genital duct.

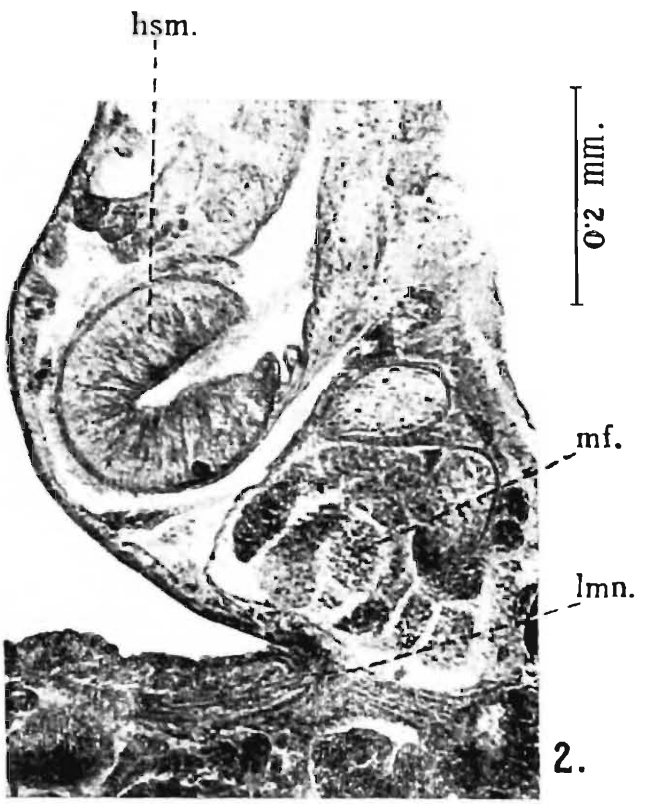
FIG. 4.—A sagittal section of the body wall showing giant nuclei.

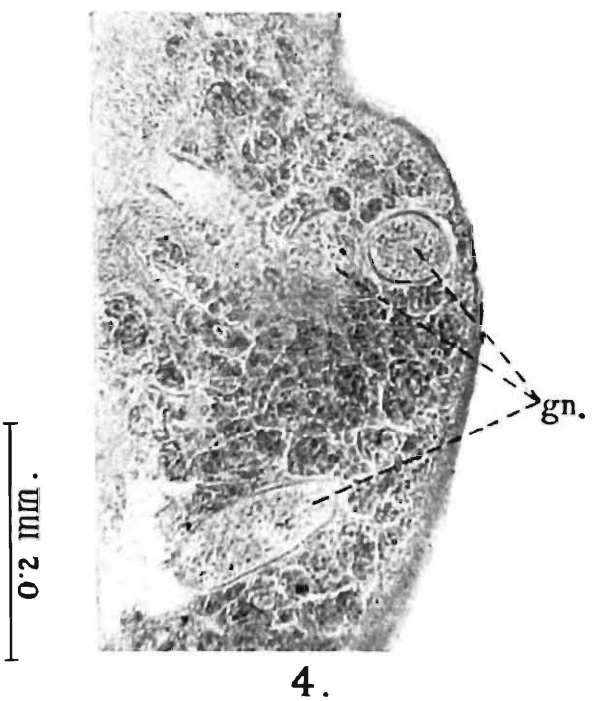
Explanation of abbreviations used in figures—

gl. genital ligament; *gn.* giant nuclei; *hsm.* horse shoe shaped muscle; *i.in.* inner involucre; *i.pr.* inner proboscis; *lmn.* lemnisci; *lvu.* lips of vulva; *mf.* muscle fibres; *mm.* muscle mass; *o.* ovary & *o. in.* outer involucre; *ov.* ova within the genital ligaments; *sp. i.* space between the inner involucre and the inner proboscis; *sp. o.* space in between the two involucres; *ut.* uterus; *va.* vagina; *va. gl.* vaginal gland; *vu.* vulva.









APORORHYNCHUS BIVOLUCRUS DAS.

TREMATODES FROM INDIAN MARINE FISHES.

PART VI.[1] MONOGENETIC PARASITES OF THE FAMILY MAZOCRAEIDAE (DICLIDOPHOROIDEA): DESCRIPTION OF A NEW SPECIES OF THE GENUS *Mazocraes* HERMANN, 1782.

By B. S. CHAUHAN, *M.Sc., Ph.D., F.Z.S., F.Z.S.I., Offg. Director, Zoological Survey of India, Calcutta.*

So far there is no record of any parasite of this family from the Indian region except that of *Mazocraeoides prashadi* by the author. Five specimens of the material dealt with in this paper were obtained by Shri G. Ramakrishna and Dr. Miss Chandy from the gills of a clupeid fish, *Dussumieria* sp., at Puri, in February 1948. On a careful examination, these specimens were found to belong to the genus *Mazocraes* (Fam. Mazocraeidae) and as they do not seem to agree with any of the known species of this genus, they are described as *M. orientalis*, sp. nov.

Family MAZOCRAEIDAE Price, 1936.

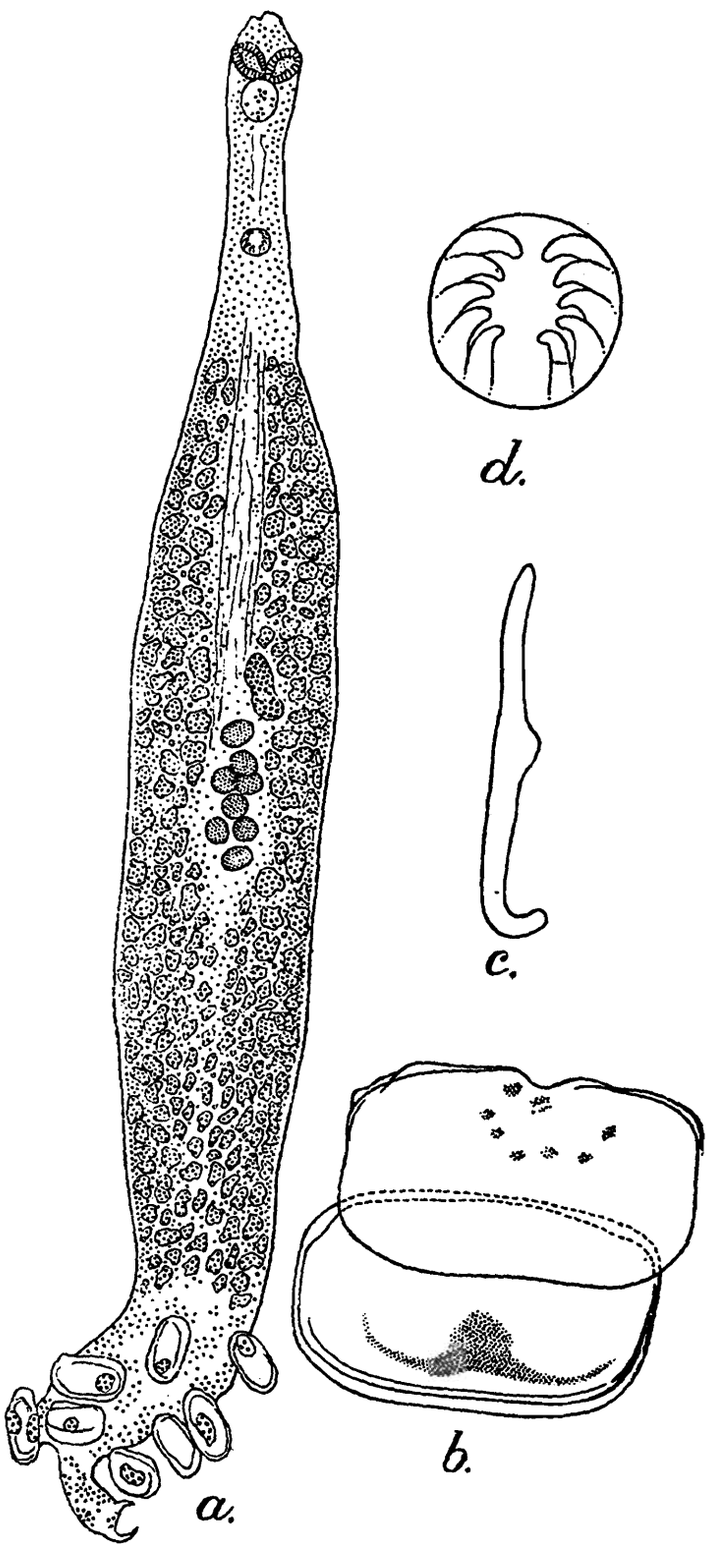
Genus **Mazocraes** Hermann, 1782.

Mazocraes orientalis, sp. nov.

Description.—Shape of body (Text-fig. 1*a*) in preserved specimens is flat, narrow and elongate, slightly tapering towards both ends. The type specimen measures 1·15 mm. in length and 0·15 mm. in maximum width which is in the region of posterior third of body. In other specimens the length varies from 0·7 mm. to 0·8 mm., breadth being nearly 0·15 mm. in all cases. Mouth is terminal, at the anterior end of body. Anterior suckers are paired, oval in shape and obliquely placed. They are lined by refractile, prismatic muscle fibres. Pharynx is round, comparatively large in size and situated just behind the anterior suckers. Prepharynx is absent. Oesophagus is thin and elongate. Intestinal caecae extend nearly up to the posterior end of the body. Posterior haptor is a somewhat triangular structure, slightly broader than the posterior end of body, but continuous with it. It carries a spatulate, terminal lappet bearing at posterior end, a pair of unequal anchors (Text-fig. 1*c*). The anchors have bifid roots and recurved tips. The haptor bears four pairs of oval clamps; symmetrically arranged in lateral rows of four on each side, on short but stout and retractile pedicels, which decrease slightly in length backwards. Clamps are of almost equal size and have pattern of framework as illustrated (Text-fig. 1*b*). Testes consist of eight oval follicles, irregularly arranged medially, in

[1] For Parts I-V see Chauhan, B. S., *Proc. Ind. Acad. Sci.* XXI, pp. 129-159 (1945); *Ibid.* XVII, pp. 97-117 (1943); *Ibid.* XVII, pp. 133-137 (1943); *Ibid.* XXV, pp. 160-173 (1945); *Ind. Journ. Helminthol.* I, pp. 63-66 (1950).

the middle third of the body, with a tendency to be in a double row. Ovary is elongate, oval, anterior to the testes and situated slightly towards the left side of the body. Vitellaria extend from the region near



TEXT-FIG. 1.—*Mazocraes orientalis*, sp. nov.

a. Entire specimen, ventral view : ×125 ; *b*. Chitinous framework of the clamp on the posterior haptor : ×693 ; *c*. One of the hooks on the terminal lappet of posterior haptor : ×693 ; *d*. Genital atrium, showing chitinous spines : ×700.

about the bifurcation of the oesophagus to almost upto the haptor. They consist of irregularly shaped but densely placed follicles. Irregularly scattered black pigment spots, particularly visible in the anterior region

and region of posterior haptor and the lappet, are observed in the body. Genital pore is oval, situated in the median line, nearly midway between the pharynx and oesophageal bifurcation. It is armed with five pairs of hooks with curved tips, arranged in two discontinuous rows (Tex-fig. 1*d*). Eggs are absent.

Discussion.—The genus *Mazocraes* Hermann contains the following valid species : *M. alosae* Hermann, 1782 (Genotype) ; *M. harengi* (van Beneden & Hesse, 1863) Nicoll, 1915 ; *M. pilchardi* (van Beneden & Hesse, 1863) Sproston, 1946. There are two *species inquirendae, viz., M. heterocotyle* (v. Ben. 1870) Sproston, 1946 and *M. cepedianum* Kimpel, 1938.

This new species is broadly distinguished from the other known species of the genus, by its pattern of framework of the clamps on haptor, shape and arrangement of genital hooks, number of terminal hooks on the posterior lappet of the haptor and structure of the lappet of haptor.

ON A NEW SPECIES OF *ZOOTHAMNIUM* STEIN (PROTOZOA : VORTICELLIDAE) FROM THE GREY MULLET, *MUGIL TADE* FORSK.

By H. KHAJURIA, *Assistant* and T. V. R. PILLAY, *I. C. I. Research Fellow, Zoological Survey of India, Calcutta.*

INTRODUCTION.

One of us, while examining a collection of Grey Mullets, *Mugil tade* Forsk., obtained from a fresh water tank at Contai (Midnapore Dist., W. Bengal) in April 1949, came across a cluster of *Zoothamnium* colonies which are described here as representing a new species. They were found attached to the scales on the latero-ventral surface of one of the specimens, a little above its vent. It may be of interest to note that this is the first record of a fully described species of *Zoothamnium* from India. Bhatia (1936) in the *Fauna of British India* does not record any species of this genus as occurring in India, while Jones and Job (1938) only report an unidentified species from the brackish water fish *Acentrogobius neilli* (Day) collected from Buckingham Canal at Madras.

The material was accidentally fixed in 5 per cent. formalin along with the fish and was later stained with Delafield haematoxylin for permanent preparations.

We have great pleasure in naming this species after Dr. S. L. Hora, Director, Zoological Survey of India, to whom we are deeply indebted for his valuable guidance and encouragement.

DESCRIPTION OF THE SPECIES.

Zoothamnium horai, SP. NOV.

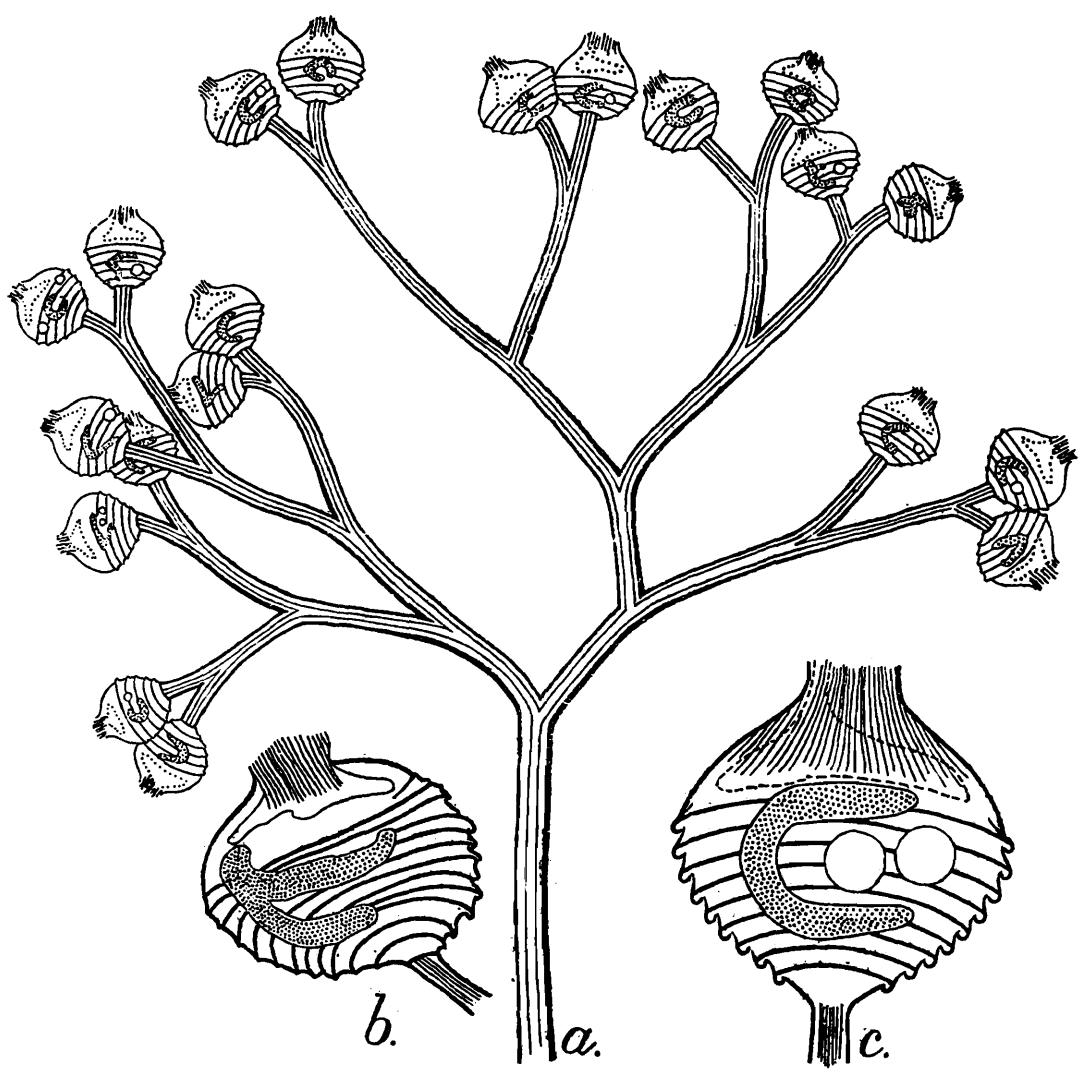
The colonies fixed in formalin are whitish in colour and are firmly attached to the scales of the fish by means of roots arising from the main stem. The main stem (pedicle) branches dichotomously and the daughter branches usually show a progressive increase in length towards the apex (text-fig. 1,*a*). As a rule, there are only two branches at a node, but one exception was met with, where there appeared to be three. The stalks of the zooids may be equal to, shorter, or longer than the zooids and thus do not bear any constant relationship with the diameter of the latter.

The zooids are all of the same shape and form, but varied considerably in size. The body-form of a zooid (text-fig. 1, *b* & *c*) is more or less globular, with the antero-posterior diameter slightly less than the diameter at right angles to it. The peristomial field is located in the middle of the anterior border and occupies about $\frac{1}{3}$ of it. A distinguishing feature of the species is the very strongly marked transverse cuticular furrows and

ridges on the posterior region of the zooids. This design is visible on about $\frac{1}{2}$ to $\frac{2}{3}$ of the body of the zooid. The anterior region appears longitudinally striated on account of the presence of the roots of the membranelle of the adoral zone. There is no reduction in the number of membranelle in this zone, as is the case in certain other species of *Zoothamnium*. The nucleus is very long and generally horse-shoe shaped, but, in some cases, was found to be variously coiled. In the preserved material the contractile vacuoles could not be distinguished from the food vacuoles.

Measurements in microns.—

Type specimen (zooid)	.. .. ..	47·7×38·6
Variations of 30 zooids	.. .. ..	Range.—36·4—72·7×31·6—63·6
		Mean—54·5×46·1



Text-fig. 1.—*Zoothamnium horai*, sp. nov.—*a*. a colony of *Z. horai* ×275 approx. (semi-diagrammatic); *b*. the type zooid×1000 (camera lucida drawing); *c*. a typical zooid ×1050 approx. (diagrammatic).

General Remarks.

The specimens, as already mentioned, were collected from a fresh water tank, where Grey Mullets are cultured in association with carps as described by Pillay (1948). Out of a total of 25 specimens of fish collected from the tank in April, 1949, only a single specimen had the

protozoan on it. They were totally absent in the fish collected from the sea and the estuary. Further collections of Mullets were made from the tank in the months of May and June, 1949, but no more specimens of the protozoan could be obtained. From this, it would appear that the association is of rare or accidental occurrence. *M. tade* is a very active fish in its natural habitats, the sea and the estuary, and have been observed to swim against strong currents. In the confined and stagnant waters of tanks, they naturally become less active, and this may probably have been responsible for the association of the protozoan with it.

The colony was seen attached to the exposed portion of the scales and had no contact with its living tissue. Apparently the animalcule could not have been harmful to the fish. It, however, derived the benefit of free locomotion and, by virtue of its position of attachment, probably was able to feed on the faecal matter of the fish as it was passed out through the vent. The *Zoothamnium* observed by Jones and Job (*op. cit.*) was found attached inside the mouth of the fish which would enable it to share the food of the fish. It will be of interest to note that in both these cases, the animalcules had attached themselves to only that part of the body of the fish, from where it can obtain food material : in one case by directly sharing its food, in the other by feeding upon its faecal matter. Since the protozoan is benefited by the association and the fish is neither benefited nor harmed, the association can be termed Synoecy (Borradaile, 1922).

AFFINITIES.

As *Z. horai* possesses zooids of similar shape and form, it belongs to the homomorphic series as distinguished from the polymorphic series, where the zooids are dissimilar. Species of the homomorphic series are easily distinguished from our new species, as none of them have zooids which in combination show the characters of a long and bent nucleus, strongly marked cuticular creases, and narrow peristomial field which are the chief characters of the species under discussion. Allied species of *Zoothamnium* described in the literature accessible to us are arranged in a key as follows :—

1.	(2) Colony unbranched, zooids arising in a cluster from the top of the main stem	*Z. simplex* Kent.
2.	(1) Colony branched	**3.**
3.	(12) Pedicle articulated or at least in the contracted condition cross-striated	**4.**
4.	(5) Pedicle articulated, not cross-striated	*Z. nutans* Cl. & L.
5.	(4) Pedicle both articulated and cross-striated, or only cross-striated	**6.**
6.	(11) Pedicle only cross-striated, not articulated	**7.**
7.	(8) Pedicle cross-striated only in the contracted condition	*Z. affine* Stein.
8.	(7) Stalk thicker and cross-striated	**9.**
9.	(10) Fresh water form. Zooid 76—90μ	*Z. d'udekemi* Kahl.
10.	(9) Marine form. Zooid 30—35μ	*Z. nanum* Kahl.
11.	(6) Pedicle both articulated and finely cross-striated	*Z. glesnicum* Cl. & L.
12.	(3) Pedicle neither cross-striated nor articulated .	**13.**

13. (22)	Nucleus much elongated and bent	**14.**
14. (17)	Zooids marked with transverse ridges and furrows	**15.**
15. (16)	Zooids in expanded condition strongly marked with transverse ridges and furrows. Zooids globular. Peristome narrow. Nucleus longer	*Z. horai*, sp. nov.
16. (15)	Zooids in expanded condition faintly cross-striated. Body funnel-shaped. Peristome broad. Nucleus smaller	*Z. adamsi* Stokes.
17. (14)	Zooids not marked with transverse ridges and furrows .	**18.**
18. (19)	Stalks much longer than the zooids	*Z. elegans* D'Udekem.
19. (18)	Stalks not longer than the zooids	**20.**
20. (21)	Nucleus smaller, transversely placed. Found on Cyclops and other Entomostracans	*Z. parasiticum* Stein.
21. (20)	Nucleus larger, with its major portion longitudinally placed. Found on *Carinogammarus*	*Z. varians* Stiller.
22. (13)	Nucleus oval or round	*Z. marinum* Mereschk.

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STUDIES ON THE CLASSIFICATION OF THE CATFISHES OF THE ORIENTAL AND PALAEARCTIC FAMILY SILURIDAE.

By JANET HAIG,

Natural History Museum, Stanford University, U. S. A.

CONTENTS.

INTRODUCTION.

The present study was undertaken in order to untangle some of the problems of classification which have beset this group. The genera have not been studied *in toto* since the days of Bleeker and Günther. In this study I have made an attempt to clarify the relationships of the various genera, which in some cases has involved revision of generic limits.

Lack of time and material has precluded a thorough analysis of the species within any genus; for the same reason no skeletal examinations were possible. It is hoped, however, that a clarification of generic limits through study of external characters will make it easier in the future for interested workers, with sufficient material at hand, to do further and much-needed work on both the genera and the species.

ACKNOWLEDGEMENTS.

For most valuable aid and guidance in this study, and the giving freely of precious time, I wish to thank Dr. George S. Myers of the Natural History Museum of Stanford University.

I should also like to express appreciation to the following men for the loan of specimens which have been of great use to me in this study: Dr. Leonard P. Schultz of the United States National Museum; Dr. William A. Gosline of the University of Michigan Museum of Zoology; and Dr. Carl L. Hubbs of the Scripps Institute of Oceanography, who called my attention to the specimens in the ichthyological collections of the University of Michigan Museum of Zoology. Mr. Leo Shapovalov of the California Division of Fish and Game was so kind as to assist me in the translation of a passage in Russian.

THE FAMILY SILURIDAE.

A.—*History of the Family.*

The catfishes as a whole (Nematognathi or Siluroidea) have been recognized as a natural group since early times. For many years all of them, with the exception of the armoured forms, were carried in the family Siluridae, named for the type genus *Silurus*.

These catfishes were variously sub-divided by Bleeker, Günther, and others, with the Siluridae (*sensu stricto*) generally recognized as a more or less homogeneous group, chiefly on the basis of external characters such as fins, barbels, and teeth. These systems of classification included some genera that are now placed in other families.

Regan (1911) was the first to separate the Old World catfish groups on the basis of thorough osteological study, although Eigenmann and Eigenmann (1890) had already done this for the South American forms. Regan gave family rank to the groups which most authors had previously called subfamilies. The name Siluridae was restricted by him to the natural group which includes *Silurus*, the type genus, and its close relatives.

The most important regional treatments of the family as a whole (none of them covering all known genera) are those of Bleeker (1858 and 1862a), Day (1878-88), Weber and Beaufort (1913), and Smith (1945). In addition, Günther (1864) reviewed all the genera known at that time, but his system has since undergone considerable revision.

B.—*Characterization of the Family.*

The Siluridae may be readily distinguished from other Old World catfishes by the following characters. The body is naked, elongate, and compressed. The head is depressed except in one genus, and covered with skin. There are 9 to 20 branchiostegal rays. The gill membranes are more or less overlapping, free from each other and from the isthmus. One pair of maxillary barbels is present, and usually one or two pairs of mandibular barbels. There are depressible teeth in both jaws and on the vomer, and often on the palatines in one genus. The dorsal fin is very short, spineless, with 1 to 7 rays, or may be entirely lacking; its

position is characteristically anterior, usually over the ventrals. The ventral fins have 6 to 14 rays. The pectorals have a spine, articulated for about half its length, and 8 to 22 rays. The anal is very long, extending from just posterior to the anal opening to the caudal or confluent with it, and is of about 48 to 110 rays. There is no adipose fin. The lateral line is straight, extending from just behind the operculum to the caudal base, and has short ventral branches, dendritic or not, but no dorsal branches. The anterior pair of nostrils is tubular ; the posterior pair is valved.

The following internal characters are given by Regan (1911, p. 560) :—

" Palatine short and broad, articulating with an antero-lateral facet of the lateral ethmoid ; pterygoid absent ; mesopterygoid small, connecting the large metapterygoid with the vomer ; hyomandibular with a broad head, articulating with pterotic and sphenotic. Lateral ethmoid with a projection for the attachment of the preorbital and with a slender posterior extension which meets a similar forward extension of the sphenotic, so that the frontal has no free edge. Post-temporal absent ; upper limb of supra cleithrum wedged between pterotic and epiotic, lower running to basioccipital ; mesocoracoid present ; hypocoracoids tapering forward below, not forming a symphysis. Vertebrae 52 to 75 (10—16+41—56) ; ribs attached to long parapophyses ; sixth vertebra free ; anterior and posterior rami of parapophysis of fourth vertebrae connected at the base only, the anterior stout, firmly attached to the limb of supracleithrum ; air-bladder free, usually large ".

According to Regan (1911, p. 556) the Siluridae have osteological characters in common with the marine faimly Plotosidae, to which they are perhaps related. They bear a superficial resemblance to the Schilbeidae, but apparently are structurally quite different.

C.—*Distribution.*

The family is confined to fresh water and is chiefly Asiatic in distribution. The species range from Eastern Siberia and the Amur Basin through Japan, Korea, and China south into the Malay Peninsula and eastward in the East Indes to Palawan, the Calamianes Group, Borneo, and Java. Westward the family ranges throughout Siam, Burma, and India to Asia Minor. There are only two European species, *Silurus aristotelis* (Agassiz) in Greece and *S. glanis* Limnuss, which ranges over a large part of Europe and eastward to the Aral Basin, the Amu-darja- and the Issyk-kul regions. The family does not occur in Africa or in the Central Asiatic Plateau.

D.—*Diagnostic Key to the Genera.*

In the course of this study several modifications in generic concepts have proved to be necessary, which will be discussed in detail under the various genera. Six currently recognized genera have been placed in synonymy. Nine genera altogether are recognized, comprising about 50 species.[1] Diagnoses are based chiefly on my study of specimens, supplemented by the published accounts of Bleeker, Vaillant, Weber and Beaufort, Herre, and Fowler. With the exception of *Hemisilurus*, representatives of all the genera were available to me for study.

1a. Mouth inferior ; gape wide but very short ; supralabial fold extending below eye and at a considerable distance from it ; snout truncated, with the anterior nostrils terminal and set close together ; posterior nostrils either just above and just anterior to eye or above and far behind eye ; anal fin very long, with 90 or more rays ; dorsal fin absent in known forms.

[1] No attempt has been made here to work out the speciation exactly.

2a. Posterior nostrils above and completely behind eye ; supralabial fold extending to behind middle of eye ; maxillary barbels not osseous and hooked, but sometimes flattened distally into a membrane fringed along one side; anal rays 90—95. .. .. 1. *Hemisilurus.*

2b. Posterior nostrils above and just anterior to eye ; supralabial fold barely to below middle of eye ; maxillary barbels short, heavy, osseous, and hooked ; anal rays 103—110 .. .. 2. *Ceratoglanis.*

1b. Mouth terminal, the lower jaw projecting to slightly shorter than upper ; supralabial fold, if extending below eye, very close to it ; snout not abruptly truncate ; anterior nostrils not terminal ; posterior nostrils never behind eye ; anal fin with 95 or fewer rays.

3a. Teeth large, arrow-shaped, wide-set, in regular rows ; head permanently upturned at an angle of 60° or more from horizontal, the snout-tip above the dorsal contour of the fish ; head and thorax at pectorals triangular in cross-section, flat below ; cross-section of head sharply angular on median line above ; pectoral fin base very long, at least 10 per cent. of standard length, the ray-bases widely spaced ; length of pectoral fin more than 25 per cent of standard length. . 3. *Belodontichthys.*

3b. Teeth conical, small, never arrow-shaped or especially wide-set ; head never normally upturned ; head flat above, neither head nor thorax triangular in cross-section ; pectoral fin base short, 7 per cent. or less of standard length, the ray-bases closely approximated ; length of pectoral fin 20 per cent. or less of standard length.

4a. Rays of anal fin excessively long, those at middle of the fin as long or longer than the distance from their bases to the dorsal contour of the fish, the rays covered for more than half their length by integument and muscles ; anal completely confluent with caudal ; head very short, 6 or more in standard length ; gillrakers rudimentary, reduced to knobs, few in number, and set very far apart. .. 4. *Silurichthys.*

4b. Rays of anal fin much shorter, those at middle of fin not as long as the distance from their bases to the dorsal contour of the fish ; anal free from caudal or narrowly connected with it, but the two never completely confluent ; head usually longer, 6½ or less in standard length ; gillrakers long or short, but never all reduced to knobs, few or many in number.

5a. Caudal fin rounded, truncate, or weakly emarginate medially with very bluntly rounded lobes ; maxillary barbels heavy, flattened ; body compressed but robust anteriorly ; anal rays covered by integument for more than half their length ; pectoral spine stout, the fin not surpassing origin of the anal ; gape horizontal to somewhat oblique. .. .. 5. *Silurus.*

5b. Caudal fin plainly forked, or deeply emarginate with pointed lobes ; maxillary barbels slender.

6a. Eye with a free orbital rim, above level of the corner of the mouth and not visible from underside of head ; gape oblique, wide and very long, reaching to or beyond anterior border of eye ; dorsal with 5 rays ; pectorals not reaching beyond origin of anal. .. .. 6. *Wallago.*

6b. Eye subcutaneous, opposite corner of mouth or ventral border on a level with it, usually not visible from underside of head ; gape not surpassing anterior border of eye ; dorsal with 1—4 rays or none.

7a. 3 or 4 dorsal rays ; gillrakers 15 or less on long limb of gill arch, shorter than the branchial filaments ; gape straight to sharply oblique ; eye opposite corner of mouth or its ventral border on a level with it.

8a. Gape horizontal, rather long but not reaching anterior border of eye ; jaws equal or lower slightly shorter ; eye opposite corner of mouth, a small portion visible from underside of head ; teeth often present on palatines ; pectoral fin short and broad, not surpassing origin of anal, its spine strongly pectinate on inner margin .. .. 7. *Hito.*

8b. Gape sharply oblique, not surpassing anterior border of eye ; jaws equal or lower prominent ; ventral border of eye on level with corner of mouth, or lower, and usually visible from underside of head ; teeth never present on palatines ; pectoral fin usually surpassing origin of anal, its spine pectinate or smooth.. 8. *Ompok.*

7b. 1 or 2 dorsal rays or none, the rays, if present, very short ; gillrakers 15 or more on long limb of gill arch, long, curved, and slender, usually as long as the branchial filaments ; gape straight to somewhat oblique, very short, not reaching the anterior border of the eye ; eye large, oppoiste corner of mouth and visible from underside of head .. .. 9. *Kryptopterus.*

While the genera are quite distinct from one another and for the most part distinguishable at a glance, still it is hard to express their differences in key form without some use of artificial characters. This is especially true with the genera *Silurus*, *Hito*, *Ompok*, and *Kryptopterus*. A thorough osteological study would probably reveal other distinguishing characters of a less artificial nature.

A TENTATIVE REVIEW OF THE GENERA OF SILURIDAE.

1. Genus **Hemisilurus** Bleeker.

Body strongly compressed; head depressed, with truncated snout. Mouth inferior, transverse, gape wide but very short; supralabial fold extending beyond middle of eye and at a considerable distance from it. Anterior nostrils close together, tubular, in front of the truncated snout. Posterior nostrils above and completely behind the posterior border of the eye. Eyes subcutaneous, above and behind corner of the mouth, not visible from underside of head. Maxillary barbels flexible, rather short, in females sometimes longer and flattened distally into a membrane which is fringed along one side. One pair of mandibular barbels, very small. Teeth in jaws short, in broad bands. Vomerine teeth in two patches. No teeth on palatines. Gillrakers 10-12 on the long limb of the gill arch. Anal free from caudal, which is deeply forked, the two lobes about equal. Dorsal fin entirely lacking. P. I, 15-I, 17; V. 8-9; A. 90-95; B. 10-12.

This genus, with the possible exception of *Ceratoglanis*, is probably the most highly specialized of all the silurid genera, and it is unfortunate that no specimen of it was available for this study. Particularly specialised characters include the position of the posterior nostrils; total lack of a dorsal fin; rudimentary mandibular barbels; inferior mouth; truncated snout; and a certain amount of sexual dimorphism, as exhibited in at least one species (*H. moolenburghi* Weber and Beaufort) in which the maxillary barbels of the female are modified.

Three species now fall within the scope of the genus: *H. chaperi* (Vaillant), Borneo; *H. heterorhynchus* (Bleeker), Sumatra and Borneo; and *H. moolenburghi* Weber and Beufort, Sumatra and Borneo.

Bleeker (1853a, p. 514)described a new species, *Wallago heterorhynchus*, from Sumatra. In 1858 (p. 295) he erected the genus *Hemisilurus*, to include those forms having the vomerine teeth in two separate patches, and no dorsal fin or mandibular barbels.* He included *H. heterorhynchus* and *H. schilbeides* (the latter now carried in *Kryptopterus*) in this genus.

In his *Atlas* (1862a) Bleeker gave another diagnosis of the genus and species. To the two species already included in the genus he added a third, *H. scleronema* (now placed in *Ceratoglanis*). The latter species was again described as new in another paper of the same year (1862b, p. 74), but the *Atlas* was apparently published first.

Günther (*loc. cit.*, p. 41) removed *H. schilbeides* Bleeker from the genus, transferring it to *Kryptopterus*.

*Forms which he included do often have mandibular barbels, which Bleeker failed to notice.

Vaillant (1891, p. 182) described a new genus and species, *Diastatomycter chaperi*, from Borneo. He gave only a brief diagnosis, but remarked on the singular position of the posterior nostrils, far behind the eye, and that aside from this character his species seemed to be closed to *Hemisilurus scleronema* Bleeker. In 1893 Vaillant (pp. 60-61) again gave a diagnosis of his new genus and species. He said that it was like *Hem-i silurus scleronema*, according to Bleeker's description and plate in his *Atlas*, but differed in having mandibular barbels, and in the position of the posterior nostrils. The illustration in the *Atlas* of *H. scleronema* shows the posterior nostrils directly behind the anterior ones, separated from them only by the maxillary barbels. Vaillant suggested that Bleeker's type should be re-examined to see if his description and plate were accurate in regard to the mandibular barbels and nostrils.

In the same year, Vaillant (1893a, pp. 66-71) gave a long and thorough description of *Diastatomycter chaperi*. He remarked that he had definitely established that the type of *Hemisilurus heterorhynchus* (Bleeker) also had the posterior nostrils behind the eye; he commented on the fact that Bleeker never mentioned this character, and that the nostril was not drawn at all in the figure† in his *Atlas*. On this basis Vaillant said that *H. heterorhynchus* should be transferred to the genus *Diastatomycter*, leaving *H. scleronema* alone in *Hemisilurus*. However, before taking this step he wanted to make sure of the accuracy of Bleeker's drawing of *H. scleronema*; and if the posterior nostrils did turn out to be behind the eye, all three species should be in *Hemisilurus*, this name having priority.

Vaillant (1902, pp. 50-51) again brought up this problem. He had acquired one specimen each of *H. heterorhynchus* and *H. scleronema* from Borneo, and had examined the types of all three species in question. He pointed out that the character of the posterior nostrils in *H. heterorhynchus* was a means of separating it from *H. scleronema*. He had definitely established the fact that the position of the nostrils in the latter species was not as shown in Bleeker's figure, but instead was much further back, above the front border of the eye. Vaillant tentatively returned the species to the genus *Hemisilurus*, remarking that he did not wish to make systematic changes at that time on the basis of the posterior nostrils, but suggesting that other workers should study this problem.

Weber and Beaufort (1913, p. 210) somewhat expanded the diagnosis of *Hemisilurus*, to allow for the presence of mandibular barbels, which are generally present but minute. Besides *H. scleronema*, *H. chaperi*, and *H. heterorhynchus*, they included a new species, *H. moolenburghi*, from Sumatra. In the female of this form the maxillary barbels are modified, distally flattened with one border split into long threads. Probably studies of large series of each of the species should be made eventually to see whether this condition occurs in other species than *H. moolenburghi*.

Myers (1938, p. 98) took the step of removing *H. scleronema* to its own genus, *Ceratoglanis*, leaving but three species in *Hemisilurus* to date.

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†It might be added that, from this figure, one would never recognize the fish's resemblance to *Diastatomycter chaperi* Vaillant or to *Hemisilurus scleronema* Bleeker.

2. Genus **Ceratoglanis** Myers.

Body strongly compressed; head depressed, with truncated snout Mouth inferior, transverse, gape wide but very short; supralabial fold extending to below middle of eye and distant from it. Anterior nostrils close together, in front of the truncated snout, in short tubes which are directed forward. Posterior nostrils barely valved, above the anterior border of the eye. Eyes subcutaneous, above and behind corner of mouth, not visible from underside of head. Maxillary barbels short, hooked, and bony, originating immediately posterior to the anterior pair of nostrils. One pair of mandibular barbels, minute. Teeth in jaws very small, in broad bands. Vomerine teeth in two small rounded patches. No teeth on palatines. Gillrakers short, stiff, and wideset, about 10 on the long limb of the gill arch. Anal free from caudal, which is deeply forked. Pectoral spine smooth. Dorsal fin entirely lacking.

P. I, 15-I, 16; V. 8; A. 103-110; B. 10-11.

In 1938 (p. 98) Myers took the step, previously suggested by Vaillant, of erecting a genus for *H. scleronema*, which differs from the other members of *Hemisilurus* in the position of the posterior nostrils and the structure of the maxillary barbels. It also has a greater number of anal rays the largest number for any member of the family.

The single species of *Ceratoglanis* is known from Sumatra, Java, and Borneo; Smith (1931, p. 181) reported one specimen from Siam.

I have examined the specimen in the U. S. National Museum, from Mandan River, Siak, Sumatra, which was mentioned by Myers (1938, p. 98). It agrees with the published descriptions of the species, except for the possession of 110 rays in the anal fin; no published accounts I found gave the number as over 105.

Bleeker, in describing *Hemisilurus scleronema* (1862a) noted the unusual hooked barbels and separated the species from *H. heterorhynchus* on this basis, but, as Vaillant (1902) commented, he failed to note the most striking difference between the two, that of the position of the posterior nostrils.

Perhaps the confusion surrounding this character, and its being so often overlooked or wrongly figured, is due to the fact that in *Ceratoglanis scleronema* and in the three species of *Hemisilurus* there are numerous mucus ducts on the mandible, which could easily be confused with the barely-valved posterior nostrils, if they were not examined carefully.

3. Genus **Belodontichthys** Bleeker.

Body strongly compressed. Head compressed, keeled, depressed only at tip of snout; head and thorax triangular in cross-section, flat below. Head permanently upturned. Gape long, at an angle of about 60-80° from horizontal. Anterior nostrils wide-set, in long tubes; posterior pair valved. Eyes sub-cutaneous, morphologically above corner of mouth, but actually low-set, just posterior to the cornner, not visible from underside of head. Maxillary barbels short, extending to ventrals or a little farther. Two mandibular barbels, shorter than eye. Teeth in jaws large, arrow-shaped, and wide-set, in three regular rows

in each jaw, those of the outer row shorter and set at a different level outside the mouth. Vomerine teeth very small, in two small patches. No teeth on palatines. Gillrakers short, stiff, elongate-conical, rather widely spaced, about 30 on long limb of gill arch. Anal free from caudal, which is deeply forked, the upper lobe the longer. Dorsal fin very short, about once in eye. Pectoral fin long, extending well into anal, about $\frac{1}{3}$-$\frac{1}{4}$ of standard length, as compared with $\frac{1}{6}$ or less in other genera; its spine not toothed. Base of pectoral very long, supported by strong muscles, about 10 per cent. of standard length (7 per cent. or less in other genera).

D. 4 ; P. I., 18-I, 22 ; V. 9-10 ; A. 85-96 ; B. 13-15.

Bleeker (1851b, p. 202) described a new fish from Borneo, *Wallago dinema*. The name *Wallago* was used for the first time in this paper (p. 198) for this fish and one other, *Wallago müllleri*, but no generic diagonosis was given. The species *Wallago dinema* was described in no great detail, yet enough to identify the fish with certainty ; for example, Bleeker mentioned the arrowed teeth and the long pectoral fins, although he erroneously described the head as being depressed.

Bleeker used the name *Wallago* in a loose sense for several Siluroid fishes until his first revision of the catfish groups in 1858, when he restricted it to two species, *W. russellii* and *W. leerii*, and placed his *W. dinema* in a new genus, *Belodontichthys*. He gave a longer and more thorough description of the fish, including the character of the keeled head, and extended its range to Sumatra. He made one change, however, which was a violation of the rules of nomenclature ; he renamed the species *B. macrochir*, making *Wallago dinema* a synonym of it. He apparently preferred the new name because it was more descriptive of the unusual pectoral fins ; nevertheless, under the International Rules of Zoological Nomenclature, this name cannot be allowed to stand. Weber and Beaufort (1913, p. 204) returned to the original and correct specific name, *dinema*, making *macrochir* a synonym of it.

Bleeker (1862, p. 394) named *B. macrochir* as the genotype of *Belo dontichthys*. In his *Atlas* (1862a, p. 80) he gave another comprehensive diagnosis of the genus and species. The accompanying illustration is very poor, not agreeing well with either Bleeker's descriptions or with the actual appearance of the fish.

Hora (1936, pp. 207-8), in a discussion of *Wallago* as a generic name, pointed out that the name *Wallago* was first used in connection with the description of *W. dinema* Bleeker (1851b, p. 202), though the genus itself was not diagnosed, and that, in accordance with strict interpretation of the International Rules of Zoological Nomenclature, the name *Wallago* should be used in place of *Belodontichthys* and a new name proposed for *Wallago attu* and other species included in *Wallago* with it. For the time being, however, Hora preferred to retain the name *Wallago* for the fishes currently so called.

Myers (1938, p. 98) again raised this question of nomenclature, concluded that the generic name *Wallago* properly belonged with *Belo dontichthys dinema*, and proposed the new genus *Wallagonia*, with *Wallago*

leerii as the genotype, for fishes previously carried in *Wallago*. Subsequent authors such as Smith (1945) concurred in this view of the problem.

More recently, however, Myers examined Bleeker's paper (1851b), which had not been available to him before and the information contained in which he had obtained from Weber and Beaufort's index to Bleeker's papers (*Fishes of the Indo-Australian Archipelago, Volume I*). It turned out that the first use of the generic name *Wallago* was not on p. 202 of this paper, as Weber and Beaufort's index had indicated, but rather on p. 198, where *Wallago* was used in connection with two species, *W. mülleri* as well as *W. dinema* (see above, p. 12). In a later note (1948, pp. 19-20) Myers remarked on this fact and that, contrary to the views expressed by him in 1938, *dinema* could not be accepted as the monotype of *Wallago*, since two species were associated with the generic name upon its first appearance. Bleeker (1862, p. 394) designated *W. attu* as the genotype of *Wallago*, and *Belodontichthys* must stand as the generic name for *dinema*. Apparently Hora (1936) also drew his conclusions from Weber and Beaufort's index thereby falling into the same error as Myers.

Belodontichthys dinema (Bleeker) is a common and well-known fish in regions where it occurs, notably Borneo, Sumatra, Siam, and the Malay Peninsula. Its large pectoral fins, large mouth, and long, sharp teeth make it ideally adapted for rapid swimming and voracious feeding.

Belodontichthys javanensis from Java, described by Hardenberg (1938, p. 311), cannot belong to this genus, judging from the description, and probably should enter the genus *Ompok* (see p. 36).

4. Genus **Silurichthys** Bleeker.

Body compressed. Head depressed, very short, $6\frac{1}{2}$-$7\frac{1}{2}$ in standard length. Mouth horizontal or very slightly oblique; gape very short, but reaching to or beyond anterior border of eye; upper jaw slightly longer. Anterior nostrils tubular, wideset. Posterior nostrils valved, before anterior border of eye. Eyes subcutaneous, well above corner of the mouth, and very small, 5-8 in head length. Maxillary barbels rather heavy, reaching about to middle of anal. Mandibular barbels longer than head, sometimes reaching origin of anal or beyond. Teeth in jaws short, in broad bands. Vomerine teeth usually in a single rounded patch, sometimes in two slightly separated patches. No teeth on palatines. Gillrakers rudimentary, sometimes consisting only of small knobs, set very far apart, not more than about 5 on the long limb of the gill arch. Anal completely confluent with caudal, which is obliquely emarginate, the upper lobe longer. Rays of anal excessively long, those at middle of the fin as long as or longer than the distance from their bases to the dorsal contour of the fish, the rays covered for more than half their length by integument and muscles.

D. 4; PI, 8-1, 11; V. 6-7; A. 48-67; B. 9.

Silurichthys is a distinct and well-defined genus, the diagnostic characters of which make it easily recognizable.

However, the status of the various species is by no means clear. Bleeker (1851c, p. 428) described *Silurus phaiosoma*, transferring it in 1858 (p. 269) to his new genus *Silurichthys*. Among other characters, S. *phaiosoma*, from Borneo, Biliton, and Banka, was stated as being brown in colour, with caudal fin 4-4⅔ in body length, and dorsal and ventral fins opposite. At the same time (1858, p. 270) Bleeker described another species, *Silurichthys hasseltii*, from Java, a mottled form with a shorter caudal fin (6 in body length). In his key (p. 269) it was stated that in both these forms the dorsal and ventral fins are opposite, and the two were differentiated on the basis of their colour, and the fact that in *S. phaiosoma* the caudal fin is somewhat forked, while in *S. hasseltii* it is not.

At the time this description was written, Bleeker had not seen a specimen of *S. hasseltii*, basing his description on a figure by Hasselt. In his *Atlas* (1862a, p. 81) he again diagnosed his two species and, having meanwhile seen the type of *S. hasseltii*, corrected his description for this form. *S. phaiosoma* was now described as having dorsal and ventral fins opposite, and being of a uniform dark brown ; *S. hasseltii* as having the dorsal in advance of the ventrals, and being mottled. Bleeker's coloured plates in the *Atlas* confirm this, if they can be considered accurate. *S. hasseltii* has also been described in 1858 as having the depth 7⅓ in the length ; in the later paper this was corrected to 6½ in the length.

Vaillant (189a, p. 63) recorded *S. hasseltii* Bleeker from Borneo. He expressed the opinion that the two species of *Silurichthys* should be united, and that skin colour and position of dorsal fin were of insufficient importance to justify their separation.

Volz (1904, p. 263) described *Silurichthys schneideri* from Sumatra, which is close to *S. phaiosoma* (Bleeker) except that there is a greater number of anal rays ; the colour was not given, but was presumably dark brown. The gape of the mouth was described as reaching the front border of the eye.

Weber and Beaufort (1913, p. 198), putting *S. schneideri* Volz with the doubtful species, remarked that it was like *S. phaiosoma* (Bleeker) except for the different number of anal rays, and the fact that the gape of the mouth reached the front border of the eye and not the middle. Bleeker had not mentioned the extent of the gape in *S. phaiosoma*, but his figure in the *Atlas* certainly does not show it reaching much beyond the front border of the eye. Weber and Beaufort's figure (p. 77) shows the gape reaching much farther.

Hora and Gupta (1941, p. 16), after an examination of specimens, thought that the differences in gape and anal count held good, but that *S. schneideri* should be considered a distinct species. Their figure of *S. schneideri*, however, shows a gape no shorter than does Bleeker's figure of *S. phaiosoma*. They extended the range of *S. schneideri* to the Malay Peninsula (Perak).

Silurichthys indragiriensis, also described by Volz (1904, p. 464), would seem to resemble *S. hasseltii* Bleeker except for a fewer number of anal rays and a stouter body (depth 5 in length instead of 6½). It was described as being mottled. Weber and Baufort (1912, p. 534), in

reporting *S. phaiosoma* for the first time from Sumatra, commented that *S. indragiriensis* Volz may be identical with *S. phaisomoa* (Bleeker). They said that the two species did not seem to differ much, but they made no comparison of the colour character of the two. In 1913 (p. 199) they placed *S. indragiriensis* as a doubtful species.

Weber and Beaufort (1913, p. 197) reported *S. phaiosoma* for the first time from " Malacca," including a figure which showed an exceptionally long caudal fin but which otherwise agreed with Bleeker's description. The gape is longer than that shown in Bleeker's figure in the *Atlas.*

Smith (1933, p. 77) reported the first record of *S. phaiosoma* from Siam. It is a question just what form he had when he made this report. His 1945 publication (p. 334) gave a description which is in accordance with Bleeker's. Smith's accompanying figure, however, is clearly of an example of *S. hasseltii* or *S. indragiriensis*, with mottled body and dorsal fin in advance of the ventals. I examined no specimens of *Silurichthys* from Siam, so just what forms do occur in that region is not clear to me.

Fowler (1934, p. 87) listed *S. phaiosoma* among species from Siam, but gave no description which would support the indentification.

Fowler (1939, p. 56) described *S. leucopodus* from Trang, Siam. It is apparently colse to *S. schneideri* Volz, differing manily in having the dorsal in advance of the ventrals, and in its white ventral fins and white-bordered pectorals, and rounded caudal fin.

From the literature available to me, the following general conclusions can be drawn as to the distinguishing characters of the various named species :

	phaiosoma	*hasseltii*	*schneideri*	*indragiriensis*	*leucopodus*
Described	Blkr. 1851c Blkr. 1858 Blkr. 1862a	Blkr. 1858 Blkr. 1862a	Volz 1904	Volz 1904	Fow. 1939
Colour	Uniform dark brown, fins darker	Mottled	Apparently dark brown	Mottled	Uniform dark brown ; white V and P borders
Relationship D- V	Opposite	D. forward	Opposite	D. forward	D. forward
Depth in body length	6-6½	6½	6½	5	6
Caudal	4-4⅔ in body l. (Blkr.) 2½ in body l. (W & B) Not deeply emarginate	5-6 in body l. Oblique to emarginate	L. somewhat greater than body depth Oblique to emarginate	?	42/5 body l. Rounded.

Anal rays	53-58	58	64	49	67
Corner mouth	?	?	To front of eye	To mid. of eye	To front of eye
Range	Banka Biliton Borneo Sumatra Malay Siam?	Java Borneo Malay?	Sumatra Malay (Perak)	Sumatra	Siam

The question remains just which of these characters are valid.

Colouration.—Great intraspecific colour variation exists among fishes. On the other hand, with these forms, the rule seems to be either definitely solid brown or distinctly mottled. It might be of value to know wehther the mottled forms habitually live in shaded forest streams, and the solidly coloured ones in more open water.

The colouration of the fins seems to be more variable, so whether the presence of white ventrals in the case of *S. leucopodus* has any particular significance is doubtful.

Relationship of dorsal to ventral.—In the opinion of Hora and Gupta (*op. cit.*), this character seems to hold in at least one case; the earlier writers expressed their doubts about it.

Depth in body length.—This undoubtedly varies with age of the fish and other factors. The depth of 42 mottled specimens from Johore and Singapore which I examined varies from about 5½ to 6½ times in body length.

Caudal.—Undoubtedly the length and the degree of emargination will vary with individuals. As for Fowler's *S. leucopodus* with a rounded caudal, only one specimen being known, this condition might be natural or might equally well be due to an injury of the fin.

Anal rays.—Most recorded counts seem to fall within a range of 53-58. *S. indragiriensis* is reported to have 49; I have at least five specimens of *Silurichthys* with a count of 48 or 49, in a series ranging from that up to 57. *S. schneideri* and *S. leucopodus* have counts of 64 and 76, respectively, in Volz's and Fowler's descriptions. Hora and Gupta gave no counts for their specimens of *S. schneideri*, but said they agreed with Volz. Further collections may reveal counts ranging between 58 and 64; within a species all through the family I have found considerable variation in this respect. On the other hand there may be a distinct break between the ray counts in these forms.

Gape.—Over this character there seems to be a considerable amount of confusion and uncertainty. According to Hora and Gupta, it holds in defining and separating *S. schneideri* (gape to front border of eye) from *S.*

phaiosoma (gape to middle of eye). However, as mentioned above, there is nothing in Bleeker's description to indicate the extent of the gape in the latter species, while his plate shows it no longer than does Hora and Gupta's plate of *S. schneideri*. In any case, it would seem that the difference would not be much, since *Silurichthys* has such a small eye set so far forward in the head. The series of mottled specimens I examined, 42 individuals from Singapore and Johore, showed variation in this respect, although other characters such as the forward dorsals held good throughout. It seems to me that the validity of the length of the gape as a character for separating species in this genus is doubtful. At any rate there is much confusion as to its use.

Disregarding this, and setting up the other characters in the form of a key, the species work out as follows :

1a. Body mottled ; dorsal in advance of ventrals	
2a. Depth 6½ in body length ; anal ray 58	*S. hasseltii* Blkr.
2b. Depth 5 in body length ; anal rays 49	*S. indragiriensis* Volz.
1b. Body solid dark brown.	
3a. Dorsal opposite ventrals.	
4a. Anal rays 53-58	*S. phaiosoma* (Blkr.)
4b. Anal rays 64	*S. schneideri* Volz.
3b. Dorsal in advance of ventrals ; anal rays 67; caudal rounded	*S. leucopodus* Fowler.

In my series of mottled specimens, the character of dorsal in advance of ventrals held throughout, although the difference was not great. The depth varied from about 5½ to 6½ in body length, and the anal count was a spread of 48-57. The length of the caudal fin varied somewhat with individuals, as did the degree of emargination. If the colour character turns out to be sound, I think it very probable that *S. hasseltii* and *S. indragiriensis* are identical, and the latter name must then be reduced to synonymy.

It is the belief of Hora and Gupta (*op. cit.*) that *S. phaiosoma* and *S. shneideri* are distinct. This conclusion will be borne out if there turns out not to be a range of anal ray counts between those given for the two species. *S. leucopodus* may be an aberrant example of *S. schenideri*, but if the position of the dorsal holds as a good specific character, it is probably distinct also. The taking of further specimens of *S. leucopodus* may answer this question one way or the other.

One dark brown specimen available to me for examination, appareantly a typical *S. phaiosoma*, had an excessively long caudal fin like that figured in Weber and Beaufort (1913).

5. Genus **Silurus** Linnaeus.

Body compressed ; head broad, depressed. Mouth horizontal or somewhat oblique ; gape long and wide, sometimes surpassing hindborder of eye. Jaws equal, or one jaw or the other longer. Anterior nostrils tubular, wideset ; posterior nostrils before anterior border of eye. Eyes subcutaneous or with a free orbital rim, above corner of mouth and not visible from the under side of the head. Maxillary barbels rather heavy, flattened, varying in length. Mandibular barbels normally two or four

in number. Teeth in jaws short, forming broad bands. Vomerine teeth in one patch or two. Gillrakers short, about 8-10 on long limb of the gill arch. Anal free from caudal or narrowly to rather broadly joined with it, the anal rays covered by integument for most of their length. Caudal rounded to weakly emarginate with bluntly rounded lobes. Pectoral spine stout, either denticulate or smooth on inner margin.

D. 2-7 ; P. I, 10-I, 17 ; V. 7-13 ; A. 50-92 ; B. 12-15.

For a long time after Linnaeus the name *Silurus* was used for all the catfishes known, with the exception of the armoured forms. All of Bleeker's early East Indian catfish species, and most of those of Cuvier and Valenciennes and other authors, were named as various species of *Silurus*, and were later transferred by Bleeker to other genera as he erected them. The genus *Silurus* was finally restricted by Bleeker (1862, p. 393) to forms with 6 barbels, vomerine teeth in two patches, eyes subcutaneous, anal united to caudal, 15 branchiostegals, and ventrals I, 10 or I, 11. This grouping included forms like *Silurus glanis* Linnaeus. In the same paper (p. 392) Bleeker proposed the new genus *Parasilurus*, with *Silurus japonicus* Temminck and Schlegel as the genotype. He distinguished this genus by the strong toothed pectoral spine, eyes with a free rim, one band of vomerine teeth, a rounded caudal, and 14-15 branchiostegal rays.

Silurus and *Parasilurus* were accepted as distinct genera by most subsequent authors. Hora (1936a, p. 352), however, did not consider the difierences between them of sufficient generic value. He found, for example, that the character of vomerine teeth in one patch or two could not be used ; in a series of *P. cochinchinensis* Cuvier and Valenciennes, he was able to show that the teeth occurred in the typical one patch in some specimens, but that in other specimens these teeth were in two patches and in still others they intergraded between the two extremes. Intraspecific variation in respect to vomerine teeth seems to occur throughout the family.

The character most used and most readily observable for distinguishing the two genera is the presence in *Silurus* of 6 barbels, and in *Parasilurus* of 4. Kimura (1935, p. 105) and Hora in the above paper (p. 352) both cited research of Atoda (1935) on the embryology of *Parasilurus asotus* (Linnaeus), from which it appears that as larvae these fishes have an extra pair of mandibular barbels which is resorbed during ontogeny. It does not seem advisable to separate genera on the basis of a character which is dependent upon physiological growth factors. Especially does this seem indicated since it can be shown that in small populations of normally 4-barbelled forms, a few individuals may appear with 6 barbels ; this is probably due to absence in these individuals of the growth-inhibiting factor for the extra pair of barbels.

Bhimachar and Rau (1941) discovered considerable variation in the number of mandibular barbels in specimens of *Silurus cochinchinensis* from southern India (see p. 24). I found such variations in a series of specimens of *Hito taytayensis* Herre (see p. 31). In view of the considerable amount of evidence against the validity of number of barbels and

distribution of vomerine teeth as generic characters in these fishes, it seems best to discard them and to include all species of both genera in *Silurus*.

As for the species in the genus, considerable confusion exists and the number of valid forms cannot be stated definitely at this time, although much work has already been done along this line.

By far the best-known form is the 6-barbelled *Silurus glanis* Linnaeus, type of the genus and family. This species is common in the rivers of Europe from the Danube eastward, and occurs more rarely in parts of France, Switzerland the Netherlands, Finland, and Sweden. It is a well-known fish wherever it occurs, chiefly due to its giant size, and a great volume of literature has been written concerning it from the standpoint of anatomy, life history, and economic value. Considering all the available information about this fish, there seems little need to do more than mention it here.

For significant accounts of *Silurus glanis* see, for example, Cuvier and Valenciennes (1839, pp. 323-351), Heckel and Kner (1858, pp. 308-312), Fries *et. al.* (1895, pp. 693-702), and Thompson (1947, pp. 43-46, 233-235). It has been identified with accounts of fishes by a number of ancient Grecian authors.

Another European representative of the genus is *Silurus aristotelis* (Agassiz) with 4 barbels, restricted to Greece and parts of Asia Minor. The history of the species is of special interest because of the long period of confusion surrounding its identity. For a full account of the history of this fish, see Gill (1907, pp. 5-13) and Thompson (*op. cit.*).

Tchang (1936, p. 37, and 1937, p. 143) made *S. aristotelis* a subspecies of *S. asotus*. Considering the gap between the limits of distribution of the two species, I cannot see how this conclusion can be considered valid.

S. glanis and *S. aristotelis* are apparently the only members of the genus and family in Europe, although Sauvage (1882, p. 163) described *Silurus chantrei*, with 4 barbels (judging from the figure), from the River Kura, Tiflis, U. S. S. R. Apparently this form has never been rediscovered since the original specimen was taken. It is barely mentioned by Berg (1933, p. 587), who remarked, without giving a reason for his statement, that the type locality record was erroneous and that the fish in reality was collected in Syria or the basin of the Tigris River.

Silurus asotus Linnaeus, with 4 barbels, is the common form of China and Japan. A number of other Chinese forms have been named, most of which are apparently synonyms of subspecies of *S. asotus*; the exact relationships of these forms are still very uncertain. Nichols (1943, pp. 33-35) made subspecies of *S. bedfordi* Regan, from Korea, and Wu (1930, p. 225) described *Parasilurus asotus longus* from Tchekiang. *S. grahami* Regan and *S. mento* Regan, both from Yunnan, are close to *asotus* and will probably eventually be placed as subspecies of it. Rendahl (1928, p. 159) doubtfully put these two in the synonymy of *S. asotus*, while Nichols (*loc. cit.* p. 34) listed them as distinct species.

Silurus cinereus (Dabry) from the Yangtse-kiang, was considered by Rendahl (1928, p. 161) as a valid species. He also (p. 162) mentioned

Silurus sinensis McClelland from Chusan, which he considered might have to be made a snbspecies of *asotus*. Nichols (*op. cit.*) also considered *cinereus* distinct, though close to *S. asotus*. *S. sinensis* he placed doubtfully in the synonymy of his *Parasilurus asotus asotus*.

Silurus cochinchinensis Cuvier and Valenciennes, with 4 barbels, is a wide-ranging species, extending from the southern foothills of the Himalayas in India to Burma, Cochin-China, southern China, and peninsular Siam. Hora and Gupta (*loc. cit.*, p. 18) also reported a single specimen of *S. cochinchinensis* from Baling, Kedah State, British Malaya, the first record for the Malay Peninsula. It is a considerably variable form, with a number of synonyms. Hora (1936a, pp. 351-356) discussed the status of the species in India, and with it synonymized *S. afghana* Günther, *Silurichthyas berdmorei* Blyth, and *Pterocryptis gangetica* Peters. Hora mentioned the fact that anal ray counts in his specimens varied from 50 to 78. He seems to have examined a large series of specimens, but unfortunately made no attempt to list or correlate ray counts according to localities. From the literature, and from the few specimens I have examined, it appears that the anal ray count of Burmese Siamese, Indo-Chinese and Chinese examples of *S. cochinchinensis* is generally under 64, and that of Indian ones usually over 70. These counts should be examined in large series of specimens; if the difference holds, the Indian form will have to be recognized as a valid species or subspecies under the name *Silurus berdmorei*, this being the oldest available name.

Another species which has always been considered distinct is a 6-barbelled form, *Silurus wynaadensis* Day, with a rather restricted range in the hills of southern India. Most that was known of it was from the descriptions and figure of Day (1868, p. 155, as *S. punctatus*, preoccupied; 1873, p. 237; and 1878-88, p. 480, pl. 111, fig. 6). Hora (1936a) discussed this form with other Indian *Silurus*, considering it and *S. cochinchinensis* to be the only two representatives of the genus occurring in India. Bhimachar and Rau (1941) found that young specimens of *S. cochinchinensis* from Mysore State exhibited variation in the number of mandibular barbels, some of them having two pairs and others but one. They did not, therefore, consider the differences between *S. cochinchinensis* and *S. wynaadensis* to be of sufficient taxonomic importance, and *wynaadensis* becomes a synonym of *cochinchinensis*, the range of which is thus extended to southern India.

However, as mentioned above, adequate studies of anal counts and other characters should be made before the limits of *S. cochinchinensis* are definitely set. If the assumption is correct that all the Indian, Siamese, Malayan, Chinese, and Indo-Chinese forms are one species, the range is great enough so that variations correlated with geography must exist which would probably at least justify the erection of subspecies. The accompanying table, of a few specimens of *S. cochinchinensis*, shows some of the observable variations according to locality. Although the sample was far too small to give any conclusive evidence, still the results suggest that variations do exist which should be studied by interested workers with large series of specimens at their disposal.

In 1933, Herre (p. 179) described a new genus and species of silurid catfish from Hong Kong, *Herklotsella anomala.* Re-examination of the holotype and two paratypes during the course of this study makes it evident that this fish is nothing but a *Silurus* either very closely related to *S. cochinchinensis* or identical with it. It agrees with the longer and slenderer examples of *S. cochinchinensis.* Nichols (*op. cit.*, p. 37) on the basis of Herre's description, made it a distinct species of *Silurus* under the name *Parasilurus anomalus.* He separated it from *S. cochinchinensis* on the basis of the equal jaws, instead of the lower jaw being included. However, in reality the lower jaw of *Herklotsella* is slightly included, as in *S. cochinchinensis.* There seems little justification for considering the form anything but *S. cochinchinensis.*

In 1936, Tchang (p. 35) referred a single specimen of a 6-barbelled *Silurus* from Kwangsi, China, to *S. wynaadensis* (i.e., *cochinchinesnsis*) from the southern Indian peninsula. He again listed *S. wynaadensis* from China in his 1937 paper (p. 142). Hora (1937, pp. 341-343) made a comparison of Tchang's fish (from the illustration) with specimens of *S. wynaadensis,* which was sufficient to show that the two forms are not the same. This left Tchang's Chinese species nameless, and Hora (p. 343) proposed for it the name *Silurus sinensis.* Later, however, his attention having been called to the fact that the name *S. sinensis* was preoccupied, Hora (1938, p. 243) replaced it with *S. gilberti.*

Mori (1936) described *Parasilurus microdorsalis* from Chosen. I had no opportunity to read this paper, so have no idea what the affinities of the species are. I could find no subsequent references to it, either as a species or in synonymy.

As present, then, there seem to be about ten currently accepted species of *Silurus* : *S. glanis* of northern and eastern Europe, with 6 barbels normally present ; *S. gilberti,* which may be a distinct 6-barbelled form, or perhaps an anomalous example of a 4-barbelled species ; *S. aristotelis* of Greece ; *S. asotus* from China and Japan, with a few subspecies ; *S. grahami* and *S. mento* from Yunnan, China, and *S. cinereus* from the Yangtse, which will probably turn out to be subspecies of *asotus* ; *S. cochinchinensis,* the geopgraphical distribution of which badly needs to be worked out ; *S. micorodorsalis* from Chosen, not since reported; and *S. chantrei* from southern Russia or Asia Minor, another doubtful form.

It is clear that, before any definite statement can be made as to the exact number of species and subspecies, their characters, and their individual variations, a thorough study of the whole genus must be made, based on a large series of specimens and a more careful correlation of the results of other workers.

Fowler (1905, p. 463) described a new genus and species, *Apodoglanis furnessi.* This fish is known from a single specimen, collected in Borneo and now in the Museum of the Philadelphia Academy of Natural Sciences. I was not able to examine the type, but judging from the description and

1 Herre's description gives "head 6 to 5·8", but re-measurement shows all three specimens to have the head over 6 in body length.

Table I.

Comparative measurements of specimens of Silurus cochinchinensis. *The proportional measurements are given in per cent.*

	INDIA.	HONG KONG.					HAINAN.			KWANGTUNG.		
Standard length	142	137	92·5	169*	129*	108*	155	126	141	121	101	98
Head-st. 1.	16·9	18·2	19·4	16·5	16·2	16·6	16·7	16·6	16·3	19·0	19·8	20·4
Eye-interorb. sp.	23·0	20·0	21·0	20·0	17·3	21·0	21·4	20·8	25·9	17·3	20·0	20·0
Eye-head	12·5	12·0	11·1	10·7	9·5	11·1	11·5	11·9	15·2	8·6	10·0	10·0
Gape-head	50·0	52·0	44·4	53·5	52·3	38·8	42·3	47·6	47·8	47·8	45·0	40·0
D. to snout-st. 1.	25·3	31·0	31·3	28·1	27·9	25·0	28·8	29·3	29·7	28·0	30·6	31·1
Ventral-st. 1.	7·0	9·4	9·1	—	10·0	10·6	8·3	8·7	9·9	6·6	vestig.	9·6
Pectoral-st. 1.	11·9	14·2	9·6	12·	12·4	12·9	12·5	12·6	12·6	14·0	15·8	13·2
P. base-st. 1.	4·9	5·1	4·3	4·1	4·6	4·6	5·1	4·7	4·9	4·1	4·9	4·0
Caudal-st. 1.	13·0	20·4	16·2	16·5	16·6	15·2	15·4	16·6	17·0	18·1	19·8	20·4
Base anal-st. 1.	58·8	62·7	60·0	65·0	62·5	62·0	61·2	60·7	60·2	59·9	62·3	63·2
Depth-st. 1.	16·1	21·5	15·1	11·2	14·7	11·1	18·0	18·2	14·8	14·8	15·8	18·3
Max. barbels-st. 1.	28·1	37·9	36·7	33·1	34·1	31·9	42·5	39·6	35·4	35·5	33·6	42·8
Dorsal rays	4	4	4	4	4	4	4	4	4	4	4	4
Anal rays	72	62	61	62	62	63	67	65	65	64	61	60
Pectoral rays	I, 13	I, 10	I, 13	I, 10	I, 10	I, 10	I, 13	I, 14	I, 12	I, 11	I, 13	I, 13
Pelvic rays	9	8	10	0	9	9	10	10	9	10	vestig.	10
Branchiostegals	13	12	12	13	13	13	14	13	13	14	12	13

*Holotype and paratypes of *Herklotsella anomala* Herre.

accompanying figure, it would seem to be a typical *Silurus*, differing only in the absence of pelvic fins. It is doubtful whether a new genus should be erected solely on the basis of lack of the pelvic fins, since the phenomenon of individual loss of these fins is widespread among fishes. Until more specimens are procured its validity as a genus must be left in serious doubt, and it is tentatively included here as a species of *Silurus*. If it does indeed prove to be a *Silurus*, the range of that widespread genus will be extended still farther south.

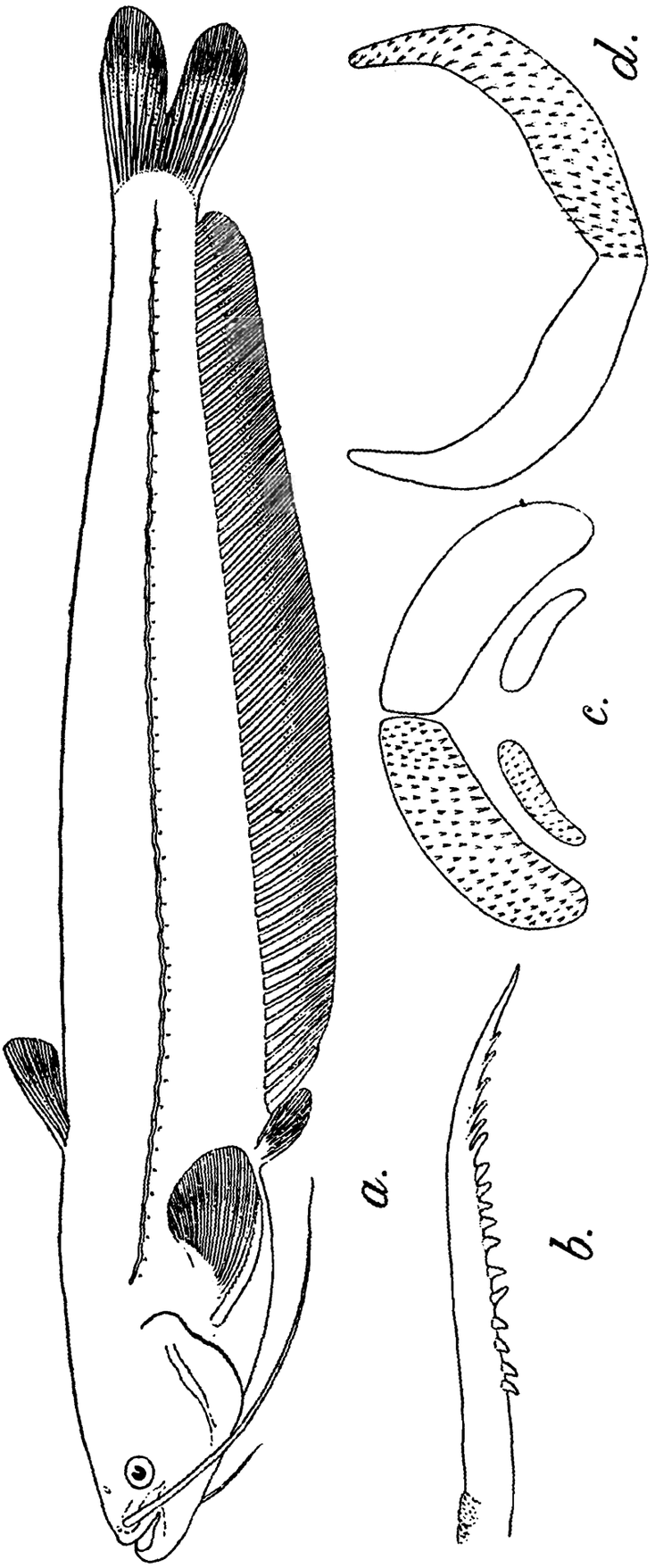
Two specimens in the collections of the Natural History Museum of Stanford University were tentatively labelled as *Ompok bimaculatus*; on examination, however, they proved to be referrable to the genus *Silurus*. The specimens were collected in the lowlands of southern India, near the coast, one at Trivandrum, Travancore, and the other at Goa, Portuguese India. The only described South Indian *Silurus* is *S. wynaadensis* (*S. cochinchinensis*; see p. 24), which appears to be restricted to higher altitudes. My two specimens are clearly a quite distinct form, which is here described as new.

It is readily distinguished from *Ompok bimaculatus*, the only other silurid from India with which it might be confused, by the eye set above the corner of the mouth; the heavy, flattened barbels; the thick integument reaching nearly to the end of the anal rays; and the weakly emarginate caudal fin with the lobes bluntly rounded, instead of the fin being forked.

Silurus goae, sp. nov.

Body elongate, compressed, becoming most markedly so posteriorly. Depth at dorsal origin about ·20 of standard length (·15-·24). Profile of dorsum evenly convex; ventral profile straight.

Head depressed. Profile of top of head curving downward to tip of snout, the curve in line with that of dorsum, with only a slight concavity at nape of neck. Length of head about ·17 of standard length (·16-·09). Gape oblique, upturned at an angle of about 45° from horizontal; wide but rather short, about ·35 of head (·33-·37), not reaching front border of eye. Lower jaw slightly longer than upper, contained in dorsal profile of head. Eye small, without a free orbital rim or with the posterior part of the rim appearing slightly free, probably due to preservation. Diameter of eye. about ·18 of head (·15-·21), about ·32 of interorbital space (·26-·38), above and behind corner of mouth. Nostrils wide-set; anterior pair in short tubes, close to tip of snout, about two eye diameters apart; posterior pair valved, about one eye diameter behind anterior pair, three eye diameters apart. Maxillary barbels rather heavy, flattened, reaching to slightly beyond origin of ventrals; one pair of mandibular barbels, slender, short, about ·50 the length of head. Teeth in jaws short depressible, in about five or six irregular rows, the inner ones slightly longer and wider-set. Teeth on vomer in two large, crescent-shaped patches, curving downward and outward in line with the jaw teeth, the patches separated from each other by a distance equal to half the length of one patch, or greater; roughly 25-30 teeth in each patch. Gillrakers


a.
b.
c.
d.

2+1+8 or 2+1+9, curved, wide-set, much shorter than branchial filaments.

Dorsal short, first two rays longest, origin opposite that of ventrals, about ·28 of distance from tip of snout to base of caudal. Pectorals short, barely reaching origin of anal, base ·05 of standard length; the spine is stout, articulated for about the distal half of the length of the fin with the non-articulated portion serrate on inner margin, the serrae being strong, straight, and wide-set. Ventrals small, immediately in advance of anal origin, ·06 of standard length. Anal long, last ray distinctly separated from base of caudal by a short interspace, the rays covered by integument almost to their tips, the base of the fin about ·66 of standard length. Caudal about ·18 of standard length (·15-·21), very weakly emarginate medially and with lobes very bluntly rounded when fin is spread.

Fin formula: D. 4; P. I, 12-I, 14; V 7-8; A. 68. Branchiostegals 13-15.

Colour in alcohol dark brown, darkest on dorsal surface; fins about same shade as body, darker at their bases; a blackish spot behind the gill opening; lateral line and base of anal rays marked with black.

Holotype, 216 mm. in length, from Goa, Portuguese India, Stanford 41889; *paratype*, 239 mm., from Trivandrum, Travancore, India, Stanford 41888. Both specimens were obtained by Dr. Albert W C. T. Herre in 1940-1941.

6. Genus **Wallago** Bleeker.

Body compressed; head depressed. Mouth oblique; gape wide and very long, reaching to or beyond anterior border of eye. Anterior nostrils tubular, set far apart. Posterior nostrils valved, before anterior border of eye. Eyes with a free orbital rim, above level of corner of mouth and not visible from underside of head. Teeth in jaws longer and sharper than in most of the genera, in broad bands. Vomerine teeth in two distinct patches. No teeth on palatines. Maxillary barbels long and slender, varying in length. Mandibular barbels normally two in number, filamentous, shorter than head. Gillakers 9-21 on long limb of gill arch, short, stiff, and wideset, often forked. Anal free from caudal, which is deeply forked to deeply emarginate with pointed lobes. Dorsal rays comparatively long, about equal to pectorals.

D. 5; P. I, 12-I, 15; V 8-11; A. 64-93; B. 15-20.

In 1801, Bloch and Schneider (p. 378) described *Silurus attu*, a new catfish from Malabar. The accompanying figure (75) is poor, but shows the long gape which is distinctive of this species.

Bleeker (1846a, p. 284) described this fish as *Silurus mülleri*, from Batavia. Later (1851b, p. 198), in using the name *Wallago* for the first time (see p. 12), he mentioned *Wallago mülleri* Bleeker, evidently the same fish, but gave no characters other than the possession of 4 barbels. In the same year (1851c, p. 427) he described an allied form from Borneo.

W. leerii. A year later (1852, p. 585) he again used the name *Wallago mülleri*, placing *Wallago bimaculatus* (equals *Ompok bimaculatus*) near it and separating it from the latter species by the character of the long gape extending beyond the eye. This character is sufficient to identify it as synonymous with *Silurus attu* Bloch and Schneider.

Bleeker (1853b, p. 108) described *Wallago russellii* from Calcutta and Batavia and included *Silurus attu* Bloch and Schneider, *Silurus boalis* Hamilton, *Silurus wallagoo* Cuvier and Valenciennes, and his own *Wallago mülleri* in its synonymy. It is hard to understand why he proposed a new specific name with several older ones available. In his catfish revision of 1858, Bleeker restricted *Wallago* to *W. russellii* and *W. leerii*, giving a detailed description of each. In his *Atlas* (1862a, p. 79) he returned to the name with the right of priority, *Wallago attu*. His accompanying figure, however, still bore the name *W russellii*. *Wallago leerii* was also described and figured.

Vaillant (1902, p. 44) described *Wallago miostoma* from Borneo. In the same paper (p. 46) he described *Wallago nebulosus*, which was listed as *Ompok nebulosus* by Fowler (1905, p. 465) and placed in the synonymy of *Wallago miostoma* by Weber and Beaufort (1913, p. 202).

Hora and Misra (*in* Hora and Gupta, *loc. cit.* p. 18) described a new species of *Wallago*, *W. tweediei*, from Pahang, Malay Peninsula. Since the fish was of great size and could not be totally preserved, its description was based chiefly on plaster casts and photographs. As well as can be determined from the available information, the fish apparently belongs to *Wallago*.

Wallago krattensis, described by Fowler (1934a, p. 335) is referrable to the genus *Ompok* (see p. 35).

The four forms belonging to the genus *Wallago* all grow to large size, *W. attu*, from India, Burma, Ceylon, Sumatra, Java, Siam, and Indo-China, is a common and well-known species ; it was described in detail by Hora (1939, p. 64). *W leerii* from Borneo, Banka, and Sumatra, and *W. miostoma* from Borneo, Sumatra, and Siam, are less common, though abundant in certain areas. I found one specimen of *W. miostoma* from Singapore, which appears to be the first record of the fish from this area. *W. tweedei* is known from the one specimen, but apparently the fishermen in the area from which the type was taken are quite familiar with it.

Myers (1938, p. 98) placed these forms in the genus *Wallagoni* restricting the name *Wallago* to the species previously called *Belodontichthys dinema*, but later reversed his decision (see p. 13).

Kner (1864-67, p. 305) described a new genus and species of silurid catfish, *Silurodon hexanema*. Kner himself remarked, and the accompanying figure (pl. 12, fig. 2) confirms, that the fish in general resembles a member of the genus *Wallago*, but differs in several respects. The eye was described as being subcutaneous, the caudal fin is rounded and joined to the anal, the vomerine teeth are in a single patch, and there are two pairs of mandibular barbels, longer than they ordinarily occur in specimens of *Wallago*. These characters this fish shares with members of

the genus *Silurus*. In addition, the single specimen on which the genus was based was said to be collected at Shanghai, which would put it out of the range of any genus but *Silurus*. On the basis of the differences from both *Silurus* and *Wallago*, Kner erected his new genus. I could find no subsequent references to this fish save that of Nichols (*loc. cit.* p. 36), who listed it as a distinct genus and species from China, but made no comment upon it.

In general body form *Silurodon hexanema* resembles *W attu*, though the gape is too short for this species. Other characters are those of *Wallago*, and except for the differences noted above it seems to fall into this genus.

The specimen probably was not actually collected at Shanghai, but further south ; it was in a bottle with another fish from Shanghai, and the data may have been mixed. Poor preservation could account for lack of a free orbital rim ; the specimen, as figured, is certainly shrivelled. Cases are known in which silurid catfishes have had their tails injured and regenerated without the typical fork and joined to the anal fin. The occurrence of vomerine teeth in a single patch, or of two pairs of mandibular barbels, has never been reported for a *Wallago*, but anomalies of this sort may be assumed to occur occasionally in this genus, just as they do in many other genera of the family. All things considered, it seems more logical to include the specimen within the genus *Wallago*, until more evidence bearing on the question is produced.

7. Genus **Hito** Herre.

Body strongly compressed ; head depressed. Mouth horizontal ; gape quite long, but not reaching the anterior border of the eye ; jaws equal or lower one slightly shorter. Anterior nostrils tubular, wideset. Posterior nostrils valved, before the anterior border of the eye. Eyes subcutaneous their ventral border on a level with the angle of the mouth and a small portion visible from the underside of head. Maxillary barbels long and slender, extending to origin of anal or less. Mandibular barbels normally two in number, about as long as head, a second hair sometimes present. Teeth in jaws short, in 4 or 5 more or less regular rows, forming broad bands. Vomerine teeth usually in one patch, sometimes completely divided into two patches. A patch of teeth present on each palatine ; the patch may be of different sizes on the two palatines, and may be present on one side only, rudimentary with two or three teeth, or lacking altogether. Gillrakers 14-15 on long limb of gill arch, slender, about $\frac{1}{2}$ as long as the branchial filaments. Anal free from caudal, which is forked, or last ray of anal joined to it by a membrane. Pectoral spine strongly denticulate on inner margin.

D. 3-4 ; P. I, 11-I, 13 ; V. 6-8 ; A. 55-68 ; B. 12-14.

Herre (1924a) described two new silurid genera and species, *Hito taytayensis* and *Penesilurus palavanensis*, from Palawan in the Philippines. This was the first record of any member of the family in the Philippines ; the only other Philippine fresh-water catfishes are two species of the family Clariidae.

No figures were given, but from the descriptions of these new forms it appears that they differ only in the following points:

Hitto taytayensis	*Penesilurus palavanensis*
One pair of mandibular barbels	Two pairs of mandibular barbels
Dorsal 3 or 4	Dorasl 2
Anal 57-61	Anal 55
Ventral 7	Ventral 6
Branchiostegals 12-14	Branchiostegals 10

Herre's original specimens of *Hito* were collected in northern Palawan; collections made later yielded specimens from Culion in 1931 and from Busuanga in 1940, both islands being in the Calamianes group north of Palawan and faunally practically identical with it. Herre (1934, p. 22) reported on those in the 1931 collection. On examination of a fine series of 63 specimens from the two latter localities, I discovered that the generic limits set by Herre must be somewhat modified. The fin counts should be: D. 3-4; V 7-8; P. I, 11-I, 13; A. 57-68. Herre gave the Philippine genera the character, unique among Siluridae, of having a small patch of teeth on each palatine. I found in the course of this study that among my Philippine specimens, only about half possessed this character, and some of this half had the teeth on one palatine only. Thus the character has not much generic value, except to indicate a tendency which is lacking in other members of the family.

Penesilurus was described from a single specimen, stated to be in poor condition. Except for a slight difference in ray counts, which can hardly be considered as having generic value, especially since some of the fins were damaged, the only difference seems to be the extra pair of mandibular barbels. As stated before, an extra pair of mandibular barbels cannot be considered as of generic, and often not of specific value in this group. Among the specimens in the series of *Hito* I examined were two that were perfectly typical except for the possession of an extra pair of mandibular barbels. All facts taken together, it seems that this is a phenomenon that probably occurs not too rarely in *Hito*, and that the type of *Penesilurus palavanensis* is nothing but a six-barbelled, badly preserved example of *Hito taytayensis*.

Herre (1924b) published descriptions of these two genera, identical with the others except that *Hito* was designated as *Hitoichthys taytayensis*. Since it cannot be determined which of the two papers has priority, I arbitrarily designate *Hito* as the generic name, reducing *Hitoichthys* to synonymy.

The range of *taytayensis* is apparently a very restricted one. Herre (1924), in a discussion of the strictly fresh water fishes of the Philippines attributed this to the fact that it ocurs in a little-inhabited region and is small and unimportant as food, and thus has never been distributed by man; also, the graphical character of Palawan and the Calamianes has prevented natural dispersal.

These forms were derived from the fauna of Borneo and Sumatra, to which they appear to be most closely related, and with which the fauna of Palawan and the Calamianes is largely identical.

Pellegrin and Chevey (1937, p. 315) described a new *Penesilurus* from Bokor, Cambodia, *P. bokorensis*. Aside from the fact that the occurrence of two isolated populations of a genus, one in the Philippines and the other in Indo-China, seems doubtful, this fish from the description certainly cannot be either a *Penesilurus* or a *Hito*, but is apparently merely a six-barbelled specimen of *Silurus cochinchinensis* Cuvier and Valenciennes. This is but another example of the remarkable amount of confusion centered around this common, protean, and apparently wide-ranging species.

8. Genus **Ompok** Lacépède.

Body strongly compressed, head depressed. Mouth sharply oblique; gape not surpassing anterior border of eye; lower jaw prominent. Anterior nostrils tubular, wideset. Posterior nostrils valved, before anterior border of eye. Eyes subcutaneous, their ventral border set on a level with corner of mouth or lower, often visible from underside of head. Maxillary barbels varying in length. Mandibular barbels two in number, in length from shorter than eye to surpassing caudal. Teeth in jaws short, in broad bands. Vomerine teeth in one or two patches, varying size. No teeth on palatines. Gillrakers rather short, curved, wideset about 7-10 on long limb of gill arch. Anal free from caudal or narrowly connected with it. Caudal forked. Pectoral spine smooth or denticulate on inner margin.

D. 3-4; P. I, 9-I, 14; V. 6-10; A. 47-82; B. 9-14.

The confusion surrounding the history and nomenclature of the genus *Ompok* has been considerable. Hora (1936a, p. 356 *et. seq.*) gave a detailed discussion of the problem. Briefly, the main points may be summarized as follows:

In 1797, Bloch (p. 17) described a new species of catfish, *Silurus bimaculatus*, from the Malabar coast of India. Lacèpède described a new genus and species, *Ompok siluroides*, in 1803 (p. 49). The description was made from a dried specimen, and was inaccurate, as was the plate accompanying it. In 1822 (p. 150) Hamilton erected the subgenus *Callichrous* without diagnosis, under which he described seven new species of Indian catfishes (as *Silurus*, the sub-generic name not being mentioned again). One of these species was later placed in the synonymy of *Wallago attu*, while another was put in a different family.

Swainson (1839, p. 306) recognized *Callichrous* as a distinct genus (spelling it *Callichrus*) and gave a diagnosis[1] which, however, might apply equally well to almost any of the silurid genera. He referred to *Callichrous* Hamilton's several species, and also *Silurus bimaculatus* Bloch.

[1] "Head large, depressed; mouth large, not vertical; dorsal fin close to the head; anal fin excessively long; vent close to the pectoral; caudal fin forked."

In the same year, Cuvier and Valenciennes (1839, p.362) placed *Ompok siluroides* in the synonymy of *Silurus bimaculatus* Bloch. Valenciennes had re-examined the badly preserved type of *Ompok siluroides* and rectified the errors in the original description. Although the specimen was in such poor condition that not much information could be obtained from it, enough could be seen to convince the authors that the fish was identical with *Silurus bimaculatus* Bloch. They concluded that since the original diagnosis was erroneous, the generic name *Ompok* was invalid.

Bleeker (1858, p. 275) erected the new genus *Pseudosilurus*, in which *Silurus bimaculatus* and *Callichrous bimaculatus* were included. Later (1862, p. 395) he returned to the name *Callichrous*, making *Pseudosilurus* a synonym of it (the former name having priority), gave a thorough diagnosis of the genus, and named *Callichrous pabda* as the genotype. In his *Atlas* (1862a, p. 85) he upheld the position of Cuvier and Valenciennes in stating that the name *Ompok* was invalid, although older than both *Callichrous* and *Pseudosilurus* ; he remarked that the genus *Ompok* was erected on an erroneous assumption (Lacèpède had believed that the dorsal fin was lacking) and the name was a mutilation of the native name "Limpok."

Day (1878-88, p. 475, and 1889, p. 129) included *Ompok kryptopterus*, *Kryptopterichthys*, *Micronema*, *Phalacronotus*, *Hemisilurus*, *Silurodes*, *Pseudosilurus*, *Silurichthys*, and *Pterocryptis* all in the synonymy of *Callichrous*.

Weber and Beaufort (1913), in their review of the silurid genera, again returned to generic rank *Kryptopterus*, *Hemisilurus*, *Silurodes*, and *Silurichthys* ; *Pseudosilurus* and *Ompok* remained in the synonymy of *Callichrous*.

Most ichthyologists have followed Bleeker's lead in discarding the name *Ompok* in favour of *Callichrous*. Hora (1936a, p. 358) agreed with this view. However, as Smith (1945, p. 337) pointed out, " the fact that a genus is inadequately or even incorrectly described does not affect the validity of the proposed name if it otherwise conforms to the requirements of zoological nomenclature." Since the type of *Ompok siluroides* was re-examined, the errors in the original description corrected, and the form definitely included in the synonymy of *Silurus bimaculatus*, which in turn is assigned to *Callichrous*, there seems to be no reason why the older name *Ompok* should not be used instead of *Callichrous*.

The status of the several forms of *Ompok* is somewhat questionable. In the past a number of species have been named, most of them admittedly closely related to one another. The status of the Indian species was discussed by Hora (1936a, p. 358 *et seq.*). He concluded that of the many forms described from that area, two can be recognized, *Ompok pabo* (Hamilton) and *Ompok bimaculatus* (Bloch), most of the other described forms falling into the synonymy of the latter species.

Ompok bimaculatus ranges all the way through Java, Borneo, Sumatra, Malaya, Siam, Indo-China, India, Burma, and Ceylon, and within this range there is considerable intraspecific variation. The anal rays for *O. bimaculatus* and its synonyms have been reported as ranging all the way between 47 and 75, and great colour, proportional, and other variations occur.

Three common forms are generally recognized : the wide-ranging *O. bimacutatus* (Bloch), with anal and dorsal fins separate and maxillary barbels longer than the head ; *O. pabo* (Hamilton), restricted to north-east India and Burma, with anal and dorsal separate and maxillary barbels shorter than the head ; and *O. leiacanthus* (Bleeker), from Sumatra, Banka, Borneo, and Singapore, with long mandibular barbels and anal connected with the base of the caudal.

In view of the great individual variation and wide geographical distribution in *Ompok bimaculatus*, it would seem that one should be able to discover a correlation between geographical location and these variations. Hora (1936a), did not include in his discussion any tabulation of anal ray counts and other characters of his specimens according to locality, and he failed to consider any members of the species outside of India. It seems entirely possible that if statistical studies based on large numbers of specimens were made, enough correlations would appear to warrant resurrection of some of the names from the synonymy in which Hora placed them, and the returning of these names to specific or at least subspecific status.

With 53 specimens of *O. bimaculatus* at hand, I made proportionaly measurements and set them up in table form, attempting to see how much variation and correlation actually existed. While the sample was too small and the range too narrow for any conclusive results, the data I obtained at least indicates that further studies should be made before the status of *Ompok bimaculatus* and its numerous synonyms can be definitely established. (See accompanying tables.)

A few other described forms not mentioned in Hora's paper should be noted. *Wallago krattensis*, described by Fowler (1934a, p. 335) from Siam, seems to be definitely an *Ompok*, judging from the description and figure, and not unlike a normal *O. bimaculatus*, except for a rather deeper body. Smith (1945) overlooked this form in his review of the Siamese fishes ; he did not include it either as a species or in synonymy. Without more specimens and further knowledge concerning it, I should not regard it as distinct from the *Ompok bimaculatus* complex.

Callichrous weberi was described by Hardenberg (1936, p. 232) from Borneo. No figure was given ; from the description it appears to differ from other described forms only in the pectoral fins being I, 9 instead of I, 10-I, 14, and 6 rays in the ventral fins instead of 7-10.

Table II.

Comparative measurements of specimens of Ompok bimaculatus *from India. The proportional measurements are given in per cent.*

	BOMBAY.	VIZAGAPATAM.	CENTRAL PROVINCES.			CALCUTTA.				
Stanford Cat no.	41885	41886	41887	41887	41887	34864	34864	34864	34864	34864
Standard length	198	103	126	101·5	90	140	135	132	128	112
Head-st. 1.	19·1	19·4	19·0	18·2	17·7	17·8	18·8	20·3	20·3	18·3
Eye-interorb. sp...	34·7	40·0	38·4	40·0	43·7	52·0	47·8	33·3	34·4	52·6
Eye-head	21·0	20·0	20·8	21·6	21·8	26·0	21·5	18·1	19·2	24·3
Gape-head	31·5	40·0	37·5	32·4	31·2	32·0	35·2	36·3	32·6	39·0
D. to snout-st. 1...	30·0	30·5	29·7	29·5	27·7	30·0	31·8	34·4	31·2	29·4
Ventral-st. 1.	8·0	7·7	6·3	5·9	6·6	5·7	6·6	7·3	6·2	6·6
Pectoral-st. 1.	18·1	18·4	19·8	17·7	20·0	20·0	20·0	16·6	21·0	17·8
P. base-st. 1.	6·5	6·7	5·5	5·4	5·5	6·4	5·9	5·3	6·2	5·3
Caudal-st. 1.	21·7	16·5	21·0	18·7	21·1	17·8	20·7	14·7	23·0	20·5
Base anal-st. 1.	60·6	62·1	65·0	64·5	62·2	60·0	63·7	58·7	61·3	66·5
Depth-st. 1.	22·7	23·3	24·2	20·6	20·0	22·1	·7	23·4	26·5	23·2
Max. barbels-st. 1.	41·4	37·8	44·4	48·7	54·4	46·0	50·3	9·3	52·3	50·0
Dorsal rays	4	4	4	4	4	4	4	4	4	4
Anal rays	64	53	64	64	61	69	2	55	61	67
Pectoral rays	I, 13	I, 12	I, 13	I, 13	I, 13	I, 14	, 13	I, 13	I, 13	I, 13
Pelvic rays	8	8	8	8	8	8	8	8	7	8
Branchiostegals	11	12	12	12	11	11	11	12	11	11

TABLE II—*contd.*

Comparative measurements of specimens of Ompok bimaculatus *from India. The proportional measurements are given in per cent.*—contd.

	CALCUTTA.										
Stanford Cat. no.	34864	34864	34864	34864	34864	34864	34864	34864	34864	34864	34865
Standard length	109	109	98·5	97·5	'97	95	92·5	89	88	82	115
Head-st. 1.	17·8	18·8	20·8	18·4	19·0	18·9	20·5	20·7	21·0	20·7	22·6
Eye-interorb. sp.	40·0	55·5	42·1	56·2	44·4	44·4	43·7	50·0	43·7	46·6	34·6
Eye-head	20·5	24·3	19·5	25·0	21·6	22·2	18·4	'24·3	18·9	20·5	17·3
Gape-head	41·4	41·4	36·5	33·3	32·4	38·8	34·2	35·1	35·1	35·2	·42·3
D. to snout-st. 1.	28·8	29·8	29·4	28·2	29·8	30·0	32·4	30·8	33·5	31·0	33·9
Ventral-st. 1.	6·4	7·7	5·0	5·6	5·6	8·4	7·5	7·8	8·5	6·0	7·8
Pectoral-st. 1.	20·6	19·7	20·3	19·4	19·5	20·0	17·2	17·9	18·1	18·2	19·1
P. base-st. 1.	5·5	5·0	6·5	5·1	4·1	5·2	4·8	6·1	5·6	4·8	7·8
Caudal-st. 1.	21·1	19·7	21·3	19·4	18·5	21·5	15·6	17·4	17·6	17·0	14·7
Base anal-st. 1.	65·5	66·5	62·9	67·1	69·5	66·3	64·8	58·4	61·3	62·1	61·7
Depth-st. 1.	21·1	21·1	19·2	20·5	20·6	21·0	21·6	22·4	17·6	21·9	22·6
Max. barbels-st. 1.	52·2	55·0	64·4	58·4	57·7	60·0	38·9	38·2	29·5	34·1	38·2
Dorsal rays	4	4	5	4	4	4	4	4	4	4	4
Anal rays	63	63	69	64	68	63	56	57	57	56	56
Pectoral rays	I, 13	1,14	I, 14	I, 13	I, 12	I, 13	I, 11	I, 11	I, 11	I, 13	I, 13
Pelvic rays	8	8	8	8	8	8	8	8	8	8	8
Branchiostegals	11	11	11	11	11	11	11	12	12	12	11

Table III.

Comparative measurements of specimens of Ompok bimaculatus *from Rangoon, Burma. The proportional measurements are given in per cent.*

Stanford Cat no.	33790	33790	33790	33790	33790	33790	33790	33790	33790	33790	33796
Standard length	133	133	130	115	110	106	99·5	97	85	83	198
Head st. 1.	18·0	20·3	17·6	17·8	21·3	19·8	18·0	18·5	17·6	18·0	22·2
Eye-interorb. sp.	35·7	35·7	40·7	50·0	30·7	34·7	44·4	44·4	43·7	53·3	35·7
Eye-head	20·8	18·5	23·9	24·3	17·0	19·0	22·2	22·2	23·3	26·6	22·7
Gape-head	43·4	44·4	39·1	43·9	46·8	42·8	41·6	36·1	36·6	40·0	52·2
D. to snout-st. 1.	27·8	35·4	30·0	30·0	33·6	33·4	26·6	29·8	28·2	28·9	36·8
Ventral-st. 1.	7·5	9·0	5·3	—	8·1	6·6	5·5	5·6	5·8	4·8	8·5
Pectoral-st. 1.	18·7	20·3	—	—	20·0	—	19·0	18·5	17·6	19·2	—
P. base-st. 1.	6·0	6·0	6·1	4·5	5·4	5·6	6·5	5·6	6·4	4·8	7·0
Caudal-st. 1.	18·0	17·2	—	—	—	—	—	20·1	20·0	18·6	—
Base anal-st. 1.	69·1	63·1	69·6	66·9	60·9	63·2	70·3	67·0	67·0	68·0	59·5
Depth-st. 1.	19·5	24·0	20·7	21·7	24·5	22·6	19·0	20·6	20·5	19·2	24·7
Max. barbels-st, 1.	49·6	60·1	57·6	54·7	38·6	39·6	60·3	53·6	52·9	53·0	41·9
Dorsal rays	4	4	4	4		4	4	4	4	4	4
Anal rays	67	59	66	68	60	58	68	69	68	65	52
Pectoral rays	I, 13	I, 13	I, 14	I, 13	I, 13	I, 13	I, 13	I, 11	I, 13	I, 14	I, 13
Pelvic rays	8	8	8	8	8	8	8	8	8	8	8
Branchiostegals	11	12	12	11	12	12	11	11	11	12	11

TABLE IV.

Comparative measurements of specimens of Ompok bimaculatus *from Ceylon. The proportional measurements are given in per cent.*

	COLOMBO						PERA-DENIYA	GALATA-BENDIYAVA
Stanford Cat. no.	22913	22913	22913	30177	30177	30177	30178	30179
Standard length	128	124	123·5	187	115	98	102	51
Head-st. 1.	17·9	18·5	19·4	19·7	20·0	21·4	20·5	19·6
Eye-interorb. sp.	33·3	30·4	29·1	30·4	27·2	31·8	32·7	33·3
Eye-head	17·3	15·2	14·5	18·9	13·0	16·6	19·0	20·0
Gape-head	32·6	30·4	35·4	40·5	34·7	33·3	38·0	40·0
D. to snout-st. 1.	32·4	31·0	31·1	34·2	32·1	30·6	33·8	35·2
Ventral-st. 1.	7·4	6·4	7·2	6·9	6·5	6·6	6·8	6·8
Pectoral-st. 1.	16·7	15·3	17·0	16·0	15·2	17·3	17·6	17·6
P. base-st. 1.	4·6	5·6	5·2	5·3	5·6	6·1	5·8	5·8
Caudal-st. 1.	15·6	17·3	17·0	18·1	17·3	22·4	15·6	—
Base anal-st. 1.	65·2	64·1	62·3	60·6	61·7	60·2	60·7	64·7
Depth-st. 1.	21·8	22·9	25·9	24·0	25·2	21·9	23·5	21·5
Max. barbels-st. 1.	31·2	34·6	37·2	38·7	38·2	46·2	43·1	39·2
Dorsal rays	4	4	4	4	4	4	4	4
Anal rays	57	61	60	62	63	63	66	68
Pectoral rays	I, 13	I, 14	I, 13	I, 14	,12	I, 14	I, 14	1,14
Pelvic rays	8	8	8	8	8	8	8	18
Branchiostegals	12	12	11	11	12	12	12	12

Table V.

Comparative measurements of specimens of Ompok bimaculatus *from Malaya and Siam. The proportional measurements are given in per cent.*

	MALAYA					SIAM	
	SINGAPORE		PERAK	PAHANG		S. E. SIAM	SINGORA
Cat. no.	31070	31070	32735	32799	32899	28824	31069
Standard length	147	129	147	891	163	175	147
Head-st. 1.	20·7	20·5	20·0	20·9	19·6	21·7	20·4
Eye-interobr. sp.	28·5	26·6	30·3	27·2	27·5	31·5	29·4
Eye-head	16·3	15·0	16·9	15·0	17·1	15·7	16·6
Gape-head	49·1	37·7	47·4	38·7	45·3	44·7	43·3
D to snout-st. 1.	32·6	31·7	32·6	34·0	33·7	34·8	32·6
Ventral-st. 1.	9·5	7·7	7·4	8.3	9·2	8·0	8·1
Pectoral-st. 1.	18·3	17·8	17·6	15·7	17·1	19·4	17·6
P. base-st. 1.	6·1	6·5	6·1	5·7	6·4	6·2	6·1
Caudal-st. 1.	17	17·0	14·9	15·9	—	17·1	14·6
Base anal-st. 1.	66·6	60·4	55·7	54·7	58·2	56·2	59·1
Depth-st. 1.	24·4	25·5	20·4	21·4	25·1	23·1	22·4
Max. barbels-st. 1.	42·8	41·0	46·9	26·1	28·2	33·1	42·8
Dorsal rays	4	4	4	4		4	4
Anal rays	56	54	56	60	56	58	57
Pectoral rays	I, 13	I, 12	I, 13	I, 13	I, 13	I, 13	I, 13
Pelvic rays	8	8	8	8	8	8	8
Branchiostegals	10	12	12	13	13	12	11

TABLE VI.

Comparative measurements of specimens of Ompok bimaculatus *from Java. The proportional measurements are given in per cent.*

	BUITENZORG		BATAVIA			
Standard Cat. no.	20496	20496	U. Mich.	U. Mich.	U. Mich.	U. Mich.
Standard length	177	158	150	140	127·5	109
Head-st. 1.	20·3	20·2	21·3	21·4	21·1	20·6
Eye-interorb. sp.	28·5	30·5	32·2	32·2	35·7	33·2
Eye-head	16·6	17·1	15·6	16·6	18·5	15·5
Gape-head	44·4	43·7	34·3	31·6	38·8	37·7
D. to snout-st. 1.	34·1	34·6	32·6	33·2	36·8	28·4
Ventral-st. 1.	9·0	8·5	8·0	9·2	8·6	8·2
Pectoral-st. 1.	18·6	16·4	18·6	20·7	20·0	19·2
P. base-st. 1.	6·2	6·3	6·0	5·7	7·0	5·5
Caudal-st. 1...	17·5	15·5	15·3	17·1	18·8	—
Base anal-st. 1.	55·3	62·9	64·0	58·5	58·0	62·3
Depth-st. 1.	23·7	23·4	24·6	25·0	27·4	22·0
Max. barbels-st. 1.	37·5	30·3	46·6	48·5	36·8	57·7
Dorsal rays	5	4	4	4	4	4
Anal rays	62	61	63	63	55	59
Pectoral rays	I, 14	I, 12	I, 13	I, 13	I, 14	I, 12
Pelvic rays	8	8	8	8	8	8
Branchiostegals	13	11	11	11	12	11

Ompok nebulosus (Vaillant), listed by Fowler (1905, p. 465), is certainly referable to the genus *Wallago*, where it was originally placed by Vaillant. Weber and Beaufort (1913) synonymized it with *Wallago miostoma*.

Ompok jaynei Fowler (1905, p. 466) was placed doubtfully by Weber and Beaufort (1913) in the synonymy of *O. leiacanthus*. It does not appear to differ from the latter species except in colouration, which is a character of doubtful value.

Hardenberg (1938, p. 311) described a new species, *Belodontichthys javanensis*, from Java. No figure was given, but from the description the fish cannot belong to the genus *Belodontichthys* as now defined. The head was described as depressed, and the pectorals are given as the length of the head without half the snout, instead of being unusually long. No mention was made of the other significant characters such as the length of the pectoral bases, the shape of the teeth, or the number and form of the gillrakers. Lacking this information it is difficult to say with certainty, but judging from the depressed head and relatively short pectoral, the fish seems to fit better into the genus *Ompok*. From what description was given it might also conceivably belong to the genus *Wallago*, although key characters such as the presence or absence of an orbital rim were not given. For the present, the status of this fish must remain uncertain.

Silurodes has been considered a distinct genus by most authors. Bleeker erected the genus in his catfish revision of 1858 (p. 271), including in it *Silurus hypophthalmus* Bleeker and *Silurus macronema* Bleeker. Later (1862, p. 394) he placed *Callichrous*, *Ompok*, and *Pseudosilurus* in synonymy with *Silurodes*, but in his *Atlas* of the same year (1862a, p. 83) he resurrected *Callichrous*, which was distinguished from *Silurodes* mainly by the occurrence in the latter genus of the vomerine teeth in one patch and the eyes lower-set. Günther (*loc. cit.*, pp. 48-49) placed *S. hypophthalmus* and *S. macronema* with *Callichrous*. Weber and Beaufort (1913, p. 205) resurrected the genus *Silurodes*, and made *S. macronema* a synonym of *S. hypophthalmus*.

Besides *Silurodes hypophthalmus* (Bleeker), two other forms are generally referred to this genus. *Callichrous eugeneiatus* Vaillant (1893, p. 61) was placed in *Silurodes* by Weber and Beaufort, as was *Callichrous borneensis* Steindachner (1901, p. 445).

Weber and Beaufort distinguished *Silurodes* from *Callichrous* only by the occurrence of the vomerine teeth in one patch, and the shorter mouth and lower-set eyes. Hora (1941, pp. 17-18) showed that there is intraspecific variation in *S. hypophthalmus* in regard to the vomerine teeth, which is not surprising considering that instances of this type of variation are known throughout the family. Hora had previously remarked (1936a. p. 357) that he did not consider this character to be of sufficient generic value. I have been unable to find any other differences between the two genera which would warrant their remaining separated, and I here include the three species normally referred to *Silurodes* under the genus *Ompok*.

9. Genus **Kryptopterus** Bleeker.

Body strongly compressed, head depressed. Mouth straight to oblique gape very short, not reaching anterior border of eye. Jaws equal, or one

jaw or the other slightly longer. Anterior nostrils tubular, wideset; posterior nostrils before anterior border of the eye or slightly behind vertical from its front border. Eyes subcutaneous, opposite the corner of the mouth and visible from underside of head, usually quite large, 2½-6 in head. Maxillary barbels very slender, varying in length. Mandibular barbles short, rudimentary, or absent. Teeth in jaws short, forming broad bands. Vomerine teeth usually in one patch, more rarely two. No teeth on palatines. Gillrakers long, curved and slender, usually as long as the branchial filaments, about 15-20 on the long limb of the gill arch. Anal free from caudal or narrowly joined to it. Caudal deeply forked. Dorsal rays, when present, short, about two in eye; dorsal sometimes lacking.

D. 0-2; P. I, 10-I, 17; V. 5-10; A. 48-93; B. 8-17.

Most of the species now carried in *Kryptopterus* were first described by Bleeker under the name *Silurus*. In his 1858 revision of the catfishes, Bleeker assigned these species to five new genera, *Kryptopterus*, *Kryptopterichthys*, *Micronema*, *Phalacronotus*, and *Hemisilurus*. These genera were distinguished from one another chiefly on the basis of the degeneration of the dorsal fin and the number of mandibular barbels as follows: -

Kryptopterus: Rudimentary dorsal, vomerine teeth in one patch, branchiostegals 10-12, 2 pairs of barbels.

Kryptopterichthys: Rudimentary dorsal, vomerine teeth in one patch, branchiostegals, 8-9, 1 pair of barbels.

Micronema: No dorsal, vomerine teeth in one patch, branchiostegals 12-14, 2 pairs of barbels.

Palacronotus: No dorsal, vomerine teeth in one patch, branchiostegals 14-17, 1 pair of barbels.

Hemisilurus: No dorsal, vomerine teeth in two patches, branchiostegals 9-13, 1 pair of barbels.

Günther (*op. cit.*) lumped all these forms into *Cryptopterus*. Weber and Beaufort (1913) returned *Hemisilurus* to generic rank, but left *H. schilbeides* with *Cryptopterus*. The generic name was again spelled *Kryptopterus* in various publications of Fowler and Smith.

Representatives of the genus *Kryptopterus* are known only from the Malay Peninsula, Siam, Sumatra, Java, Borneo, and Indo-China, but within this relatively restricted range there are probably more species than occur in any other silurid genus. Although the genus itself is well defined, there is considerable confusion surrounding the species. About fifteen forms are recognized at the present time, some of which are probably invalid, while others are doubtless as yet undescribed. The genus is in need of a thorough revision, but due to lack of sufficient material no such attempt could be made here.

Probably most of the difficulty in distinguishing the species as they now stand is due to the fact that separations have been largely artificial. These fishes have very few external characters by which they may be differentiated; they are keyed out chiefly on the basis of presence or absence of a dorsal fin, length of barbels, distribution of vomerine teeth

and general body proportions. It has been demonstrated that throughout the family Siluridae considerable intraspecific variation may occur in regard to such characters, and it is likely that species of *Kryptopterus* have been badly confused through too-great dependence on them, as well as through paucity of material of many of the described forms. I found great difficulty in keying out specimens in the Stanford collections, because they did not conform with the published descriptions.

It was found necessary to use the number of rays in the dorsal fin as a key character for separating *Kryptopterus* from the other genera, although not as a prime classificatory character as had been the case with some previously written keys to the silurid genera. The result is likely to be unnatural divisions when such a character as the number of rays of the dorsal fin, in a series of species which show a progressive, and perhaps heterophyletic, degeneration of that fin, is used as a primary basis of classification. It seems useful, however, to make some use of this character at present, albeit with full knowledge of its possibly small phylogenetic importance.

I found an unnamed specimen from Singora, Siam, which I identified as *Kryptopterus macrocephalus* (Bleeker). The length of the specimen, with caudal, is 73 mm. It agrees with the description of Weber and Beaufort (1913, p. 217) except that the vomerine teeth are in two rounded, slightly separated patches instead of in a single patch, and the anal rays are 48 rather than 52. Other specimens of *K. macrocephalus* in the fish collections of the Stanford Natural History Museum also have the vomerine teeth in two patches; apparently there is considerable intraspecific variation in this respect. The species has previously been recorded only from Sumatra, Borneo, and the Malay Peninsula (Perak and Johore). With this specimen the range is extended to peninsular Siam.

A CHECK-LIST OF THE GENERA AND SPECIES OF THE FAMILY SILURIDAE.

The species here listed are for the most part currently recognized; there is some doubt as to whether all of them are valid. Included after the synonymy of each species is a list of specimens examined in the course of this study. Unless otherwise stated, the numbers following these specimens are catalogue (register) numbers of the fish collections in the Natural History Museum of Stanford University.

1. Genus **Hemisilurus**, Bleeker.

1858. *Hemisilurus*, Bleeker, *Ichthyol. Archipel. Ind.* I, p. 295 (type; *Wallago heterorhynchus* Bleeker; 1853*a*; p. 514; by subsequent designation of Bleeker; 1862; p. 395).

1891. *Diastatomycter*, Vaillant, *Bull. de la Soc. Philomathiq. d. Paris* (8) III; p. 182 (type by monotype; *Diastatomycter chaperi* Vaillant; 1891; p. 182).

Hemisilurus chaperi (Vaillant).

1891. *Diastatomycter chaperi*, Vaillant, *Bull. de la Soc. Philomathiq. d. Paris* (8) III; p. 182 (type-locality; Borneo).

1893. *Diastatomycter chaperi*, Vaillant, *Bull. de la Soc. Zoologiq. d. France* XVIII; p. 61.

1913. *Hemisilurus chaperi*, Weber & Beaufort, *Fish; Indo-Austral. Archipel.* II; p. 211.

Range.—Borneo.

Hemisilurus heterorhynchus (Bleeker).

1853*a*. *Wallago heterorhynchus*, Bleeker, *Nat. Tijds. Ned. Ind.* V; p. 514 (type-locality; Sumatra).

1858. *Hemisilurus heterorhynchus*, Bleeker, *Ichthyol. Archipel. Inst.* I; p. 296.

1862*a*. *Hemisilurus heterorhynchus*, Bleeker, *Atal. Ichthyol.* II; p. 94. pl. lxliii; fig. 2.

1864. *Hemisilurus heterorhynchus*, Günther, *Cat. Fish. Brit. Mus.* V; p. 54.

1913. *Hemisilurus heterorhynchus*, Weber & Beaufort, *Fish, Indo-Austral. Archipel.* II; p. 211.

Range.—Sumatra and Borneo.

Hemisilurus moolenburghi, Weber & Beaufort.

1913. *Hemisilurus moolenburghi*, Weber & Beaufort, *Fish. Indo-Austral. Archipel.* II; p. 212; figs. 84-85 (type-locality; Sumatra).

1936. *Hemisilurus moolenburghi*, Hardenberg, *Treubia* XV; p. 232.

Range.—Sumatra and Borneo.

2. Genus **Ceratoglanis**, Myers.

1938. *Ceratoglanis*, Myres, *Copeia*, No. 2, p. 98 (type by original designation *Hemisilurus scleronema* Bleeker, 1861*a*, p. 93).

Ceratoglanis scleronema (Bleeker).

1862*a*. *Hemisilurus scleronema*, Bleeker, *Atl. Ichthyol.* II; p. 93; pl. ci (type-locality; Java).

1862*b*. *Hemisilurus scleronema*, Bleeker, *Versl. Akad. Amsterdam* XV; p. 74 (described as new; but the description in 1862*a* evidently published first).

1913. *Hemisilurus scleronema*, Weber & Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 214, fig. 86.

1938. *Ceratoglanis scleronema*, Myers, *Copeia*, No. 2, p. 98.

1945. *Ceratoglanis scleronema*, Smith, *U. S. Nat. Mus. Bull. No.* 188, p. 339.

Range.—Java, Borneo, Sumatra, and Siam.

Specimens examined.—Mandan R., Siak, Sumatra, one example. U. S. National Museum 93287.

3. Genus **Belodontichthys**, Bleeker.

1858. *Belodontichthys*, Bleeker, *Ichthyol. Archipel. Ind.* I; p. 266 (type, *Wallago dinema* Bleeker; 1851*b*; pp. 198; 202; equals *Belodontichthys macrochir* Bleeker; 1858; p. 266; by subsequent designation of Bleeker; 1862; p. 394).

Belodontichthys dinema (Bleeker).

1851*b*. *Wallago dinema*, Bleeker, *Nat. Tijds. Ned. Ind.* II; pp. 198; 202 (type-locality; Borneo).

1858. *Belodontichthys macrochir*, Bleeker, *Ichthyol. Archipel. Ind.* I; p. 266 (equals *Wallago dinema* Bleeker; 1851*b*; pp. 198, 202).

1862. *Belodontichthys macrochir*, Bleeker, *Versl. Akad. Amsterdam* XIV; p. 394.

1862*a*. *Belodontichthys macrochir*, Bleeker, *Atl. Ichthyol.* II; p. 80; pl. lxxxvi; fig. 2;

1913. *Belodontichthys dinema*, Weber & Beaufort, *Fish, Indo-Austral. Archipel.* II; p. 204; fig. 79.

1938. *Wallago dinema*, Myers, *Copeia*; No. 2; p. 98.

1945. *Wallago dinema*, Smith, *U. S. Nat. Mus. Bull.* No. 188, p. 335.

Range.—Borneo, Sumatra, Malay Peninsula, and Siam.

Specimens examined.—Palembang, Sumatra; two examples. University of Michigan (uncatalogued) Bang Sai, Siam; one example. U. S. National Museum 103314.

4. Genus **Silurichthys**, Bleeker.

1858. *Silurichthys* Bleeker, *Ichthyol. Archipel. Ind.* I; p. 269 (type ; *Silurus phaiosoma* Bleeker, 1851c; p. 428, by subsequent designation of Bleeker; 1862; p. 394).

Silurichthys hasseltii, Bleeker.

1858. *Silurichthys hasseltii*, Bleeker, *Ichthyol. Archipel. Ind.* I; p. 270 (type-locality; Java).

1862*a*. *Silurichthys hasseltii*, Bleeker, *Atl. Ichthyol.* II; p. 82; pl. lxxxvii; fig. 1.

1904. ?*Silurichthys indragiriensis*, Volz. *Annal. Soc. Zoologiq. Suisse* XII, p. 264 (type-locality, Sumatra).

1913. *Silurichthys hasseltii*, Weber & Beaufort, *Fish, Indo-Austral. Archipel.* II; p. 198.

1913. ?*Silurichthys indragiriensis*, Weber & Beaufort, *ibid.*, II; p. 199.

Range.—Java, Borneo, Sumatra, and Malay Peninsula (?)

Specimens examined.—

Singapore; Straits Settlements; British Malaya; one example. 31075

Mandai Rd. ; Singapore ; Straits Settlements ; British Malaya ; twenty-nine examples. 32701.

Jurong ; Singapore ; Straits Settlements ; British Malaya ; three examples. 32700.

Gunong Pulai ;	Johore	State ;	British	Malaya ;	one example.	32697.
,,	,,	,,	,,	,,	,,	four examples.	31079.
Kota Tinggi,	,,	,,	,,	,,	one example.	32698.
,,	,,	,,	,,	,,	,,	one example.	39335.
,,	,,	,,	,,	,,	,,	two examples.	32699.

Silurichthys leucopodus, Fowler.

1939. *Silurichthys leucopodus*, Fowler, *Proc. Acad. Nat. Sci. Philadelphia* LXLI; p. 56; figs. 4-6 (type-locality; Trang, Siam).

Range.—Siam.

Silurichthys phaiosoma (Bleeker).

1851c. *Silurus phaiosoma*, Bleeker, *Nat. Tijds. Ned. Ind.* II; p. 428 (type-locality; Borneo).

1858. *Silurichthys phaiosoma*, Bleeker, *Ichthyol. Archipel. Ind.* I; p. 269.

1862*a*. *Silurichthys phaiosoma*, Bleeker, *Atl. Ichthyol.* II; p. 81; pl. lxxxvii; fig. 2.

1913. *Silurichthys phaiosoma*, Weber & Beaufort, *Fish, Indo-Austral. Archipel.* II, p. 197, fig. 77.

1945. *Silurichthys phaiosoma*, Smith, *U. S. Nat. Mus. Bull.* No. 188, p. 334.

Range.—Borneo, Sumatra, Malay Peninsula, and Siam (?)

Specimens examined.—Telok Anson, Perak State, British Malaya, one example. 31076.

Silurichthys schneideri Volz.

1904. *Silurichthys schneideri*, Volz. *Annal. Soc. Zoologiq. Suissee* XII, p. 263 (type-locality; Sumatra).

1913. *Silurichthys schneideri*, Weber & Beaufort, *Fish. Indo-Austral. Archipel.* II; p. 198.

1941. *Silurichthys schneideri*, Hora & Gupta, *Bull. Raffls. Mus., Singapore.* No. 17, p. 166, pl. ii, fig. 1.

Range.—Sumatra and Malay Peninsula.

Silurichthys, sp.

Specimens examined.—Mawai District, Jahore State, British Malaya. two examples. 31074.

5. Genus **Silurus**, Linnaeus.

1758. *Silurus Linnaeus, Syst. Nat.*, p. 304 (type; *Silurus glanis* Linnaeus. 1758, p. 304, by subsequent designation of Bleeker, 1862, p. 393).

1856. *Glanis* Agassiz, *Proc. Amer. Acad. Arts & Sci.* III, p. 333 (type by monotype, *Glanis aristotelis* Agassiz, 1856, p. 333, preoccupied by *Glanis* Rafinesque 1818).

1861. *Pterocryptis* Peters, *Monotsb. Konig, Akad. Wissens. Berlin*, p. 712 (type by monotype, *Pterocryptis gangelica* Peters, 1861, p. 712, equals *Silurus cochinchinenis* Cuvier & Valenciennes, 1839, p. 352).

1862. *Parasilurus* Bleeker, *Versal. Akad. Amsterdam* XIV, p. 392 (type by original designation, *Silurus japonicus* Temminck & Schlegel, 1847, p. 226, equals *Silurus asotus* Linnaeus; 1758, p. 304).

1905. *Apodoglanis* Fowler, *Proc. Acad. Sci. Philadelphia*, p. 463 (type by original designation, *Apodoglanis furnessi*, Fowler, 1905, p. 463).

1933. *Herklotsella* Herre, *Hong Kong Naturalist* IV, p. 179 (type by original designation, *Herklotsella anomala* Herre, 1933, p. 179, equal *Silurus cochinchinensis* Cuvier & Valenciennes, 1939, p. 352).

Silurus aristotelis (Agassiz).

1856. *Glanis aristotelis, Agassiz, Proc. Amer. Acad. Arts. & Sci.* III, p. 333 (type-locality Greece).

1890. *Silurus aristotelis*. Garman, *Bull. Essex Inst.* XXII; p. 8.

1892. *Parasilurus aristotalis*, Hoffman & Jordan, *Proc. Acad. Nat. Sci. Philadelphia*, p. 241.

1936. *Silurus asotus* var. *aristotelis*, Tchang, *Bull. Fan Mem. Inst. Biology (Zoology)*, VII; p. 37.

Range.—Greece.

Silurus asotus, Linnaeus.

1758. *Silurus asotus*, Linnaeus, *Syst. Nat.* p. 304 (type-locality, Asia).

Silurus asotus, Linnaeus.

1758. *Silurs asotus*, Linnaeus, *Syst. Nat.*, p. 304 (type-locality, Asia).

1787. *Silurus dauricus*, Pallas, *Nova Acta Acad. Petropol.* I; p. 359, pl. ii; fig. 2 (type-locality, Dauria).

1839. *Silurus dauricus*, Cuvier & Valenciennes, *Hist. Nat. Poiss.* XIV, p. 351.

1842. *Silurus punctatus*, Cantor, *Ann. Mag. Nat. Hist.* (1) IX, p. 485 (type-locality, Chusan, China).

1844. ?*Silurus sinensis*, McClelland, *Cal. Jour. Nat. His.* II, p. 402. (type-locality, Chusan, China).

1944-45. *Silurus xanthosteus*, Richardson, in *Hinds, R. Brinsely*, The *Zoology of the voyage of H. M. S.* " *Sulphur* " *Etc.....London* I, p. 133, pl. lvi, figs. 12-14 (type-locality, Chusan and Canton, China).

1846. *Silurus sinensis*, Richardson, *Rept. Brit. Assoc. Advancement of Sciences* for 1845, p. 281.

1847. *Silurus japonicus*, Temminck & Schlegel, in *Siebold; Phillip Frang, Fauna Japonica. Lugduni Batavorum*, p. 226, pl. civ; fig. 1 (type-locality, Japan).

1864-67. *Silurus asotus*, Kner, *Zoologisch. Theil. Fische. Vienna*, p. 303.

1901. *Parasilurius asotus*, Abbott, *Proc. U. S. Nat. Mus.* XXIII, p. 483.

1943. *Parasilurus asotus asotus*, Nichols, *Nat. Hist. Central Asia* IX, p. 34.

1913. *Silurichthys schneideri*, Weber & Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 198.

Range.—China, Japan, and Eastern Russia.

Specimens examined.

Canton ; Kwantung Prov.; China; one example. 24207.
" " " " three examples. 24230.
" " " " three examples. 28164.

Hong Kong; China; one example. 28007.

Tien-Tsin; Hopeh Prov.; China; three examples. 6441.

Tsien Tang R.; Chekiang Prov.; China; two examples. 32533.

Tinghai; Chusan Id.; China; one example. 32493.

Chusan Id. China; four examples. 33918.
" " " one example. 33919.

Tamusui R.; Formosa; one example. 23019.

Inzampo; Formosa; two examples. 23170.

Korea; two examples. 26537.

Chikugo R.; Kurume; Kyushu Id.; Japan, two examples. 7835.

Lake Biwa; Honshu Id.; Japan; two examples. 7870.
Tsuchiura; " " " ; one example. 7891.

Silurus asotus bedfordi, Regan.

1908. *Silurus bedfordi*, Regan, *Proc. Zool. Soc. London*, p. 61; pl. ii, fig. 3 (type-locality, Kimhoa and Chong-ju, Korea).

1943. *Parasilurus asotus bedfordi*, Nichols, *Nat. Hist. Central Asia* IX, p. 35.

Range.—Chekiang, China and Korea.

Specimens examined.—Seoul, Korea, one example. 23628.

Silurus asotus longus (Wu).

1930. *Parasilurus asotus longus*, Wu, *Bull. du Mus. d' Hist. Nat.* (2) II, p. 225. fig. 1 (type-locality, near Tien-tai Mountain, Tchekiang; China).

1937. *Silurus asotus* var. *longus*, Tchang, *Bull. Fan. Mem. Inst. Biology (Zoology*, VII, p. 143.)

1943. *Parasilurus asotus longus*, Nichols, *Nat. Hist. Central Asia* IX, p. 35.

Range.—Chekiang, China.

Silurus chantrei, Sauvage.

1882. *Silurus chantrei*, Sauvage, *Bull. de la Soc. Philomathiq. d. Paris* (7) VI. p. 163 (type-locality, supposedly Kura River, Tiffls, Southern U. S. S. R., in reality from Syria or basin of the Tigris, *vide* Berg; 1933, p. 587).

1884. *Silurus chantrei*, Sauvage, *Nouvel. Archiv. du Mus. d'Hist. Nat.* (2) VII, p. 19; pl. i, fig. 1.

Range.—Probably Asia Minor.

Silurus cinereus Dabry.

1872. *Silurus cinereus*, Dabry, *La pisciculture et la peche in China*, *p.* 189 (type-locality, Yangtse, China).

1928. *Parasilurus cinereus*, Rendahl, *Ark. f. Zool.* XXA, p. 161.

1943. *Parasilurus cinereus*, Nichols, *Nat. Hist. Central Aisa* IX, p. 34.

Range.—Yangtse, China.

Silurus cochinchinensis Cuvier & Valenciennes.

1839. *Silurus cochinchinensis*, Cuvier & Valenciennes, *Hist. Nat. Poiss.* XIV, p. 352 (type-locality, Cochinchina).

1860. *Silurichthys berdmorei*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 156 (type-locality, Tenasserim, Bengal).

1861. *Pterocryptis gangelica*, Peters, *Monats. Konig; Akad. Wissens. Berlin*, p. 712 (type-locality, Ganges, probably in Assam or the eastern Himalayas, *vide* Hora, 1936*a*, p. 355).

1864. *Silurus afghana*, Günther, *Cat. Fish. Brit. Mus.* V, p. 34 (type-locality Afghanistan is probably erroneous, most likely should be Assam, *vide* Hora, 1936*a*, p. 354).

1864. *Silurus cochinchinensis*, Günther, *ibid.*, V, p. 34.

1864. *Cryptopterus gangeticus*, Gunther, *ibid.*, V, p. 44.

1868. *Silurus punctatus*, Day, *Proc. Zool. Soc. London*, p. 155 (type-locality, Wynaad, India) (not *S. punctatus* Cantor, 1842, p. 485).

1873. *Silurus wynaadensis*, Day, *ibid.*, p. 237 (type-locality, Wynaad, India).

1873. *Silurus dukai*, Day, *ibid.*, p. 239 (type-locality, Darjeeling, India).

1878-88. *Callichrous gangeticus*, Day, *Fish. India*, p. 476.

1878-88. *Silurus wynaadensis*, Day, *ibid.*, p. 480, pl. 111, fig. 6.

1878-88. *Silurus cochinchinensis*, Day, *ibid.*, p. 481, pl. 113, fig. 2.

1933. *Herklotsella anomala*, Herre, *Hong Kong Naturalist* IV, p. 179 (type-locality, Hong Kong).

1937. *Penesilurus bokorensis*, Pellegrin & Chevey, *Bull. de la Soc. Zoologique de France* LXXII, p. 315 (type-locality, Bokor, Cambodia).

1941. *Silurus cochinchinensis*, Hora & Gupta, *Bull. Raffl. Mus., Singapore*, No. 17, p. 18.

1943. *Parasilurus cochinchinensis*, Nichols, *Nat. Hist. Central Asia* IX, p. 35.

1943. *Parasilurus anomalus*, Nichols, *ibid.*, IX, p. 35.

1945. *Parasilurus cochinchinensis*, Smith, *U. S. Nat. Mus. Bull.* No. 188, p. 333.

Range.—Cochinchina, Siam, Malay Peninsula (Kedah), Burma and India.

Specimens examined.—

Hong Kong, China, one example. 26769 (holotype of *Herklotsella anomala*).

,, ,, two examples. 14841 (partypes of *H. anomala*).

,, ,, one example. 30271.

,, ,, one example. 31659.

Mountain stream near Ting Wu Monastery, Kwantung Prov. China, twelve examples. 32800.

Nodoa, Hainan Id., Kwantung Prov. China, two examples. 31763.

Central part of Hainan Id., Kwantung Prov., China, one example. 39627.

Kalimpong Duars and Siliguri Terai, Tista R. drainage, Bengal Prov., India, one example. 41890.

Silurus (?) **furnessi** (Fowler).

1905. *Apodoglanis furnessi*, Fowler, *Proc. Acad. Nat. Sci. Philadelphia*, p. 463, fig. 2 (type-locality, Borneo).

Range.—Borneo.

Silurus gilberti Hora.

1936. *Silurus wynaadensis*, Tchang, *Bull. Fan Mem. Inst. Biology* (*Zoology* VII, p. 35 (not *S. wynaadensis* Day, 1873; p. 237) (type-locality, Lunchow, China).

1937. *Silurus sinensis*, Hora, *Rec. Ind. Mus.* XXXIX, p. 341 (replaces *S. wynaadensis* Tchang, 1936, p. 35, preoccupied by *Silurus sinensis* McClelland, 1844, equals *S. asotus* Linnaeus, 1758).

1938. *Silurus gilberti*, Hora, *Rec. Ind. Mus.* XL, p. 243 (replaces *S. sinensis* Hora, 1937, p. 341).

Range.—Lunchow, China.

Silurus glanis Linnaeus.

1758. *Silurus glanis*, Linnaeus, *Syst.* Nat., p. 304 (type locality, Asia and Europe).

1839. *Silurus glanis*, Cuvier & Valenciennes, *Hist. Nat. Poiss.* XIV; p. 323.

1858. *Silurus glanis*, Heckel & Kner, *Die susswasserfische der ostreichische etc.*, p. 308.

1895. *Silurus glanis*, Fries; Ekstrom, & Sundevall, *A history of Scandinavian Fishes*, pt. 2; p. 693.

1933. *Silurus glanis*, Berg; *Les poiss. d. eaux Lonc. d. l'U, R. S. S.*; p. 585.

Range.—Eastern and Northern Europe and Asia Minor.

Specimens examined.—Volga R., Samara, Russia, two examples. 20587.

Silurus goae, sp. nov.

Specimens examined.—Goa, Portuguese India, one example. 41889 (holotype). Trivandrum, Travancore, India, one example. 41888 (paratype).

Silurus grahami Regan.

1907. *Silurus grahami*, Regan, *Ann. Mag. Nat. Hist.* (7) XIX; p. 64 (type-locality, Yunnan, China).

1943. *Parasilurus grahami*, Nichols, *Nat. Hist. Central Asia* IX; p. 34.

Range.—Yunnan, China.

Silurus mento Regan.

1904. *Silurus mento*, Regan, *Ann. Mag. Nat. Hist.* (7) XIII; p. ? (type-locality, Yunnan Fu, China).

1943. *Parasilurus mento*, Nichols, *Nat. Hist. Central Asia* IX, p. 34.

Range.—Yunnan, China.

Silurus microdorsalis (Mori).

1936. *Parasilurus microdorsalis*, Mori, *Doubutsugaku Zasshi* XLVIII; p. ? (type-locality, Chosen).

Range.—Korea.

6. Genus **Wallago** Bleeker.

1851*b*. *Wallago* Bleeker, *Nat. Tijds. Ned. Ind.* II, p. 198 (type, *Silurus mulleri*, Bleeker, 1846*a*, p. 284, equals *Silurus attu* Bloch & Schneider, 1801, p. 378, equals *Wallago russellii*, Bleeker, 1853*b*, p. 108, by subsequent designation of Bleeker, 1862, p. 394).

1864-67. ?*Silurodon* Kner, *Zoologisch. Theil. Fische. Vienna*, p. 305 (type by monotypy, *Silurodon hexanema* Kner, 1864-67, p. 305).

1938. *Wallagonia* Myers, *Copeia*, No. 2, p. 98 (type by original designation, *Wallago leerii* Bleeker 1851*c*, p. 427).

Wallago attu (Bloch & Schneider).

1801. *Silurus attu*, Bloch & Schneider, *Syst. Ichthyol.*, p. 378, pl. lxxv (type-locality, Malabar).

1822. *Silurus boalis*, Hamilton, *Fish. Ganges*, p. 154, pl. xxix, fig. 49 (type-locality, River Ganges, India).

1838. *Schilbe boalis*, Sykes, *Trans. Zool. Soc.* II, p. 368, pl. lxiv, fig. 2.

1839. *Callichrus macrostomus*, Swainson, *Natural history and Classification of Fishes etc.* II, p. 306 (type-locality not given).

1839. *Silurus wallagoo*, Cuvier & Valenciennes, *Hist. Nat. Poiss.* XIV, p. 354 (type-locality, Bengal).

1846*a*. *Silurus mulleri*, Bleeker, *Nat. Gen. Arch. Ned. Ind.* III, p. 284 (type-locality, Batavia, Java).

1851*b*. *Wallago mulleri*, Bleeker, *Nat. Tidjs. Ned. Ind.* II, p. 198.

1852. *Wallago mulleri*, Bleeker, *ibid.*, III, p. 585.

1853*b*. *Wallago russellii*, Bleeker, *Verh. Batav. Genootsch* XXV, p. 108 (type-locality, Calcutta and Batavia).

1858. *Wallago russellii*, Bleeker, *Ichthyol. Archipel. Ind.* I, p. 262.

1862*a*. *Wallago attu*, Bleeker, *Atl. Ichthyol.* II, p. 79, pl. lxxxvi, fig. 1.

1878-88. *Wallago attu*, Day, *Fish. India*, p. 479, pl. cxi, fig. 4.

1913. *Wallago attu*, Weber & Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 201.

1938. *Wallagonia attu*, Myers, *Copeia*, No. 2, p. 98.

1939. *Wallagonia attu*, Hóra, *Jour. Bomay Nat. Hist. Soc.* XLI, p. 64.

1945. *Wallagonia attu*, Smith, *U. S. Nat. Mus. Bull.* No. 188, p. 332.

Range.—Java, Sumatra, Ceylon, India, Burma, Siam and Indo-china.

Specimens examined.—

Poona, Bombay Pres., India, one example. 34869.

Pulta, India, one example. 34870.

Nidadavolw, Vizagapatam Dist., Madras Pres., India, one example. 41891.

Bisrampur, Central Pro., India, one example. 41892.

Wallago (?) **hexanema** (Kner).

1864-67. *Silurodon hexanema*, Kner, *Zoologisch. Thoil. Fische. vienna*, p. 305, pl. xii, fig. 2 (type-locality, Shanghai, China, probably erroneous).

1943. *Silurodon hexanema*, Nichols, *Nat. Hist. Central Asia* IX, p. 36.

Range.—Not known.

Wallago leerii Bleeker.

1851*c*. *Wallago leerii*, Bleeker, *Nat. Tijds. Ned. Ind.* II, p. 427 (type-locality, Borneo).

1858. *Wallago leerii*, Bleeker, *Ichthyol. Archipel. Ind.* I, p. 264.

1862*a*. *Wallago leerii*, Bleeker, *Atl. Ichthyol.* II, p. 80, pl. 85.

1913. *Wallago leerii*, Weber & Beaufort, *Fish. Ind. Austral. Archipel.* II, p. 202.

1938. *Wallagonia leerii*, Myers, *Copeia*, No. 2, p. 98.

Range.—Sumatra and Borneo.

Wallago miostoma Vaillant.

1902. *Wallago miostoma*, Vaillant, *Poissons. Notes from the Leyden Mus.* XXIV, p. 44 (type-locality, Borneo).

1902. *Wallago nebulosus*, Vallant, *ibid.*, XXIV, p. 46 (type-locality, Borneo).

1905. *Ompok nebulosus*, Fowler, *Proc. Acad. Nat. Sci. Philadelphia*, p. 465.

1913. *Wallago miostoma*, Weber & Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 202, fig. 78.

1938. *Wallagonia miostoma*, Myers, *Copeia*, No. 2, p. 98.

1945. *Wallagonia miostoma*, Smith, *U. S. Nat. Mus. Bull.* No. 188, p. 332.

Range.—Borneo, Sumatra, Siam and Malay Peninsula.

Specimens examined.—Singapore, Straits Settlements, British Malaya, one example. 14859.

Wallago tweediei (Hora & Misra).

1941. *Wallagonia tweediei*, Hora & Misra (*in* Hora & Gupta, 1941, *Bull. Raffl. Mus.*, Singapore, No. 17, p. 18, figs. 2-3) (type-locality, Pahang, Malay Peninsula).

Range.—Malay Peninsula (Pahang).

7. Genus **Hito** Herre.

1924*a*. *Hito* Herre, *Philippine Jour. Sci.* XXIV, p. 702 (type by original designation, *Hito taytayensis* Herre, 1924*a*. p. 703).

1924*b*. *Hitoichthys* Herre, *Proc. Pan-Pacific Sci. Congress* II, p. 1570 (substitute for *Hito* : same type).

1924*a*. *Penesilurus* Herre, *Phillippine Jour. Sci.* XXIV, p. 703 (type by original designation, *Penesilurus palavanensis* Herre, 1924*a*, p. 704).

Hito taytayensis Herre.

1924*a*. *Hito taytayensis*, Herre; *Phillippine Jour. Sci.* XXIV, p. 703 (type-locality, Taytay, Palawan, Philippine Isds).

1924*b*. *Hitoichthys taytayensis*, Herree, *Proc. Pan-Pacific Sci. Congress* II, p. 1570.

1924*a*. *Penesilurus palavanensis*, Herre, *Philippine Jour. Sci.* XXIV, p. 704, (type-locality, Lake Manguao, Palawan, Philippine Isds).

1924*b*. *Penesilurus palavanensis*, Herre, *Proc. Pan-Pacific Sci. Congress* II, p. 1570.

Range.—Palawan, Culion and Busuanga, Philippine Isds.

Specimens examined.—

Creek flowing into Halsey Harbour, Culion Id., Philippine Isds., twenty-five examples. 27108.

Karig Malan Creek, Culion Id., Philippine Isds., twenty examples. 27290.

San Nicolas, Busuanga Id., Philippine Isds., three examples. 38374.

Watan Creek, Busuanga Id., Philippine Isds., eleven examples. 38375.

Singay, Busuanga Id., Philippine Isds., four examples. 39152.

8. Genus **Ompok** Lacépéde.

1803. *Ompok* Lacépéde, *Hist. Nat. Poiss*, V, p. 49 (type- by monotypy, *Ompok siluroides* Lacepede, 1803, p. 49).

1803. *Ompok* Lacépéde, *ibid.*, V, pl. i, fig. 2 (misspelling).

1822. *Callichrous* Hamilton, *Fish. Ganges*, p. 149 (type, *Silurus* (*Callichrous*) *pabda* Hamilton, 1822, p. 150, equals *Ompok siluroides* Lacépéde, 1803, p. 49, *Silurus bimaculatus* Bloch, 1797, p. 17, by subsequent designation of Bleeker, 1862, p. 395).

1858. *Silurodes* Bleeker, *Ichthyol. Archipel. Ind.* I; p. 271 (type, *Silurus hypophthalmus* Bleeker, 1846, p. 149, by subsequent designation of Bleeker; 1862, p. 394).

1858. *Pseudosilurus* Bleeker, *ibid.*, I, p. 275 (type, *Silurus* (*Callichrous*) *pabda Hamilton*, 1822, p. 150, equals *Ompok siluroides* Lacépéde, 1803, p. 49, equals *Silurus bimaculatus* Bloch, 1797, p. 17, by subsequent designation of Bleeker, 1862, p. 395).

Ompok bimaculatus (Bloch).

1797. *Silurus bimaculatus*, Bloch, *Ichthyol. Hist. Nat. d. Poiss.*, pt. II, p. 17, pl. ccclxiv (type-locality, Malabar).

1803. *Ompok siluroides*, Lacépéde, *Hist. Nat. Poiss.* V, p. 49, pl. i, fig. 2 (fig. misspelled *Ompock*) (type-locality not given, probably Batavia).

1822. *Silurus chechra*, Hamilton, *Fish. Ganges*, p. 152 (type-locality, Kosi R., India).

1822. *Silurus canio*, Hamilton, *ibid.*, p. 151 (type-locality, north-eastern Bengal).

1822. *Silurus canio*, Hamilton, *ibid.*, p. 151 (type-locality, north-eastern Bengal).

1822. *Silurus duda*, Hamilton, *ibid.*, p. 152 (type-locality, Kosi R., India).

1822. *Silurus pabda*, Hamilton, *ibid.*, p. 150, pl. xxv, fig. 47 (type-locality, Bengal, India).

1838. *Silurus lamghur*, Heckel, *Fisch. Caschmir*, p. 82 (type-locality, Kashmir, India).

1838. *Schilbe pabo*, Sykes, *Trans. Zool. Soc.* II, p. 367 (not *Silurus pabo* Hamilton, 1822, p. 153) (type-locality, Deccan, India).

1839. *Callichrus nebulosus*, Swainson, *The Natural history & Classification of* Fishes etc. II, p. 306 (equals *Silurus chechra* Hamilton, 1822, p. 152).

1839. *Callichrus bimaculatus*, Swainson, *ibid.*, II, p. 306.

1839. *Callichrus vittatus*, Swainson, *ibid.*, II, p. 306 (equals *Silurus pabda* Hamilton, 1822, p. 150).

1839. *Callichrus immaculatus*, Swainson, *ibid.*, II, p. 306 (equals *Silurus canio* Hamilton, 1822, p. 151).

1839. *Callichrus affinis*, Swainson, *ibid.*, II, p. 306 (equals *Silurus duda* Hamilton, 1822, p. 152).

1839. *Silurus bimaculatus*, Cuvier & Valenciennes, *Hist. Nat. Poiss.* XIV, p. 360.

1839. *Silurus anostomus*, Cuvier & Valenciennes, *ibid.*, XIV, p. 363 (type-locality, Bengal).

1839. *Silurus pabda*, Cuvier & Valenciennes, *ibid.* XIV, p. 364.

1839. *Silurus mysoricus*, Cuvier & Valenciennes, *ibid.*, XIV, p. 364. (type-locality, Mysore, India).

1839. *Silurus microcephalus*, Cuvier & Valenciennes, *ibid.*, XIV, p. 365 (type-locality, Bengal).

1839. *Silurus malabaricus*, Cuvier & Valenciennes, *ibid.*, XIV, p. 353 (type-locality, Malabar, India).

1842. *Silurus indicus*, McClelland, *Cal. Jour. Nat. Hist.* II, p. 583 (type-locality, India).

1845. *Silurus bimaculatus*, Bleeker, *Nat. Gen. Arch. Ned. Ind.* II, p. 511.

1852. *Wallago bimaculatus*, Bleeker, *Nat. Tijds. Ned. Ind.* III, p. 585.

1853*b*. *Wallago microcephalus*, Bleeker, *Verh. Batav. Genootsch* XXV, p. 110.

1853*b*. *Wallago bimaculatus*, Bleeker, *ibid.*, XXV, p. 54.

1853*b*. *Wallago malabaricus*, Bleeker, *ibid.*, XXV, p. 54.

1853*b*. *Wallago pabda*, Bleeker, *ibid.*, XXV, p. 54.

1853*b*. *Wallago anostomus*, Bleeker, *ibid.*, XXV, p. 109.

1858. *Pseudosilurus bimaculatus*, Bleeker, *Ichthyol. Archipel. Ind.* I, p. 275.

1858. *Phalacronotus siluroides*, Bleeker, *ibid.*, I, p. 304.

1860. *Pseudosilurus macropthalmos*, Blyth, *Jour. As. Soc. Bengal* XXIX, p. 156 (type-locality, Tenasserim, Bengal, India).

1862*a*. *Callichrous bimaculatus*, Bleeker, *Versl. Akad. Amsterdam* XIV, p. 84, pl. lxxxvii, fig. 3.

1864. *Callichrous bimaculatus*, Günther, *Cat. Fish. Brit. Mus.* V, p. 45.

1864. *Callichrous ceylonensis*, Günther, *ibid.*, V, p. 46 (type-locality, Ceylon).

1864. *Callichrous chechra*, Günther, *ibid.*, V, p. 46.

1864. *Callichrous anostomus*, Günther, *ibid.*, V, p. 47.

1864. *Callichrous pabda*, Günther, *ibid.*, V, p. 47.

1864. *Callichrous canio*, Günther, *ibid.*, V, p. 48.

1864. *Silurichthys lamghur*, Günther, *ibid.*, V, p. 36.

1867. *Crytopterus latovittatus*, Playfair, *Proc. Zool. Soc. London*, p. 16 (type-locality, Cachar, India).

1869*a*. *Callichrous macrophthalmus*, Day, *ibid.*, p. 613.

1869*a*. *Callichrous notatus*, Day, *ibid.*, p. 616 (type-locality, Burma).

1871. *Callichrous egertoni*, Day, *ibid.*, p. 710 (type-locality, Punjab, India).

1878-88. *Callichrous bimaculatus*, Day, *Fish. India*, p. 476, pl. cx, figs. 4-5.

1878-88. *Callichrous sindensis*, Day, *ibid.*, p. 476, pl. cx, fig. 1 (type-locality, Sind, India).

1878-88. *Callichrous macrophthalmus*, Day, *ibid.*, p. 478, pl. cx, figs. 2-3.

1913. *Callichrous bimaculatus*, Weber & Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 209.

1934*a*. *Wallago krattensis*, Fowler, *Proc. Acad. Nat. Sci. Philadelphia*, p. 335, fig. p. 336 (type-locality, Kratt, South-east Siam).

1935. *Ompok bimaculatus*, Fowler, *ibid.*, p. 96.

1938. *Ompok pabda*, Fowler, *Fish. Bull., Singapore*, No. 1, pp. 45, 248

1945. *Ompok bimaculatus*, Smith, *U. S. Nat. Mus. Bull.* No. 188, 337.

Range.—Sumatra, Java, Borneo, Malaya, Siam, Indo-China, India, Burma and Ceylon.

Specimens examined.—

Tungabhadra R., Dharwar, Bombay Pres., India, one example. 41885.

Vizagapatam, Madras Pres., India, one example. 41886.

Sheonath R., Bisrampur, Central Prov., India, three examples. 41887.

Calcutta, Bengal Prov., India, sixteen examples. 34864.

Calcutta, Bengal Prov., India, one example. 34865.

Ceylon, three examples. 22913.

Colombo, Ceylon, three examples. 30177.

Peradeniya, Ceylon, one example. 30178.

Galatabendiyava, Nikateraviya, Ceylon, one example. 30179.

Rangoon, Burma, ten examples. 33790.

Rangoon, Burma, one example. 33796.

Kao Sabap, stream tribuatary to Chantabun R., S. E. Siam, one example. 28824.

Singora, Siam, one example. 31069.

Singapore, Straits Settlements, British Malaya, two examples. 31070

Bukit Merah, Perak State, British Malaya, one example. 32735.

Bukit Sago, Kuantan, Pahang State, British Malaya, two examples. 32899.

Buitenzorg, Java, two examples. 20469.

Batavia, Java, four examples. University of Michigan (uncatalogued).

Ompok borneensis (Steindachner).

1901. *Callichrous borneensis*, Steindachner, *Abhandl. Sinckenberg. Naturforsc Gesellsch.* XXV, p.4 45 (type-locality, Serawal, Borneo).

1913. *Silurodes borneensis*, Weber & Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 206.

Range.—Borneo.

Ompok eugeneiatus (Vaillant).

1893. *Callichrous eugeneiatus*, Vaillant, *Bull. de la Soc. Zoologiq. d. Franc* XVIII, p. 61 (type-locality, Borneo).

1893*a*. *Callichrous eugeneiatus*, Vaillant, *Nouvell. Archiv. Mus. d. Hist. Nat.* (3) V, p. 65, pl. ii, fig. 3.

1912. *Silurodes eugeneiatus*, Weber & Beaufort, *in Maas Alfrd, Durch Zentral-Sumatra* II, p. 534.

1913. *Silurodes eugeneiatus*, Weber & Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 207, fig. 80.

Range.—Borneo.

Ompok hypophthalmus (Bleeker).

1846. *Silurus hypophthalmus*, Bleeker, *Nat. Gen. Ned. Ind.* III, p. 149 (type-locality, Batavia, Java).

1851*b*. *Silurus macronema*, Bleeker, *Nat. Tijds. Ned. Ind.* II, p. 203 (type-locality, Borneo).

1858. *Silurodes hypophthalmus*, Bleeker, *Ichthyol. Archipel. Ind.* I, p. 272.

1858. *Silurodes macronema*, Bleeker, *ibid.*, I, p. 273.

1862*a*. *Silurodes hypophthalmus*, Bleeker, *Atl. Ichthyol.* II, p. 83, pl. lxxxviii, fig. 2.

1862*a*. *Silurodes macronema*, Bleeker, *ibid.*, II, p. 83, pl. lxxxviii, fig. 1.

1864. *Callichrous hypophthalmus*, Günther, *Cat. Fish. Brit. Mus.* V p. 48.

1864. *Callichrous macronema*, Günther, *ibid.*, V, p. 49.

1913. *Silurodes hypophthalmus*, Weber & Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 205.

1945. *Silurodes hypophthalmus*, Smith, *U. S. Nat. Mus. Bull.* No. 188, p. 336.

Range.—Borneo, Java, Sumatra, Siam and Malay Peninsula.

Specimens examined.—Telok Anson, Perak State, British Malaya, one example. 31077. Pasak R., Siam, one example. U. S. National Museum 103225.

Ompok (?) **javanesis** (Hardenberg).

1938. *Belodontichthys javanensis*, Hardenberg, *Treubia* XVI, p. 311 (type-locality, Java).

Range.—Java.

Ompok leiacanthus (Bleeker).

1853. *Wallago leiacanthus*, Bleeker, *Nat. Tijds. Ned. Ind.* V, p. 189 (type-locality, Banka).

1858. *Pseudosilurus leiacanthus*, Bleeker, *Ichthyol. Archipel. Ind.* I, p. 281.

1862*a*. *Callichrous leiacanthus*, Bleeker *Atl. Ichthyol.* II, p. 85, pl. lxxxix, fig. 2.

1864. *Callichrous liacanthus*, Günther, *Cat. Fish. Brit. Mus.* V, p. 47.

1905. *?Ompok jaynei*, Fowler, *Proc. Acad. Nat. Sci. Philadelphia*, p. 466 (type-locality, Borneo).

1913. *Callichrous leiacanthus*, Weber & Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 208, fig. 82.

1940. *Ompok leiacanthus*, Herre, *Bull. Raffl. Mus. Singapore*, No. 16, p. 53.

Range.—Sumatra, Borneo, and Malaya (Singapore).

Specimens examined.—Mandai Road, Singapore, Straits Settlements, British Malaya, one example. 32702.

Ompok pabo (Hamilton).

822. *Silurus pabo*, Hamilton, *Fish. Ganges*, p. 153, pl. xvii, fig. 48 (type-locality, Brahmaputra R., near Assam, India).

864. *Callichrous pabo*, Günther, *Cat. Fish. Brit. Mus.* V, p. 48.

1869*a*. *Callichrous nigrescens*, Day, *Proc. Zool. Soc. London*, p. 616 (type-locality, Burma).

1878-88. *Callichrous pabo*, Day, *Fish. India*, p. 477, pl. cx, fig. 6.

1929. *Callichrous pabo*, Prashad & Mukerji, *Rec. Ind. Mus.* XXXI, p. 177.

Range.—Northeast India and Burma.

Ompok weberi (Hardenberg).

1937. *Callichrous weberi*, Hardenberg, *Treubia* XVI, p. 9 (type-locality, Borneo).

1938. *Callichrous weberi*, Hardenberg, *ibid.*, XVI, p. 232.

Range.—Borneo.

9. Genus **Kryptopterus** Bleeker.

1858. *Kryptopterus* Bleeker, *Ichthyol. Archipel. Ind.* I, p. 283 (type, *Silurus cryptopterus* Bleeker, 1851, p. 270, equals *Kryptopterus* micropus Bleeker, 1858, p. 284, by subsequent designation of Bleeker, 1862, p. 395).

1958. *Kryptopterichthys* Bleeker, *ibid.*, I, p. 288 (type, *Silurus bicirrhis* Cuvier and Valenciennes, 1839, p. 367, equals *Kryptopterichthys palembangensis* Bleeker, 1858, p. 288, by subsequent designation of Bleeker, 1862, p. 395).

1858. *Micronema* Bleeker, *ibid.*, I, p. 298 (type *Silurus micronemus* Bleeker, 1846*a*, p. 289, equals *Micronema typus* Bleeker, 1858, p. 300, by subsequent designation of Bleeker, 1862, p. 395).

1858. *Phalacronotus* Bleeker, *ibid.*, I, p. 302 (type, *Silurus apogon* Bleeker, 1851*a*, p. 67, equals *Phalacronotus leptonema*, Bleeker, 1858, p. 304, by subsequent designation of Bleeker, 1862, p. 395).

Kryptopterus apogon (Bleeker).

1851*a*. *Silurus apogon*, Bleeker, *Nat. Tijds. Ned. Ind.* II, p. 67 (type-locality, Borneo).

1852. *Silurus leptonema*, Bleeker, *ibid.*, III, p. 584 (type-locality, Palembang, Sumatra).

1855. *Silurus micropogon*, Bleeker, *ibid.*, IX, p. 419 (type-locality, Borneo).

1858. *Phalacronotus leptonema*, Bleeker, *Ichthyol. Archipel. Ind.* I, p. 304.

1858. *Phalacronotus micropogon*, Bleeker, *ibid.*, I, p. 306.

1862*a*. *Phalacronotus leptonema*, Bleeker, *Atl. Ichthyol.* II, p. 92, pl. lxliv, fig. 2.

1862*a*. *Phalacronotus micropogon*, Bleeker, *ibid.*, II, p. 92 pl, lxliv, fig. 1.

1864. *Cryptopterus micropogon*, Günther, *Cat. Fish. Brit. Mus.* V, p. 43.

1913. *Cryptopterus apogon*, Weber & Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 221, fig. 87.

1933. *Kryptopterus apogon*, Smith, *Jour. Siam Soc., Nat. Hist. Suppl.* IX, p. 75.

1945. *Kryptopterus apogon*, Smith, *U. S. Nat. Mus. Bull.* No. 188, p. 343.

Range.—Sumatra, Borneo, and Siam.

Kryptopterus bicirrhis (Cuvier & Valenciennes).

1839. *Silurus bicirrhis*, Cuvier & Valenciennes, *Hist. Nat. Poiss.* XIV, p. 367 (type-locality, Java).

1852. *Silurus palembangensis*, Bleeker, *Nat. Tijds. Ned. Ind.* III, p. 584 (type-locality, Palembang, Sumatra).

1858. *Kryptopterichthys palembangensis*, Bleeker, *Ichthyol. Archipel. Ind.* I, p. 290.

1858. *Kryptopterichthys bicirrhis*, Bleeker, *ibid.*, I, p. 292.

1862*a*. *Kryptopterichthys palembangensis*, Bleeker, *Atl. Ichthyol.* II, p. 88, pl. lxl, fig. 3.

1862*a*. *Kryptopterichthys bicirrhis*, Bleeker, *ibid.*, II, p. 89, pl. lxl, fig. 1.

1864. *Cryptopterus amboinensis*, Günther, *Cat. Fish. Brit. Mus.* V, p. 40 (type-locality, Amboyan, S. China Sea).

1864. *Cryptopterus palembangensis*, Günther, *ibid.*, V, p. 40.

1864. *Cryptopterus bicirrhis*, Günther, *ibid.*, V, p. 41.

1905. *Kryptopterus palembangensis*, Fowler, *Proc. Acad. Nat. Sci. Philadelphia*, p. 468.

1913. *Cryptopterus bicirrhis*, Weber & Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 217.

1935. *Kryptopterus bicirrhis*, Fowler, *Proc. Acad. Nat. Sci. Philadelphia*, p. 96.

1945. *Kryptopterus bicirrhis*, Smith, *U. S. Nat. Mus. Bull.* No. 188, p. 341.

Range.—Java, Sumatra, Borneo, Siam, and Malay Peninsula.

Specimens examined.—Streams near Bentong, Pahang State, British Malaya, three examples. 31980.

Kryptopterus bleekeri Günther.

1864. *Cryptopterus bleekeri*, Günther, *Cat. Fish. Brit. Mus.* V, p. 44 (type-locality, Siam).

1865. *Micronema bleekeri*, Bleeker, *Ned. Tijdschr. Dierk.* II, p. 34.

1945. *Kryptopterus bleekeri*, Smith, *U. S. Nat. Mus. Bull.* No. 188, p. 344.

Range.—Siam and Indo-China.

Kryptopterus cheveyi Durand.

1940. *Cryptopterus cheveyi*, Durand, *Inst. Oceanographique d. l'Indochine* No. 36, p. 19, pl. iv (type-locality, Kaskos, R., Cambodia).

Range.—Cambodia, Indo-China.

Kryptopterus cryptopterus (Bleeker).

1851. *Silurus cryptopterus*, Bleeker, *Nat. Tijds. Ned. Ind.* II, p. 270 (type-locality, Borneo).

1858. *Kryptopterus micropus*, Bleeker, *Ichthyol. Archipel. Ind.* I, p. 284 (type-locality, Sumatra and Borneo).

1862*a*. *Kryptopterus micropus*, Bleeker, *Atl. Ichthyol.* II, p. 86, pl. lxxxix, fig. 3.

1864. *Cryptopterus micropus*, Günther, *Cat. Fish. Brit. Mus.* V, p. 42.

1905. *Kryptopterus cryptopterus*, Fowler, *Proc. Acad. Nat. Sci. Philadelphia*, p. 468.

1913. *Cryptopterus cryptopterus*, Weber & Beaufort, *Fish. Indo-Austral, Archipel.* II, p. 218.

1945. *Kryptopterus cryptopterus*, Smith, *U. S. Nat. Mus. Bull.* No. 188, p. 340.

Range.—Borneo and Sumatra to Malaya and Siam.

Specimens examined.—Menam Chao Phya at Bangkok, Siam, one example. 28829.

Kryptopterus hexapterus (Bleeker).

1851*b*. *Silurus hexapterus*, Bleeker, *Nat. Tijds. Ned. Ind.* II, p. 203 (type-locality, Borneo).

1858. *Micronema hexapterus*, Bleeker, *Ichthyol. Archipel. Ind.* I, p. 301.

1862*a*. *Micronema hexapterus*, Bleeker, *Atl. Ichthyol.* II, p. 91, pl. lxlii, fig. 1.

1864. *Cryptopterus hexapterus*, Günther, *Cat. Fish. Brit. Mus.* V, p. 43.

1913. *Cryptopterus hexapterus*, Weber & Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 222.

1934. *Kryptopterus hexapterus*, Fowler, *Proc. Acad. Nat. Sci. Philadelphia*, p. 87.

1945. *Kryptopterus hexapterus*, Smith, *U. S. Nat. Mus. Bull.* No. 188, p. 342.

Range.—Sumatra, Java, Borneo, and Siam.

Kryptopterus lais (Bleeker).

1851*c*. *Silurus lais*, Bleeker, *Nat. Tijds. Ned. Ind.* II, p. 428 (type-locality Borneo).

1858. *Kryptopterichthys lais*, Bleeker, *Ichthyol. Archipel. Ind.* II, p. 291.

1862*a*. *Kryptopterichthys lais*, Bleeker, *Atl. Ichthyol.* II, p. 88, pl. lxl, fig. 2.

1864. *Cryptopterus lais*, Günther, *Cat. Fish. Brit. Mus.* V, p. 42.

1913. *Cryptopterus lais*, Weber & Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 218.

Range.—Borneo.

Kryptopterus limpok (Bleeker).

1852. *Silurus limpok*, Bleeker, *Nat. Tijds. Ned. Ind.* III, p. 583 (type-locality, Palembang, Sumatra).

1858. *Kryptopterus limpok*, Bleeker, *Ichthyol. Archipel. Ind.* I, p. 286.

1862*a*. *Kryptopterus limpok*, Bleeker, *Atl. Ichthyol.* II, p. 87, pl. 91, fig. 2.

1864. *Cryptopterus limpok*, Günther, *Cat. Fish. Brit. Mus.* V, p. 39.

1913. *Cryptopterus limpok*, Weber & Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 219.

1945. *Kryptopterus limpok*, Smith, *U. S. Nat. Mus. Bull.* No. 188, p. 340.

Range.—Sumatra, Borneo, Siam, and Malay Peninsula (Pahang).

Kryptopterus lumholtzi Rendahl.

1922. *Cryptopterus lumholtzi*, Rendahl, *Nyt. Magazin f. Naturvidensk., Zoolog. Mus. Kristiana*, No. 6 p. 200 (type-locality, Borneo).

Range.—Borneo.

Kryptopterus macrocephalus (Bleeker).

1858. *Kryptopterichthys macrocephalus*, Bleeker, *Ichthyol. Archipel. Ind.* I, p. 293 (type-locality, Sumatra?).

1862*a*. *Kryptopterichthys macrocephalus*, Bleeker, *Atl. Ichthyol.* II, p. 89, pl. lxxxix, fig. 2).

1906. *Cryptopterus bicirrhis*, Popta, *Notes from the Leyden Mus.* XXVII, p. 26 (not of Cuvier and Valenciennes, 1839, p. 367) (type-locality, central Borneo).

1913. *Cryptopterus macrocephalus*, Weber & Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 217.

1937. *Kryptopterus macrocephalus*, Herre & Myers, *Bull. Raffl. Mus. Singapore*, No. 13, p. 67.

Range.—Sumatra, Borneo, Malay Peninsula (Perak, Johore) and Siam.

Specimens examined.—

Bukit Merah, Parak State, British Malaya, one example. 31071.

Kota Tinggi, Johore State, British Malaya, three examples. 33863.

Near Kulai, Johore State, British Malaya, ten examples. 39334.

Singora, Siam, one example. 14840.

Kryptopterus micronema (Bleeker).

1846*a*. *Silurus micronemus*, Bleeker, *Nat. Gen. Arch. Ned. Ind.* III, p. 289 (type-locality, Batavia).

1851*c*. *Silurus phalacronotus*, Bleeker, *Nat. Tijds. Ned. Ind.* II, p. 429 (type-locality, Borneo).

1858. *Phalacronotus micruropterus*, Bleeker, *Ichthyol. Archipel. Ind.* I, p. 307 (type-locality, Palembang, Sumatra).

1858. *Micronema typus*, Bleeker, *ibid.*, I, p. 300 (type-locality, Batavia, Java).

1859. *Micronema phalacronotus*, Bleeker, *Enumeratio specierum piscium in Archipel. Ind. observatarum*, p. 139.

1862*a*. *Micronema typis*, Bleeker, *Atl. Ichthyol.* II, p. 91, pl. lxlii, fig. 2.

1902. *Cryptopterus micronema*; Vaillant, *Notes from the Leyden Mus.* XXIV, p. 48.

1905. *Micronema phalacronotus*; Fowler; *Proc. Acad. Nat. Sci. Philadelphia*, p. 469.

1913. *Cryptopterus micronema*, Weber & Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 221.

1934. *Kryptopterus micronema*, Fowler, *Proc. Acad. Nat. Sci. Philadelphia*, LXXXVI, p. 87.

1937. *Kryptopterus deignani*, Fowler, *ibid.*, LXXXVI, p. 136, figs. 10-12 (type-locality, Me Poon, Siam).

1945. *Kryptopterus micronema*, Smith, *U. S. Nat. Mus. Bull.* No. 188, p. 343.

Range.—Java, Borneo, Siam, and Malay Peninsula (Johore, Singapore).

Kryptopterus mononema (Bleeker).

1847. *Silurus mononema*, Bleeker, *Verh. Batav. Genootsch* XXI, p. 8 (type-locality, Java).

1858. *Kryptopterus mononema*, Bleeker, *Ichthyol. Archipel. Ind.* I, p. 287.

1862*a*. *Kryptopterus mononema*, Bleeker, *Atl. Ichthyol.* II, p. 87, pl. lxll, fig. 1.

1864. *Cryptopterus mononema*, Günther, *Cat. Fish. Brit. Mus.* V, p. 39.

1913. *Cryptopterus mononema*, Weber & Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 220.

Range.—Java and Sumatra.

Kryptopterus moorei Smith.

1945. *Kryptopterus moorei*, Smith, *U. S. Nat. Mus. Bull.* No. 188, p. 342, fig. 78 (type-locality, Menam Chao Phya, Siam).

Range.—Siam.

Kryptopterus schilbeides (Bleeker).

1858. *Hemisilurus schilbeides*, Bleeker, *Ichthyol. Archipel. Ind.* I, p. 297 (type-locality, Sumatra and Borneo).

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Range.—Sumatra and Borneo.

Kryptopterus sp.

Specimens examined.—Muar, Johore State, British Malaya, one example. 31072.

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* Numbers in parentheses refer to Bleeker's papers, as listed by Weber and Beaufort in their index to Bleeker's Works (Fishes of the Indo-Australian Archipelago, vol. 1).

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EUDACTYLOPUS KRUSADENSIS, A NEW SPECIES OF HARPACTICOID COPEPOD FROM KRUSADI ISLAND, IN THE GULF OF MANAAR.

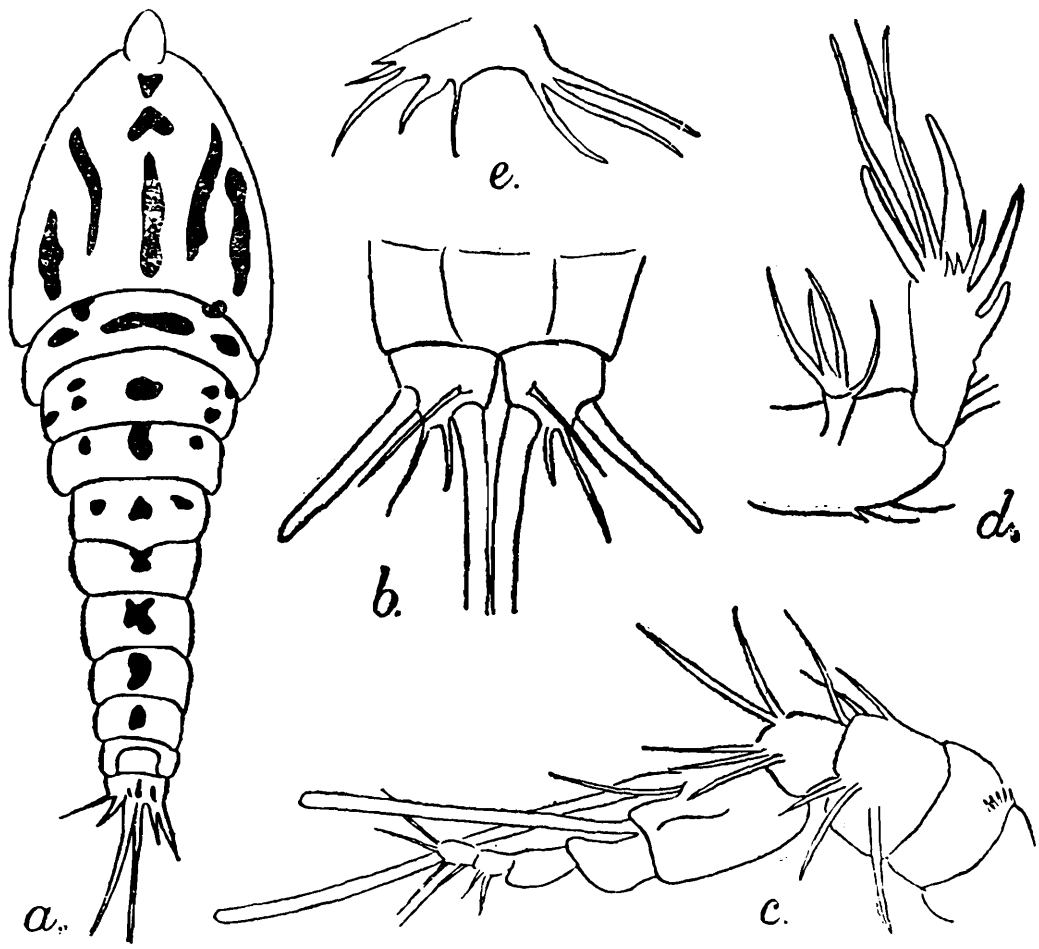
By S. KRISHNASWAMY, *Zoology Laboratory, Madras University.*

In a tow-net collection made on 22nd March 1949 (night collection) in Kundugal Channel, three males belonging to the genus *Eudactylopus* were found. These specimens differ from all the other known species of the genus and are hence described here as a new species. The holotype is lodged in the Indian Museum at Calcutta. (ZSI. Reg. No. C2979/1).

Size.—Male 0·739 mm. (Excluding the caudal setae) (Text fig. 1*a*).

Colour.—The dorsal side is marked with deep blue lines as in *E. striatus* and *E. fasciatus* Sewell.

Body.—The cephalosome is longer than broad. The rostrum is very prominent and mobile. The thoracic segments decrease in breadth gradually. The abdomen is five jointed. The furcal rami are broader than long and each ramus carries a long inner seta, three short slender setae and a spine towards the outer side (Text-fig. 1*b*). The inner seta is nearly as long as the whole animal.



TEXT-FIG 1.—*Eudactylopus krusadensis* sp. *a.* Dorsal view ♂ (×120); *b.* Furcal rami (×100); *c.* Antennule (×400); *d.* Antenna (×400); *e.* Maxilla$_1$ (×600).

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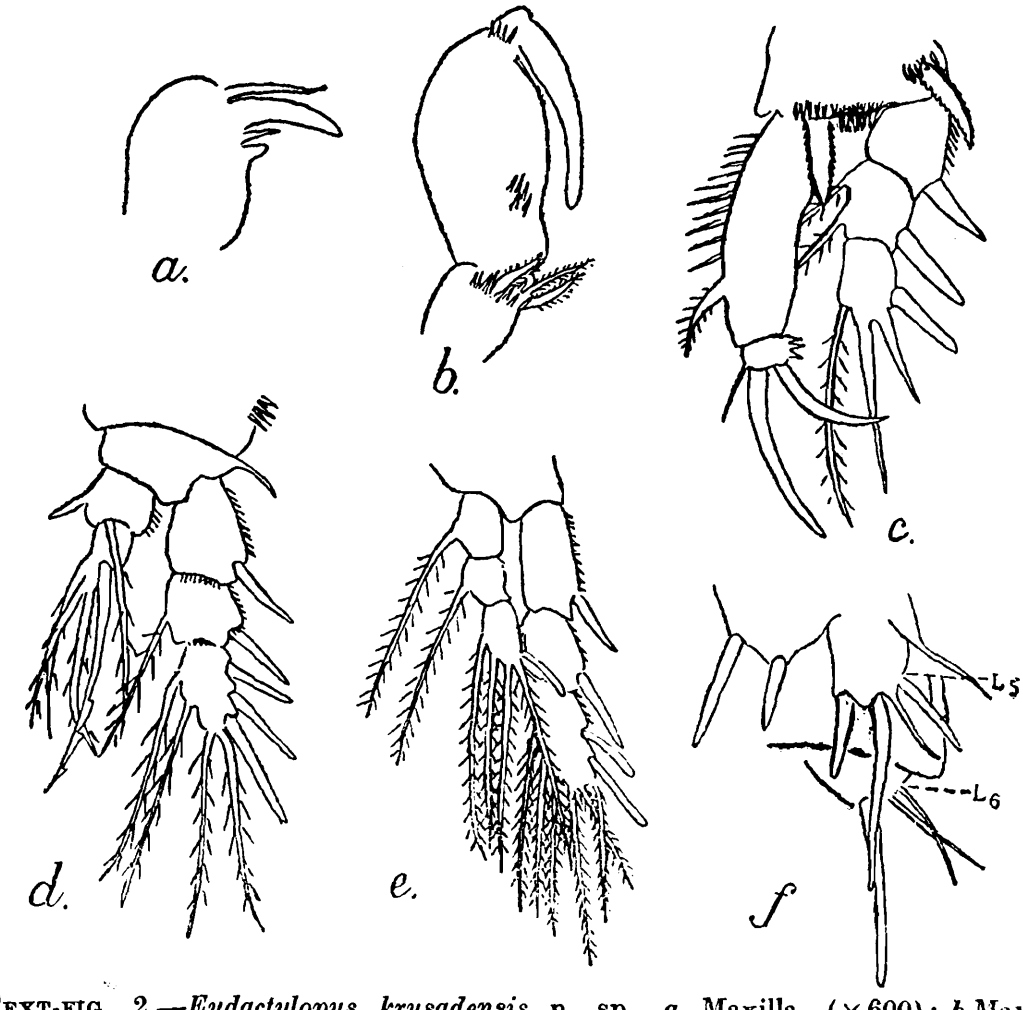
Appendages.—The antennule is nine jointed and the joints have the following proportionate lengths

1.	2.	3.	4.	5.	6.	7.	8.	9.
6.	7.	11.	7.	16.	8.	7.	3.	3.

The fifth segment carries two 'aesthetes' The number of setae and their arrangements are shown in the figure (Text-fig. 1*c*). The 'hinge' lies between the sixth and the seventh joint. The *antenna* is biramous. The endopod is two jointed and the first joint carries a seta and the second joint three setae. The exopod is single jointed. The outer margin carries a number of spinules, two stout spines, and a seta. There are two stout apical spines and three setae (Text-fig. 1*d*). The *Mandible* as in other members of the genus. The first maxilla as shown in the figure (Text-fig. 1*e*). The *second maxilla* consists of a triangular, broad plate with one stout claw and two setae on the inner side (Fig. 2 *a*). The *Maxilliped* is two-jointed and prehensile. The basal joint carries three plumose spines on the inner distal corner. The second joint is very swollen and is hinged to a stout claw at the apex. There is a small seta at the base of the claw. The inner margin of the second joint carries a number of spinules (Text-fig. 2*b*). *The first swimming feet* is biramous. The basipod carries two stout spines one towards the outer and one towards the inner side. The exopodite is three jointed. The first joint has its outer margin hirsute and carries a stout spine, the second joint carries an outer spine and two slender setae on the inner side. The terminal joint has two lateral and two apical spines. The endopodite is two jointed. The first joint is very long and has a short plumose spine on its inner side about its distal margin and is armed with spinules. The second joint carries one slender seta, two stout claw-like spines at the apex and has its outer margin spinulated (Text-fig. 2*c*). The basipodite of the *second swimming feet* has a spine on the outer side. The exopodite is three jointed. The first joint carries an outer lateral spine, the second joint one outer lateral spine and an inner seta and the terminal joint three outer lateral spines and four inner setae. The outer margin of first and second joints are armed with fine teeth. The endopodite is three jointed. The first joint carries teeth on the outer side and a short spine on the inner side. The second joint carries a long seta and the third joint three long setae and a specialised seta armed with spinules (Text-fig. 2*d*). The exopodite as well as the endopodite of the *third swimming feet* are 3-jointed. The first exopod joint carries one outer lateral spine, the second joint one outer lateral spine and an inner seta and the terminal joint three outer spines and five inner setae. The first and second endopod joints carry an inner seta each and the terminal one outer spine, two outer and three inner setae (Text-fig. 2*e*). The *fourth swimming feet* resembles the third one. The *fifth leg* consists of a basal expansion tipped with two stout spines on the inner side and a slender seta on the outer side and an inner joint with three spines and a seta (Text-fig. 2 L5). The sixth leg is represented by a long stout spine and two setae on the outer side (Text-fig. 2 L6).

Remarks.—The genus *Eudactylopus* contains the following eight species, *E. robustus* (claus), *E. latipes* (T. Scott), *E. opima* (Brian),

E. spectabilis (Brian), *E. striatus*, *E. fasciatus*, *E. anomala* Sewell and *E. australis* Nicholls. The present form closely resembles *E. striatus* and *E. fasciatus* Sewell, but differs from them both in size in the structure of the endopod of the antenna and the first leg. The structure of the fifth leg also differs from these known species.



TEXT-FIG. 2.—*Eudactylopus krusadensis* n. sp. *a.* Maxilla$_2$ (×600); *b.* Maxillipede (×600); *c.* First swimming feet (×400); *d.* Second Swimming feet (×400); *e.* Third swimming feet (×400); *f.* Fifth (L5) and sixth (L6) legs (×600).

Eudactylopus krusadensis can be defined as follows: Length 0·739 mm. The dorsal side of the animal with striations. The antennule is nine jointed, the 'hinge' lying between the sixth and the seventh joint. Endopod of antenna with four stout spines and four setae. The endopod carries a number of spinules also. Endopod of first leg two jointed. First joint armed with spines on the inner margin. There is a stout seta also on the inner margin. The terminal joint with two stout claw-like spines and a seta. The basal expansion of the fifth leg tipped with two spines on the inner side. The second joint with three stout spines and a seta. Sixth leg represented by a long, stout, spine and two setae.

ACKNOWLEDGMENT.

It is a pleasure to acknowledge my indebtedness to Dr. C. P. Gnanamuthu, Director, Zoology Laboratory, Madras University for the guidance and help and to Lt.-Col. R. B. Seymour Sewell, F.R.S., of

Cambridge for having gone through the paper and offered several valuable suggestions and helpful criticisms.

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SCOTT, A., 1909.—The copepoda of the 'Siboga' Expedition. Part I. Free swimming, littoral and semi-parasitic copepoda. *Siboga Exped. Monogr.* XXIXa, pp. 1—323.

SEWELL, R. B. S., 1940.—Copepoda Harpacticoida. *Scient. Rept., John Murry* Exped., VII, pp. 117—351.

SOME INDIAN SPIDERS OF THE FAMILY HERSILIIDAE.

By T. B. SINHA, *M.Sc., F Z. S. Research Scholar, Zoological Survey of India, Calcutta.*

INTRODUCTION.

The following study is based on unnamed spiders of the family Hersiliidae present in the Collection of the Zoological Survey of India. (Indian Museum) Calcutta. The material comprises seven species, of two genera, as follows :—

Genus **Hersilia** Audouin.

1. *H. savignyi* Lucas.
2. *H. pectinata* Thorell.
3. *H. stevensi*, sp. nov.
4. *H. kalimpongensis*, sp. nov.
5. *H. moulmeinensis*, sp. nov.
6. *H. fletcheri*, sp. nov.

Genus **Tama** Simon.

7. *T. gravelyi*, sp. nov.

ACKNOWLEDGMENTS.

I am grateful to Dr. S. L. Hora, Director, Zoological Survey of India for providing me with all the necessary facilities. My thanks are also due to Dr. E. Browning of the British Museum (Natural History), London, for supplying me the information regarding the location of types of certain species and camera lucida drawings of a few species, and also to Mr. K. S. Pradhan and Dr. A. P. Kapur (both of the Zoological Survey of India) for their valuable suggestions and help in the preparation of this paper.

SYSTEMATIC ACCOUNT.

Genus **Hersilia** Audouin.

(*Type*: *H. caudata*, Audouin, Egypt).

1826*. *Hersilia*, Audouin, in *Sav. Descript. Egypte Arach. p.* 114.

1895. *Hersilia*, Thorell, *Descriptive Catalogue of the Spiders of Burma*, p. 56.

1900. *Hersilia*, Pocock, *Faun. Brit. Ind.* Arach. p. 241.

1921. *Hersilia*, Gravely, *Rec. Ind. Mus.* XXII, p. 410.

1936. *Hersilia*, Dyal, *Bull. Dept. Zool. Panjab Univ. Lahore, I*, p. 127.

* Could not be consulted in original.

Distribution.—Africa, Madagascar, and Oriental region.

Key to the species of Hersilia.

a. Females.

1.	Clypeus longer than the length of the ocular quadrangle.	2
	Clypeus shorter than the length of the ocular quadrangle.	4
2.	Vulva bilobed	*H. savignyi* Lucas.
	Vulva trilobed	3
3.	Median lobe of vulva posteriorly rounded.	*H. stevensi*, sp. nov.
	Median lobe of vulva posteriorly angular.	*H. pectinata* Thorell.
4.	Vulva without a pair of apertures; Side lobes fairly bigger in size than the median lobe	*H. moulmeinensis*, sp. nov.
	Vulva with a pair small apertures; Side lobes and median lobe practically of the same size	*H. fletcheri*, sp. nov.

b. Males.

1.	Patella of palp raised. Tibia of palp unarmed.	*H. savignyi* Lucas.
	Patella of palp not raised. Tibia of palp armed or unarmed	2
2.	Tibia of palp unarmed	*H. kalimpongensis*, sp. nov.
	Tibia of palp armed	*H. pectinata* Thorell.

Hersilia savignyi Lucas.

1836*. *Hersilia savignyi*, Lucas, *Mag. Zool. 6 anne, Classe*, VII, fig. 1.

1900. *Hersilia savignyi*, Pocock, *Faun. Brit. Ind. Arach.* p. 241, fig. 82.

1921. *Hersilia savignyi*, Gravely, *Rec. Ind. Mus.* XXII, p. 410.

1936. *Hersilia savignyi*, Dyal, *Bull. Dept. Zool. Panjab Univ. Lahore* 1, p. 218, pl. xii, figs. 18-21.

Material examined.—

Ceylon.—Peradeniya, viii. 1910 (1♂, Juv.); Colombo, 19-ii-1914 (2♂, 1♀). India. Travancore: Arakutti, 24-i-1928 (*H. S. Rao*) (1♂). Cochin State: Trichur, 0-300 ft., 1-4-x-1914 (*F. H. Gravely*) (1♂, 1♀); Chalakudi, 14-30-ix-1914 (*F. H. Gravely*) (1♂, 1♀). Mysore State: Bangalore, *Ca.* 3,000 ft., 15-x-1910 (*N. Annandale*) (1♂, 1♀). Madras, 8-ix-1914 (*F. H. Gravely*) (1♀). Bombay State: Koyna Valley, Jambi, *Ca.* 2,100 ft., 24-26. iv. 1912 (*F. H. Gravely*) (1♀): Yenna Nalley, Medha, *Ca.* 2,200 ft., 17-23. iv. 1912 (*F. H. Gravely*) (3♀, 1 Juv.); Vulvan, 28-x-1912 (1♂, 1♀) Orissa: Puri, 20-viii-1911 (*N. Annandale & F. H. Gravely*) (2♂, 7♀), 24-28-i-1911 (*N. Annandale & F. H. Gravely*) (1♂, 5♀, 2 Juv.); Satpara, 16-ii-1914 (*S. W. Kemp*) (1♀); Chilka, Rambha Lake, 24-i-1914. (*N. Annandale*) (1♀). Uttar Pradesh: Dehra Dun, 16-ix-1914 (*N. C. Chatterji*) (1♀); Bara Banki, Mowai, 11-13-v-1910 (*M. M.*) (1♀). Bihar: Dinapur, 16-xii-1914-23-i-1915 (*Caunter*) (5♀, 3 Juv.); Siripur, viii-1913 (*Mackenzie*) (1♂, 5♀); Pusa, 5-10-ii-1915 (*F. H. Gravely*) 5♂, 9♀, 4 Juv.); Katihar), 8-31-viii-1914 (*C. Paiva*) (1♂, 1♀); Ranchi, Village Kumto near Lahardaga, 24-x-1928 (*M. shariff*) (1♀); Chota Nagpur, Chakardharpur, 29-ix-x-10-1911 (*F. H. Gravely*) (1♂, 6♀), 27-28-xii-1910 (*F. H. Gravely*), (1♂, 1♀). Bengal Serampur, 1916 (*Mrs. Drake*) (1♂), 7-ii-1916 (*Mrs. Drake* (1♀), I-1915 (*Mrs. Drake*) (4♂); Sibpore, Botanical Gardens, 4-iv-1913 (*F. H. Gravely*) (1♀), Calcutta, Museum Compound, 15-i-1911 (*F. H. Gravely*) (1♀), 29-viii-1911 (*F. H. Gravely*) (1♀), vi-1914 (*F. H. Gravely*) (♀), 21-vii-1914 (*F. H. Gravely*) (1♂), Calcutta Maidan, 7-i-1911 (*F. H. Gravely*) (1♂), at light (1♀), 5-viii-1911 (*F. H. Gravely*) (1♂), Rains 1912 (*F. H. Gravely*) (1♂), 19-vii-1914 (*C. Paiva*) (1♂), (3♂, 3♀); Jessore, Harail (1♀). Burma.—Lashio, 3,000 ft. 23-viii-1914 (*T. B. Fletcher*) (1♂); Pegu (4♂, 2♀).

Besides the above mentioned localities, specimens from Matheran, S. India are also present in the named collection of the Zoological Survey of India.

*Could not be consulted in original.

Measurements.—♀. Body 10 mm. long; Carapace 3·5 mm. long.
♂. Body 6·5 mm. long; Carapace 3 mm. long.

Distribution.—Ceylon, India, Pakistan, Burma.

Hersilia pectinata Thorell.

1895. *Hersilia pectinata*, Thorell, *Descriptive Catalogue* of the Spiders of Burma p. 58, (*Type-locality* ; Rangoon, Burma).

1900. *Hersilia pectinata*, Pocock, *Faun. Brit. Ind.* Arach. pp. 241, 242.

Material examined.—

CEYLON.—Peradeniya, 4-iv-1910 (2♂). INDIA.—Mysore State: Coorg, Savira-Butti near Polibetta, 22-v-1914 (*T. B. Fletcher*) (1♀).

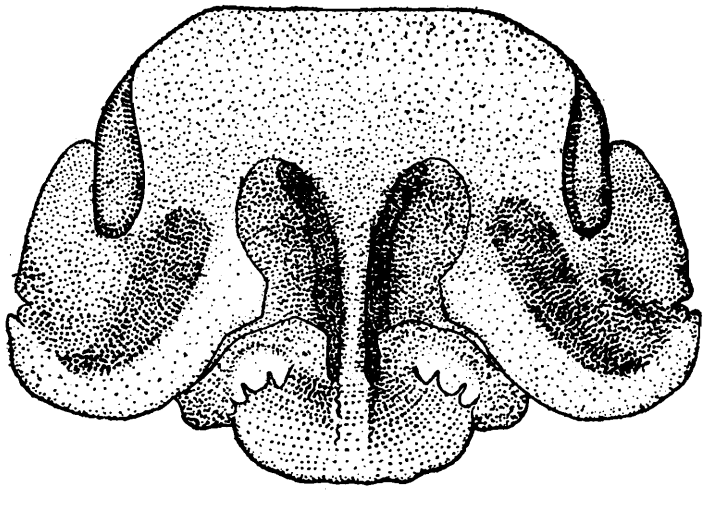
It is with hesitation that the Savira-Butti specimen has been assigned to this species, as the epigyneal plate is not very clear.

Measurements.—♂. Body 12·1 mm. long; Carapace 3·8 mm. long.
♂. Body 10·8 mm. long; Carapace 3·5 mm. long.

Distribution.—Ceylon, India, Burma, and Malaya Peninsula.

Hersilia stevensi, sp. nov.

The dorsum of the abdomen is yellow and has four pairs of spots, besides the black mid-longitudinal band which is narrower posteriorly. This band is crossed over along its length by four transverse black lines. The venter of the abdomen is olive yellow and so is the sternum. The tibia and the tarsi of the pedipalp are marked with black spots basally and dorsally and the tips of the tarsi are also black.



TEXT-FIG. 1.—Vulva of *Hersilia steve nsi*, sp. nov. : ×40.

The cephalic region is clothed with thick silvery pubescence and the clypeus much exceeds the length of the ocular quadrangle.

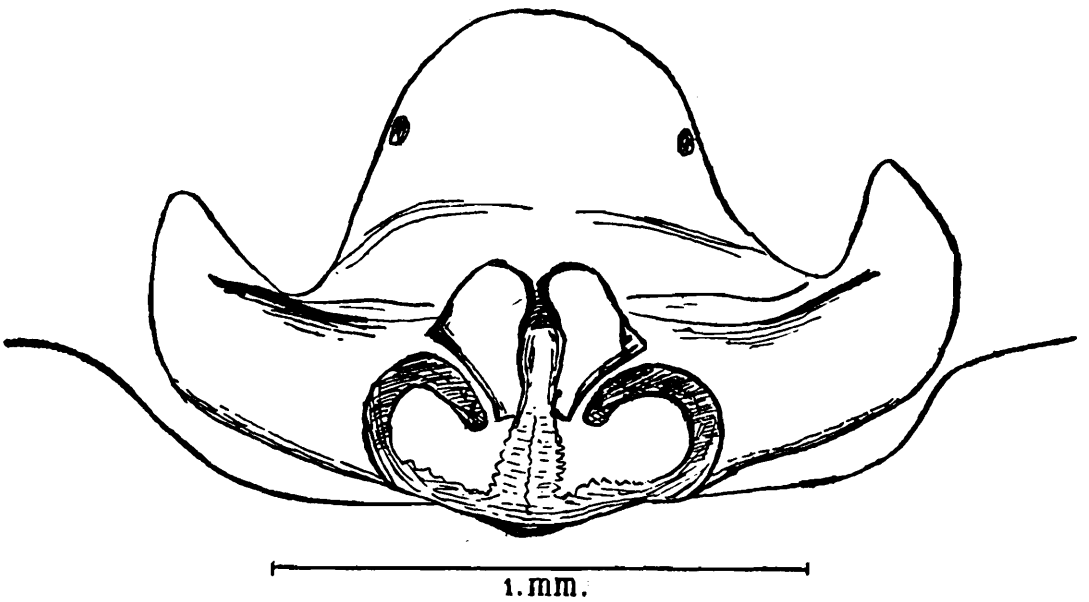
The vulva (Text-fig. 1) is trilobed and the lateral lobes are very big while the median lobe is rounded posteriorly.

The species is close to *H. pectinata* Thorell, but differs from it in the shape of the median lobe being rounded posteriorly in this species, while it is angular posteriorly in *H. pectinata* Thorell (Text-fig. 2).

Measurements.—Body 10 mm. long; Carapace 4·2 mm. long.

Material examined.—

Holotype. Reg. No. 2280/18, Zoological Survey of India (Gopaldhara, Darjiling district of E. Himalayas, 1916, *H. Stevens*, ♀). *Paratypes.*—Reg. No. 2287/18, Zoological Survey of India (Gopaldhara, Darjiling district of E. Himalayas, 1916, *H. Stevens*, 2♀).



TEXT-FIG. 2.—Vulva of *Hersilia pectinata* (from Punduloya, Ceylon. Reproduced with the kind permission of the authorities of the *Brit. Mus. Nat. Hist. Lond.*)

Hersilia kalimpongensis, sp. nov.

In general coloration it resembles *H. savignyi* Lucas. Legs seem to have black annulations which have fainted due to long immersion in spirit. This species is characterised by the absence of a raised conical prominence on the patella and by the absence of spinules on the tibia of the palp. The femur is dorsally beset with a pair of strong hairs near its distal end in addition to a number of smaller ones. The clypeus is shorter than the length of the ocular quadrangle.

The species is close to *H. clathrata* Thorell but differs from it in having only one pair of black spots on either side of the middle on the dorsum of the abdomen and the length of the first femur which is shorter than thrice the length of the carapace.

Measurements.—Body 4·8 mm. long; Carapace 2·2 mm. long; First femur 6·3 mm. long.

Material examined.—

Holotype. Reg. No. 2281/18, Zoological Survey of India (Kalimpong, 4,100 ft. Darjiling district of E. Himalayas, 1-ix-1916, *S. W. Sutherland* ♂). Left palpus of the Holotype mounted on a slide Reg. No. 2285/18, Zoological Survey of India.

Hersilia moulmeinensis, sp. nov.

Three pairs of spots are seen on the dorsum of the abdomen. Due to long immersion in spirit the general coloration has become dull.

The clypeus is shorter than the length of the ocular quadrangle and the femur is slightly smaller than thrice the length of the carapace.

Vulva is trilobed as seen in the text-fig. 3*b*. The side lobes are very big and are narrowly separated from each other by a slender median lobe. A pair of apertures which are seen on epigyneal plate of the succeeding species are absent in this.

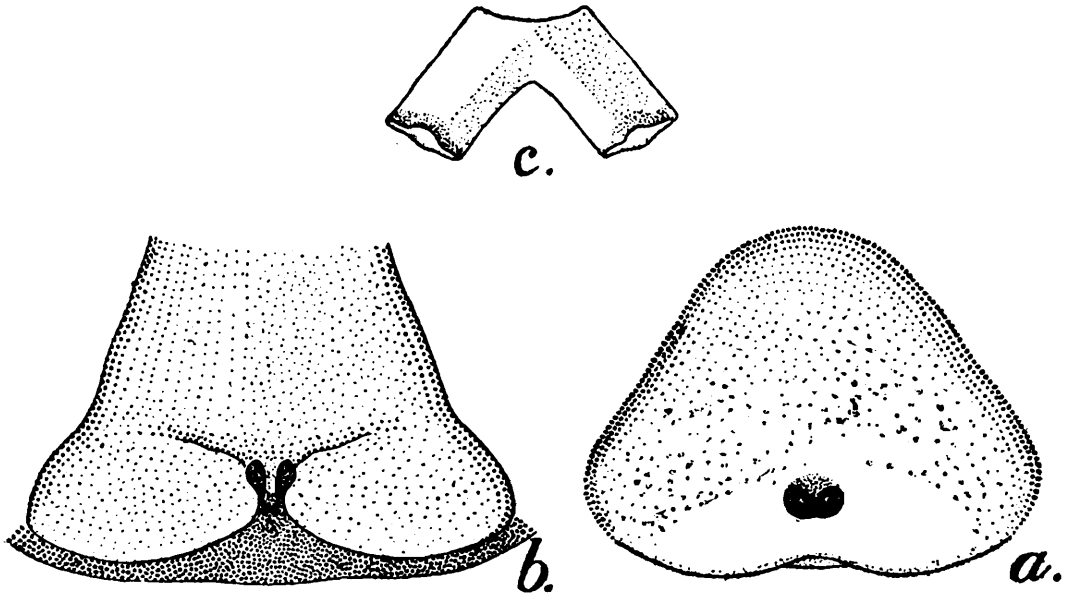
Measurements.—Body 8·6 mm. long; Carapace 3·6 mm. long; First femur 10·6 mm. long.

Material examined.—

Holotype. Reg. No. 2282/18, Zoological Survey of India (Moulmein, Burma, ♀)

Hersilia fletcheri, sp. nov.

In general coloration it is akin to *H. pectinata* Thorell and has the clypeus shorter than the length of the ocular quadrangle. Three pairs of spots are present on either side of the middle on the dorsum of the abdomen.



TEXT-FIG. 3. *a.*—Vulva of *Hersilia fletcheri*, sp. nov.: ×40; *b.* Vulva of *H. moulmeinensis*, sp. nov.: ×40; *c.* Vulva of *Tama gravelyi*, sp. nov.: ×40.

Vulva (Text-fig. 3*a.*) is trilobed and is with a pair of apertures on the epigyneal plate. The median lobe is practically of the same size as the side lobe and is rounded posteriorly.

The species differs from *H. moulmeinensis* in having a pair of apertures on the epigyneal plate and in the size of the side and median lobes which are nearly of the same size.

Measurements.—Body 9·9 mm. long; Carapace 3·6 mm. long, First femur 11·2 mm. long.

Material examined.—

Holotype. Reg. No. 2283/18, Zoological Survey of India (Moulmein, Burma, on a tree, 16-x-1914, *T. B. Fletcher*, ♀).

Genus **Tama** Simon.

(Type, *T. edwardsi* Lucas, Algeria, N. Africa.)

1882. *Tama*, Simon, *Ann. Mus. Stor. nat. Genova*, XVIII, p. 256

1900. *Tama*, Pocock, *Faun. Brit. Ind.* Arach. p. 242.

Distribution.—Africa ; Oriental region ; Australia and America.

Tama gravelyi, sp. nov.

Carapace is blackish with a reddish line in the middle which bifurcates anteriorly and demarcates the cephalic from the thoracic region. The ocular quadrangle is a little wider than long and much exceeds the length of the clypeus, which is slightly longer than the diameter of the anterior median eyes. The sternum is slightly wider than long and is of olive-yellow colour.

The dorsum of the abdomen is mottled and a pale mid-longitudinal band extends backwards from the anterior margin up to the middle of the abdomen. The posterior half of the abdomen is more thickly mottled than the anterior half and has a few scattered spots in the anterior region. Three pairs of dark circular spots, of which the anterior ones being the largest, are present about the middle and posterior to the pale mid-longitudinal band. The venter of the abdomen, is uniformly olive-yellow, but for the eight pairs of dark spots in the area between the epigynum and spinners.

Vulva is bilobed as seen in the text-fig. 3*c*. This species differs from *T variata* Pocock in the shape of the vulva which is bilobed in this new species.

Measurements.—Body 8·7 mm. long ; Carapace 3·7 mm. long.

Material examined.—

Holotype. 2284/18, Zoological Survey of India (Cochin State, Kavalai, 1,300-3,000 ft. 24-27-ix-1914, *F. H. Gravely*, ♀). *Paratypes.*—Reg. No. 2286/18, Zoological Survey of India (Cochin State, Kavalai, 1,300-3,000 ft., 24-27-ix-1914, *F. H. Gravely*, 2♀).

MGIPC—M—6 ZSI—31-8-51—450.