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NOTES ON FISHES IN THE INDIAN MUSEUM.

XLVI.—ON A NEW FISH OF THE GENUS *Laubuca* FROM COCHIN.

By A. G. K. MENON, M.A., I.C.I. Research Fellow, National Institute of Sciences of India, Delhi.

(From the Laboratories of the Zoological Survey of India, Calcutta.)

In July 1950, Dr. Hora received a single specimen of a little aquarium fish for identification from Mr. Sam J. Dadiburjor, Aquarist, Bombay. In a letter, that he wrote to Dr. Hora, he stated that the fish collected, was reported to be from Cochin and that he had succeeded in breeding it in an aquarium. As Dr. Hora was then on leave, he instructed me to examine the fish and send a report to Mr. Dadiburjor. The fish could be referred to the genus *Laubuca*, but the beautiful colour markings on the body appeared to be very characteristic, not so far found in any other member of the genus. A request was, therefore, made to Mr. Dadiburjor for a few more specimens of the fish. He very readily complied with the request and sent me five more specimens, which on examination were found to represent a new species. They are now described here under the name *Laubuca dadiburjori*, sp. nov., after Mr. Sam J. Dadiburjor who brought this interesting fish to the notice of science.

Mr. Dadiburjor has supplied the following observations on the breeding habits of the fish :—

“ As I had a perfect pair, I set myself the task of breeding them, though their breeding habits were unknown to me. The pair was conditioned on live food and after a few days the female was very heavy with spawn as was evident from the full appearance of her body.

I removed the pair to a small aquarium of about four gals. capacity, planted the tank with “ *Vallisneria* ”, a small bunch of “ *Cabomba* ” and one large leaved plant, “ *Aponogeton undulatum* ”. The tank contained fresh-water. The next morning the male began chasing the female, but she showed no sign of spawning and the chasing continued till about 3 P.M. when the female got exhausted and appeared to swim with jerky movements. I became interested and watched them closely.

After a short while I found to my great surprise that the female approached jerkily one of the leaves of the ‘ *Aponogeton* ’ and started gliding over the leaf contacting her vent with the upper surface of the leaf while the male was all the time hovering over her. Then suddenly he came close to her side and grasped her in the crescent he made of his body. During this momentary embrace about 20 crystal-clear eggs were deposited on the leaf. The female then swam away and the same process was repeated on a thin blade of ‘ *Vallisneria* ’; in this case a few eggs dropped to the bottom of the tank as the leaf was not quite broad. In all four such batches were laid, and after the fourth batch the female started picking up the eggs. She devoured nearly all the eggs from the fourth batch. In order to save the remaining eggs, I quickly removed the parents from the breeding tank and impatiently awaited the result. The eggs hatched in about 24 hrs. at an average temperature of 80°F. Not a single egg was infertile. The young were extremely small and very transparent. They were seen hanging from the plants and on the sides of the aquarium. After three days the young began to swim freely but remained close to the surface. I fed them first on very fine infusoria, and when they were about two weeks old I started feeding them on the large sized infusorians. The fry were consuming a large quantity of food as was evident from their protruding bellies and were progressing satisfactorily.

I had taken two more spawnings from the same pair and they spawned in like manner in aquariums of the same capacity. The interval between the two spawnings was about 5 days. From this I think they are frequent breeders. One peculiarity I noticed was that this fish always spawned towards evening and not in the morning hours as do many other species."

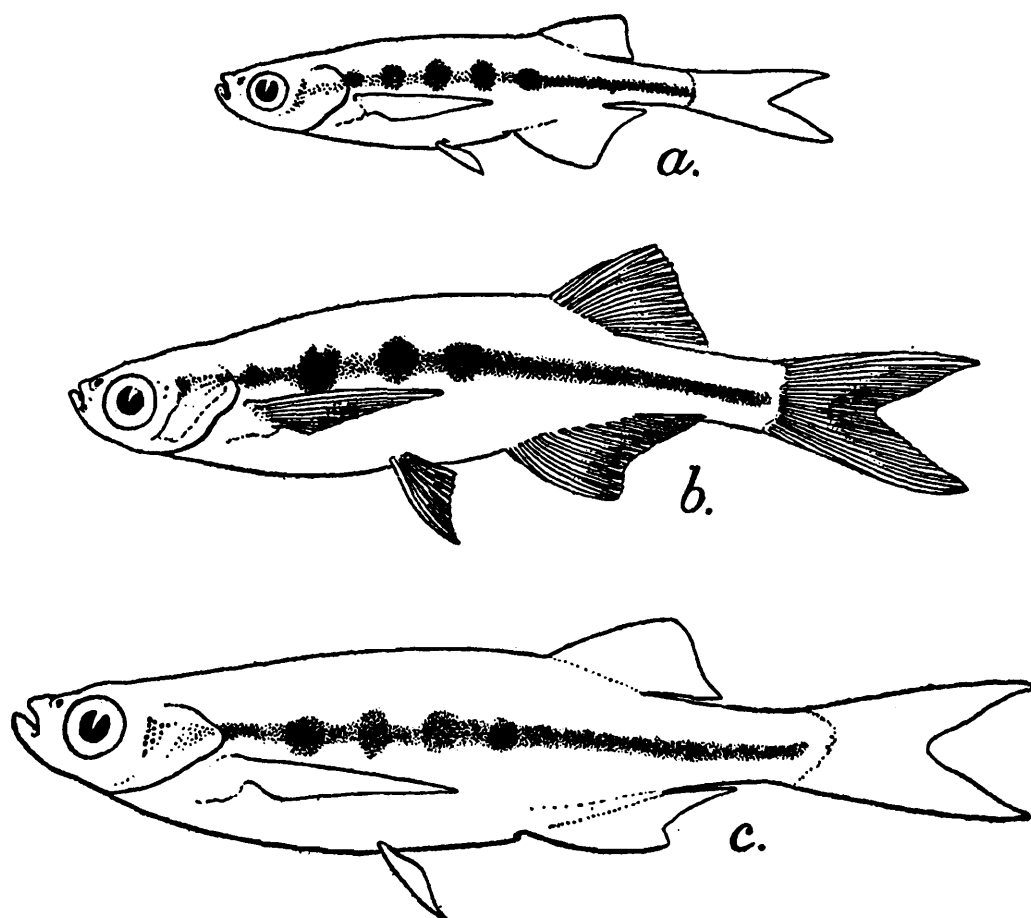
***Laubuca dadidurjori*, sp. nov.**

D. 2/7., A. 3/11., P. 1/7., V. 1/5., C. 19 ; L. 1.30-34 ; L. tr. 7.

In *Laubuca dadidurjori* the dorsal profile rises gently from the tip of the snout to the origin of the dorsal fin beyond which it slopes down to the base of caudal fin. The ventral profile is bow-shaped. The body is greatly compressed from side to side with a sharply cutting abdominal edge. The length of the head is somewhat shorter in the male than in the female ; its length is contained from 3.4 to 4 times in the standard length. The greatest width of the head is contained from 1.7 to 2 times and its height at occiput 1.5 times in its length. The eyes are large dorso-lateral in position and visible from the ventral surface. The diameter of the eye is greater than the length of the snout and considerably smaller than the inter-orbital width ; it is contained from 3 to 3.5 times in the length of the head. The eyes are situated entirely in the anterior half of the head. The inter-orbital space is almost flat or slightly convex. The mouth is directed obliquely upwards. Barbels are absent. The depth of the body is somewhat shorter than the length of the head in the female and is almost equal in the male ; it is contained 4.1 to 4.4 times in the standard length. The body is covered with firmly adherent scales ; those on the dorsal surface are fairly conspicuous, but those on the lower half of the fish are hardly distinguishable. There are 30 to 34 scales in a longitudinal series and 7 rows in a transverse series. There are 16 to 18 pre-dorsal scales. The lateral line pierces only 8 anterior scales and is totally absent in the posterior region.

The dorsal fin commences in the posterior third of the body without the caudal and its origin is opposite to the 4th branched ray of the anal fin ; it contains 2 spines and 7 branched rays. The pectoral fin is long and pointed ; it is much longer than the length of the head and extends beyond the base of the pelvic fin. The pelvic fin is considerably shorter ; it does not extend to the anal opening which is situated just anterior to the anal fin. The base of the anal fin is considerably longer than that of the dorsal ; it contains 3 spines and 11 branched rays. The depth

of the caudal peduncle is about 2·3 times in its length. The caudal fin is longer than the head ; it is deeply furcate with lobes of almost equal length.



TEXT-FIG. 1.—Lateral view of three specimens of *Laubuca dadiburjori* sp. nov. showing variations in the markings on the body.

a. A juvenile specimen of 16 mm. in length without caudal $\times 4$; *b.* A mature male specimen of 24·5 mm. in length without caudal $\times 4$; *c.* A mature female specimen of 27 mm. in length without caudal $\times 4$.

In spirit specimens there is a lateral black band along the middle of the body extending from the angle of the opercles to the base of the caudal with three distinct black dots on it in the male specimens and four in the female. In younger specimens the number of black dots on the lateral band vary from four to six. There is also a black band along the dorsum from the occiput to the base of the dorsal fin. Fins are without any colour markings.

Mr. Dadiburjor observed that in life the lateral band is steel blue in colour and that there is, in addition, a golden stripe above the blue band.

Types.—F. $\frac{541}{2}$, Male, *Holotype*; F. $\frac{542}{2}$, One Female and four

Juvenile *Paratypes*; Zoological Survey of India, *Calcutta*.

Locality.—Cochin (S. India).

Relationships.—In general facies and scale-count, *Laubuca dadiburjori* is remarkably related to *Laubuca maassi* found in Sumatra. *Laubuca dadiburjori* can, however, be easily distinguished from the South-East Asian form by the presence of the characteristic black dots on the lateral band and the incomplete lateral line. The resemblances exhibited by these two forms occurring in such widely separated areas as Sumatra and Cochin are very significant and lead to the conclusion that possibly these two species may have evolved from a common ancestor and their present diagnostic features are most probably results of isolation in widely separated localities.

Measurements in millimetres.

Total length without caudal	..	27.0	24.50	16.50	16.0	16.0	13.5
Depth of the body	..	6.50	5.5	3.70	3.70	3.65	3.2
Length of head	..	7.0	6.0	5.0	5.0	4.50	4.0
Width of head	..	4.0	3.5	2.50	2.50	2.50	2.0
Height of head at occiput	..	4.50	4.0	3.0	3.0	3.0	2.50
Length of snout	..	2.0	1.30	1.20	1.20	1.20	1.0
Diameter of eye	..	2.10	1.80	1.50	1.50	1.50	1.20
Interorbital width	..	3.0	3.0	2.50	2.50	2.30	2.0
Longest ray of dorsal	..	5.0	4.50	3.0	3.0	3.0	2.20
Length of pectoral	..	8.50	7.0	5.0	5.0	5.0	4.50
Length of ventral	..	3.0	3.0	2.0	2.0	2.0	1.75
Length of anal	..	5.50	4.50	3.0	3.0	2.50	2.0
Length of caudal peduncle	..	5.50	4.70	3.0	3.0	3.10	2.5
Least height of caudal peduncle		2.50	2.20	1.20	1.20	1.25	1.2

NOTES ON FISHES IN THE INDIAN MUSEUM.

XLVII.—REVISION OF THE GLYPTOSTERNOID FISHES OF THE FAMILY SISORIDAE, WITH DESCRIPTIONS OF NEW GENERA AND SPECIES.

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[PLATE I.]

INTRODUCTION.

In 1922, while discussing the structural modifications of the fish of mountain torrents, in a foot note, one of us¹ suggested certain nomenclatorial changes in the Glyptosternoid group of the Sisorid fishes, and thereby restricted the use of the generic name *Glyptosternum* McClelland to the species in which “*the first ray of the pectoral and ventral fins soft and pinnate, giving off soft pointed cartilaginous rays along the anterior margin ; which are enveloped in the membrane of the fin*” (Italics are ours). Blyth² had already restricted this name for *G. reticulatum* McClelland from Afghanistan in which the nature of the first ray of the paired fin had been described by McClelland³ as quoted above. As other species under *Exostoma* Blyth, such as *Exostoma labiatum* McClell. (Hora, *loc. cit.*, p. 37, text-fig. 1a), showed a similar structure of the first ray of the paired fins, they were also referred to *Glyptosternum*. As the structure of the first ray of the paired fins of the so-labelled type-specimen of *Exostoma berdmorei* Blyth, the type of the genus *Exostoma*, showed features similar to those of species included under *Glyptothorax* Blyth and dissimilar to that described for *Glyptosternum*, *Exostoma* was considered a synonym of *Glyptothorax*. These nomenclatorial changes were subsequently elaborated by Hora⁴ in his revision of the composite genus *Glyptosternon* McClelland, wherein he discussed Regan's⁵ classification of Glyptosternoid fishes into *Parexostoma* Regan, *Euchiloglanis* Regan and *Exostoma* Blyth. Hora recognised differences in dentition among the species included by him under *Glyptosternum* and in fact figured four main types. He, however, stated that :—

“by relying only on the arrangement and the nature of the teeth, the genus *Glyptosternum* can be split up into four groups, but there are equally important characters such as the nature of the gill opening and the labiat fold, which do not permit of such a division.”

Regan⁶ in a note on the Siluroid genera *Glyptosternum* and *Exostoma* did not agree with Hora's conclusions and with regard to the former genus remarked that “I do not think the matter can be carried further until *Gl. reticulatus* has been rediscovered and redescribed.” Norman⁷ in describing two new fishes from Tonkin, made comments on the Siluroid genera *Glyptosternum* and *Exostoma* and upheld Regan's

¹ Hora, S. L., *Rec. Ind. Mus.*, XXIV, pp. 33, 37 (1922).

² Blyth, E., *Journ. As. Soc. Bengal*, XXIX, p. 153 (1860).

³ McClelland, J., *Calcutta Journ. Nat. Hist.*, II, pp. 584-585 ; 587-588 (1842).

⁴ Hora, S. L., *Rec. Ind. Mus.*, XXV, pp. 1-44, pls. i-iv (1923).

⁵ Regan, C. T., *Ann. Mag. Nat. Hist.*, (8), VIII, p. 564 (1911).

⁶ Regan, C. T., *Ann. Mag. Nat. Hist.*, (9), XI, p. 608 (1923).

⁷ Norman, J. R., *Ann. Mag. Nat. Hist.*, (9), XV, p. 570 (1925).

classification, in spite of Annandale's¹ clear exposition of the relative merits of Regan's and Hora's points of view. Whereas, Annandale agreed with Hora that the stage had not then reached of splitting up McClelland's *Glyptoternum* as restricted to *G. reticulatum*, Norman recognised Hora's four types of dentition groups and established a new genus *Glaridoglanis* for Hora's *Glyptosternum andersonii*.

In 1931, Myers² examined the nomenclatorial position of the genera *Glyptothorax* and *Glyptosternum* and concluded :

"Thus it seems certain that the name *Glyptosternon* belongs with the group usually called *Exostoma*. This group has, however, been split into four genera by Norman (paper mentioned below, in foot note). Hora does not recognize these groups as of generic rank, and he does not attempt to place *G. reticulatum* in his key. Until more material of this type species is obtained from McClelland's type locality, the name *Glyptosternon* cannot be applied to any of the four, all of which are good genera. Hora's attempt to change the type of *Glyptosternon* from *reticulatum* to *labiatum* is in violation of the International Rules and cannot be accepted. Furthermore, it appears to be fairly certain (following Hora and Annandale) that the type of *Exostoma* (*E. berdmorei*) is a *Glyptothorax* and that the group called *Exostoma* by Norman is at present without a name (unless it is found that *Glyptosternon* actually belongs here").

In 1932, Hora³ announced the rediscovery of McClelland's *G. reticulatum* and showed that it was in fact the same species as *Parexostoma stoliczkae* (Day). His material was then obtained from Chitral whence waters drain into the Kabul river, the type locality of the species. If any doubt was still left about the identity of *G. reticulatum*, it was finally removed when specimens were reported upon by Hora from Afghanistan.⁴

Smith⁵ and Berg⁶ recognised *Glyptosternum* as restricted to *G. reticulatum* with *Parexostoma* Regan as its synonym. Smith described a new genus in this group from Siam, mostly on teeth characters, but recognized *Exostoma* Blyth in his key to the five genera then known in this group. In 1934, Hora⁷ gave a detailed definition of the genus *Glyptosternum* and also commented on the distribution and bionomics of the species *G. reticulatum*. He stated that "*In view of this evidence it is now possible to split up the composite assemblage and to define the generic limits of each group*" (Italics are ours). Though Hora was then prepared to recognise a number of genera in this heterogenous assemblage of species included by him under *Glyptosternum*, he did not actually do so. He only redefined the genus *Glyptosternum* and offered no comments on the status of other genera recognised by Regan, Norman and Smith.

We have now re-examined the rich material of Glyptosternoid fishes in the collection of the Zoological Survey of India (*Ind. Mus.*, Calcutta)

¹ Annandale, N., *Ann. Mag. Nat. Hist.*, (9), XII, 573 (1923).

² Myers, G. S., *Lingnan Sci. Journ.*, X, p. 260 (1931).

³ Hora, S. L., *Ann. Mag. Nat. Hist.*, (10), X, p. 176 (1932); *Curr. Science* I, p. 130 (1932).

⁴ Hora, S. L., *Journ. Bombay Nat. Hist. Soc.* XXXVI, p. 697 (1933); *ibid*, XXXVII, p. 787 (1935).

⁵ Smith, H. M., *Journ. Siam Soc., Nat. Hist. Suppl.*, IX, pp. 70-74 (1933).

⁶ Berg, L. S., *Poiss. Eaux Douces, U. S. S. R.*, 3rd Ed., pt. ii, p. 596 (1933).

⁷ Hora, S. L., *Rec. Ind. Mus.*, XXXVI, pp. 285-292 (1934).

and have carefully assessed their diagnostic characters in the light of the opinions discussed above. As a result of this study, we have been obliged to create some new genera for a satisfactory classification of these remarkable torrential fishes. As is usual with the Siluroids, we have based our major subdivisions on the nature of teeth in both jaws and the form of the teeth-bands. The extent of the gill-openings, nature of the post-labial groove, number of branched rays in the pectorals, extent of the pectorals in relation to the commencement of the pelvics, form of caudal peduncle, the extent of the pelvics in relation to vent and the commencement of the anal fin, etc., are no doubt adaptive characters induced by the factors of a torrential stream environment, but fairly well-marked to be given a generic significance. The above characters are a mix up as was pointed out by Hora in 1923, but the systematics of the group are now sufficiently clear to recognise the following genera :—

Key of the Glyptosternoid genera.

I. All teeth in both jaws conical and pointed.

A. Teeth in upper jaw forming a continuous band which is produced backwards at the sides. (Post-labial groove widely interrupted).

1. Gill-openings extending to ventral surface of body.
Pectorals with 11 branched rays. .. *Glyptosternum* McClelland.
2. Gill-openings restricted to the dorsal surface.
Pectorals with 13 branched rays. .. *Coraglanis*, gen. nov.

B. Teeth in upper jaw forming a bilobed band which is not produced backwards at the sides. Gill-openings restricted to dorsal surface.

1. Post-labial groove interrupted. Pectorals with 13 to 17 branched rays. .. *Euchiloglanis* Regan.
2. Post-labial groove continuous. Pectorals with 16 to 19 branched rays. .. *Myeraglanis*, gen. nov.

II. All teeth in both jaws not conical and pointed.

A. Teeth in upper jaw form a narrow, continuous band which is not produced backwards at the sides.

1. Teeth in both jaws greatly compressed, with broad, emarginate or notched apices (Post-labial groove widely interrupted ; gill-openings restricted to the dorsal surface ; pectorals with 10 branched rays. ... *Glaridoglanis* Norman.
2. Teeth in upper jaw conical and pointed, those in lower jaw of two distinct types : posterior conical and pointed while the anterior much larger with slender base and free end expanded into a truncate-spatulate shape with inner surface slightly hollow. (Post-labial groove continuous ; gill-openings restricted to dorsal surface ; pectorals with 17 or 18 branched rays. ... *Oreoglanis* Smith.

- B. Teeth in upper jaw arranged in two well-separated patches. Teeth in both jaws oar-shaped, flattened distally, depressed and directed backwards (Post-labial groove continuous; gill-openings restricted to the dorsal surface; Pectorals with 10 or 12 branched rays; in one species 17 to 18 branched rays). *Exostoma* Blyth.

Glyptosternum McClelland.

1842. *Glyptosternon*, McClelland, in part, *Calcutta Journ. Nat. Hist.*, II, p. 584.
 1860. *Glyptosternon*, Blyth, *Journ. As. Soc. Bengal*, XXIX, p. 152.
 1905. *Parexostoma*, Regan, *Ann. Mag. Nat. Hist.*, (7), XV, p. 182.
 1923. *Glyptosternum* (in part Group I.), Hora, *Rec. Ind. Mus.*, XXV, p. 30.
 1934. *Glyptosternum*, Hora, *Rec. Ind. Mus.*, XXXVI, p. 285. (Synonymy, discussion and characterisation of the genus).

For the diagnostic features of *Glyptosternum*, reference may be made to the key above and to the detailed description given by Hora in 1934.

Genotype.—*Glyptosternum reticulatum* McClelland.

Distribution.—Head waters of the Indus (Basgo, Sneema, Leh, Ladak and the Kashmir Valley), head waters of the Kabul River (Afghanistan and Chitral), the Oxus River System (the Syr-Darya and the Amu-Darya in Eastern Turkestan, and Bamain River in Afghanistan), Eastern Tibet and Sikkim.

Key to the species of Glyptosternum McClelland.

- I. Rayed and adipose dorsals separated by considerable space.
- A. Caudal peduncle 3 times as long as deep. Pectorals extending $\frac{2}{3}$ to $\frac{3}{4}$ of the distance to the bases of the pelvics. *G. reticulatum* McClell.
- B. Caudal peduncle 2 times as long as deep. Pectorals extending $\frac{1}{2}$ to $\frac{3}{8}$ of the distance to the bases of the pelvics. *G. maculatum* Regan.
- II. Rayed and adipose dorsals almost continuous; caudal peduncle $2\frac{1}{2}$ times as long as deep. Pectorals extending $\frac{3}{4}$ of the distance to the bases of the pelvics. *G. akhtari* Silas, sp. nov.

Glyptosternum reticulatum McClelland.

1842. *Glyptosternon reticulatus*, McClelland, *Calcutta Journ. Nat. Hist.*, II p. 584.
 1934. *Glyptosternum reticulatum*, Hora, *Rec. Ind. Mus.* XXXVI, p. 287. (synonymy, distribution, sexual-dimorphism, proportion of sexes and bionomics).

Type-locality.—Sir-i-Chushma, at the source of the Kabul River, Afghanistan.

Type-specimen.—Does not seem to have been preserved.

Logo-types.—Several specimens have now been obtained from Chitral and Afghanistan whence waters drain into the Kabul River. No specimen from Sir-i-Chushma has, however, been collected in recent years. Major A. E. Farwell¹ obtained specimens of *Oreinus* and *Nemachilus* from

¹Hora, S. L., *Journ. Romb. Nat. Hist. Soc.*, XXXVII, p. 784, (1935).

there. It is probable that the conditions of life in the spring may have changed since Griffith obtained his specimens which were reported upon by McClelland.

Distribution.—Same as that of the genus with the exception of the Bamian River, Eastern Tibet and Sikkim.

List of specimens in the Zoological Survey of India Collection (Indian Museum).

Reg. No.	Locality.	Donor or Collector.	No. of specimens and state of preservation.
497	Harwan, Kashmir.	Purchased from F. Day. Original of Day's <i>Fishes of India</i> , pl. cxvii, fig. 3. Type of <i>Exostoma stoliczkae</i> Day.	1 specimen. Left pectoral and part of the pelvices slightly damaged.
F.10133/1	Harwan, Kashmir.	Kashmir Survey	.. 2 specimens. Dorsal and left pectoral of one specimen damaged.
F.641/2	From a small rapid stream near Kola Tee, Ladak-Kashmir.	Dr. Hutchinson	.. 2 specimens. In good state of preservation.
1102	Sneema, Kashmir.	Purchased from F. Day.	5 specimens in good state of preservation.
1104			
1105			
1106			
1107	Basgo, Kashmir.	Do.	.. 4 specimens in good state of preservation.
1113			
1114			
1115			
1116	Leh, Kashmir.	Do.	.. 3 specimens in good state of preservation. 1 specimen slightly damaged.
1196			
1197			
1198	Palagra stream, 2 miles below Kunisht in Chitral.	Dr. B. N. Chopra	.. 16 specimens. All in good state of preservation.
F. 11307/1			
F. 11308/1	Lutkuh River, Chitral.	Do. ..	.. 2 specimens in good state of preservation.
F. 11309/1	Mastung River between Koghazi and Mustung, Chitral.	Do. ..	.. 1 specimen in good state of preservation.

List of specimens in the Zoological Survey of India Collection (Indian Museum)—contd.

<i>Reg. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>No. of specimens and state of preservation.</i>
F. 11310/1	Small spring between Tar and Drosh, Chitral.	Dr. B.N. Chopra ..	1 specimen.
F. 11311/1	Kamramgol, near its Junction with Chitral river below Aranda, Chitral.	Do. ..	.. 2 specimens in good state of preservation.
F. 11312/1	Bambout river between Daimeli and Karakal, Chitral.	Do. ..	. 75 specimens. All in good state of preservation.
F. 11312/1	Chitral	Do. ..	.. 24 specimens. A few in very bad state of preservation.
F. 11516/1	Paghman river, Afghanistan.	British Legation, Kabul.	1 specimen in a fairly good state of preservation.
F. 11640/1	Surchat river, Afghanistan.	Zoological Museum der Universitat, Moscow (Russia).	1 specimen in good state of preservation.

***Glyptosternum maculatum* (Regan).**

1905. *Parexostoma maculatum*, Regan, *Ann. Mag. Nat. Hist.* (7), XV, p. 183.
 1923. *Glyptosternum maculatum*, Hora, *Rec. Ind. Mus.* XXV, p. 36, text-fig. 1, pl. iii, figs. 4 and 5.

Type-locality.—Lhasa, Tibet.

Type-specimen.—In the collection of the British Museum of Natural History (2 specimens, type not specified).

List of specimens in the collection of the Zoological Survey of India (Indian Museum).

<i>Reg. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>No. of specimens and state of preservation.</i>
F. 2145/1	Gyangtse, Tibet	Capt. F. H. Stewart, I.M.S.	1 specimen. The head near the occiput is slightly damaged.
F. 10132/1	Sikkim	Lord Carmichael ..	1 specimen. The caudal peduncle is badly damaged.

Since Hora examined this collection in 1923, one specimen from Gyangtse appears to have been lost in the floods of the Varuna River at Banaras in September 1943.

The specimen from the Sikkim Himalayas bears no definite locality, but it can safely be presumed that it may have come from the streams along the northern slopes of the Himalayas in the region of Sikkim. Extensive collections made in the Tista drainage have not revealed the presence of this species. Along with its two other congeners, it can be assigned to the Trans-Himalayan fauna.

***Glyptosternum akhtari* Silas, sp. nov.**

(PLATE I, FIGS. 4-6)

D. 1/6/0; A. 1/5; P. 1/11; V. 1/5; C. 17.

In general facies, *Glyptosternum akhtari* resembles *G. reticulatum* but differs from it in having more extensive paired fins, and adipose dorsal. The head and the body are greatly flattened and the ventral profile is horizontal. The dorsal profile is slightly arched. The ventral surface of the head is closely papillated.

The length of the head is contained $4\frac{3}{4}$ to 5 times and the depth of the body and 7 to $7\frac{1}{2}$ times in the total length. The head is slightly longer than broad. The eyes, which are placed midway between the tip of the snout and the post-orbital part of the head are small and are not visible from the ventral surface. The interorbital width is $3\frac{1}{2}$ to 4 times in the length of the head.

The maxillary barbels reach nearly the upper angles of the gill-openings. The outer mandibular barbels are longer than the inner and are as long as the nasal barbels. The length of the nasal barbels are contained $2\frac{1}{4}$ to $2\frac{1}{2}$ times in the length of the head, and they extend beyond the eye. The post-labial groove is broadly interrupted. The width of the mouth is contained $2\frac{1}{2}$ to $2\frac{3}{4}$ times in the length of the head. The teeth in both jaws are pointed, and in the upper jaw they form a band which is produced backwards at the sides. In the lower jaw they are in two distinct bands which are pointed at the sides. The gill-openings extend for a short distance on the ventral surface. The width of the isthmus is nearly half the length of the head.

The dorsal commences nearer to the tip of the snout than to the base of the caudal fin. The distance from the tip of the snout to the commencement of the dorsal is contained $1\frac{1}{2}$ times in the distance from the commencement of the dorsal to the base of the caudal fin. The dorsal fin arises a little in front of the extremity of the pectorals. The pectorals are a little longer than the head and possess 11 branched rays. The outer ray of the pectoral and pelvic fins correspond to the structure described by McClelland for *G. reticulatum* and figured by Annandale. The pelvics extend for a short distance beyond the anal fin. The caudal fin is truncate. The least height of the caudal peduncle is contained about $2\frac{1}{2}$ times in its length. The vent is placed closer to the commencement of the anal fin than to the origin of the pelvics. The adipose dorsal arises beyond the free extremity of the dorsal and is not confluent with the caudal.

In spirit, the colour of the specimens is greyish with the ventral surface lighter. The posterior portions of the anal and caudal fins are black.

The following table shows the main differences between *G. akhtari* and *G. reticulatum* :—

<i>G. akhtari.</i>	<i>G. reticulatum.</i>
1. Least height of caudal peduncle is contained $2\frac{1}{2}$ times in its length.	Least height of caudal peduncle is contained 3 times in its length.
2. The adipose dorsal commences behind the free extremity of the dorsal.	The adipose dorsal is separated from the free extremity of the dorsal by a considerable distance.
3. The pelvics extend for a short distance beyond the commencement of the anal.	The pelvics are separated from the commencement of the anal by a considerable distance.
4. The distance between the tip of the snout and the origin of the dorsal is contained $1\frac{1}{2}$ times in the distance between the commencement of the dorsal and the base of the caudal.	The distance between the tip of the snout and the origin of the dorsal is contained nearly 2 times in the distance between the commencement of the dorsal and the base of the caudal.
5. The length of the dorsal is contained about $5\frac{1}{2}$ times in the total length.	The length of dorsal is contained $7\frac{1}{4}$ to 8 in the total length.

Type-locality.—Bamian River, Oxus Watershed, Afghanistan.

Type-specimen.— F. 643/2, Zoological Survey of India, (Indian Museum). There is also a cotype No. F. 644/2.

The species is named after Mr. A. S. Akhtar, Professor of Biology, Faculty of Medicine, University of Kabul, Afghanistan, in slight recognition of the valuable collections of fish he made in Afghanistan from time to time for Dr. S. L. Hora of the Zoological Survey of India.

Coraglanis gen. nov.

(PLATE I FIG. 1-3)

1934. *Euchiloglanis* (in part), Kimura, *J. Shanghai Sci. Inst.*, Sec. 3, I, p. 178.

For the diagnostic features of the genus *Coraglanis* reference may be made to the key on page 7. For a detailed description, the account of the only species known given below may be consulted.

Genotype.—*Coraglanis kishinouyei* (Kimura).

Type-locality.—Chengtú or Kiating, Szechwan, China.

We have great pleasure in associating this remarkable genus with the name of Dr. Cora D. Reeves, now on the staff of the Montreal College, Montreal, North Carolina, U. S. A., who collected the specimens in 1940.

Coraglanis kishinouyei Kimura.

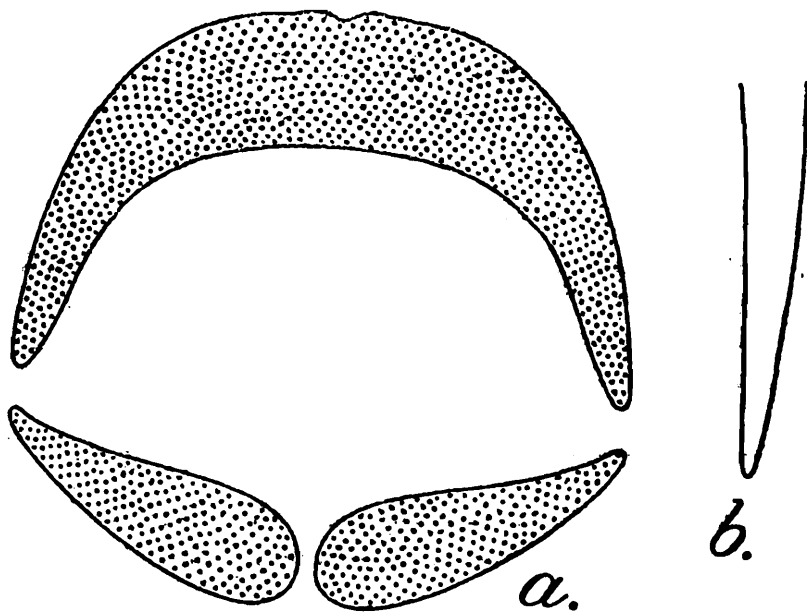
1934. *Euchiloglanis kishinouyei*, Kimura, *J. Shanghai Sci. Inst.*, sec. 3, I, pp. 178-179, pl. vi, fig. 1-3.

D. $1\frac{1}{6}$ 0; P. $1\frac{1}{13}$; V. $1\frac{1}{5}$; A. $1\frac{1}{5}$; C. 17.

To this remarkable species are referred two medium sized specimens obtained by Dr. Cora D. Reeves from the markets of Chengtú and Kiating in China. Their characteristic features are drawn up below.

The head and body are considerably depressed. The dorsal profile is slightly arched, and rises gradually from the tip of the snout to the origin of the dorsal fin, whence it slopes down gradually to the caudal peduncle, where it is horizontal. The head is slightly longer than broad. It is contained $3\frac{1}{4}$ to 4 times in the standard length. The depth of the body is half or slightly more in the length of the head. It is also contained $7\frac{1}{2}$ to $8\frac{3}{4}$ in the total length. The length of the snout is equal to the postorbital part of the head. The eyes, which are dorso-lateral in position, are situated in the middle of head and are not visible from the ventral surface. The diameter of the eye is contained $9\frac{1}{2}$ to $10\frac{1}{2}$ times and the interorbital width about 2 times in the length of the snout. The diameter of the eye is also contained about 5 times in the interorbital width. The snout is considerably depressed and broad anteriorly.

The mouth is subterminal and is more transverse than crescentic. It is fringed anteriorly by a thick lip which is continuous with the fold of the lower lip at the angles of the mouth. The post-labial groove is broadly interrupted. The teeth are sharp and those on the upper jaw form a transverse band, which is produced backwards at the sides. The teeth on the lower jaw form two bands which are pointed towards the sides.



TEXT-FIG. 1. Teeth bands of *Coraglanis kishinouyei* along with a tooth of the upper jaw magnified. a. Teeth bands $\times 5$; b., One tooth $\times 30$.

Four pairs of barbels are present. The nasal barbels extend up to the preorbital part of the eyes. The maxillary barbels are provided with very broad bases and on the ventral surfaces of their outer half bear striated pads of adhesive skin. The maxillary barbels also extend nearly to the upper angle of the gill-openings. The gill-openings are restricted and extend only upto above the base of the pectoral spine. The gill membrane is broad and free throughout its length.

The dorsal fin originates posterior to the base of the pectoral fin, but slightly in advance of the free extremity of the pectorals. The length

of the dorsal is greater than the depth below it and is contained about $6\frac{1}{4}$ times in the total length. The dorsal possesses 6 branched rays. The paired fins are broad, rounded and horizontally placed. They are vertical in their inner and horizontal in their outer halves. The pectorals are as long as the head and are separated from the pelvics by a short distance. The number of branched rays in the pectorals is 13. The pelvics commence opposite the posterior end of the base of the dorsal, and are almost as long as the dorsal and possess 5 branched rays. The anal is with 6 rays. The adipose dorsal is long and low and separated from the caudal by a short distance. The caudal is truncate and its length is contained $7\frac{1}{2}$ times in the total length. The caudal peduncle is about 3 times as long as deep.

The colour of the specimens in spirit is brown all over the dorsal surface and the sides of the body, while the fins and the lower surface are pale. The caudal is tinged with a broad dark transverse band.

Type-locality.—Chengtú or Loshan (=Kiating) markets (Min River drainage), Szechwan, China.

Type specimen, 126.5 mm. in total length.—M. 158522 is placed in the Museum of Zoology, University of Michigan, Ann Arbor, Michigan, U. S. A.

Cotype, 113.25 mm. in total length.—F. 646/2, deposited in the collection of the Zoological Survey of India, (Indian Museum), Calcutta.

Euchiloglanis Regan.

- 1874. *Chimarrichthys*, Sauvage, *Rev. et. Mag. Zool.*, XXV, p. 332. (The name preoccupied *vide* O'Shaughnessy, *Zool. Record*, 1874).
- 1905. *Chimarrichthys*, Regan, *Ann. Mag. Nat. Hist.* (7), XV, p. 182.
- 1907. *Euchiloglanis*, Regan, *Rec. Ind. Mus.*, I, p. 158. (Substitute name for *Chimarrichthys* Sauvage).
- 1923. *Glyptosternum* in part, Group III, Hora in part, *Rec. Ind. Mus.*, XXV, p. 32.
- 1925. *Euchiloglanis*, Norman, *Ann. Mag. Nat. Hist.* (9), XV, p. 572.
- 1933. *Euchiloglanis*, Smith, *Journ. Siam. Soc. Nat. Hist. Suppl.*, IX, p. 71.

Though the diagnostic features of *Euchiloglanis* have been tabulated by Regan, Norman and Smith, its complete diagnosis has not yet been given. We have not examined any specimen of the type-species, *E. davidi* (Sauvage), but a new description of this was furnished by Norman in 1925. The genus *Euchiloglanis* is redefined here as follows :—

The genus *Euchiloglanis* comprises small and medium sized, greatly flattened, Sisorid fishes in which the head and the anterior part of the body are depressed and the tail is compressed from side to side. The skin is soft and is minutely papillated on the ventral surface. The eyes are minute and subcutaneous. They are situated on the dorsal surface of the head, and are not visible from the ventral surface. The mouth is transverse and is situated considerably behind the snout. The teeth are

pointed, those on the upper jaw form a band which is not produced backwards at the sides. The fold of the lower lip is broadly interrupted. There are 8 barbels, 2 nasal, 2 maxillary and 4 mandibular. The maxillary barbels are provided with very broad bases and on the ventral surface of their outer halves bear striated pads of adhesive skin. The gill-openings are narrow and restricted to the sides of the head, and extend only up to the middle of the base of the pectoral spine. The gill membranes are broad and free throughout their entire length.

The fins are without spines and the structure of the outer ray of the paired fins are as that described by McClelland for *G. reticulatum* and figured by Annandale. The dorsal fin is situated closer to the snout than to the base of the caudal. The dorsal arises anterior to the extremity of the pectorals, but is equidistant from the base of the pectoral and the middle of the base of the pelvics. The adipose fin is low and long. The paired fins are broad, rounded, and horizontally placed; they are vertical in their inner halves and horizontal in their outer halves. The skin on the ventral surface of the first rays of paired fins are corrugated in pinnate folds for the purpose of adhesion. The caudal fin is obliquely truncate or somewhat rounded.

Genotype.—*Euchiloglanis davidi* (Sauvage).

Type-locality.—Eastern Tibet.

Distribution.—Tao in upper Burma; Nga Kyankka Kyoukguet; Eastern Tibet; Szechwan, Lo-Ma Ho, tributary of River Mekong at Lamping, Yunnan, China; Pharping in Nepal; Darjeeling and Kurseong Teesta Drainage and Abor Hills, Assam.

Key to the species of the genus Euchiloglanis Regan.

I. Lower angle of the gill-opening above the base of the pectoral spine.

A. Pectoral fin extending scarcely $\frac{2}{3}$ of the distance from its base to the base of the pelvics.
Band of teeth in the upper jaw partially divided in the centre. Pectorals with 15 branched rays. *E. feae* (Vinciguerra).

B. Pectoral fin extending $\frac{3}{4}$ or more of the distance from its base to the base of the pelvics.
Band of teeth in the upper jaw not divided.

1. Pectorals with 13-15 branched rays. Caudal peduncle much longer than deep.

a. Width of mouth $2\frac{1}{2}$ in length of head.
Caudal peduncle $2\frac{3}{4}$ times as long as deep. *E. davidi* (Sauvage).

b. Width of mouth $2-2\frac{1}{2}$ in length of head.
Caudal peduncle 3 times as long as deep. *E. myzostoma* Norman.

2. Pectorals with 16-17 branched rays. Caudal peduncle about as long as deep. *E. hodgarti* (Hora).

II. Lower angle of the gill-opening opposite the base of the pectoral spine.

A. Band of teeth in the upper jaw partly divided in the centre. Pectorals with 13 branched rays. *E. sinensis*, sp. nov.

B. Band of teeth in the upper jaw not divided in the centre. Pectorals with 16 branched rays. *E. macrotrema* Norman.

Euchiloglanis feae (Vinciguerra).

1923. *Glyptosternum feae*, Hora, *Rec. Ind. Mus.*, XXV, p. 37.

1925. *Euchiloglanis feae*, Norman, *Ann. Mag. Nat. Hist.*, (9), XV, p. 572.

We have examined eight specimens of *E. feae* in the collection of the Zoological Survey of India. A cotype received from the Genova Museum and examined by Hora in 1923 is present in the collection. The specimens agree in all details with Vinciguerra's description of the species.

<i>Reg No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>No. of specimens and state of preservation.</i>
T. 10260/1	Tao, Upper Burma.	Exchange, Genova Museum.	1 specimen (Co-type).
F. 645/2	Nga Kyankka-Kyou- kguet, Burma.	..	7 specimens.

Euchiloglanis davidi (Sauvage).

1923. *Glyptosternum davidi*, Hora, *Rec. Ind. Mus.*, XXV, p. 37.

1925. *Euchiloglanis davidi*, Norman, *Ann. Mag. Nat. Hist.*, (9), XV, pp. 574-575.

Sauvage¹ (1874) in describing this species made no comments about the nature of the labial fold. We have not examined any specimen of *E. davidi*. Regan² (1905) and later Norman (1925), who redescribed this species, have shown that its labial fold is widely interrupted.

Euchiloglanis davidi is known from Eastern Tibet, Yunnan and Szechwan in China.

Euchiloglanis myzostoma Norman.

1923. *Euchiloglanis myzostoma*, Norman, *Ann. Mag. Nat. Hist.*, (9), X, pp. 562-562.

1925. *Euchiloglanis myzostoma*, Norman, *Ann. Mag. Nat. Hist.*, (9), XV, p. 573.

E. myzostoma described by Norman in 1923 is represented by a single specimen in the collection of the Zoological Survey of India. *E. myzostoma* is closely related to *E. davidi*, from which it differs in the relatively longer caudal peduncle and narrower mouth.

<i>Reg. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>No. of specimens and state of preservation.</i>
F. 10435/1	Lo-ma Ho, tributary of river Mekong at Lamping, Yunnan, China.	British Museum, Ex- change.	1 specimen. Ventral surface is slightly damaged.

¹ Sauvage E., *Rev. et. Mag. Zool.* XXV, p. 333 (1874).

² Regan, C. T., *Ann. Mag. Nat. Hist.* (7), XV, p. 183 (1905).

Euchiloglanis hodgarti (Hora).1923. *Glyptosternum hodgarti*, Hora, *Rec. Ind. Mus.*, XXV, p. 38.1925. *Euchiloglanis hodgarti*, Norman, *Ann. Mag. Nat. Hist.*, (9), XV, pp. 573.

We have examined abundant material of *E. hodgarti* present in the collection of the Zoological Survey of India. For a detailed description of this species reference may be made to Hora's work.

E. hodgarti is known from Nepal, Darjeeling and Assam.

<i>Reg. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>No. of specimens and state of preservation.</i>
F. 1553/1	Pharping, Nepal	Mr. Hodgart. (TYPE)	1 specimen.
Cat. 598	Darjeeling	Stoliczka	1 specimen.
2631	Darjeeling	Purchased from F. Day	1 specimen.
F. 88/1	Kurseong	Ditto.	1 specimen.
F. 7776-7/1	Between Rotung and Rening, Abor Hills, Assam.		2 specimens.
F. 10080/1	Darjeeling	G. E. Shaw . . .	1 specimen.
F. 11379/1	From Riyang and Rangbi rivers, Teesta Valley.	G. E. Shaw and E. O. Shebbeare.	4 specimens.

Euchiloglanis macrotrema Norman.1925. *Euchiloglanis macrotrema*, Norman, *Ann. Mag. Nat. Hist.*, (9), XV, pp. 570-571.

E. macrotrema closely resembles *E. feae* (Vinciguerra) from which it is distinguished by its larger gill-openings and more slender caudal peduncle. We have not examined specimens of this species. For a detailed description reference may be made to Norman's work.

E. macrotrema is known from Ngoi-Tio, Col des Nuages, Tonkin (latitude 4,500—6,500 feet) in Indo-China. Norman's description is based on two specimens from the type locality.

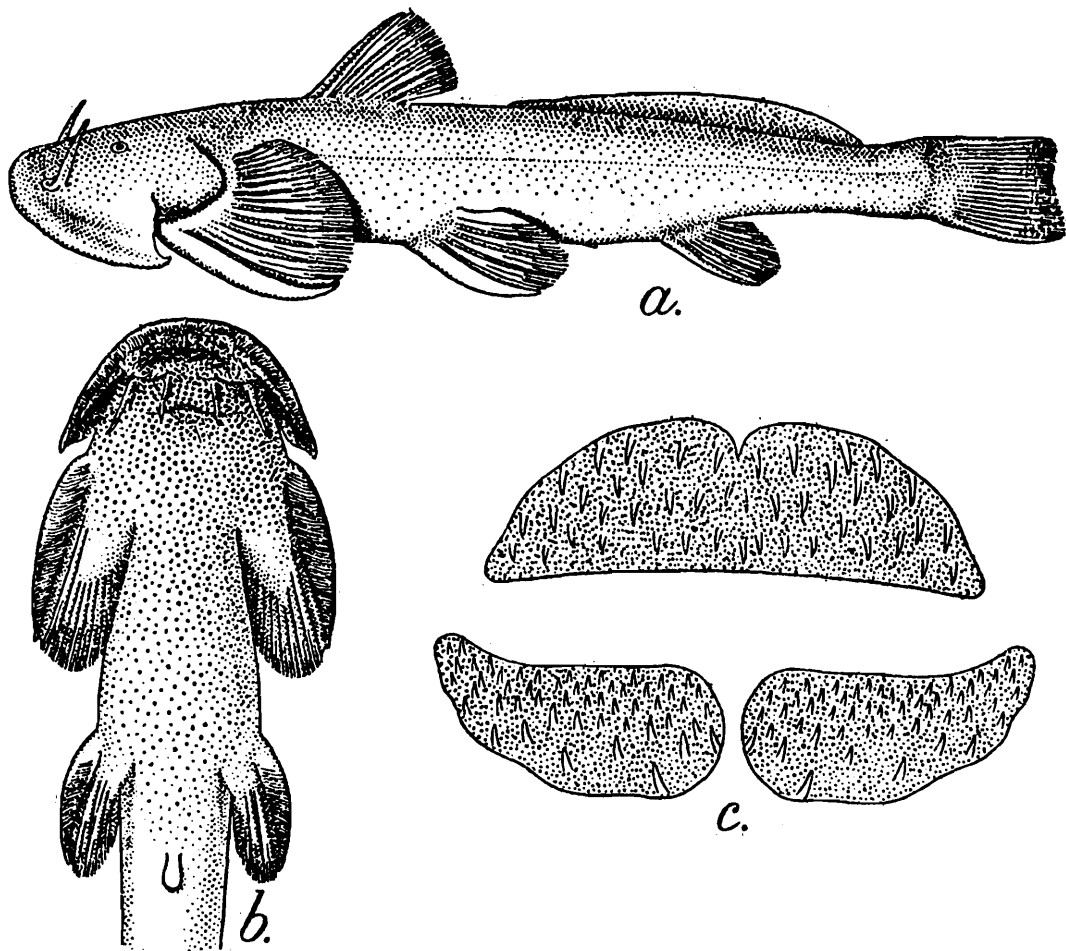
Euchiloglanis sinensis, sp. nov.

D. 1/6/0 ; A. 1/5 ; P. 1/13 ; V 1/5 ; C. 17.

To this species is referred a single specimen, received from the Fan Memorial Institute of Biology, Peiping, China. It is readily distinguished from other species of the genus by certain well defined characters, such as the nature of the teeth band, the number of branched pectoral rays, and the relative length proportions.

The head and the body are greatly depressed. The dorsal profile is slightly arched and the ventral surface is flattish and horizontal up to the anal, whence it slightly rises up to the caudal. The ventral surface anterior to the base of the pectorals is minutely papillated. The length of the head is $4\frac{1}{2}$ to $4\frac{3}{4}$, and the depth of the body is $6\frac{1}{2}$ to 7 in the standard length. The head is slightly longer than broad. The eyes are very small, are placed dorso-laterally and are not visible from the ventral surface. The eyes are placed in the posterior half of the head and their diameter is contained $9\frac{1}{2}$ to 10 times in the length of the snout and $4\frac{3}{4}$ in the interorbital distance. The snout is longer than the post orbital

part of the head. The interorbital width is contained 4 times in the length of the head.



Text-fig. 2. *Euchiloglanis sinensis*, sp. nov. a. Lateral view, $\times 5/7$; b. Ventral view, $\times 5/7$; c. Teeth bands of upper and lower jaws.

The teeth in both jaws are conical and pointed. In the upper jaw they form a band which is not produced backwards at the sides. The band of teeth in the upper jaw is partly divided in the centre anteriorly. The gill-openings extend to opposite the lower end of the pectoral base. The gill membranes are broad and free throughout their entire length.

The dorsal arises closer to the snout than to the base of the caudal. The distance between the tip of the snout and the commencement of the dorsal is contained slightly more than two times in the distance between the origin of the dorsal and the base of the caudal. The origin of the dorsal is in front of the extremity of the pectoral and is equidistant from the upper end of the pectoral base and the middle of the pelvic base. The length of the dorsal is equal to or slightly more than the depth of the body below it. The paired fins are broad, rounded and horizontally placed. They are vertical in their inner and horizontal in their outer halves. The pectorals have 13 branched rays, and are about as long as the head. The pectorals are separated from the pelvics by a short distance. The pelvics possess five branched rays and are slightly longer than the dorsal. The anal has 6 rays. The caudal is truncate. The least height of the caudal peduncle is contained $3-3\frac{1}{2}$ times in its length.

The colour in spirit is dark greyish. The ventral surface and the free ends of the fins are lighter in colour.

Type-specimen.—F. 12208/1, Zoological Survey of India (Indian Museum), Calcutta.

The specimen was received from the Fan Memorial Institute of Biology, Piepeing, China, under the name *Euchiloglanis davidi* without any locality label, but presumably it is from some part of China, possibly Yunnan.

Myersglanis, gen. nov.

1869. *Exostoma* (in part), Day, *Proc. Zool. Soc. London*, p. 525.

1923. *Glyptosternum* (in part), Hora, *Rec. Ind. Mus.*, XXV, p. 42.

1925. *Euchiloglanis* (in part), Norman, *Ann. Mus. Nat. Hist.*, (9), XV, p. 574.

The genus *Myersglanis* is established to accommodate a distinct generic type included by Day (1869), Hora (1923) and Norman (1925) under the genera *Exostoma*, *Glyptosternum* and *Euchiloglanis* respectively. This monotypic genus is represented now by the species *blythi* (Day). This species was included, along with *Glyptosternum feae* and *G. hodgarti*, by Hora (*op. cit.*) in his 'third group', but he distinguished it from the latter two species by the continuous nature of the fold of the lower lip. Later Norman in 1925 included Hora's *Glyptosternum blythi* along with *G. macropterus* under the genus *Euchiloglanis*, but in his key he differentiated these two species from the other species of *Euchiloglanis* by the continuous nature of the fold of the lower lip. The nature of the dentition has made us provisionally assign *E. macropterus* to the genus *Oreoglanis* Smith. The continuous nature of the fold of the lower lip being by itself a character of generic importance and second in importance only to the nature of the dentition, distinguishes Norman's *Euchiloglanis blythi* (Day) from all other species of the genus *Euchiloglanis*. In order to bring about a satisfactory classification of these torrential fishes we have been obliged to recognize *E. blythi* (Day) under a distinct genus, *Myersglanis*, which may be characterised as follows :—

Members of the genus *Myersglanis* are small and greatly flattened Sisorid fishes in which the head and the anterior part of the body are considerably depressed and the tail is compressed from side to side. The eyes are minute, subcutaneous and situated on the dorsal surface of the head. The teeth are all conical and pointed. The teeth in the upper jaw form a transverse band which is not produced backwards at the sides. The band of teeth in the lower jaw is divided in the centre, and is pointed towards the sides. The fold of the lower lip is continuous. There are 8 barbels, 2 nasal, 2 maxillary and 4 mandibular. The maxillary barbels are provided with broad bases. Gill-openings are narrow and extend only up to the middle of the base of the outer pectoral ray. The gill membrane is broad and free throughout its length.

The dorsal is situated nearer to the tip of the snout than to the base of the caudal. The fins, as in *Glyptosternum* McClelland, are without spines. The outer ray of the paired fins approximate more or less to the structure described by McClelland for *G. reticulatum* and figured by Annandale. The paired fins are rounded, flattened and horizontal.

They are vertical in their inner and horizontal in their outer halves. The skin on the ventral surface of the outer ray of the paired fins is corrugated in pinnate folds for the purpose of adhesion.

Myersglanis blythi (Day.)

1869. *Exostoma blythi*, Day, *Proc. Zool. Soc. London*, p. 525.

1923. *Glyptosternum blythi*, Hora, *Rec. Ind. Mus.*, XXV, p. 42.

1925. *Euchiloglanis blythi*, Norman, *Ann. Mag. Nat. Hist.*, (9), XV, p. 574.

Exostoma blythi was originally described by Day from two unlocalized specimens, which are at present in the collection of the Zoological Survey of India, Indian Museum. In 1871 Day referred certain other specimens from the rivers below Darjeeling to this species. Hora in 1923 separated the Darjeeling specimens as a distinct species, *Euchiloglanis hodgarti*. *M. blythi* differs from *Euchiloglanis* Regan in its continuous labial fold. The specimens are in a bad state of preservation so a redescription of it, as far as possible, is given below.

D. $1\frac{1}{6}/0$; P. $1\frac{1}{16}$; V $1\frac{1}{5}$.

The head and the anterior part of the body are considerably depressed. The dorsal profile is slightly arched. It rises from the tip of the snout to the base of the dorsal whence it slopes down gradually to the base of the caudal. The head is about as long as broad. The snout corresponds in length to the post orbital part of the head. The length of the head is contained $4\frac{1}{2}$ to 5 times in the standard length. The eyes are small and are placed dorsally in the middle of the head and are not visible from the ventral surface. The teeth are all conical and pointed, and in the upper jaw form a transverse band which is not produced backwards at the sides. The fold of the lower lip is continuous. The gill-openings are restricted to the sides and do not extend to the ventral surface. The gill membranes are broad and free throughout their length.

The dorsal arises closer to the snout than to the base of the caudal. The dorsal is also placed entirely in advance of the pelvics. The paired fins are broad, rounded and horizontally placed; they are vertical in their inner halves and horizontal in their outer halves. The outer rays of the paired fins are pinnate and correspond in structure to that described by McClelland for *G. reticulatum*. The pectorals have 16 branched rays and are separated from the pelvics by a short distance. The pelvics contain 5 branched rays, and extend beyond the vent. The anal is situated far behind the vent, and its origin is closer to the base of the caudal than to the origin of the pelvics. Due to the present condition of the specimens it is not possible to determine the nature of the adipose dorsal and the caudal.

Type-specimen.—A. S. B. Cat. 599 : Two unlocalized specimens.

According to Regan¹ *M. blythi* is known from Pharping in Nepal. We have not examined the material studied by Regan but Nepal could be taken as the habitat of this species.

¹ Regan, C. T., *Rec. Ind. Mus.*, I, p. 158 (1907).

Glaridoglanis Norman.

1923. *Glyptosternum* (in part, Group II), Hora, *Rec. Ind. Mus.*, XXV, p. 32.

1925. *Glaridoglanis*, Norman, *Ann. Mag. Nat. Hist.*, (9), XV, p. 574.

1933. *Glaridoglanis*, Smith, *Journ. Siam. Soc. Nat. Hist. Suppl.*, IX, p. 71.

Although the diagnostic features of *Glaridoglanis* have been drawn up by Hora, Norman and Smith, a complete description of this genus has not so far been furnished. Since we have examined two specimens of the type-species, *G. andersonii* (Day), we are able to draw up a description for this genus. The genus *Glaridoglanis* may be characterized as follows :—

The genus *Glaridoglanis* comprises medium-sized, flattened Sisorid fishes in which the head and anterior part of the body are depressed and the tail is compressed from side to side. (Due to the desiccated condition of the specimens it is not possible to determine the nature of the skin). The eyes are minute and are placed on the dorsal surface of the head and are not visible from the ventral surface. The mouth is transverse and subterminal. The teeth are greatly compressed, with apices broad, truncate or notched, those of the upper jaw forming a band which is not, produced backwards at the sides. The teeth in the lower jaw form two bands which are pointed towards the sides. The folds of the lower lip are broadly interrupted. There are 8 barbels, 2 nasal, 2 maxillary and 4 mandibular. The maxillary barbels are provided with very broad bases and on the ventral surface in their outer halves bear striated pads of adhesive skin. The gill-openings are wide and extend to opposite the base of the pectorals, but do not extend to the ventral surface. The fins are without spines, the first rays of the pectoral and pelvic fins are soft and pinnate, giving off soft, pointed, cartilagenous rays along the anterior margin which are enveloped in the membrane of the fin. The dorsal, which is placed nearer to the tip of the snout than to the base of the caudal, arises slightly in advance of the free extremity of the pectorals, and entirely in front of the pelvics. The skin on the ventral surface of the outer rays of the paired fins is drawn out in pinnate folds to serve for purposes of adhesion.

Type-species.—*Glaridoglanis andersonii* (Day).

Type-locality.—Hotha in Yunnan and Ponsee, China.

***Glaridoglanis andersonii* (Day).**

1923. *Glyptosternum andersonii*, Hora, *Rec. Ind. Mus.*, XXV, p. 32.

1925. *Glaridoglanis andersonii*, Norman, *Ann. Mag. Nat. Hist.*, (9), XV, p. 574.

To this species are referred two specimens in the collection of the Zoological Survey of India, (*Indian Museum*). Hora in 1923 had examined 4 specimens of *G. andersonii*, and since then two of the specimens Cat. 596 have been lost, apparently, in the floods of the Varuna river at Banaras in September 1943. The remaining two specimens are badly desiccated. In one the head is separate from the rest of the body. The fins are all damaged. The outer rays of the pectoral and pelvic fins correspond to

the structure described by McClelland for *G. reticulatum* and figured by Annandale.

Reg. No.	Locality.	Donor or Collector.	No. of specimens and state of preservation.
F. 9173/1 F. 9174/1	Hotha in Yunnan and Pensee, China.	Dr. J. Anderson	2 specimens. Badly desiccated. The head is separated from the rest of the body in one of the specimens.

Oreoglanis Smith.

1933. *Oreoglanis*, Smith, *Journ. Siam. Soc. Nat. Hist. Supp.*, IX, (1), pp. 70-74.

1945. *Oreoglanis*, Smith, *Bull. U. S. Nat. Mus.* 188, p. 395.

For the diagnostic features of *Oreoglanis*, reference may be made to the key for the genera and to Smith's original description.

Genotype.—*Oreoglanis siamensis* Smith.

Distribution.—Kang River, near Doi Angka ; Northern Siam ; Kakhyen Hills and Pazi, Monghong Hsipai State, northern frontier of Burma.

Key to the species of Oreoglanis Smith.

- I. Teeth in the upper jaw conical and pointed.
Teeth in the lower jaw are compressed and possess truncate apices. Pectorals with 19 branched rays *O. macropteron* (Vinciguerra).
- II. Teeth in the upper jaw conical and pointed.
Teeth in the lower jaw of two distinct types, the posterior like those of the upper jaw and the anterior much larger, the bases slender, the free ends expanded into truncate spatulate shape with inner surface slightly hollowed. Pectorals with 17 or 18 branched rays *O. siamensis* Smith.

Oreoglanis macropteron (Vinciguerra).

1923. *Glyptosternum macropteron*, Hora, *Rec. Ind. Mus.*, XXV, p. 39.

1925. *Euchiloglanis macropterus*, Norman, *Ann. Mag. Nat. Hist.*, (9), XV, p. 574.

Four specimens of this species examined by Hora in 1923 have since been lost, probably in the floods of the Varuna river at Banaras in September 1943. Of the original four specimens, three were presented to the Museum by Mr. J. Coggin Brown and the remaining one by Dr. Vinciguerra of the Genova Museum.

O. macropteron differs from *Euchiloglanis davidi* in the continuous nature of the fold of the lower lip and the number of branched rays in the pectorals. It resembles *Myersglanis blythi* in the former character. Hora in (1923) has shown that in *O. macropteron* the teeth in the lower jaw differed from those of the other species.

Locality.—Northern frontier of Burma, Kakhyen Hills and Pazi, Monghong Hsipai State.

Oreoglanis siamensis Smith.

1933. *Oreoglanis siamensis*, Smith, *Journ. Siam. Soc. Nat. Hist. Supp.*, IX, (1), pp. 72-74, pl. 3, figs. 1 and 2, Text-fig. 4.
 1945. *Oreoglanis siamensis*, Smith, *Bull. U. S. Nat. Mus.* 188, p. 395.

Smith in 1933 described this species in detail. His observations were confirmed by Hora, who examined the specimens sent to him by Smith. The topotype, which was deposited in the collection of the Zoological Survey of India (*Indian Museum*), has been lost, most probably in the floods of the Varuna river at Banaras in September 1943.

Type-locality.—Taken from the river Karg, near the base of the Doi Angka, Northern Siam (December 3rd, 1928).

Exostoma Blyth.

1860. *Exostoma*, Blyth, *Journ. As. Soc. Bengal*, XXIX, p. 154.
 1864. *Exostoma*, Günther (in part), *Cat. Brit. Mus. Fish.*, V, p. 264.
 1878. *Exostoma*, Day (in part), *Fish. India*, p. 501.
 1889. *Exostoma*, Day (in part), *Faun. Brit. Ind., Fish.*, I, p. 108.
 1905. *Exostoma*, Regan, *Ann. Mag. Nat. Hist.*, (7), XV, p. 182.
 1925. *Exostoma*, Norman, *ibid.*, (9), XV, p. 574.
 1933. *Exostoma*, Smith, *Journ. Siam. Soc. Nat. Hist. Suppl.*, IX, p. 71.

The genus *Exostoma* was established by Blyth to accommodate a fourth distinct generic type included by McClelland in his composite genus *Glyptosternon*. The other genera are *Glyptosternum* McClelland (*vide supra*, p. 8), *Pseudecheneis* Blyth and *Glyptothorax* Blyth. *Exostoma* was characterized by him as follows :—

“Otherwise generally similar to *Glyptothorax*, but with no pectoral disk, the dorsal spine exceedingly slender (if always present?) and the eyes somewhat larger. Lips reflected and spread continuously round the mouth, so as to form a broad flat sucker. Two distinct lateral lobes of minute card-like teeth, both above and below, reflected much apart and having an obviously suctorial centre. Only one pair of lower cirri situated at the posterior corners of the reflected lower or hinder lip: the entire lower parts smooth and flat. Anal fin small; the adipose dorsal lengthened but very slight and low, extending nearly to the caudal.”

He first described a new species *E. berdmorei* under it which has to be regarded as the type, but also referred *Glyptosternon labiatus* McClelland from the Mishmi Hills to this genus.

Blyth seems to have been very clear about the limits of the four genera into which he divided McClelland's *Glyptosternon*, for he observed :

“Dr. Bleeker refers the (*Pimelodus*) *nangra* B. H., to *Glyptosternon*; but this I cannot understand. *Vide* Hamilton's published figures. He also gives a *Gl. platypogon* (K. et. V. H.), from Java and Hindustan, and *Gl. Platypogonoides*, Blkr., from Sumatra; both which appear to fall under *Glyptothorax*, nobis, *ut. supra*.”

Depending upon an old damaged specimen labelled as *Exostoma berdmorei* from Tenasserim bearing the A.S.B. Cat. No. 600 in the collection of the Zoological Survey of India, (*Indian Museum*) and taking it as the type-specimen of the species, Hora¹ proposed certain

¹ Hora, S. L., *Rec. Ind. Mus.*, XXIV, p. 33 Foot-note (1922); *ibid.* XXV, p. 8 (1923).

nomenclatorial changes by which he assigned *Exostoma* Blyth to the synonymy of *Glyptothorax* Blyth. This led to great controversy in which Regan¹, Annandale², Norman³ and Myers⁴ joined. The position was summed up by Myers as follows: "Furthermore it appears to be fairly certain (following Hora and Annandale) that the type of *Exostoma* (*E. berdmorei*) is a *Glyptothorax* and that the group called *Exostoma* by Norman is at present without a name (unless it is found that *Glyptosternon* actually belongs here)." Smith⁵ the last worker, to deal with this group of fishes, recognised the generic name *Exostoma* in the same sense as Regan and Norman without any comments.

In our present revision of these Sisorid fishes, two important considerations have led us to doubt the specimen A. S. B. Cat. No. 600 as being the type of *Exostoma berdmorei*. Firstly, as noted above, Blyth's description of the genus, which is fairly comprehensive, goes against this specimen being the type. Secondly, two specimens registered as A. S. B. Cat. No. 597 and referred to by Hora as *Glyptosternum* sp. in the *Records of the Indian Museum*, XXV, p. 43, 1923, seem to agree in every respect with Blyth's description of *Exostoma berdmorei*. It would thus appear that when the specimens were transferred from the Museum of the Asiatic Society of Bengal between 1864 to 1868, the labels may have got mixed up. We are now describing these specimens here as *E. berdmorei* and agree to the nomenclature proposed by Regan and Norman for these fishes.

The genus *Exostoma* may now be re-defined as follows :—

The genus *Exostoma* comprises small and medium-sized, greatly flattened, Sisorid fishes in which the head and the anterior part of the body are depressed and the tail is compressed from side to side. The skin is soft and is sparsely covered with minute papillae in the region anterior to the pectorals on the ventral surface. The eyes are minute, subcutaneous, and situated on the dorsal surface of the head. The mouth is more or less crescentic and is situated considerably behind the tip of the snout. The teeth are rather large, movable, oar-shaped, flattened distally and directed backwards, and are arranged in two distinct patches in the upper jaw. The fold of the lower lip is continuous. There are 8 barbels, 2 nasal, 2 maxillary and 4 mandibular. The maxillary barbels are provided with broad bases and on the ventral surfaces of their outer halves bear striated pads of adhesive skin. The gill-openings are wide but do not extend to the ventral surface of the head. The gill membrane is broad and free throughout its length. The fins are without spines. The outer ray of the paired fins are soft and pinnate giving off soft pointed cartilagenous rays along the anterior margin which are enveloped in the membrane of the fin. The dorsal is situated entirely behind the pectorals, but slightly in advance of the pelvics. The adipose fin, which is separated by a considerable distance from the

¹ Regan, C. T., *Ann. Mag. Nat. Hist.*, (9), XI, p. 608 (1923).

² Annandale, N., *ibid.*, (9), XII, p. 573 (1923).

³ Norman, J. R., *ibid.*, (9), XV, p. 571 (1925).

⁴ Myers, G. S., *Lingnan Sci. Journ.*, X, p. 260 (1931).

⁵ Smith, H. M., *Journ. Siam. Soc. Nat. Hist. Suppl.*, IX, p. 71 (1933).

dorsal, is long and low and may or may not be confluent with caudal. The paired fins are broad, rounded and horizontally placed. They are vertical in their inner and horizontal in their outer halves. The skin on the ventral surface of the first ray is produced into fine pinnate folds for the purpose of adhesion. The caudal fin may be truncate, forked slightly or deeply emarginate.

Type-species.—*Exostoma berdmorei* Blyth.

Type-locality.—Tenasserim, Burma.

Distribution.—Putao plains in North-Eastern Burma; Catcin in Burma; Pazi, Monghong-Hsipi State, Northern Shan States in Burma, Tenasserim, Burma; Abor and Naga hills in Assam.

Key to the species of the genus Exostoma Blyth.

I. Caudal fin truncate or slightly emarginate.

A. Pectorals with 10 branched rays,

1. Adipose dorsal confluent with the caudal.
Caudal peduncle $3-3\frac{1}{4}$ times as long as deep. *E. vinciguerrae* Regan.

2. Adipose dorsal not confluent with the caudal.
Caudal peduncle $2-2\frac{1}{2}$ times as long as deep *E. stuarti* (Hora).

B. Pectorals with 17-18 branched rays *E. Yunnanensis* (Tchang).

II. Caudal fin forked or deeply emarginate.

A. Gill-openings greatly restricted and extending to above the base of the Pectorals. Pectorals with 10 branched rays *E. berdmorei* Blyth.

B. Gill openings wide and extend to opposite the base of the pectoral spine. Pectorals with 12 branched rays *E. labiatum* (McClelland).

***Exostoma vinciguerrae* Regan.**

1923. *Glyptosternum vinciguerrae*, Hora, *Rec. Ind. Mus.*, XXV, p. 41.

1923. *Glyptosternum chaudhurii*, Hora, *Rec. Ind. Mus.*, XXV, p. 41.

1925. *Exostoma vinciguerrae*, Norman, *Ann. Mag. Nat. Hist.*, (9), XV, p. 574.

It was pointed out by Norman that *E. vinciguerrae* Regan includes *G. chaudhurii* Hora and we have now been able to confirm this finding. A number of specimens of this species are present in the collection of the Zoological Survey of India, Indian Museum.

<i>Reg. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>No. of specimens and state of preservation.</i>
F. 9741/1	Putao plains, N.E. Burma, Tibetan frontier.	Mr. Murray Stuart.	1 specimen. (Type of <i>E. chaudhurii</i> .)
F. 10259/1	Catcin in Burma	Received from Genova Museum.	2 specimens. (Co-types.)
F. 6665/1 F. 6667/1 F. 6669/1 F. 6671/1	} Pazi, Monghong, Hsipi State, Northern Shan States, Burma.	Mr. J. Coggin Brown	4 specimens.

Exostoma stuarti Hora.

1923. *Glyptosternum stuarti*, Hora, *Rec. Ind. Mus.*, XXV, p. 39.

1925. *Exostoma vinciguerrae* (in part), Norman, *Ann. Mag. Nat. Hist.*, (9), XV, p. 574.

To this species was referred a single specimen collected by Dr. Murray Stuart from the Nam-Yak river, at Tanja in Northern Burma. Norman in 1925 treated this species as a synonym of *E. vinciguerrae*, along with *E. chaudhurii* (Hora). After having examined specimens of all the three species we find that *E. stuarti* differs considerably from *E. vinciguerrae* and *E. chaudhurii*, whereas the latter two resemble each other in all salient features.

Reg. No.	Locality.	Donor or Collector.	No. of specimen and state of preservation.
F. 9742/1	Nam-Yak river at Tanja, Putao Plains, N. Eastern Burma near Tibe- tan frontier.	Mr. Murray Stuart.	1 specimen.

Exostoma yunnanensis (Tchang).

1935. *Glyptosternum yunnanensis*, Tchang, *Bull. Fan. Mem., Inst. Biol.* VI, (4), pp. 174-175, fig. 1.

1936. *Glyptosternum yunnanensis*, Tchang, *ibid.*, VII, (1), p. 47.

Tchang (1935), in describing a new Catfish, *Glyptosternum yunnanensis* from Yunnan, has given its complete diagnosis. The nature of the dentition, teeth bands and the labial fold clearly indicate its place in the genus *Exostoma*. For the sake of completeness, it may be well to reiterate here Tchang's description of the species, which runs as follows :—

“ Body elongate, anterior part depressed, caudal peduncle rather compressed ; head depressed and covered superiorly with soft skin ; no thoracic adhesive apparatus ; gill openings narrow, not extending to lower surface of body ; eyes superior, very small ; nostrils close together separated by a short barbel, situated nearer tip of snout than anterior margin of eye ; maxillary barbels short and broad ; 4 mandibular barbels ; fold of lower lip flat, broad and continuous ; teeth rather large, movable, oar shaped, flattened distally, arranged in two well separated bands or patches in each jaw ; body naked ; lateral line straight ; dorsal short ; dorsal spine very weak, situated in front of ventral, about midway gill opening and ventral origin ; adipose dorsal long and low, much longer than dorsal and anal ; pectorals broad, just reaching ventral, with a weak spine. Ventral surface of spine plaited ; Pectorals with 17 ; in one 18 branched rays. Ventral not reaching vent ; anal short ; caudal subtruncate ”. (*Italics are ours.*)

From *Exostoma vinciguerrae* Regan, found in Upper Burma, *E. yunnanensis* differs in the much longer body and the larger number of branched rays in the pectoral fin.

Type-locality.—Yunnan.

Type specimen is preserved in the Zoological Museum of Fan Memorial Institute of Biology, Peiping.

Exostoma berdmorei Blyth.

1869. *Exostoma labiatum*, Day, *Proc. Zool. Soc. London*, p. 525.
1923. *Glyptosternum* sp., Hora, *Rec. Ind. Mus.*, XXV, p. 43.
1925. *Exostoma berdmorei*, Norman, *Ann. Mag. Nat. Hist.*, (9), XV, p. 574.

Two specimens now preserved in the Zoological Survey of India were referred by Day (*op. cit.*) as *Exostoma labiatum*. Hora in 1923 found that they differed from *E. labiatum*, so he treated them as *Glyptosternum* sp. We have given reasons above (*vide supra*, pp. 23-24) for considering these specimens as the types of *Exostoma berdmorei*. A brief description of these specimens is furnished below :

D. $1\frac{1}{6}|0$; P. $1\frac{1}{10}$; V $1\frac{1}{5}$.

To this species are referred two medium sized, greatly flattened fishes in which the head and the anterior part of the body are considerably depressed and the tail is compressed from side to side. The skin is soft. The eyes are small but easily distinguishable. They are placed dorsally in the posterior half of the head, and are not visible from the ventral surface.

The length of the head is $5\text{--}5\frac{1}{6}$ times and the depth of the body 9-10 times in the standard length. The head is about as broad as long. The interorbital width is nearly $3\frac{1}{2}$ to $3\frac{3}{4}$ times contained in the length of the head. The snout, which is more pointed than in other species, is longer than the postorbital part of the head. The maxillary barbels reach only up to the base of the pectorals. The nasals are short and do not extend up to the eyes. The outer mandibular barbels are longer than the inner and correspond in length to the nasal barbels. The fold of the lower lip is continuous. The width of the mouth is contained 2 to $2\frac{1}{2}$ times in the length of the head. The teeth are rather larger, movable, oar shaped and flattened distally, depressed and directed backwards, and are arranged in two well separated bands or patches in each jaw. The gill openings do not extend to the lower surface of the body.

The dorsal originates closer to the snout than to the base of the caudal, and slightly in advance of the pelvics. The pectorals possess 10 branched rays and do not reach the pelvics. The pelvics have 6 branched rays and are separated from the vent by a short distance. The least height of the caudal peduncle is contained $2\frac{1}{2}$ to $2\frac{3}{4}$ times in its length. In spirit the colour is pale yellowish.

<i>Reg. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>No. of specimens and state of preservation.</i>
Cat. 597		A. S. B. . .	2 specimens. In very bad condition. The head is damaged in both the specimens.

Exostoma labiatum (McClelland).

1889. *Exostoma labiatum*, Day, *Fauna. Brit. Ind. Fish.*, I, p. 108.
1923. *Glyptosternum labiatum*, Hora, *Rec. Ind. Mus.* XXV, p. 42.
1925. *Exostoma labiatum*, Norman, *Ann. Mag. Nat. Hist.*, (9) XV, p. 574.

D. $1\frac{1}{6}|0$; P. $1\frac{1}{12}$; V 6 ; A. $1\frac{1}{5}$; C. 17.

Both in the *Fishes of India* and in the *Fauna of British India*, Day gave a short account of *E. labiatum*. In view of the fact that we have examined a number of specimens of *E. labiatum*, and as there exists no detailed description of this species elsewhere, we are redescribing it here. The species *E. labiatum* may be characterized as follows :

In general characters *E. labiatum* resembles *E. berdmorei*, but differs from it in having larger number of branched pectoral rays. The head and the body are considerably depressed. The ventral profile is flattish and horizontal. The dorsal profile is slightly arched. It rises from the tip of the snout to the commencement of the dorsal, whence it gradually slopes down to the base of the caudal. The ventral surface of the head behind the mouth, and the sides of the head are sparsely and minutely papillated.

The length of the head is contained $5\frac{1}{2}$ to 6 times and the depth of the body 8 to $10\frac{1}{2}$ times in the total length. The head is almost as long as broad. The eyes are minute and are placed almost in the middle of the head. The diameter of the eye is contained $4\frac{1}{2}$ times in the length of the snout and 3 times in the interorbital width. The interorbital width is $3\frac{1}{2}$ to $3\frac{3}{4}$ times contained in the length of the head.

The maxillary barbels reach nearly the upper angle of the gill-openings. They are broad at their bases and along the outer halves on the ventral surface are provided with a number of folds to help in adhesion. The outer mandibular barbels are longer than the inner and are about $\frac{3}{4}$ in the length of the nasal barbels. The nasal barbels extend for a short distance beyond the eyes. The inner mandibular barbels are very short and are confluent at their bases with the fold of the lower lip. The fold of the lower lip is continuous. The width of the mouth is contained $2\frac{1}{2}$ times in the length of the head. The teeth are large, movable, oar shaped, and flattened distally and directed backwards. In the upper jaw, they are arranged in two distinct patches. The gill openings reach to opposite the base of the pectorals, but do not extend to the ventral surface.

The dorsal commences nearer to the tip of the snout than to the base of the caudal fin. The dorsal fin is placed entirely posterior to the pectoral fins but slightly in advance of the pelvic fins. The paired fins are broad, rounded and horizontal in their outer halves. The pectorals, which are slightly longer than the head possess 12 branched rays. The pelvics are about as long as the dorsal. The outer ray of the paired fins correspond in structure to that figured by Annandale¹ for *G. vinciguerrae* (Regan). In *E. vinciguerrae* and *E. labiatum*, the pinnate processes on the outer face of the ray are less well developed than in *G. reticulatum* and other species. But in the general structure they are exactly the same. According to Annandale "In others such as *G. vinciguerrae* and *G. labiatum*, the structure is precisely the same, so far as its outline is concerned, therefore the rays agree precisely particularly in the species first mentioned, with both McClelland's description of *G. reticulatum* and Dr. Hora's figure of *G. labiatum*" The pelvics do not reach the vent. The adipose dorsal is long and low and is confluent with the caudal. The caudal is deeply emarginate.

¹ Annandale N., *Ann. Mag. Nat. Hist.*, (9), XII, p. 575 (1923).

In spirit the colour of the specimens vary from light yellow to greyish. In the latter case, the ventral surface and the fins are lighter in colour.

<i>Reg. No.</i>	<i>Locality.</i>	<i>Donor or Collector.</i>	<i>No. of specimens and state of preservation.</i>
F. 7728/1	Egar Stream between Renging and Rotung Assam.	Dr. S. W. Kemp	1 specimen.
F. 10131/1	Abor country, Assam.	Capt. de Courcy	2 specimens.
F. 11817/1	Sakhai, Lizho river, Naga Hills.	Dr. B. Prashad and Dr. B. N. Chopra	4 specimens.
F. 11818/1	Sakhai, Tiza river, Naga Hills.	Ditto	2 specimens.
F. 11819/1	Ditto	Ditto	15 specimens.
F. 11820/1	P u r o b a m i and Sahunyu, sources of the Tiza river, Naga Hills, Assam.	Mr. J. H. Hutton ..	4 specimens.

EXPLANATIONS OF PLATE I.

Two Species of Glyptosternoid Fishes.

Coraglanis kishinouyei (Kimura).

FIG. 1.—Lateral view.

FIG. 2.—Dorsal view of head and body.

FIG. 3.—Ventral view of head and body.

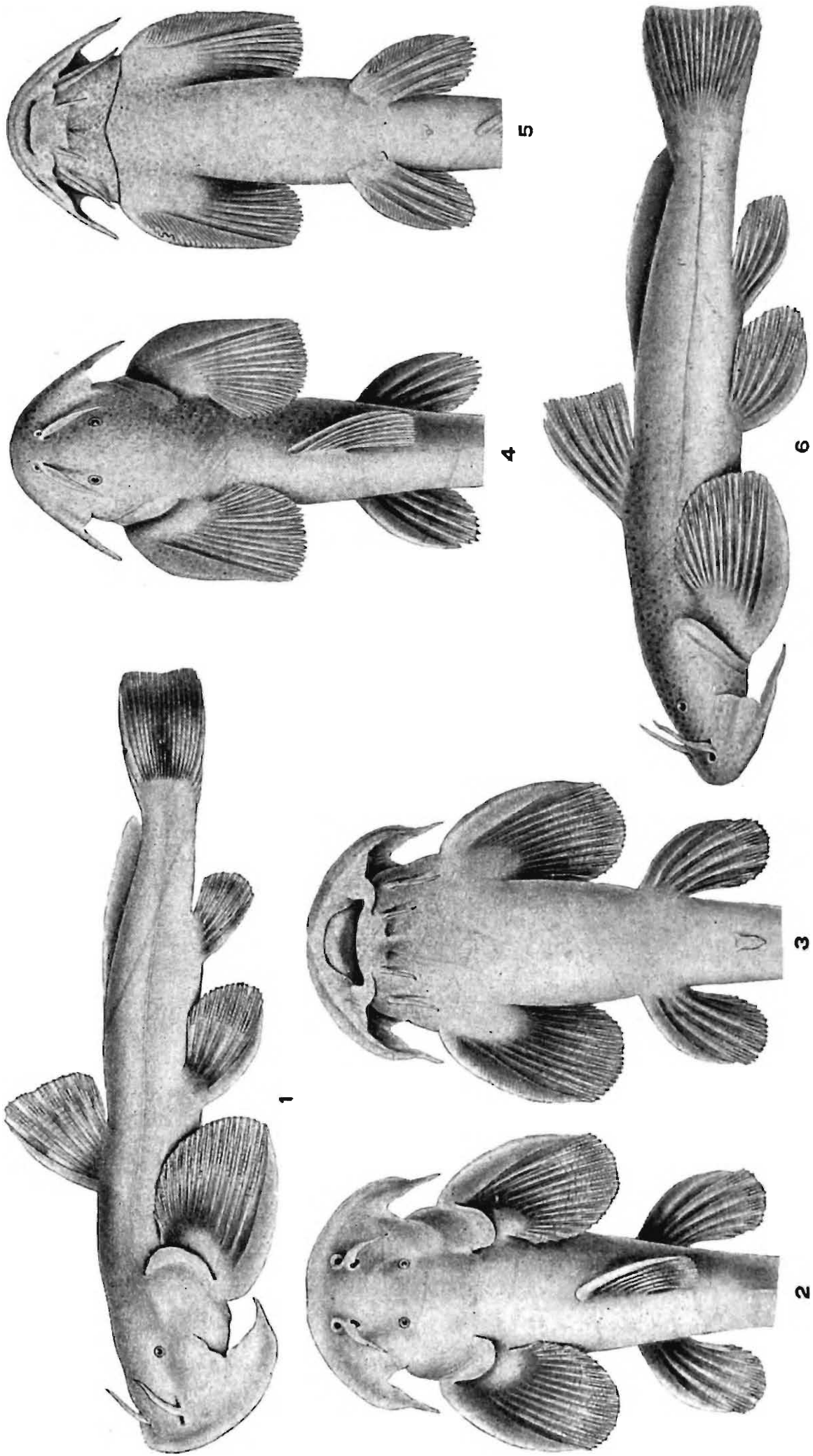
Glyptosternum akhtari Silas, sp. nov.

FIG. 4.—Dorsal view of head and body.

FIG. 5.—Ventral view of head and body.

FIG. 6.—Lateral view.

All figures are of natural size.



GLYPTOSTERNOID FISHES

LAND SHELLS OF THE GENUS *ENA* TURTON FROM SWAGNI MAIDAN, PARBATTI VALLEY, PUNJAB, WITH DESCRIPTION OF A NEW SPECIES (MOLLUSCA, GASTROPODA : FAMILY ENIDAE)

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PLATES II, III.

INTRODUCTION.

In July, 1949, Dr. G. S. Puri, Ecologist, Forest Research Institute and College, Dehra Dun, sent for determination one lot of dry shells to the Director, Zoological Survey of India, with the following interesting remarks relating to the ecological conditions which he himself studied at the time of collecting the specimens :—

"I have collected these specimens of freshwater shells from a moraine (perhaps, of sub-recent age) at an altitude of 10,000 ft., at Swagni Maidan in Pulga in the Parbatti Valley. The soil was deep clayey, brownish in colour and the specimens were found embedded (0.2" depth) in the clay."

Again, "snow line is just a few hundred feet (perhaps, 300 or so) above the place where these specimens were collected and snow water flows to this place in summer. During winter Swagni Maidan remains under water, and it is probable that glaciers must have descended to this level during the past. The glaciation in the valley may be of Pleistocene and also post-Pleistocene age. In some neighbouring valleys glaciers slip down the precipitous slopes even at the present time and such phenomenon is quite common. As a matter of fact, throughout the length and breadth of the Maidan these shells were found".

He has also been good enough to send me two very beautiful photographs which give a clear idea about the topography of the place wherefrom the specimens were collected. I am reproducing these photographs in Plate III (Figs. 1, 2). In this connection he also wanted to know if there was any lacustrine conditions prevailing at Swagni Maidan at the time of the occurrence of the shells. But after carefully examining the shells I found that they represent the true land snails of the genus *Ena* Turton, not freshwater ones as assumed by Dr. Puri. So, this may possibly lead one to think that there were no lacustrine conditions prevailing at Swagni Maidan at the time of the occurrence of the shells, and that the flow of snow water in the place from the snow line lying just a few feet above, as pointed out by Dr. Puri, might be responsible for making the soil clayey. The matter was referred to Dr. P. K. Ghose, Palaeontologist, Geological Survey of India, Indian Museum, Calcutta, for opinion, who also arrived at the same conclusion.

When the specimens were further examined more critically, all of them (excepting one which I suspected to be a new form of *Ena* from a study of the characters displayed by its shell) appeared to show certain features in their shell-characters somewhat closely resembling those of the species *E. domina* on the one hand and *E. arcuata* on the other (though tending more towards the latter in essential details). But since our entire named collections of that family were very badly damaged by the Varuna flood of 1943 at Banaras and, as such, no reliable specimens of

the group were available here for comparison, I felt a bit confused as to the exact identity of the shells in question. So, I sent them all (including that interesting solitary specimen marked as 2b and the rest as 2a) to Dr. W. J. Rees of the British Museum (Nat. Hist.), London, for his expert opinion. The latter has kindly favoured me with the following reply :—

No. 2a. "*Ena arcuata* Hutton—compares well with specimens from Calcutta, N. W. India and Mahasu in the B. M. Collection".

No. 2b. "*Ena* (sp. ?)—this appears to be a distinct species of which specimens are not available here for comparison. The nearest approach is *Ena vibex* Hutton but the striations are far more prominent than in your specimen".

It is quite clear from the above remarks that the peculiarities I noticed in the solitary shell (No. 2b) have been approved by the expert in the British Museum and, as such, may warrant a separate specific rank for the latter, while the rest of the specimens (No. 2a) may easily be referred to the species *E. arcuata*. So, I consider it a great pleasure to designate the new species as *Ena purii* after Dr. G. S. Puri who collected the specimens.

Family ENIDAE.

Sub-family ENINAE.

Ena arcuata (Hutton).

(Pl. II, Figs. 1-12.)

A detailed discussion about the nomenclature of this interesting species is made by Reeve¹, while a good account of its systematic position, salient features and geographical distribution is given by Gude². But there are two very interesting points which may be worth-mentioning here. That is, firstly, Swagni Maidan appears to be a new record; secondly, the measurements taken show that the largest shell (fig. 12) in the series of 45 specimens (excluding the two new ones) is 21 mm. in length and 8 mm. in diameter (with its aperture 7.5 mm. × 6 mm.) which certainly exceeds the previous record of 18 mm. × 7.5 mm. known in case of a shell from Mukraj, Salt Range, Punjab. The smallest shell (fig. 1) is 12.5 mm. in length and 5 mm. in diameter (with its aperture 5 mm. × 4 mm.). It also appears true from the observations made on these shells and the facts on record that if the length of a shell is found to be maximum in the series, its diameter may not also be so. Similar appears to be the case regarding the length and diameter of the aperture too. Out of 45 shells, I have taken photographs of only 12 showing the range of variations in shape and size as well as in other characters.

Locality.—Swagni Maidan (alt. 10,000 ft.), gently sloping meadow—originally a moraine—without tree growth, in Pulga in the Parbatti Valley, Kulu Sub-division, Punjab.

Specimens.—Reg. No. M $\frac{16062}{2}$ Zoological Survey of India.

¹ Reeve, L. *Conch. Icon.* V, pl. lxxvii, sp. 478 (1849).

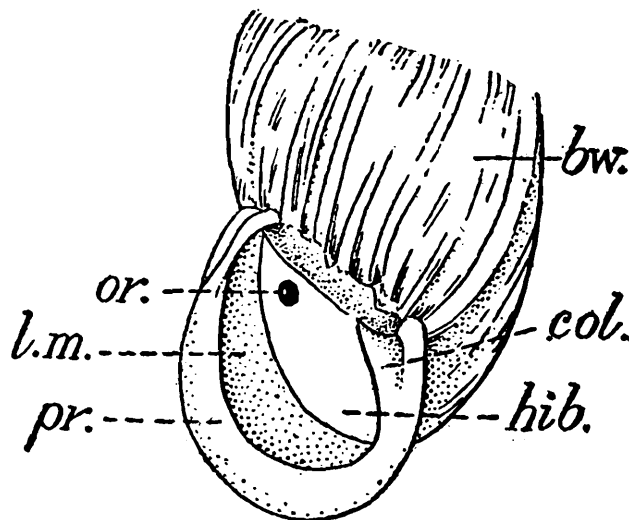
² Gude, G. K., *Faun. Brit. Ind. Mollusca*, II, pp. 239, 240, fig. 89 (1914).

***Ena purii*, sp. nov.**

(Pl. II, Figs. 13, 14.)

At first I found only one large shell (fig. 13) of this remarkable species in the collection mixed up with those of *E. arcuata*, which appeared quite unique in the series. But later on another young specimen was also found in the lot showing similar structural peculiarities. A detailed description of this new species is given below :—

Shell small, sinistral, ovato-cylindrically turreted, somewhat resembling *E. vibex* in appearance, umbilicated, uniformly covered with a very thin, chalky-white coating on the last four whorls, which more or less conceals the original horny-brown colour visible only on the uppermost whorls, apex obtuse ; whorls $8\frac{1}{2}$, regularly increasing, convex, each one adorned on the surface with numerous distinct longitudinal plications (all of which may not be equal in size or regularly arranged) giving it a corrugated tin-like appearance somewhat-like that of *E. nevilleiana* (Theobald), the plications gradually becoming more prominent from above downwards ; sutures more impressed and oblique ; aperture



TEXT FIG. 1. Ventral view of the shell of *Ena purii*, sp. nov. showing the hibernaculum *in situ*. X6.

hib. hibernaculum ; *bw.* bodywhorl ; *col.* columella ; *l. m.* lumen of the mouth of shell ; *pr.* peristome ; *or.* orifice.

oblong-ovate somewhat-like that of *E. arcuata*, interior pale brownish, edentate ; peristome (Text-fig. I, *pr.*) broad, reflected as in *E. arcuata*, but not united upwards with the columella (*col.*) which is dilated, slanting and curved (at the place where it unites with upper lip) like that of the latter. The beautiful colour streaks on the surface, so characteristic of *E. arcuata*, *E. vibex* and others, are entirely lacking in this case.

In the young shell (fig. 14) there are only 7 whorls with a similar chalky-white coating on the last four, but the plications appear quite indistinct or obsolete on the first two. The peristome is very thin and not reflected, while the columella is less dilated and somewhat straight, but more angular below. The bodywhorl appears more convex.

To my utter surprise, I found on a closer examination of the large shell the presence of a thin, opaque, calcareous plate, called hibernaculum (see Text-fig. I. *hib.*) or epiphragm, within the lumen of its mouth (l. m.). Such a remarkable structure can only be found in case of the inoperculate and aestivating land snails, which enables the animals to tide over the most unfavourable climatic conditions, such as, extreme heat or cold, when they retreat themselves within the shells, lie there in a condition of torpor or comatose by closing the aperture with the epiphragm and saving with great difficulty only the skin and flesh on stored up food during this prison life. So, it is quite evident that the animal which occupied the shell in question certainly passed through such a hard and difficult time before it died. It is known from the note given by Dr. Puri that the shells of this new species as well as those of *E. arcuata* were collected on 29th May, 1949. But unless the living specimens can be collected in the field and treated carefully in order to see when they actually come out of the shells after the comatose condition by tearing off the epiphragm, it is difficult to ascertain (simply by examining the dead shells) the exact time, either summer or winter, which urge the snails to form this peculiar structure as a measure of protection. The same difficulty arises in the present case also. But it is true that the animal died before it could release itself from its summer or winter sleep.

The hibernaculum is oblong-ovate, quite complete, somewhat convex externally, and occupies the extreme lower part of the lumen of the mouth within the bodywhorl. Its position indicates that it may correspond to the last one of the series of three or more such plates (situated at close or short intervals) as described and figured by Annandale and Rao (1925)¹, Hora (1927)² and Rao (1927)³ in case of some land snails, namely, *Zootecus insularis* (Ehr.) from the Salt Range, Punjab, *Macrochlamys glauca* Benson from the Kangra Valley, Western Himalayas, and *Glessula (Rishetia) hastula* Benson from Pashok (Eastern Himalayas) in the Darjeeling District, Northern Bengal. The lower portion of the hibernaculum is somewhat angular, but the upper portion is more produced towards the upper extremity like a cone and forms an acute angle there. Slightly below this cone-shaped extremity is found a distinct circular orifice (*or*) which the animal possibly used for the purpose of respiration during the period of aestivation.

Measurements.—The large shell measures 15 mm. in length and 5.5 mm. in diameter with its aperture 5 mm. × 4 mm., while the young one measures 9 mm. in length and 4 mm. in diameter with its aperture 3.5 mm. × 2.5 mm.

Type-locality.—Swagni Maidan (alt. 10,000 ft.), a gently sloping meadow—originally a moraine—without tree growth, in Pulga in the Parbatti Valley, Kulu Sub-division, Punjab.

Holotype.—Reg. No. M $\frac{16063}{2}$ Zoological Survey of India.

Paratype.—Reg. No. M $\frac{16064}{2}$ Zoological Survey of India.

¹ Annandale, N. and Rao, H. S., *Rec. Ind. Mus.*, XXV, pp. 394, 395 (1925).

² Hora, S. L., *Rec. Ind. Mus.*, XXIX, pp. 56-62 (1927).

³ Rao, H. S., *Rec. Ind. Mus.*, *ibid.*, pp. 50-56 (1927).

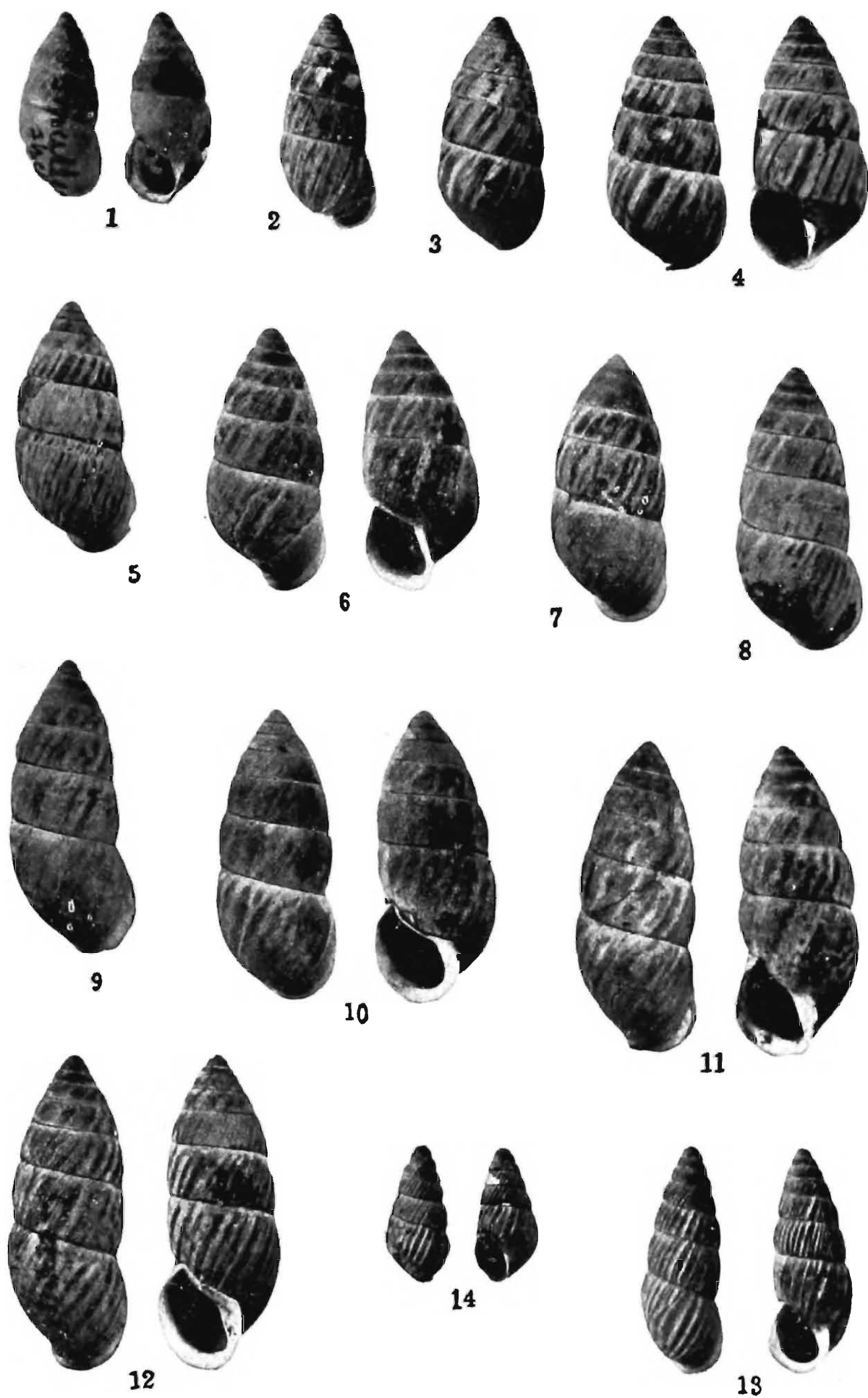
Remarks.—In the general appearance of its shell, the new species, *Ena purii*, somewhat approaches *Ena vibex*, but differs from it markedly in having distinct longitudinal plications (instead of striations) on the surface, more impressed and oblique sutures. It also shows some resemblance to *E. arcuata* regarding the shape of its aperture and also in the character of the inner and outer lips. Moreover, the nature of rugation or plication on the surface approximates nearly to *E. nevilliana*.

I am greatly indebted to Dr. W. J. Rees of the British Museum (Nat. Hist.), London, for the care and interest with which he has examined the specimens and also for the opinions freely bestowed. My grateful thanks are due to Dr. G. S. Puri, Forest Research Institute and College, Dehra Dun, who kindly supplied me all the necessary information wanted with great promptitude together with two very beautiful photographs.

EXPLANATION OF PLATE II.

FIGS. 1 to 12.—Shells of *Ena arcuata* (Hutton) from Swagni Maidan, Punjab $\times 2$.

FIGS. 13 and 14.—Shells of *Ena purii*, sp. nov. from the same locality $\times 2$.



MOLLUSCA FROM PUNJAB.

EXPLANATION OF PLATE III.

FIG. 1.—A view from Swagni Maidan looking south showing limit of moraine and silver fir.

FIG. 2.—A view from the same looking further east showing streaks of spruce and silver fir (on right) extending above moraine on screes opposite scrap slope with Kail at lower levels ; and snow at higher levels further right background.



ON SOME LAMELLIBRANCHS FROM MAURITIUS, WITH DESCRIPTION OF ONE NEW SPECIES OF THE GENUS *MONTACUTA* (MOLLUSCA).

By H. C. RAY, M.Sc., D.Phil., Assistant Zoologist, Zoological Survey of India, Calcutta.

INTRODUCTION.

Among the workers who contributed towards our knowledge of the conchology of Mauritius or Isle de France (a name obtained during French occupation), the names of Bernardin (1773)¹, Sganzin (1843)², Adams (1867, 1868)³, Nevill (1871, 1875)⁴, Lienard (1877)⁵, von Martens (1880)⁶, Sowerby (1893)⁷, Germain (1921)⁸ and Leloup (1941)⁹ deserve special mention. This well-known East African island lies in the western part of the most extensive marine conchological province, called the Indo-Pacific, and abounds with marine life of all sorts. A few years back Viader (1937)¹⁰ in his revised catalogue tried to gather together the names of all forms of molluscs so far recorded from that island and to arrange them systematically in the respective groups. This work may be used with great profit by all workers in the field as it provides ready-made information as to the number of species inhabiting the island, but the nomenclature and classification used do not appear satisfactory in all cases.

The materials used in this paper consist of dry shells of Lamelli-branches which were received from Dr. R. Viader of the Mauritius Institute, Mauritius. But he did not supply the necessary details, such as, the exact localities, dates of collection, etc. of the specimens. The collection, though very small and poor too in the number of species, appears quite interesting as it comprises four different genera, namely, *Montacuta*, *Cardita*, *Tellina* and *Aloidis*, of which the first one is being recorded for the first time from Mauritius represented by a new species designated as *M. (M.) viaderi* in honour of Dr. Viader. Moreover, the existence of *Tellina murrayi* Smith in Mauritius out of its habitual latitude in the Rain island, off Cape York, North Australia (155 fathoms), is also quite remarkable. Altogether six species are dealt with in this paper.

I am grateful to Dr. W. J. Rees of the British Museum (Nat. Hist.), London, for his invaluable help in the identification of *Tellina murrayi* Smith after a careful comparison with the type found in the collection of the Challenger Expedition. My thanks are also due to Dr. R. Viader for taking the trouble in supplying me some useful information about the genera *Montacuta* and *Aloidis*.

¹ Bernardin, St. Pierre. B, *Voy. a l'Isle de France, a l'Isle de Bourbon, etc.* (1773).

² Sganzin, V., *Cat. Coq. aux Iles de France, de Bourbon et de Madagascar* (1843).

³ Adams, H., *Proc. Zool. Soc. London* (1867, 1868).

⁴ Nevill, G. and H., *Journ. As. Soc. Bengal* XL, Part 2, pl. 1 (1871); *ibid.* (1875).

⁵ Lienard, E., *Cat. Faun. Malac. de l'Isle Maurice et de ses Dependances* (1877).

⁶ von Martens, E., *In Mobius's Beitrage zur Meeresfauna der Insel Mauritius und der Seychellen* (1880).

⁷ Sowerby, G. B., *Proc. Malac. Soc. London* 1 (1893).

⁸ Germain, L., *Faun. Malac. Terres. et Fluv. des Mascareignes* (1921).

⁹ Leloup, E., *Maur. Inst. Bull.* 2 (1), pp. 1-13 (1941).

¹⁰ Viader, R., *Maur. Inst. Bull.* 1 (2), (1937).

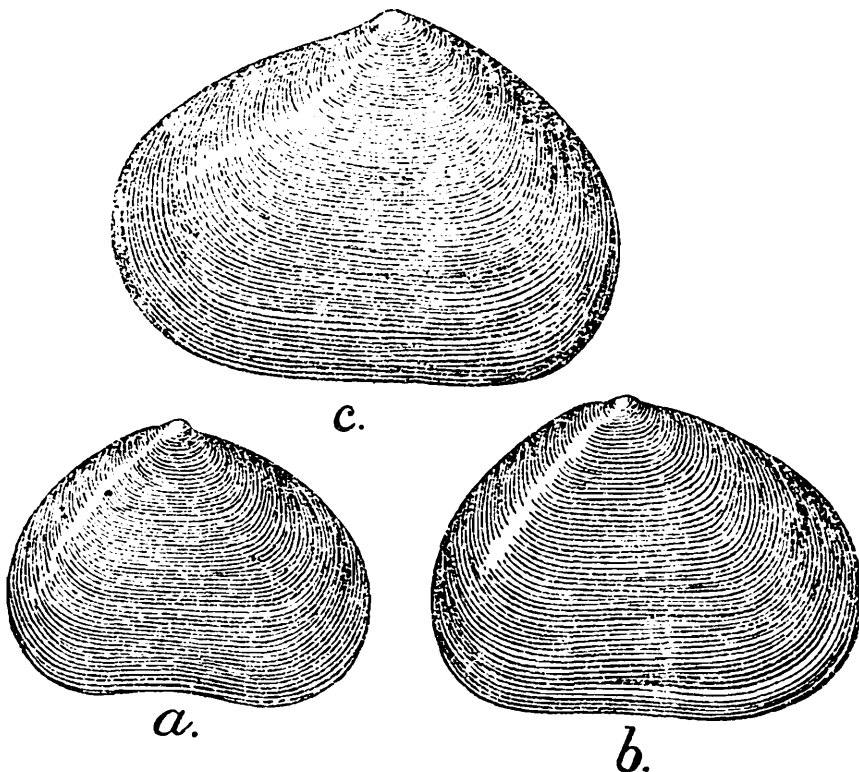
SYSTEMATIC ACCOUNT.

Family MONTACUTIDAE.

Genus *Montacuta* Turton, 1822.Sub-genus *Montacuta* s.s.*Montacuta viaderi*, sp. nov.

Three small separate valves are found in the collection which appear to differ so markedly in shape and character from those of the existing species of *Montacuta* that I feel justified to describe them as a new species under the name of *M. viaderi*. The specimens marked *a*, *b*, *c*, vary amongst themselves in size and measure 13 mm. in length and $5\frac{1}{2}$ mm. in height, 11 mm. in length and $8\frac{1}{4}$ mm. in height, and $9\frac{1}{4}$ mm. in length and 7 mm. in height respectively. The new species is described as follows :—

Shell small, thick, somewhat triangularly ovate, slightly compressed behind the middle as in *M. pelseneeri* Prashad, longer than high, surface covered with thin greyish epidermis but that is scraped off on the upper part (more in *a* and *b*), more or less roughly and regularly concentrically striated throughout ; posterior side rather short with the dorsal margin convex and very sloping and showing slight concavity near the umbones (more marked in *a* and *b*) ; anterior side a little longer and narrower



TEXT-FIG. 1.—Valves of *Montacuta (Montacuta) viaderi*, sp. nov., from Mauritius, X 5.

with the dorsal margin gradually sloping but showing more concavity in *c* than in *a* and *b*, and finally obliquely rounded at the end ; umbones subcentral, bluntly acute, slightly elevated above and curved forwards instead of backwards ; ventral margin contracted in the middle (more so in *a* and *b*), the concavity gradually being reduced with growth (see

in *c*), the margin on either side of it gradually raised upwards slightly narrowing anteriorly but the posterior dorsal margin being more sloping and convex and aided by the general concavity below gives the shell a somewhat blunt beak-shaped appearance which is more marked in *a* and *b* than in *c*; interior of the valve white and glossy in *a* and *b*, but dull in *c*.

Type-locality.—Mauritius, East Africa.

Holotype.—Reg. No. M. 16085/2 Zoological Survey of India.

Paratype.—Reg. No. M. 16036/2 Zoological Survey of India.

Remarks.—The new species *Montacuta* (*M.*) *viaderi* appears very closely allied to *M. pelseneeri* Prashad¹ from the Bay of Badjo, west coast of Flores (155 fathoms), but differs from it in essential details. To be more sure about the occurrence of the genus *Montacuta* in Mauritius, I wrote a letter to Dr. Viader requesting him to let me know if the genus *Montacuta* is at all represented by any species there and he kindly favoured me with the following reply:

“ I have not yet met with any *Montacuta* nor has any been recorded from Mauritius yet as far as I know.” (*Letter of 8th September, 1950.*)

So, the species *viaderi* undoubtedly marks the first record of the genus *Montacuta* in Mauritian waters.

Family CARDITIDAE.

Genus **Cardita** Bruguière, 1792.

Subgenus **Cardita** s. s.

Cardita calyculaeformis Deshayes, 1863.

1863. *Cardita calyculaeformis*, Deshayes, *Cat. Moll. Reunion*, p. 21 (no. 55), pl. iii, figs. 10, 11.

1880. *Cardita* (*Mytilocardia*) *calyculaeformis*, von Martens, in *Mobius's Beiträge zur Meeresfauna der Insel Mauritius und der Seychellen*, p. 321.

1922. *Cardita calyculaeformis*, Lamy, *Journ. de Conchyliol.* LXVI, p. 231 (*foot-note*).

Deshayes's original name *calyculaeformis* for the species appears to have been slightly emended by von Martens as *calyculaeformis*, though he wrongly relegates it to the family Astartidae. Tryon² not only perpetuates the same error, but commits more blunder in quoting an entirely wrong name “*corbiculaeformis*” for the species. Moreover, he creates a great confusion about its systematic position while putting it wrongly under the genus *Actinobolus* Klein.

The most remarkable feature which may readily distinguish this species from any other in the group is its ovato-oblong, sub-quadri-lateral and arcuated shell ornamented on the surface with more or less regular, conspicuous, strong, granulated radial ribs—the postero-median

¹ Prashad, B., *Monogr. Siboga-Exped. Pelecypoda* LIHC, p. 172, p. v, fig. 28 (1932).

² Tryon, G. W., *Proc. Acad. Nat. Sci. Philadelphia*, p. 253 (1872).

ones of which are larger. Moreover, the anterior side is short and truncated, while the posterior side is large and broad. The umbones are acute and obliquely arcuate. These interesting features are more or less apparent in the five young shells before me. The surface of the shell is white and sparsely spotted with dark-brown—the spots sometimes appearing much darker and prominent in the youngest shells and quite visible even from the inner side. The entire ventral margin along the inner side is stained with dark-brown and the stain may even extend upwards along the dorsal margin. The outer side of the dorsal margin appears straight for some distance and then forming a slight angulation posteriorly gradually slopes downwards and becomes obliquely truncated below. This may possibly be due to the shells being too young. The largest shell in the collection measures 5 mm. in length, 4 mm. in height and 3.5 mm. in diameter, while the smallest one is 3.5 mm. $\times$ 2.5 mm.

Distribution.—*Cardita* (*C.*) *calyculaeformis* Deshayes was originally described from Reunion (or the isle of Bourbon in East Africa). Although no mention is made of this species by Viader in his comprehensive Catalogue of the Mauritius shells, von Martens appears to have put it on record in his paper already referred to.

***Cardita nodulosa* Lamarck, 1819.**

1819. *Cardita nodulosa*, Lamarck, *Hist. Nat. Anim. sans Verteb.* VI, p. 25.
 1843. *Cardita rufescens*, Reeve, *Conch. Icon.* 1, pl. iv, figs. 19a, 19b.
 1880. *Cardita* (*Mytilicardia*) *rufescens*, von Martens, in *Mobius's Beiträge zur Meeresfauna der Insel Mauritius und der Seychellen*, p. 321.
 1916. *Cardita nodulosa*, Hedley, *Journ. Roy. Soc. Western Australia* 1, p. 12.
 1922. *Cardita nodulosa*, Lamy, *Journ. de Conchyliol.* LXVI, pp. 236-239.
 1937. *Cardita rufescens*, Viader, *Maur. Inst. Bull.* 1(2), p. 64.

The application of Lamarck's name "*rufescens*" to the species appears more appropriate in view of the red colour of its shell and this may possibly be the reason why Reeve called it "Red *Cardita*". But since it is antedated by Lamarck's name "*nodulosa*" many authors have preferred the use of the latter. The inclusion of the species into the family Astartidae by von Martens is rather erroneous. Lamy who has discussed its nomenclature and synonymy considers Valenciennes's *modulosa* (1846) and Clessin's *rubida* (1888) as its synonyms. Reeve's *nodulosa* figured in pl. ix, no. 44 of *Conch. Icon.* is not the same as Lamarck's *nodulosa* (= *rufescens*). The original description of *C. nodulosa* was based on two right valves found in the collection of the Paris Museum which were obtained by Peron and Lesueur, in 1801, from New Holland.

The species is characterized by its elongately-oval, red-coloured shell which is nicely adorned on the surface with conspicuous ribs bearing imbricating scales. The shells before me appear quite young and agree somewhat closely with Reeve's figures regarding colouration and ribbing, though the scales do not appear so prominent and regular in all cases. The dorsal margin is slightly angular posteriorly as in *C. calyculaeformis*, but this angulation may be lost in the adult. The largest shell in the lot measures 5 mm. in length, 3.5 mm. in height and 3 mm. in diameter.

Distribution.—*Cardita* (*C.*) *nodulosa* Lamarck is a wide-spread species in the Indo-Pacific.

Family TELLINIDAE.

Genus **Tellina** Linnaeus, 1758.**Tellina murrayi** Smith, 1885.

1885. *Tellina murrayi*, Smith, *Zool. Chall. Exped. Lamellibranchia*, XIII, pp. 98. 99, pl. iii, figs. 8-8b. (*Type* : British Museum (Nat. Hist.), London).

This very rare and interesting species is represented in the collection by only three separate valves. Since our entire collection of the family Tellinidae is very badly damaged by the Varuna flood of 1943 at Banaras and, as such, no authenticated specimens were available here for comparison I thought it better to send the specimens in question to Dr. W. J. Rees of the British Museum (Nat. Hist.), London, for opinion. The latter has been good enough to take the trouble of comparing them with the type and giving me the following information: "*Tellina murrayi* Smith compared with the type in Challenger Coll. and seems to be identical as regards structures, hinge, etc.; but your specimens are somewhat larger and in better condition."

Regarding shape colouration and sculpture the specimens in the collection seem to correspond to Smith's description and figures. The crenulation on the surface of the shell, so characteristic of the species, is produced by fine, somewhat distant, more or less regular, concentric lirae and the more numerous and closely packed radial ones—the latter arising from the small but acute and prominent umbones. The concentric lirae appear to form slight but distinct angulations at the place where they meet the conspicuous radial ridge near the narrowed and somewhat rostrate posterior end. The largest valve is 10 mm. in length and 6 mm. in height, while the smallest one is 8 mm. in length and $4\frac{3}{4}$ mm. in height. The latter appears to be more or less equal in size to the holotype of *T. murrayi* measuring 8 mm. $\times$ $4\frac{1}{2}$ mm.

Distribution.—*Tellina murrayi* Smith was originally recorded from the Rain Island, off Cape York, North Australia (155 fathoms), Coral sand. Since then it has not been known to occur anywhere else. Its existence in Mauritius is, therefore, of great interest.

Angulus (Exotica) rhomboides (Quoy & Gaimard, 1833-35).

1833-35. *Tellina rhomboides*, Quoy & Gaimard, *Voy. Astrolabe*, Zool. III, p. 502, pl. lxxxi, figs. 4-7.

1867. *Tellina rhomboides*, Reeve, *Conch. Icon.* XVII, pl. xxii, figs. 114a, 114b.

1932. *Tellina (Angulus) rhomboides*, Prashad, *Monogr. Siboga Exped. Pelycypoda*, LIIC, pp. 192, 193.

1935. *Angulus (Exotica) rhomboides*, Thiele, *Handb. der Syst. Weichtierk.* II, p. 919.

1937. *Tellina rhomboides*, Viader, *Maur. Inst. Bull.* 1(2), p. 65.

Prashad while discussing the nomenclature of the species *rhomboides* interpreted Megerle's *Angulus* (1811) as a sub-genus of *Tellina*. But later on Thiele gave *Angulus* a distinct generic rank (a view followed

by Adam et Leloup¹ also) and treated Jousseau's *Exotica* (1918), which Prashad considered as "superfluous", as one of the sections of the subgenus *Fabulina* Gray (1851). Prashad seems to have rightly supported Dunker² and Smith in considering Deshayes's *clathrata* (1835) as a synonym rather than a substitute for *rhomboides* as suggested by Iredale³, and Viader has also upheld the same conclusion. Hirase⁴, no doubt, records with some hesitation this species from Japan, but unfortunately he relegates it to the genus *Macoma* Leach (1819). Smith has discussed the diagnostic features of the species.

The species *rhomboides* is greatly variable in form and character of the shell and is commonly called the "Rhomboidal Tellina". There are three complete shells and two separate valves in the collection which agree with the description of the type, save that the radial pinkish rays on the surface of the oblong and obliquely wedge-shaped shell are faintly visible in some or wanting in others. The largest shell in the lot is 13 mm. in length, 7.5 mm. in height and 3.5 mm. in diameter, while the smallest one is 11 mm. × 6 mm. × 3 mm.

Distribution.—While dealing with *Angulus (E.) rhomboides* (Q. & G.) Smith (1885, p. 104) remarked: "The distribution of this pretty shell is as extended as its colour is variable." Its wide range extends into the Persian Gulf, Red Sea, Gulf of Suez, Mauritius, Madagascar, Zanzibar, Mozambique, Natal, Minikoi, Ceylon, Nicobars, Malay Archipelago, Cocos—Keeling Is., Timor, Macassar, Sailus Ketjil in Paternoster Islands, Sulu and Banda Anchorage, New Caledonia, Cape York in North Australia, Levuka in Fiji Islands, Philippines and Japan.

Family ALOIDIDAE.

Genus **Aloidis** Megerle von Muhlfieldt, 1811.

Subgenus **Aloidis** s.s.

Aloidis modesta (Hinds, 1843).

1843. *Corbula modesta*, Hinds, *Proc. Zool. Soc. London*, p. 57.

1893. *Corbula modesta*, Melvill and Abercrombie, *Mem. and Proc. Manchest. Lit. and Phil. Soc.* (4) VII, p. 49.

1930. *Corbula modesta*, Oostingh, *Misc. Zool. Sumatrana*, XLIX, p. 11.

1932. *Aloidis modesta*, Prashad, *Monogr. Siboga Expt. Pelecypoda*, LIHC, pp. 308, 309.

1941. *Aloidis modesta*, Gravely, *Bull. Mad. Govt. Mus. N. S.* V(1), pp. 64, 102.

Hinds's *Corbula modesta* was based on specimens from the straits of Macassar and island of Ticao found in the collection of Sir Edward Belcher and Hugh Cuming. But the true systematic position of the species has been in a state of great confusion owing to its inclusion into

¹ Adam, W. & Leloup, E., *Mem. Mus. Roy. Hist. Nat. Belg.* Hors Ser., II, Face, 20, p. 97 (1939).

² Dunker, W., *Ind. Moll. Mar. Japan*, p. 191 (1882).

³ Iredale, T., *Mem. Queens. Mus.* IX, p. 266 (1929).

⁴ Hirase, S., *A Coll. of Jap. Shells*, p. 25, pl. xlv, fig. 7 (1934).

the families Myidae and Corbulidae by different authors. Winckworth¹ in his paper entitled "*Notes on Nomenclature*" has discussed the validity of the genus *Aloidis* and Prashad, Gravely, Viader and others have also followed him. But recently Vokes² has suggested the revival of Lamarck's generic name *Corbula* in suppression of Megerle's name *Aloidis* and also advanced a classification of the group, though his view appears to have received very little support. Prashad and Smith have discussed the synonymy, diagnostic features and affinity of the species *A. modesta*, while Reeve³ has figured it in pl. ii, Nos. 14a, 14b.

Two small separate valves of the same size (9 mm. in length and 5.5 mm. in height) represent this well-known species in the collection. The slightly produced and angularly keeled anterior side and beautifully sculptured surface of the valves with prominent concentric ribs ranging one upon the other like steps amply justify their inclusion into the species *modesta*. But they do not seem to present the carnelian red on the inner side which may possibly be due to their young age.

Distribution.—*Aloidis (A.) modesta* (Hinds) has a wide range in the Indo-Pacific, having been recorded from Bombay, Mauritius, Madras Pamban, Tuticorin, Muttuwartu, Ceylon, Sumatra, Bay of Kankamaraan, South Coast of Kangeang, Sailus Ketjil, Anchorage off Pulu Kawassang, Bay of Bima, Pulu Sanguisiapo, Tawi Tawi Islands, Sulu Archipelago and Banda Anchorage, Amboina, Off Nukalofa, Tongatabu, Malacca, Rua-sura Island in Solomon Archipelago and the Philippines. But its range is also known to extend to Whydah on the Dahomey shore on the Atlantic in West Africa. There are specimens in our named collections from Gwadur in Baluchistan, Andamans and Aden about which no mention is found in literature.

¹ Winckworth, R., *Proc. Malac. Soc. London* XIX, p. 15 (1930).

² Vokes, H. E., *Bull. Amer. Mus. Nat. Hist.* LXXXVI, pp. 1-32 (1945).

³ Reeve, L., *Conch. Icon.* II (1843).

TREMATODES FROM INDIAN MARINE FISHES.

PART VII.¹—ON MONOGENETIC PARASITES OF THE FAMILY CAPSALIDAE BAIRD, 1853 (CAPSALOIDEA) FROM INDIAN REGION, WITH DESCRIPTION OF A NEW SPECIES OF THE GENUS *CAPSALA* BOSC, 1811.

By B. S. CHAUHAN, M.Sc., Ph. D., F.Z.S., F.Z.S.I., Assistant Superintendent, Zoological Survey of India, Calcutta.

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INTRODUCTION.

Adequate attention has not been paid so far to the study of this group of parasites from the Indian region. The only records of the occurrence of the parasites of this family from this area are those by Bell (1891) from Madras and Luhe (1906) and Linstow (1906) from Ceylon. This paper gives a brief review of the previous work on the group from the Indian region and description of a new species of the genus *Capsala*, collected from the Arabian Sea of Indian Ocean at Bombay.

Family CAPSALIDAE Baird, 1853.

Subfamily CAPSALINAE Johnston, 1929.

Genus **Capsala** Bosc., 1811.

Capsala laevis (Verrill, 1874) Johnston, 1929 ; Price, 1938.

(Text-fig. 1, *a* and *b*)

.Syn. *Tristoma laeve* Verrill, 1874.

Tristomum histiophori Bell, 1891.

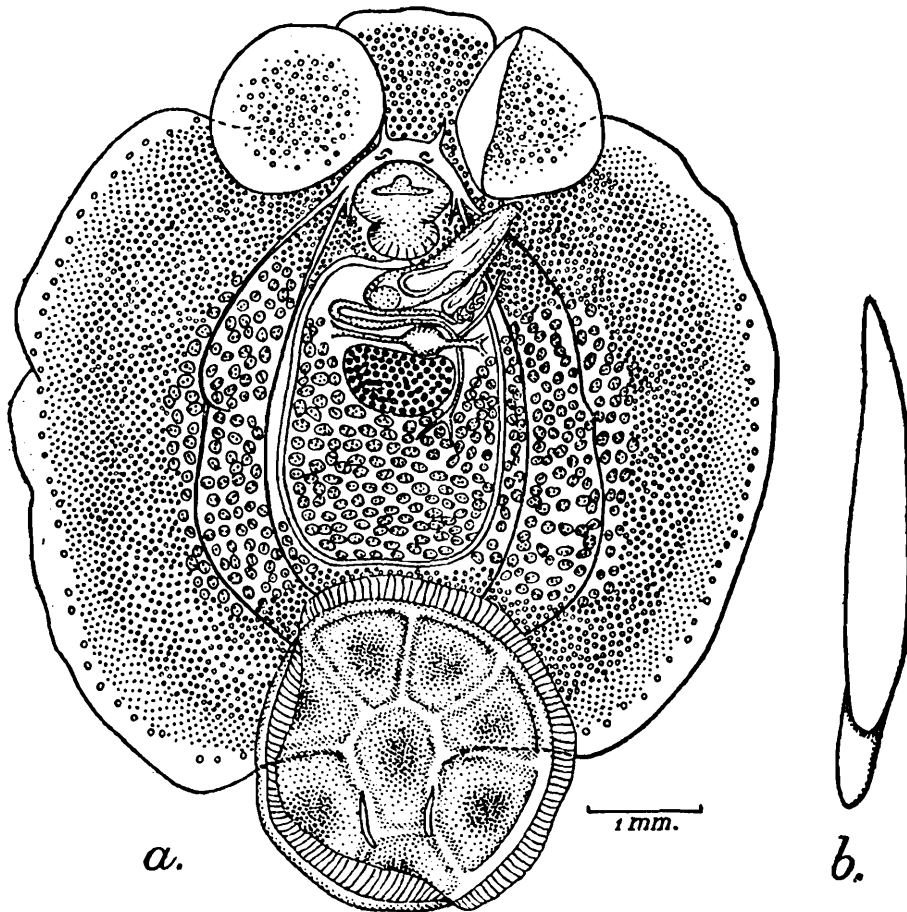
Tristoma laeve var. *armata* Goto, 1899.

Bell (1891) obtained his material from the collections of Dr. F. Day. They were labelled as “parasites from *Histiophorus* (sic) *brevirostris*

¹ For Parts I-VI 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) ; *Ibid.* XXV, pp. 160-173 (1945) ; *Ind. Journ. Helminthol.* II, pp. 63-66. (1950) ; *Rec. Ind. Mus.* XLVIII, pp. 63-66 (1950).

² Named in honour of my grandfather late Dr. Sir H. S. Gour, Founder, University of Sagar (M. P.), India.

Madras". Bell described them as a new species under the name, *Tristomum histiophori* Bell, 1891. Goto in 1894, created a new species *T. ovale* and considered that probably it was identical with Bell's species. Later on (1899) he created two varieties of his species *T. ovale*; var. *armata* Goto (1899) for forms with cuticular spines on the dorsal margins



TEXT-FIG. 1.—*Capsala laevis*.—a. Entire worm; b. Haptor hook (after Price 1939).

of the body, to which he referred Bell's species *T. histiophori* and var *inermis* Goto (1899) for forms without any trace of dorsal spines to which he referred his species *T. ovale* Goto, 1895. Setti (1899) independently of Goto determined that *T. laeve* and *T. ovale* were identical with *T. histiophori* Bell—after examining the types of latter—(as *T. laeve*). Later workers, Johnston (1929), Price (1938) and Spruston (1946) agree in regarding *T. histiophori* Bell as synonym of *T. laevis* (Verrill, 1874).

***Capsala megacotyle* (v. Linstow, 1906).**

Johnston, 1929; emend. Price, 1938.

(Text-fig. 2, a and b.)

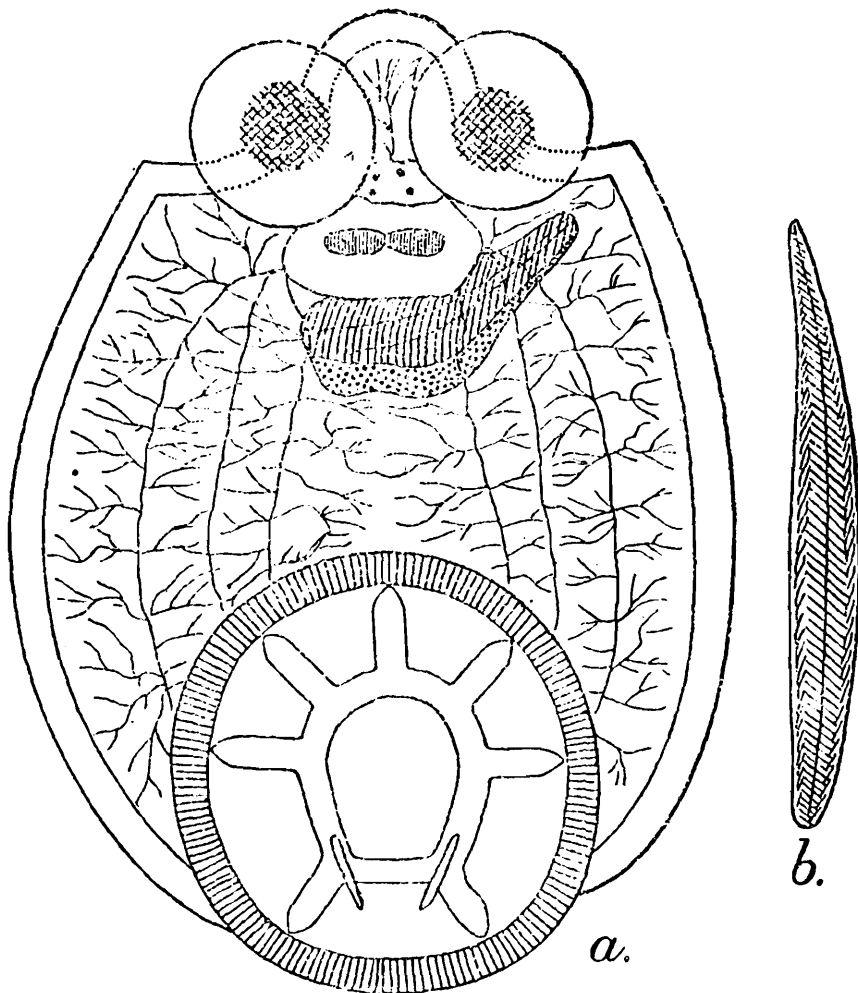
Syn. *Tristoma megacotyle* von Linstow, 1906.

Capsala megacephala Johnston, 1929—a *lapsus* for *megacotyle*.

Tristomella megacotyle Guiart, 1938.

Von Linstow (1906) collected his specimens from the surface of the body of a Sword fish, *Histiophorus* sp. from Beruwala, Ceylon, on February

5, 1904 and described them as *Tristoma megacotyle*. Johnston (1929) transferred it as a valid species under the genus *Capsala* as *Capsala*



TEXT-FIG. 2.—*Capsala megacotyle*.—a. Entire worm; b. Haptor hook (after Linstow 1906).

megacephala which is obviously a *lapsus calami* for *C. megacotyle*. Guiar (1938) transferred it to his new genus, *Tristomella* Guiart, 1938. It is now regarded as *C. megacotyle*.

Capsala ovalis (Goto, 1894) Price, 1938; emend. Sproston, 1946.
(Text-fig. 3 a, b and c.)

Tristomum ovale Goto, 1894.

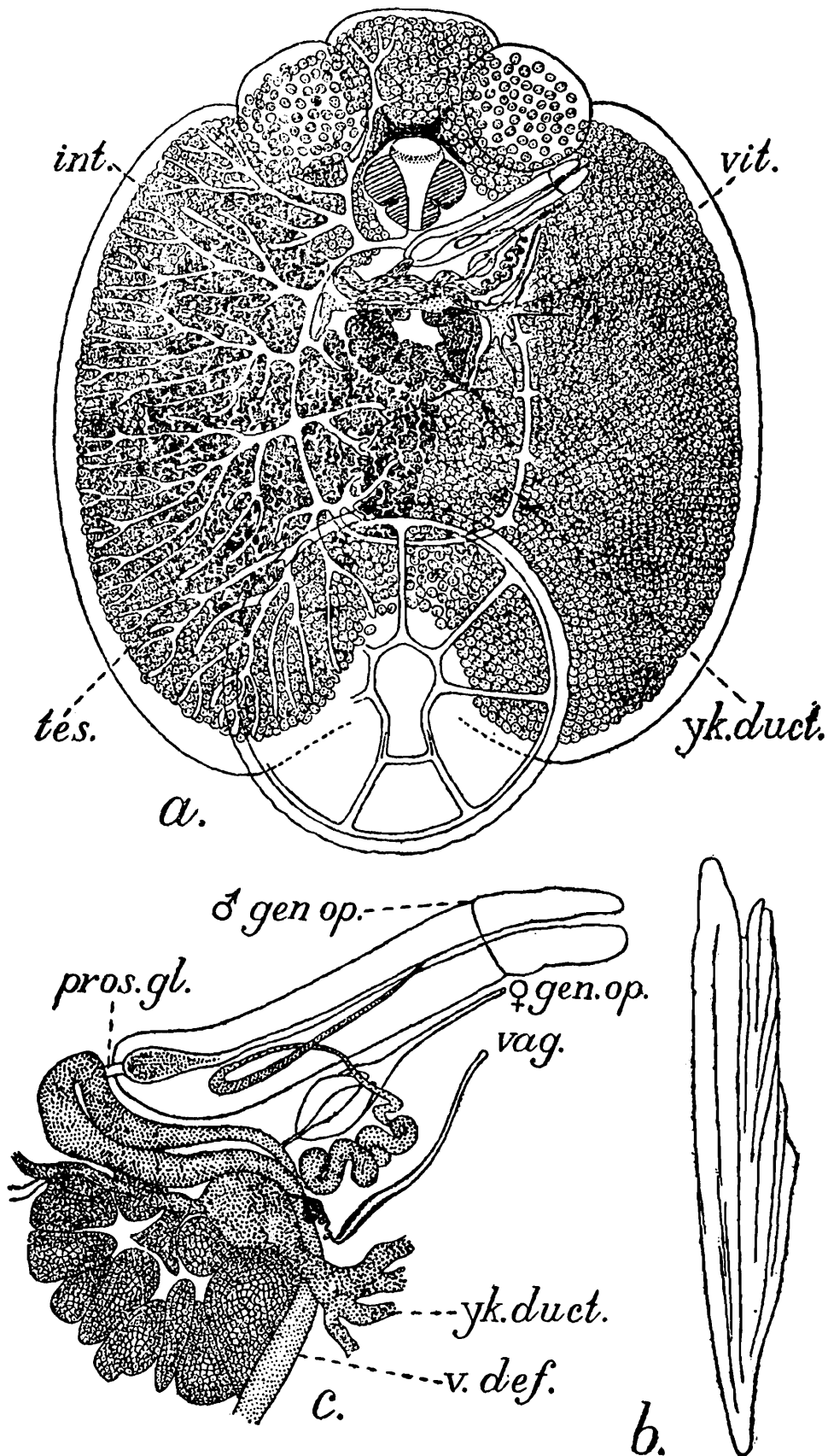
Tristoma ovale Setti, 1899.

Capsala ovale Price, 1938.

Syn. *Tristomum laeve* var. *inermis* Goto, 1899.

Von Linstow (1906) described a new species of the genus *Tristomum* as *T. megacotyle*, from the surface of the body of a sword fish, *Histiophorus* sp. from Ceylon. At the end of his description he states that "a similar, though much larger species, also living upon *Histiophorus*, is *Tristomum laeve* Verrill=*T. ovale*, Goto; the length of this species amounts to 13 mm. and its breadth 12 mm., the diameter of the anterior suckers equals to 1/7 of the body length; the rays of the caudal sucker

are narrow, its margin unstriated and the rods are expanded and irregularly lacinate at the roots”.



TEXT-FIG. 3.—*Capsala ovalis*.—*a*. Entire worm (ventral view), testes represented only on one side. *b*. Haptor hook $\times 70$ diam. *c*. Central portion of the genital organs viewed as a transparent object from the ventral side $\times 29$ diam (after Goto, 1894).

Key to lettering : *int.*, intestine ; *pros. gl.*, prostate gland ; *tes.*, testis ; *vag.*, vagina ; *v. def.*, vas deferens ; *vit.*, vitellaria ; *yk. duct.*, yolk duct ; δ *gen. op.*, male genital opening ; η *gen. op.*, female genital opening.

“(Cf. S. Goto, Studies on the Ectoparasitic Trematodes of Japan *Journ. Coll. Science, Japan*, VIII, part 1, Tokyo, 1894, pp. 241-244.)”

Species *Tristoma ovale* was created by Goto in 1894. However, in 1899, after examination of the type material he regarded *T. ovale* and *T. histiophori* as synonymous to *T. laevis* but created two varieties of the species, *T. laevis* Verrill, var. *armata* Goto, 1899 for forms with cuticular spines on the dorsal margins of the body, *e.g.* those of Verrill and Bell and var. *inermis* Goto, 1899 for forms with total absence of dorsal spines and regarded his species *T. ovale* Goto, 1894, as synonymous with the later. Price (1938) considers that the varietal differences are of specific rank and reinstates *T. ovale* as distinct from *Capsala laevis*. Sproston (1946) emends the name to *C. ovalis* on grounds of grammatical agreement in consultation with Dr. H. A. Baylis.

In view of the reinstatement of the species *C. ovalis* by Price (1938) as valid species, it is difficult to say whether the specimens with which Linstow (1906) was dealing were *Capsala laevis* or *Capsala ovalis*. However, since Linstow's forms were similar to *C. megacotyle* and *C. laevis* it appears that most probably his material was *C. ovalis* (Goto, 1894) Price, 1938.

C. ovalis (Goto, 1894) appears to be an interesting form in that it has pharynx constricted, body is without marginal dorsal spines, ovary is much lobed and the testes are irregular in shape and are of more or less lobed nature.

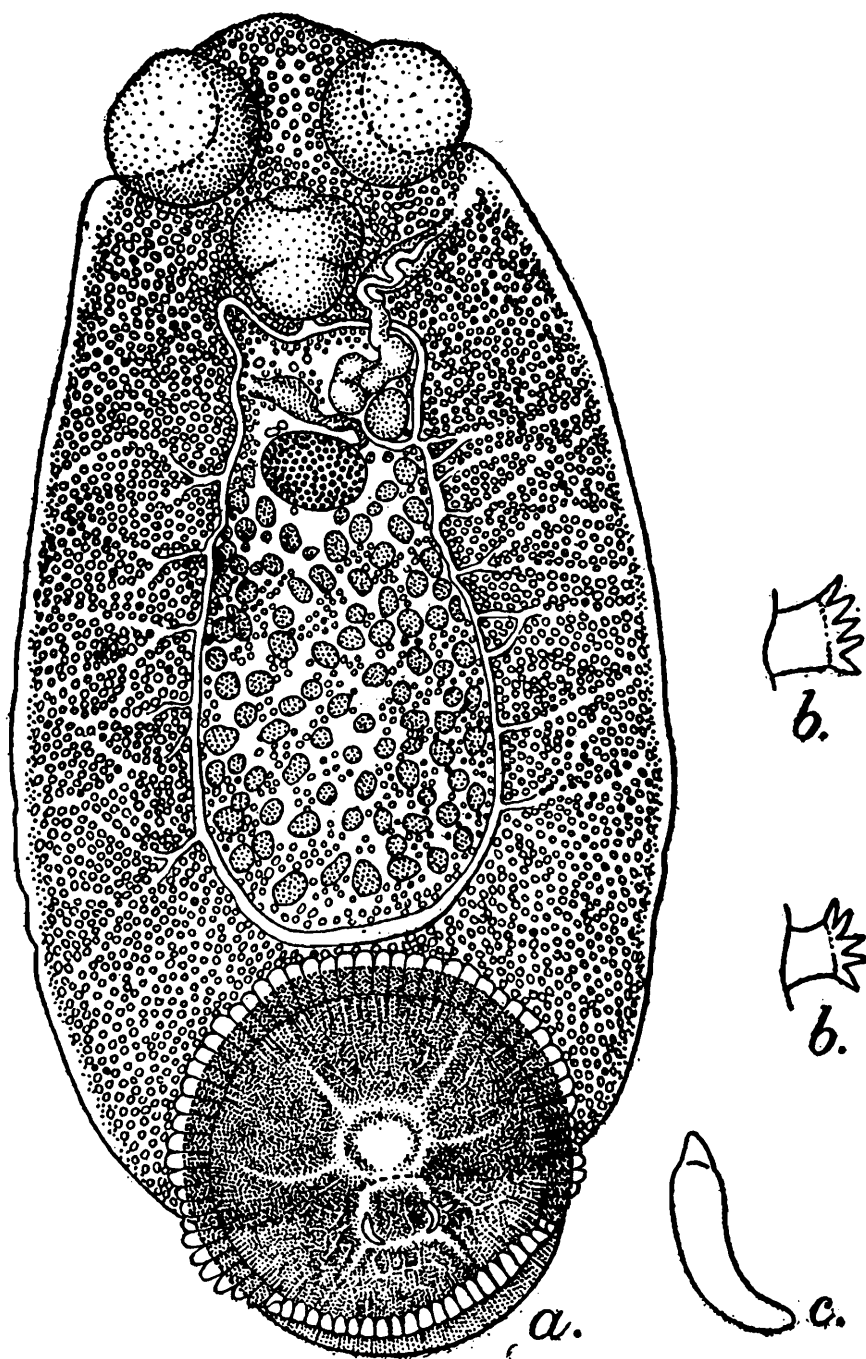
***Capsala gouri*, sp. nov.**

(Text-fig. 4 *a*, *b*, and *c*. & Text-fig. 5 *a* and *b*).

Four specimens of different sizes of this worm were collected by Prof. and Mrs. Rangnekar from the operculum of the fish *Thynnus thunnina* C. V in the winter season, in 1947.

Description.—Body of the parasite is elongately oval, slightly tapering anteriorly, with anterior border being convex. Anterior lobe of body is divided from the median by a slight constriction where the anterior suckers are attached. Ventral papillae appear to be absent. The type specimen measures 3.30 mm. in length and 1.55 mm. in width (maximum) which is in the region of posterior third of the body. Measurements of other paratype specimens are as given in the chart below. Lateral margins are entire with a single row of dorsal marginal chitinous spines. They are not crown-shaped but simple 5-6 cuspid. Anterior suckers are circular or slightly oval measuring 0.4 mm., about one eighth of body length. Posterior sucker is circular, projecting beyond the body by about one third of its length and is about one third of body length. It is provided with marginal striated membrane. Its internal surface is divided into areas by six main ridges, the posterior septa probably having slight tendency for sub-division towards the lips. Ventral surface of the haptor is covered with papillae. The haptor has one pair of gourd shaped hooks, tapering posteriorly, probably with a slight tendency for recurving at the border end for muscle attachment. No marginal

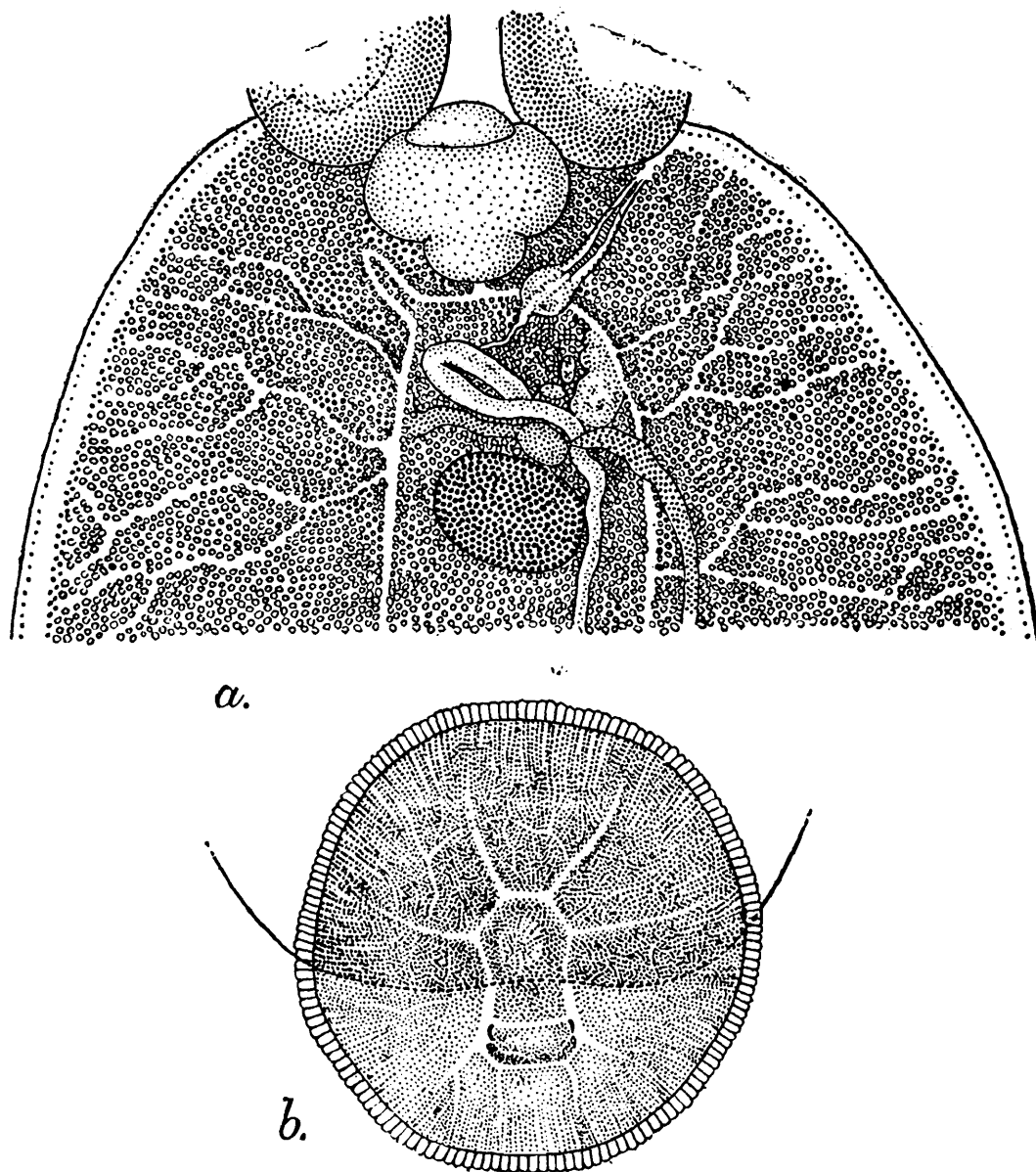
hooklets were observed. Mouth is of moderate size, situated in between and at the plane of the hinder end of the anterior suckers. Pharynx is divided by a constriction into two parts. Oesophagus is very short. Intestinal crura are continuous with each other behind, a little in front of the posterior sucker with numerous dendritic branches on the outside. There is common genital opening on the left side of the pharynx, near the posterior end of the left anterior sucker. Cirrus pouch is club shaped with its base lying laterally on the left side of the pharynx.



TEXT-FIG 4.—*Capsala gouri*, sp. nov. a. Entire worm, ventral view $\times 50$; b. Dorsal marginal spines $\times 600$; c. Haptor hook $\times 300$.

Penis is long and thick. Ovary is median and is situated at the hinder end of the anterior third of the body. It is oval and compact without any lobes. Oviduct is coiled, arising at the front end of the ovary in the median line, proceeding forward into the ootype. Uterus is not very long. It opens into the genital atrium near its bottom. No eggs were observed. Vitellaria are mostly confined to the lateral margins and

anterior lobe of the body but a few scattered ones are found in the central testicular region also. Yolk ducts are paired. Yolk reservoir is small. Vaginal opening is situated a little behind the common genital opening. Vaginal canal proceeds as usual backwards and forwards the



TEXT-FIG 5.—*Capsala gouri*, sp. nov. *a.* Anterior portion, enlarged, showing genital organs, $\times 50$; *b.* Haptor showing haptor rays $\times 30$.

median line after forming a globular receptaculum seminis, which opens with the yolk reservoir. Testes are small, globular, many in number, confined to the mid region between the intestinal crura and do not extend anteriorly beyond the level of the ovary.

Measurements in millimetres.

			Total length of body including haptor.	Length of body proper excluding projecting portion of haptor.	Maximum breadth of body.	Diameter of haptor.
Specimen No. 1	..	..	ca. 7.25	6.05	4.01	3.35
Specimen No. 2	..	..	6.65	5.40	3.50	2.35
Specimen No. 3	..	..	3.30	2.90	1.65	0.93
Specimen No. 4	..	..	2.85	2.50	1.55	0.90
Length of body proper			(1) 1.8; (2) 2.3;			
Diameter of haptor			(3) 3.1; (4) 2.8.			

Discussion.—There are three genera in the subfamily Capsalinae; *Capsala* Bosc, 1811; *Tristoma* Cuvier, 1817 and *Capsaloides* Price, 1938. Out of these the genus *Capsala* is distinguished from the other two in having the pharynx constricted and the testes usually, if not always, extending laterally to intestinal crura. In the other two genera, the pharynx is without a constriction and testes are confined to the inter-intestinal field. Of the other two, the genus *Capsaloides* is characterised by having the posterior rays of the haptor bifid distally, haptoral hooks being with clawed tips and the dorsal marginal spines being crown-shaped in a single longitudinal row. In *Tristoma*, the posterior rays of haptor are not bifid distally, haptoral hooks are without clawed tips and the dorsal marginal spines, when present, are not crown-shaped. They are in numerous short rows.

The new species *C. gouri* is unique in having combination of some characters of all the three genera of the subfamily. It resembles *Capsala* in having the pharynx distinctly constricted and also in the shape of the anchors. It agrees with *Capsaloides* and *Tristoma* in having the testes entirely between the intestinal crura. It further resembles *Capsaloides* in probably having the posterior rays of haptor bifid distally and in having the dorsal marginal spines in a definite single longitudinal row. It resembles *Tristomum* in having anchors without clawed tips.

Price (1938) gave a list of 16 species as valid species of the genus *viz.* *Capsala martinieri* (Bosc, 1811), type species; *C. biparasitica* (Goto, 1894); *C. foliacea* (Goto, 1894); *C. interrupta* (Monticelli, 1891); *C. katsuwonina* (Ishii, 1936); *C. laevis* (Verrill, 1875) Johnston, 1929, *C. lintoni* Price, 1938; *C. maccallumi* Price, 1939; *C. magrona* (Ishii, 1936); *C. megacotyle* (Linstow, 1906); *C. nozawae* (Goto, 1874); *C. onchidiocotyle* (Setti, 1899); *C. ovale* (Goto, 1894); *C. pelamydis* (Taschenberg, 1878); *C. peoyi* (Vigueras, 1935) and *C. squali* (E. Blanchard, 1847). Sproston (1946), after her studies brought in five more, under the genus, as valid species, *viz.*, *C. cephalata* (Risso, 1826) St. Remy, 1898; *C. cutanea* (Guiart, 1938) Sproston, 1946; *C. grimaldii* (Guiart, 1938) Sproston 1946; *C. molae* (E. Blanchard, 1847) Johnston, 1929; *C. thynni* (Guiart, 1938) Sproston, 1946. She also emended the specific names of the following three species in consultation with Dr. H. A. Baylis on grammatical grounds *viz.* *C. katsuwonina*, *C. magrona* and *C. ovale* to *C. katsuwoni*, *C. magronum* and *C. ovalis* respectively.

Out of these 21 valid species under the genus, the following three are recorded from the Indian region *viz.* *C. megacotyle*, *C. laevis* and *C. ovalis*.

The new species *C. gouri* differs from *C. megacotyle* in the relative shape, ratio of the anterior and posterior suckers to the body length, number of ribs on the posterior sucker and shape of cuticular rods on the posterior sucker. Specimens of *C. laevis* of Linstow, 1906, appear to differ from the new species in the ratio of the suckers and in the nature of the margin of the posterior sucker being unstriated, the rods being expanded and irregularly laciniate at the roots and in the shape of bars. *C. histiophori* Bell (syn. to *C. laevis*) differs from the new species in that its posterior sucker projects by about one third of its diameter beyond

the margin of body and the parallel rows of chitinous corpuseles are absent.

The new species is particularly characterised in having a constricted pharynx, testes being confined within the intestinal crura, posterior sucker being with striated fringe, the posterior pairs of ribs on the posterior sucker having a tendency for bifurcation and in the shape of the anchors being simple curved rods and the marginal spines being in a definite longitudinal row with typical shape of *Capsala* spines.

Subfamily *BENEDENIINAE* Johnston, 1931.

Genus *Benedenia* Diesing, 1858.

Benedenia macrocolpa (Lühe, 1906) Johnston, 1939.

(Text-fig. 6 a, b, c, and d.)

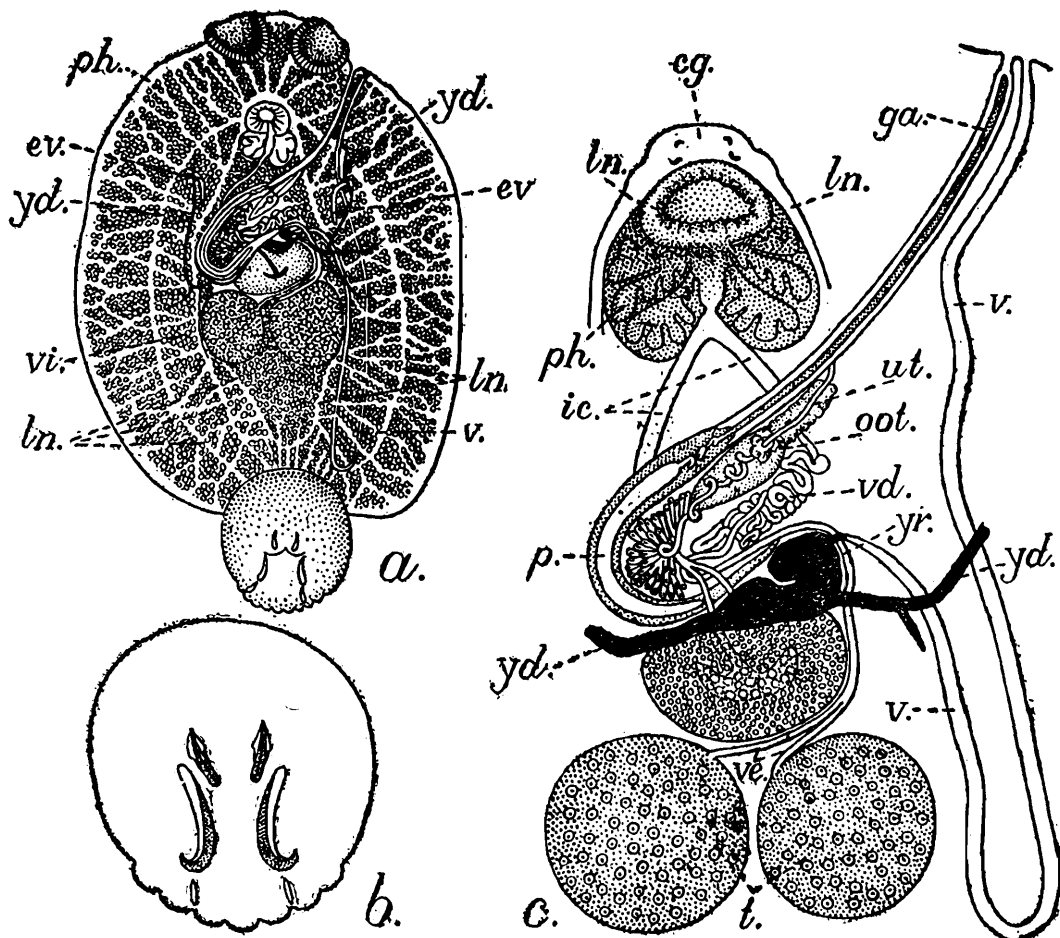
Syn. *Epibdella* (*Benedenia sensu* Montic.) *macrocolpa* Linstow, 1906.

Benedenia macrocolpa MacCallum, 1927.

Benedenia (*Benedeniella*) *macrocolpa* Johnston, 1929.

Benedenia macrocolpa Meserve, 1938.

This species was described by Lühe in 1906 as *Epibdella* (*Benedenia sensu* Montic.) *macrocolpa* from the skin of *Rhinoptera javanica* Mull.



TEXT-FIG. 6.—*Benedenia macrocolpa*. a. Entire worm, ventral view, b. Haptor with three pairs of hooks; c. Genital organs, magnified. (after Linstow, 1906.)

Key to lettering: *cg.*, cerebral ganglion with the two pairs of eyes; *ev.*, excretory vesicle; *ga.*, genital atrium; *ic.*, intestinal caeca; *ln.*, longitudinal nerve; *oot.*, ootype; *ov.*, ovary; *p.*, penis; *ph.*, pharynx; *te.*, testis; *ut.*, uterus; *v.*, vagina; *ve.*, vasa efferentia; *vi.*, vitellarium; *yd.*, yolk ducts; *yr.*, yolk reservoir

and Henle from Kalpitiya (3 specimens) and Dutch Bay, Ceylon (2 specimens). It is regarded at present as *Benedenia macrocolpa*.

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ON A NEW SPECIES OF ACANTHOCEPHALA OF THE GENUE *MEDIORHYNCHMS* (VAN CLEAVE, 1916) FROM INDIA.

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Berar, India.

INTRODUCTION

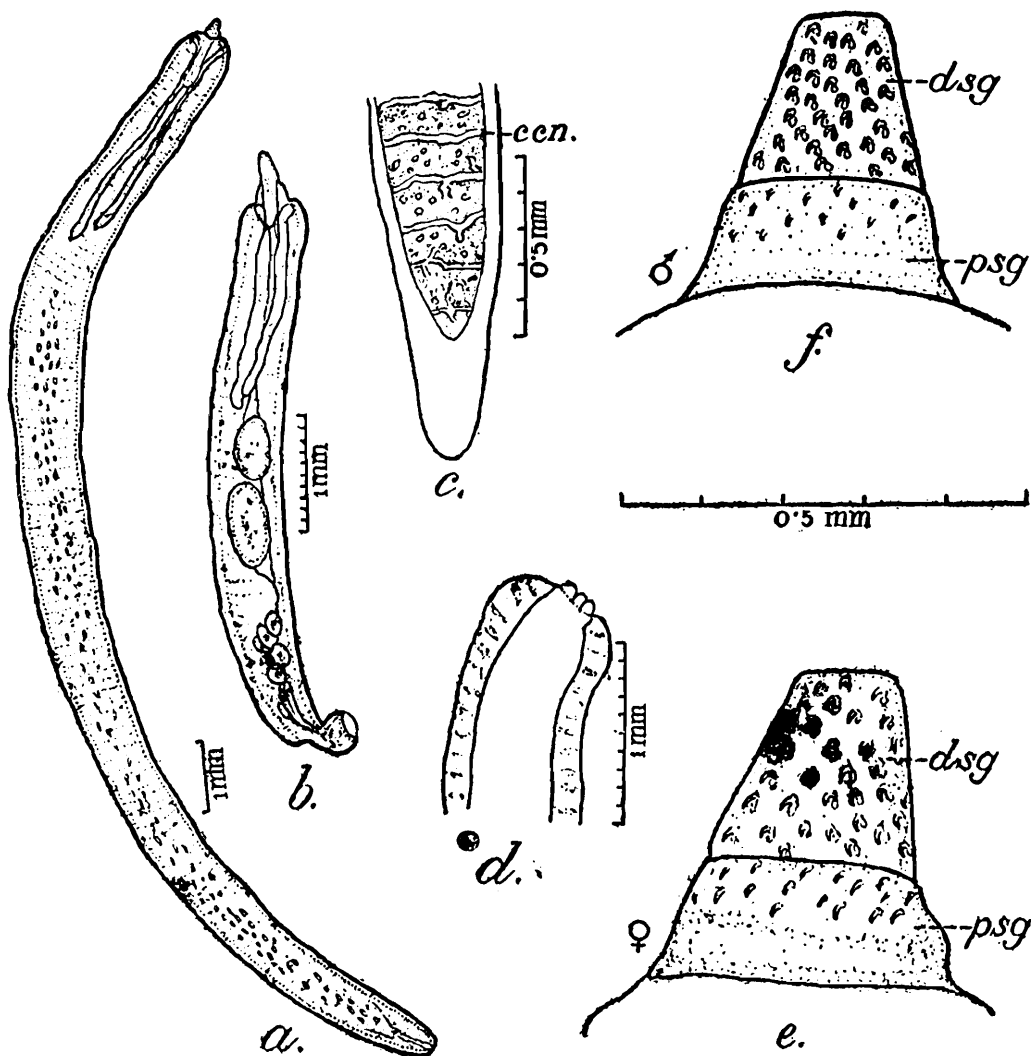
I possess in my collection several larval, immature and mature forms of Acanthocephala mainly collected from amphibians, reptiles, some mammals and falconid birds. These belong to the genera *Centrorhynchus* and *Echinorhynchus*, some of which I have described. I collected some Acanthocephala from birds other than the Falconidae such as the Blue-jay (*Coracias benghalensis*), House-Sparrow (*Passer domesticus indicus*) and Seven Sisters (*Turdoides somervillei*). I examined about 150 specimens of House-Sparrow. Most of them harboured cestodes and nematodes and from only one I collected four specimens of Acanthocephala, which on examination were found to belong to the genus *Mediorhynchus*, Van Cleave. Of these three were females and one male. They were firmly attached to the wall of the intestine and one of the three female specimens could be released from its hold with considerable difficulty. It retracted its proboscis completely. The female specimen was sectionised to enable me to describe it as fully as possible. The specimens were cleared in lactophenol and in creosote.

SYSTEMATIC ACCOUNT.

***Mediorhynchus passerus*, sp. nov.**

Diagnosis : Female.—Entire length 16.4 mm ; maximum width in the region of mid body 1.0 mm ; posterior end 0.5 mm. in width ; entire length of proboscis 0.36 mm ; length of distal segment 0.23 mm, breadth at tip 0.13 and at base 0.23 mm, length of proximal segment 0.13 mm, breadth at base 9.33 mm ; hooks arranged spirally, 7 spiral rows with 5 to 6 hooks in each on the distal segment and the same number of spiral rows with 2 to 3 hooks in each on the distal segment ; root of hooks on distal segment measure 19 μ to 30 μ , and base rounded, protruding portion of hooks 10 μ to 20 μ long, hooks on the proximal segment almost completely embedded, 14 to 18 μ long ; proboscis sheath with single layered muscle wall and length of proboscis sheath 0.46 mm ; breadth of the anterior part of the proboscis sheath 0.13 mm and of the narrow posterior part 0.07 mm ; length of lemnisci 2.6 mm, width 0.08 mm to 1.7 mm, giant nuclei present in linear order through out lemnisei measure 0.08 mm $\times$ 0.03 mm ; giant nuclei also present in subcuticle measuring 0.026 mm $\times$ 0.01 mm to 0.056 mm $\times$ 0.026 mm ; embryo oval shaped, measuring 0.03 mm $\times$ 0.02 mm with 3 concentric coverings.

Male.—Entire length of the body 5.6 mm, width 0.6 mm. Other diagnostic features are the same as described for the female; testes one behind the other; anterior. testis measures 0.56×0.31 mm, posterior testis measures 0.8×0.38 mm.



TEXT-FIG. 1.—*Mediorhynchus passerus*, sp. nov.

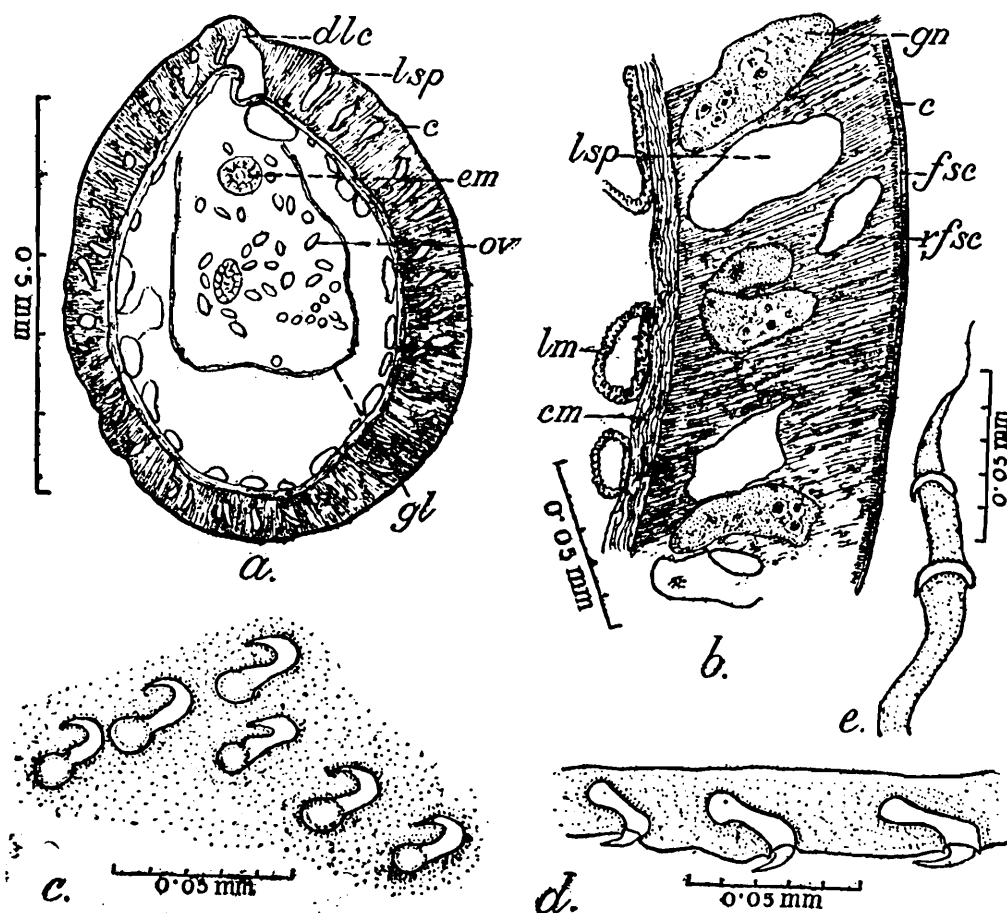
a. Female specimen, entire; b. Male specimen, entire; c. A. slice of body wall; d. retracted proboscis; e. female proboscis; f. male proboscis. (Ccn., circular canal; dsg., distal segment; psg., proximal segment).

Description.—In the living condition, the worms show traces of segmentation which is probably due to the highly developed lacunar system. The male and female show pronounced sexual dimorphism like some other species of this genus. Van Cleave (1947) states, "In fact the difference between males and females is so great that it is equivalent to the difference between distinct species in some other representatives of this genus" In view of this, I thought it convenient to describe the two sexes separately.

Body.—(text-fig. 1a) Body is cylindrical and uniform in thickness except at the posterior extremity where it tapers. The total length of the worm is 16.4 mm, and width 1.0 mm, and at the narrow posterior end 0.5mm.

Body wall.—The body wall is 0.08 to 0.10 mm in thickness. Below the outermost cuticle (text-fig. 2*b*, *c*) there is a thin region of fibrillar subcuticle (text-fig. 2*b*, *fsc*) below which the fibrillae of the subcuticular layer are radially disposed (text-fig. 2*b*, *rfsc*). It is traversed by lacunar spaces (text-fig. 2*b*, *lsp*) of various sizes and by giant nuclei (text fig. 2*b*, *gn*) situated at various intervals. Each giant nucleus measures 0.026×0.01 mm to 0.056×0.02 mm. Below this region there is a narrow layer of circular muscles (text-fig. 2*b*, *cm*) and below it longitudinal muscles (text-fig. 2*b*, *lm*). These longitudinal muscles do not form a continuous layer but form patches of bands from the anterior to the posterior end of the worm. These bands consist of muscle fibres so arranged as to leave a central space between them.

Lacunar system.—There is a main lacunar canal (text-fig. 2*a*, *dlc*) situated on the dorsal side of the worm running in the median line. It extends from the base of the proboscis to very nearly the posterior end of the worm. The circular canals (text fig. 1*c*, *ccn*) are situated at regular

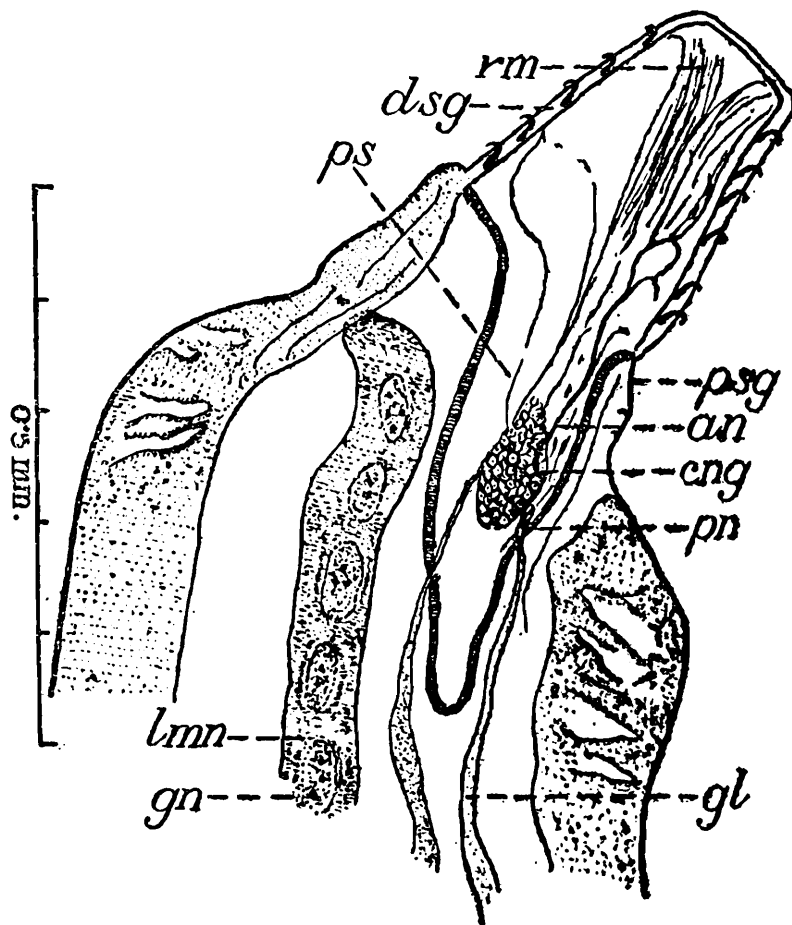


TEXT-FIG 2.—*Mediorhynchus passerus*, sp. nov.

a. Transverse section through mid-body; *b.* A part of the same, magnified; *c.* A slice of the anterior segment of the proboscis; *d.* Sagittal section of the wall of distal segment of proboscis; *e.* Sagittal section of the wall of proximal segment of proboscis (*c.*, cuticle; *cm.*, circular muscle; *dlc*, dorsal lacunar canal; *em*, egg-mass; *fsc*, fibrillar sub-cuticle; *gl*, genital ligament; *gn.*, giant nucleus; *lm*, longitudinal muscle; *lsp*, lacunar space; *ov*, embryo; *rfsc*, radial fibrillar sub-cuticle).

intervals, and in transverse sections both are seen to lie entirely in the radial fibrillar subcuticle. A small slice (text fig. 1*c*) of the body wall cut longitudinally shows the circular canals one over the other showing branches. The relation of the circular canals to the median dorsal one is obscure and could not be made out.

Proboscis.—The entire proboscis (text-fig. 1e) measures 0.36 mm in length. The distal segment (text-fig. 1e, *dsg*) is conical in shape, 0.23 mm, long, 0.13 mm in width at the tip of the cone and 0.23 mm in width at the base. The proximal segment (text-fig. 1e, *psg*) of the proboscis is 0.13 long and 0.33 mm in width. Hooks on the proboscis are arranged in diagonal spiral rows and since in a mount of the worm in any position only a small part of the spiral is seen, it is not possible to count the total number. There are 7 spiral rows with 5 to 6 hooks in each row on the distal segment and the same number of spiral rows with 2 to 3 hooks in each on the proximal segment. The total number of hooks is not of any diagnostic significance in this genus. Van Cleave (1947) states, "As Meyer (1931) has maintained for these forms, the hook arrangement is in the form of diagonal spirals. This departure from the arrangement in straight, parallel longitudinal rows renders enumeration extremely difficult. It is wholly impossible to follow spirals from one surface to the other specially because the tips of the hooks are so frequently obscured by cuticular elevations of the body wall. Since number and arrangement of the hooks had been the chief characteristic on which species had been described it has been necessary in the present study to reevaluate the features on which species may be distinguished."



TEXT-FIG. 3.—*Mediorhynchus pilsnerus*, sp. nov.

Sagittal section through the proboscis and anterior part of the body.

an, anterior nerve; *cng*., central nerve ganglion; *lmn*, lemniscus; *pn*, posterior nerve; *ps*, proboscis sheath; *rm*, retractor muscles. (Other lettering as in text-figs. 1 and 2).

Hooks.—Hooks (text-figs. 2 c & d) of the distal segment vary much in size and shape from those on the proximal segment (text-fig. 2e). Hooks on the distal segment have large ensheathed roots rounded bases

each measuring $19\ \mu$ to $30\ \mu$. The base is embedded in the thick sub-cuticle of the proboscis wall. The free part of the hook *viz* the portion which protrudes out of the proboscis wall is sharp and short and measures $10\ \mu$ to $20\ \mu$ in length. Hooks on the proximal segments are almost completely embedded in the wall of the proboscis so that only a small part of the hook is free. The base is not rounded as in those of the distal segment.

Proboscis sheath.—The proboscis sheath (text-fig. 3, *ps*) measures 0.46 mm in length. The broad anterior part measures 0.13 mm in width and the narrow posterior part measures 0.07 mm in width. The wall of the proboscis sheath is composed of a single muscle layer.

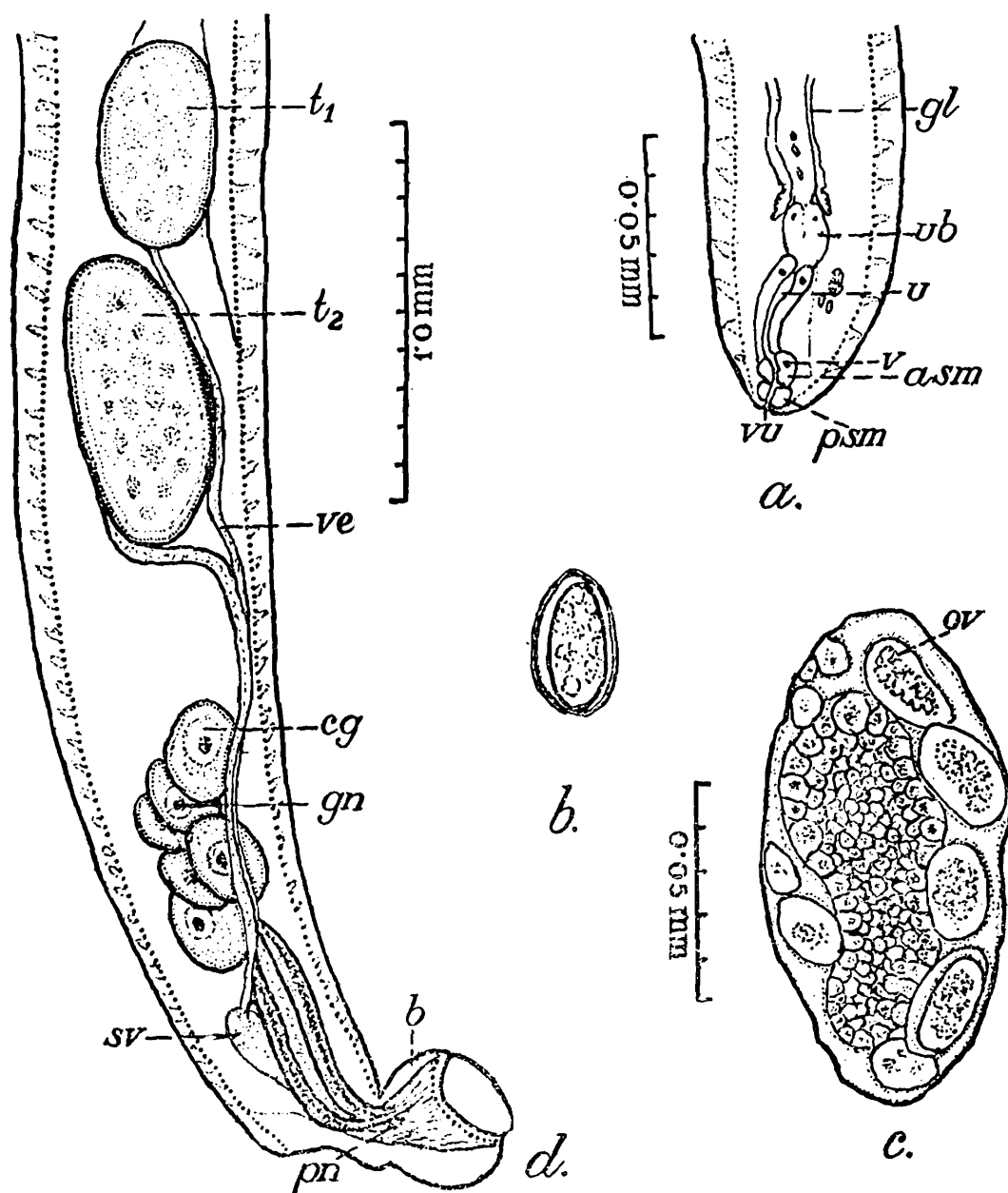
Lemnisci.—The lemnisci (text-fig. 3, *lmn*) are long and finger like and they measure 2.6 mm in length and 0.08 to 1.7 mm in width. In gittal sections they show the presence of giant nuclei arranged one behind the other in a linear row. A giant nucleus measures (text-fig. 3, *gn*) 0.08×0.03 mm.

Nervous system.—The central nerve ganglion (text-fig. 3, *cng*) is situated in the middle of the proboscis sheath. From it, nerves are given off both to the anterior and posterior regions of the worm. Nerves anteriorly (text-fig. 3, *an*) to the retractor muscles of the proboscis and posteriorly (text-fig. 3, *pn*) to the genital ligaments could be clearly made out both in whole worms cleared in lactophenol and in sagittal sections.

Genitalia.—The genital ligaments (text-fig. 3, *gl*) arise from the sides of the proboscis sheath at the level of the nerve ganglion, enclose the egg masses between them and finally rest on the uterine bell (text-fig. 4a, *ub*). In close proximity of the uterine bell, each ligament is slightly broader. The embryo mass (text-fig. 4c) measures $0.12\ \text{mm} \times 0.06\ \text{mm}$. Its central region is full of embryos in different stages of maturity. The more mature embryos are found at the periphery of the embryo mass. Each embryo (text-fig. 4b) is oval in shape measuring 0.03×0.02 mm and is enclosed within three concentric egg-membranes. The uterine bell is spherical and measures 0.15×0.10 mm and lies immediately behind the egg masses. At its posterior end lies the elongated uterus (text-fig. 4a, *u*) with a narrow lumen and thick walls showing in a sagittal section the presence of two nuclei anteriorly placed. These nuclei are much smaller than the giant nuclei. The uterus measures 0.2 mm in length; it is 0.06 mm in width at its posterior end and 0.1 mm at its anterior end immediately behind the uterine bell. The uterus is continued into a narrow vaginal canal (text-fig. 4a, *v*) measuring 0.12 mm in length. The vaginal canal is guarded on each side by an anterior (text-fig. 4a, *asm*) and a posterior sphincter muscle-mass (text-fig. 4a, *psm*). The terminal opening of the vaginal canal is the vulva (text-fig. 4a, *vu*).

Male.—(text-fig. 1b) It is not necessary to describe again the body wall, lacunar system, position of the central nerve ganglion, as these structures are similar to female worms. The male is much smaller than the female being about one third its size and measures 5.6 mm in length and 0.6 mm in maximum width. It is uniformly thick except at the proboscis and at its posterior end where it constricts immediately anterior

to the bursa (text-fig. 4*d*, *b*). In the only male specimen at my disposal the total length of the proboscis is the same as in the female specimens. The distal part of the proboscis (text-fig. 1*e*, *dsg*) is 0.23 in the female and 0.21 (text-fig. 1*f*, *dsg*) in the male and the proximal part of the proboscis (text-fig. 1*e*, *psg*) is 0.13 in the female and 0.15 in the male (text-fig. 1*f*, *psg*). This small difference in the relative lengths of the two regions in the two sexes may be due to unequal contraction of the proboscis and does not appear to be a character of taxonomic importance.



TEXT-FIG. 4.—*Mediorhynchus passerus*, sp. nov.

a. Sagittal section of the posterior extremity of female, showing genital organs *b.* Embryo; *c.* Egg mass; *d.* Male genital organs. [*asm*, anterior sphincter muscle; *b.* bursa; *cg.*, cement glands; *ov*, embryo; *pn.*, penis; *sv.*, seminal vesicle; *ti.*, anterior testis; *t2*, posterior testis; *v.*, vagina; *ve.*, vas efferens; *vu.*, vulva] (Rest of the lettering as in other figures).

Genitalia.—The genital ligaments have the same position as in the female. The two oval testes (text-fig. 4*d*, *t1* & *t2*) are one behind the other, the anterior (text-fig. 4*d*, *t1*) is slightly smaller. The anterior

testis measures 0.56×0.31 mm. and lies approximately in the middle of the body. The posterior testis (text-fig. 4d, *t2*) measures 0.8×0.38 mm. Each gives off a vas efferens (text-fig. 4d, *ve*) and the two unite behind the posterior testis to form the vas deferens which runs by the side of the cement gland (text-fig. 4d, *cg*). It enlarges behind the cement glands to form a vesicula seminalis (text-fig. 4a, *sv*) and ultimately opens in the penis (text-fig. 4d, *pn*), which is seen protruding in the everted bursa. I could see only six cement glands though there ought to be eight. Van Cleave (1949) states, "It has long been recognised that eight globular or pear shaped cement glands are characteristic of the Archiacanthocephala" He further states that "the pairing of the glands is not always followed exactly since occasionally in some species and regularly in others the individual parts are less symmetrically arranged in such instances they often overlap one another, obscuring the pattern of their arrangement and making the recognition of the number difficult" I consider that in the male specimen I have in my possession, there is overlapping and hence actually I see only six. Each cement gland measures 0.28×0.10 mm in the cleared specimen. Each gland is a uninucleated structure with centrally placed giant nucleus. This observation conforms to that of Van Cleave's (1949). He states, "This is the case in all forms of the Archiacanthocephala." The cement ducts form two groups and open in the bursa. The bursa is a cup shaped structure 0.40 mm in width with an opening 0.25 mm in diameter.

SYSTEMATIC POSITION.

Heteroplus, Kostylev, 1914.

Mediorhynchus, Van Cleave, 1916.

Empodius, Travassos, 1917.

Leiperacanthus, Bhalerao, 1937

The genus *Mediorhynchus* was created by Van Cleave in 1916, and was included by him in the family Centrorhynchidae, which he created to include the genera *Mediorhynchus* and *Centrorhynchus*. Travassos (1917) included the genus *Mediorhynchus* in the family Gigantorhynchidae, which was included in the order Archiacanthocephala by Meyer (1932-33) in his monograph on Acanthocephala, Van Cleave later accepted the inclusion of the genus *Mediorhynchus* in the family Gigantorhynchidae realizing the mistake he made in considering only one character viz., the insertion of the proboscis sheath in the middle of proboscis as of value in assigning it to the family Centrorhynchidae. Meyer (1932-33) includes in the family Gigantorhynchidae the genera *Empodius* Travassos 1916, *Mediorhynchus* Van Cleave 1916, and *Gigantorhynchus* Hamann 1892. Bhalerao (1937) described a new species of Acanthocephala belonging to the genus *Leiperacanthus* for which he created a new family Leiperacanthidae. Van Cleave (1947) considers Bhalerao's genus, *Leiperacanthus* as synonymous with *Mediorhynchus*. He states, "The nomenclatorial history of the genus *Mediorhynchus* has been long and intricately involved." Kostylev in Europe, Travassos in

South America and Van Cleave in North America worked independently on this genus. Kostylev (1914) described some species of *Acanthocephala* and assigned to a new genus, *Heteroplus*. Independently of Kostylev, Van Cleave (1916) created the genus *Mediorhynchus* for species of *Acanthocephala* which could be included in the genus *Heteroplus*. The genus name *Heteroplus* was preoccupied and hence the species described by Kostylev (1914) and those described by Van Cleave (1916) were all included in the genus *Mediorhynchus* by Van Cleave (1916).

Travassos (1917) unaware of the work of Kostylev and of Van Cleave which have not been mentioned by him in the list of reference, described some *Acanthocephala* and assigned them to the genus *Empodius*, which he created. Later (1924), however, he accepted that the genus *Empodius* was synonymous with the genus *Heteroplus*. Van Cleave (1947) states, "This attempt of revival of direct synonymy as a generic name is in open violation of Article 36 of the International rule of Zoological nomenclature of 1926." Be that as it may, the name *Heteroplus* was preoccupied and therefore all species included in this genus have to be included in the genus *Mediorhynchus*, the two genera being perfectly similar. Thus all species belonging to the genera *Heteroplus* (Kostylev, 1914), *Mediorhynchus* (Van Cleave, 1916) and *Empodius* (Travassos 1917) and *Leiperacanthus* (Bhalerao 1937) belong to the genus *Mediorhynchus*, Van Cleave, 1916.

Southwell and Macfie (1925) retained the genus *Empodius*. They said that Van Cleave disregarded completely the structure of the wall of the proboscis sheath. In *Mediorhynchus*, the proboscis sheath wall is composed of a single layer of muscle, whereas in *Heteroplus* and *Empodius* the wall has a double layer. Commenting on this Van Cleave (1947) states, "The individuals who have maintained that there is a double wall to the receptacle in forms ascribed to *Empodius*, *Heteroplus*, *Leiperacanthus* and some species of *Mediorhynchus* have been misled into interpreting a portion of the specialized musculature for retraction of the neck and front part of the trunk as an integral part of the receptacle. There is no distinction of any sort between the receptacle in *Mediorhynchus* and these forms which have been ascribed to other genera."

Meyer (1932-33) retains the genus *Empodius* commenting on this Van Cleave states, "The only feature which Meyer found available to distinguish between his two artificial groups of species were (a) texture of the egg membranes, (b) relative size of the body and (c) the relative degree of pseudosegmentation. Two of these features (b & c) are wholly quantitative and the third (a) the texture of the membranes, is probably more of a quantitative than qualitative distinction. Relative differences are very generally recognized as of not more than specific value in taxonomy". He further stated that the genus *Leiperacanthus* (Bhalerao 1937) is also a synonym of the genus *Mediorhynchus*. Van Cleave (1947), "The para-proboscidial sacs which Bhalerao regarded as "altogether a new structure in the organization of the *Acanthocephala*" have been observed in many species of *Mediorhynchus* and were figured by Skrjabin in his drawing of *Mediorhynchus empodius*"

Webster (1948) comments on Van Cleave's reasons for abolishing the genera *Empodius* Travassos (as amended by Meyer 1933) and *Leiperacanthus* Bhalerao (1937) as follows:—"Van Cleave failed to explain the structure and function of the paraboscidual sacs. He failed to examine specimens of *Mediorhynchus empodius* (Skrjabin, 1913) *Mediorhynchus giganteus*, Meyer, 1931, and *Leiperacanthus gallinarum* Bhalerao, 1937, each of which served as the type species or best studied species of genera recognized by such authorities as Meyer, 1933, Leiper (in Bhalerao, 1937) and Tubangui and Masilungan (1946)".

These controversies relating to the synonymy of *Empodius* and *Leiperacanthus* with *Mediorhynchus* are still undecided in considering these as synonymous.

(b) The characters of genus *Mediorhynchus* (Van Cleave, 1916).

1. Acanthocephala of medium size.
2. Proboscis insertion near the middle of the proboscis wall.
3. Receptacle of a single walled muscular sac.
4. Invertors of proboscis passing through its wall some distance anterior to the posterior tip of the receptacle.
5. Central nervous system near the centre of the proboscis.
6. Cement glands, pear shaped, usually 8 in number.
7. Proboscis hooks of two distinct type, those anterior to the insertion with flask shaped roots, bases of roots broad, hooks on the posterior-
ptar not with reflected roots.
8. Embryos with three concentric membranes.

The worm described in this paper is characterised by the possession of all these characters except that the number of cement glands is found to be 6, but may be 8 for reasons already mentioned.

I have carefully compared the characters of this species with the characters of the species previously described in the genera *Empodius*, *Mediorhynchus* and *Leiperacanthus*, and I find that this is a new species, which I propose to designate *Mediorhynchus Passerus* sp. nov.

(c) Comparison of *M. passerus*, sp. nov. with other species:—

The species of *Mediorhynchus* (including the species of the genera *Empodius* and *Leiperacanthus*) fall into two distinct categories viz., those in which hooks on the proboscis are arranged in longitudinal rows atleast on the anterior part of the proboscis and those in which they are arranged in spiral rows. To the first category belong the species:

M. empodius (Travassos, 1916, 1917), *M. robustus* (Van Cleave, 1916) *M. grandis* (Van Cleave, 1924), *M. emberizae* (Travassos, 1924), *M. pinto* (Travassos, 1923, 1924), *M. oswaldocruzi* (Travassos, 1923, 1924), *M. vaginatus* (Baer, 1925), *M. zeosteropis* (Travassos 1926), *M. mirabilis* (Baer, 1925), *M. (Empodius) otidis* (Kostylev, 1914b), *M. (Empodius) numidae* (Baer, 1925), *M. (Leiperacanthus) gallinarum* (Bhalerao, 1937), *M. garruli* (Yamaguti, 1939). The worm described belongs to the second category and in this group are included the species;

Table indicating the important characters of *M. micracanthus* *M. tenuis* *M. (Empodius) taeniatus* *M. (Empodius) giganteus* and *M. colini*.

		<i>M. micracanthus</i> (Rudolphi, 1819)	<i>M. tenuis</i> (Meyer, 1931)	<i>M. (Empodius) taeniatus</i> (Linstow, 1901).	<i>M. (Empodius) giganteus</i> (Meyer, 1931)	<i>M. colini</i> . (Webster, 1948)
Body dimensions	♀	20 mm long 0.75 mm max. breadth	30 to 33 mm long 0.5 to 0.75 mm max breadth	♀ and ♂ almost of equal size, 90 to 115 mm. 2.5 to 3 mm max. long. breadth	110 mm long 2 mm max. breadth	24 to 31 mm long 0.6 to 1 mm broad.
	♂	Not known	12 mm long 0.5 mm max. breadth		35 mm long	Not known
Proboscis dimen- sions	Anterior segment	0.3 mm × 0.25 mm				
	Posterior segment	0.12 mm × 0.355 mm	0.65 mm total length 0.35 mm max. breadth	0.86 mm total length 0.4 mm max. breadth	0.35 mm total length, 0.4 mm max. breadth	292 μ total length 288 μ max. breadth
Number of rows and hooks	Anterior segment	8 spiral rows ; 9 to 10 hooks in each row	12 to 14 spiral rows ; 9 hooks in each row	6 spiral rows ; 5 hooks in each row	8 spiral rows ; 9 hooks in each row	12 spiral rows ; 7 hooks in each row
	Posterior segment	16 spiral rows ; 3 to 4 hooks in each row	25 spiral rows ; 10 hooks in each row	12 spiral rows ; 16 hooks in each row		48 longitudinal rows ; 3 to 4 hooks in each row
Size of hooks	Anterior segment	0.175 mm long	Not known	Not known	Not known	31 μ to 35 μ
	Posterior segment	Not known	Not known	Not known	Not known	26 μ to 28 μ
Proboscis sheath dimensions		0.65 mm long	Not known	Not known	1 mm long	1.08 to 1.25 mm long 274 μ max. breadth
Lemnisc dimensions		3.2 mm long	3.5 mm long	Not known	4 mm long	3.48 to 3.56 mm long
Size of embryo		0.05 mm × 0.026 mm	0.06 mm × 0.037 mm	0.1 mm × 0.04 mm	0.066 mm × 0.034 mm	18 μ × 217
Host		Birds	<i>Saxicola bimaculata</i>	<i>Numida pitlorhyncha</i> <i>N.</i> <i>rickwa</i> , <i>Otis tarda</i> , <i>O.</i> <i>macqueni</i> , <i>Oedicane-</i> <i>mus crepitans</i>	<i>Maleagris gallopavo</i>	<i>Colinus virginianus tex-</i> <i>anus</i>
Locality		Europe	Egypt	Africa	Dutch East Africa	Texas

The species described in this paper does not resemble any of the foregoing known forms in its body length, in the number of hooks in each row, in the size of hooks where known and in the size of the embryo. These differences taken together justify the creation of a new species for this form for which I propose the name *Mediorhynchus passerus*. The specific diagnosis of this species is given at the beginning of the description.

The cotypes are deposited in Zoological Survey of India, Calcutta (Reg. No. W. 3773/1).

Host.—*Passer domesticus indicus*.

Locality.—Amraoti, Berar, India.

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- 1949.—Morphological and phylogenetic interpretations of the cement glands in the Acanthocephala. *Journ. Morph.* LXXXIV, pp. 427-457.
- WEBSTER, J. D., 1948.—A new Acanthocephala from the Bob-white *Jour. Parasit.* XXXIV, pp. 84-86.

SOME INDIAN SPIDERS OF THE FAMILY ARGIOPIDAE.

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INTRODUCTION.

The following study is based mainly on the unnamed spiders of the family Argiopidae, present in the collection of the Zoological Survey of India (Indian Museum), Calcutta. The material comprises 34 species of 11 genera. Three new species of the genus *Argiope*, viz., *A. shillongensis* (from Shillong, Assam), *A. pradhani* (from Peshawar, Bihar and Assam) and *A. kalimpongensis* (from Coorg, S. India, Darjiling Dist., Bengal, and Sibsagar, Assam) have been described. *Argiope arcuata* Simon, *A. lalita* Sherriffs and *Ordgarius hobsoni* (Cambridge) are now being recorded for the first time from Fiyush district (Arabia), Bengal and Bihar (India), respectively.

The following references although mentioned in the text, could not be consulted in original :

1. *Trans. Sapporo Nat. Hist. Soc.* CIII.
2. Savigny in *Aud. & Serv. Egypte Ar.* XXII.
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SYSTEMATIC ACCOUNT.

Key to the genera dealt with in this paper--

1. Spinnerets surrounded by a chitinous circular wall *Gasteracantha* Sundevall.
Spinnerets not surrounded by a chitinous wall .. 2.
2. Chelicerae without boss or with rudimentary boss 3.
Chelicerae with well developed boss .. 4.
3. Maxillae narrow at base, dilated and externally angled at the apex. *Leucage* White.
Maxillae not narrow at base, neither dilated nor externally angled at the apex. *Tetragnatha* Latreille.

4. Tarsi with metatarsi longer than the total length of patella and tibia 5.
 Tarsi with metatarsi not longer than the total length of patella and tibia .. 7.
5. Lip wider than long; posterior row of eyes strongly procurved. Anterior lateral eyes much smaller than the posterior laterals *Argiope* Audouin.
 Lip longer than wide; posterior row of eyes straight or recurved. Anterior and posterior lateral eyes subequal 6.
6. Abdomen pentagonal. Carapace flattened .. *Herennia* Thorell.
 Abdomen not pentagonal. Carapace not much flattened *Nephila* Leach.
7. Head conical in front. Lateral eyes wide apart .. *Poltys* Koch.
 Head otherwise in front. Lateral eyes not wide apart 8.
8. Carapace with four symmetrically arranged tubercles. Abdomen very broad .. *Ordgarius* Keyserling.
 Carapace smooth or irregularly tubercular. Abdomen not very broad .. 9.
9. Cephalic part of cephalothorax demarcated from the thoracic by a deep semicircular furrow *Cyclosa* Mengo.
 Cephalic part of cephalothorax not demarcated from the thoracic by a deep semicircular furrow .. 10.
10. Posterior row of eyes procurved .. *Araneus* Clerck.
 Posterior row of eyes recurved *Cyrtophora* Simon.

Genus *Nephila* Leach.

(Type *N. maculata* (Fabricius) China).

1815. *Nephila*, Leach, *Zool. Misc.* II, p. 133.
 1900. *Nephila*, Pocock, *Faun. Brit. Ind.*, Arach. p. 217.
 1912. *Nephila*, Dahl, *Mitt. Zool. Mus. Berlin*, VI, p. 27.

Distribution.—Tropical and rarely subtropical countries of the world.

Nephila (*Nephila*) *maculata* (Fabricius).

1793. *Aranea maculata*, Fabricius, *Ent. Syst.* II, p. 425 (*Type-locality*: China).
 1900. *Nephila maculata*, Pocock, *Faun. Brit. Ind.*, Arach. pp. 217, 218, fig. 68.
 1912. *Nephila* (*Nephila*) *maculata*, Dahl, *Mitt. Zool. Mus. Berlin* VI, pp. 52-54.

Material examined—

CEYLON—Suduganga, 1,386 ft., vii. 1923 (*S. White*) (11♀).—INDIA.—Cochin State : Kavalai, 1,300-3,000 ft., 24-27 ix. 1914 (*F. H. Gravely*) (1♀, Juv.). Courtallum, xi. 1921 (*M. O. T. Iyengar*) (1♀). Shevaroy Hills : Nagalaur, 3,900 ft., 6-15. vi. 1929 (*H. S. Pruthi*) (9♀, 3 Juv.). Mysore State : Shimoga, Shallow stream on the Eastern bank of Tunga river, 8. xii. 1928 (*B. Prashad & H. S. Rao*) (1♀, Juv.) Jog falls, 29. xi. 1928 (*B. Prashad & H. S. Rao*) (1♀). Bombay State : N. Kanara dist., Stream on Jog-Gersopha Road 29.xi. 1928 (*H. S. Rao*) (3♀), Jog, (*B. Prashad & H. S. Rao*) (1♀); Bandra, 7 x. 1925 (2♀). Orissa (Orissa dist.) 1916 (*C. Humble*) (1♀). Bengal : Gmatia (2♀); Serajgunj, 13. xi. 1928 (*D. L. Corbet*) (1♀); Sankari, 31. x. 1935 (*M. N. Datta*) (1♀); Sahibgunj, 25. ix. 1870 (3♀); Howrah, 4. x. 1908 (*T. Jellicoe*) (2♀), Amta, xii. 1929 (*N. P. Banerji*) (1♀),

Dum-Dum, 16. x. 1922 (*R. P. Mullins*) (1♂, 1♀), Calcutta (3♀); Darjiling dist., Kalimpong, 1914 (*S. W. Sutherland*) (1♀), 26. x. 1939 (5♀), 1934 (*Gonour Ram*) (1♂), 20-21. x. 1939 (2♂), 28. vii. 1916 (*S. W. Sutherland*) (1♀), *S. W. Sutherland* (4♂, 5♀), 2,000-4,500 ft., 28. vii. 1916 (*S. W. Sutherland*) (2♂), (1♀), Teesta, 3,000 ft., 12. viii. 1916 (*S. W. Sutherland*) (2♂), Soom, 4,000-5,000 ft., 9. vii. 1934 (*Carmichael's Coll.*) (5♀), Ghumti, 4,000 ft., viii. 1912 (*Carmichael's Coll.*) (1♀), Sukna, x. 1914 (*Mrs. Drake*) (1♂), Singla, 1,500 ft., viii-ix. 1912 (*Carmichael's Coll.*) (1♂), vi. 1913 (*Carmichael's Coll.*) (4♀), Pedong, 28. x. 1939 (1♂), 29. x. 1939 (2♀); Mymensingh dist., Ishwargunj (1♀). BURMA—Kyeinchoung forest, 20. iii. 1931 (*Biswas*) (1♂); Myitkeyina dist., Nyaungbin, a village at the north end of Indawgyi Lake, 7-10. xi. 1926 (*B. Chopra*) (6♀, 1 Juv.). NICOBARS—Kamorta Island (*Marine Survey*) (1♀), (*I. M. Puri*) (4♀).

Besides the above-mentioned localities, specimens from the following places are also present in the named material of the Zoological Survey of India :

CEYLON—Kandy; Peradeniya (*E.S.I.*). INDIA—Cochin State : Prambikulam, 1,700-3,200 ft. Uttar Pradesh : Hardwar (*W. H. Phelus*) : Dehra Dun (? *Woodmason*). Assam : Darrang (*Godwin-Austin*). Sikkim (*T. B. Fletcher*); Tavoy; MALAYA PENINSULA—(*Moti Ram*); Ta ping; Penang. SINGAPORE. ANDAMAN ISLANDS : Port Owen; Ross Island; Canistan Island.

Measurements.—Body 22-41.8 mm. long; carapace 6-13.5 mm. long fourth tibia 5.8-15.5 mm. long.

Distribution.—The species is known from Ceylon, India, Burma Sikkim, Andaman and Nicobar Islands, Malaya Peninsula, China and Japan.

***Nephila (Trichonephila) clavata* Koch.**

1877. *Nephila clavata*, Koch, *Verh. z.-b. Wien.* XXVI, p. 741 (*Type-locality* : Japan).
 1900. *Nephila clavata*, Pocock, *Faun. Brit. Ind.*, Arach. pp. 218, 219.
 1912. *Nephila (Trichonephila) clavata*, Dahl, *Mitt. Zool. Mus. Berlin* VI, pp. 35, 74.
 1933. *Nephila clavata*, Saito, *Trans. Sapporo Nat. Hist. Soc.* XIII, pt. 1, pp. 32-61, pl. 1.

Material examined—

INDIA—Bengal : Darjiling dist. Kurseong, x. 1930 (*Sasanka Sarkar*) (2♂); Pedong, 29. x. 1939 (2♂). Assam : Shillong (Under stones along the sides of Ewelyn Ridle and the Golf Course), 7-8. xii. 1930 (*H. S. Rao*) (1♀); Shillong-Cherrapunji Road, near Shillong, 6. xii. 1930 (*H. S. Rao*) (1♀), Shillong, 15. xi. 1930 (*H. S. Rao*) (2♀), 3. xii. 1930 (*H. S. Rao*) (5♀), 2. ix. 1926 (*B. N. Chatterji*) (9♀), 24. ix. 1926 (*B. N. Chatterji*) (2♀); Jaintia Hills, Streams near Mawlynkeng, 1. xii. 1930 (*H. S. Rao*) (1♀), Jowai-Choungpung bridlepath, 24. xi. 1930 (*H. S. Rao*) (1♀). BURMA—N. Shan States : Round about Namkham, Ca. 2,500 ft. xi. 1926 (*H. S. Rao*) (1♀). SIAM—Patalung : Lampam, 15. i. 1916 (*N. Annandale*) (1♂).

Besides the above mentioned localities, specimens from the following places are also present in the named material of the Zoological Survey of India :

PERSIAN BALUCHISTAN—Hung (*W T Blanford*); ANDAMAN ISLAND. LACCADIVE ISLAND. Kiltan. JAPAN—Komatsu (*L. Biva*).

In the specimen from Shillong-Cherrapunji, the base of protarsus of the first leg is yellowish.

Measurements.—Body 17.2- 20.3 mm. long ; carapace 6.7-2 mm. long ; fourth tibia 6.5- 7.1 mm. long.

Distribution.—The species is known from Persian Baluchistan, India, Burma, Andaman and Laccadive Island, Siam, Japan.

Nephila (Nephilaengys) malabarensis (Walckenaer).

1841. *Epeira malabarensis*, Walckenaer, *Ins. Apt.* II p. 103 (*Type-locality* : Malabar Coast, India).
 1890. *Nephilengys malabarensis*, Thorell, *Ann. Mus. Stor. Nat. Genova*, XXVIII, p. 188.
 1900. *Nephila malabarensis*, Pocock, *Faun. Brit. Ind.*, Arach. p. 219.
 1912. *Nephila (Nephilengys) malabarensis*, Dahl, *Mitt. Zool. Mus. Berlin* VI, pp. 49, 77.

Material examined—

CEYLON—(3♀). INDIA—Shevaroy Hills, S. Arcot (*Jaffer*) (1♀). Bombay State : Bombay (7♀). Bihar—Chota Nagpur : Purulia (*F H. Gravely*) (2♀). BURMA—Moulmein (5♀). MALAYA PENINSULA—Perak (*Moti Ram*) (5♀, 2 Juv.). SIAM—Patalung : Lampam, 12. i. 1916 (*N. Annandale*) (3♀).

Besides the above mentioned localities, specimens from INDIA—Cochin State : Chalakudi, and SINGAPORE are also present in the Zoological Survey of India.

In both the specimens from Purulia, Bihar, the sternum is yellow and bordered on all sides by blackish tinge. In Moulmein specimens labium is yellow and the head part of the cephalothorax is covered with many spine-like hairs.

Measurements.—Body 17.8—25.3 mm. long ; carapace 7.6—9.3 mm. long.

Distribution.—The species is known from, Ceylon, India, Burma, Nicobar Islands, Singapore, Siam, Thailand, Java, New Guinea, Bismarck-Archipelago and Australia.

Genus ***Herennia*** Thorell.

(*Type*, *H. ornatissima* (Doleschall), Amboina, Molucca).

1877. *Herennia*. Thorell, *Ann. Mus. Stor. Nat. Genova* X, p. 70.
 1900. *Herennia*, Pocock, *Faun. Brit. Ind.*, Arach. p. 219.

Distribution.—Tropical Asia, Malaysia and Papuasia.

***Herennia ornatissima* (Doleschall).**

1859. *Epeira ornatissima*, Doleschall, *Verh. Nat. Vereen Nederland. India*, V. No. 5, p. 32 (*Type-locality* : Amboina, Molucca).
 1900. *Herennia ornatissima*, Pocock, *Faun. Brit. Ind.*, Arach. pp. 219, 220, fig. 69.

Material examined—

India.—Cochin State : Prambikulam, 1,700-3,200 ft., 16-24. ix. 1914 (*F. H. Gravely*) (4♀).

Besides the above mentioned locality, specimens from the following places are also present in the named material of the Zoological Survey of India :

INDIA—Cochin State : Chalakudi (*F. H. Gravely*). Mysore State : Coorg : Polibetta, Vijapet (*T. B. Fletcher*). Bengal : Darjiling dist., Kalimpong, 2,000-4,500 ft. (*S. W. Sutherland*), 2,000-4,000 ft. (*S. W. Sutherland*), 4,100 ft. (*S. W. Sutherland*), Pashok 3,500 ft. (*F. H. Gravely*), Ghumti, 1,500-5,000 ft. (*Carmichael's Coll.*), Sukna (*Mrs. Drake*), Gopaldhara (*H. Stevens*). Assam : Nazeerah (*Foster*) ; Garo-Hills, Above Tura, 2,000-3,900 ft. (*A. Kemp*). BURMA—Hopin (*T. B. Fletcher*) ; Myitkyina (*T. B. Fletcher*) ; Yamethin (*T. B. Fletcher*) ; Pegu Yoma. ANDAMAN ISLANDS. SINGAPORE.

Measurements.—Body 14-20 mm. carapace 4.8-6.8 mm. long.

Distribution.—The species is already known from Ceylon, India, Burma, Andaman Island, Singapore and Austro-Malaysia.

Genus *Argiope* Savigny.

(Type, *A. lobata* (Pallas).

1825. *Argiope*, Savigny, in *Aud. & Serv. Egypt. Ar.* XXII, pt. 4, p. 121.
 1900. *Argiope*, Pocock, *Faun. Brit. Ind.*, Arach. p. 220.
 1921. *Argiope*, Gravely, *Rec. Ind. Mus.* XXII, p. 412.
 1936. *Argiope*, Dyal, *Bull. Dept. Zool. Panjab Univ., Lahore*, I, p. 189.

Distribution.—Tropical, Subtropical and Temperate countries.

Key to the Species of Argiope.

- | | |
|--|------------------------------------|
| 1. Abdomen with caudal process and large lateral lobes | 2. |
| Abdomen without caudal process and large lateral lobes | 3. |
| 2. Coxae and trochanters of 3rd and 4th legs spined | <i>A. arcuata</i> Simon. |
| 3. Abdomen dorsally and posteriorly with longitudinal black and white markings arranged alternately | <i>A. lalita</i> Sherriffs. |
| Abdomen dorsally and posteriorly without such markings | 4. |
| 4. Abdomen evenly oval in outline | 5. |
| Abdomen pentagonal | 6. |
| 5. Abdomen dorsally with a band of silky hairs, broad in front and narrowed behind | <i>A. catenulata</i> (Doleschall). |
| Abdomen dorsally with no such band of silky hairs | <i>A. pradhani</i> , sp. nov. |
| 6. The large triangular olive black patch behind incompletely divided by a transverse bar of yellow colour | <i>A. shillongensis</i> , sp. nov. |

- No such transverse bar of yellow colour on the large triangular olive black patch 7.
7. Anterior pale trapezoidal area on the upper side of abdomen completely divided by a single broad transverse olive brown stripe .. *A. undulata* Thorell.
- No such brown stripe dividing the anterior pale trapezoidal area on the upper side of the abdomen 8.
8. Internal sclerite of vulva very large .. *A. pulchella* Thorell.
- Internal sclerite of vulva small 9.
9. Size big, more than 13 m.m. in length *A. kalimpongensis*, sp. nov.
- Size small, upto 12 m.m. in length *A. anasuja* Thorell.

Argiope arcuata Simon.

1884. *Argyope arcuata*, Simon, *Ann. Mus. Stor. Nat. Genova* XX, p. 343
(*Typelocality*: Burma).
1900. *Argyope arcuata*, Pocock, *Faun. Brit. Ind.*, Arach. pp. 220, 221, fig. 70.

Material examined—

ARABIA—Fiyush dist., near Aden, 1915 (*R.B.S. Sewell*) (1♀). INDIA—West India : Kachh (5♀).

Besides the above mentioned localities, specimens from the following places are also present in the named collection of the Zoological Survey of India :

India--Bihar : Chota Nagpur, Chakardharpur (*F H. Gravely*). Madhya Pradesh (*Burton*).

In all the specimens from Kachh, the spinules on the coxae and trochanters of 3rd legs are very weak. The palpi are brownish yellow and the annulations of legs are not clear in some of the specimens.

Measurements.—Body 19.5-21.6 mm. long ; carapace 4.8-7.1 mm. long.

Distribution.—The species is known from India and Burma and is now being recorded from Arabia.

Argiope lobata (Pallas).

1772. *Aranea lobata*, Pallas, *Spic. Zool.* II, pt. 9, p. 46, t. iii, fig. 14.
1900. *Argyope lobata*, Pocock, *Faun. Brit. Ind.*, Arach. p. 221.
1938. *Argiope lobata*, Kolasvary, *Zool. Anz., Leipzig*, CXXIII, p. 22.

Material examined—

INDIA—Madhya Pradesh : Nagpur, 28. ii-1-iii. 1919. (*F H. Gravely*) (15♂, 3 Juv.).

The specimens are interesting in that they have faint longitudinal markings dorsally on the posterior end of the abdomen and also because of their smaller size than the usual form.

Measurements.—Body 12.3-18.5 mm. long ; carapace 2.1-3.6 mm. long.

Distribution.—India.

***Argiope pulchella* Thorell.**

1881. *Argiope pulchella*, Thorell, *Ann. Mus. Stor. Nat. Genova*, XVII, p. 74
(*Type-locality* : Siam).
 1900. *Argiope pulchella*, Pocock, *Faun. Brit. Ind.*, Arach. p. 221, 222.
 1921. *Argiope pulchella*, Gravely, *Rec. Ind. Mus.* XXII, pp. 412, 413,
fig. 3b.
 1936. *Argiope pulchella*, Dyal, *Bull. Dept. Zool. Punjab Univ., Lahore* I, p. 90,
pl. xi, fig. 8.

Material examined—

CEYLON.—Trincomale dist., Niroddumnai, ii. 1914 (*Henry Coll.*) (1♀).

INDIA—Cochin State : Trichur, 0-300 ft., 1-4. x. 1914 (*F. H. Gravely*) (1♀), Forest tramway, mile 21, 400 ft., x. 1914 (*F. H. Gravely*) (1♀), Prambikulam, 1,700-3,200 ft., 14-16. x. 1914 (*F. H. Gravely*) (9♀, 3 Juv.) Ernakulam, 11-14. ix. 1914 (*F. H. Gravely*) (4♀). *Mysore State* : Coorg Saivra-Butti, Pollibetta, 21. v. 1914 (*Fletcher Coll.*) (1♀), 22. v. 1914 (*Fletcher Coll.*) (3♀). Bengal : Gmatia (3♀, 1 Juv.), Calcutta, Maniktolla, 8. ix. 1912 (*F. H. Gravely*) (1♂, 1♀), Calcutta (2♀). BURMA—Arakan (*Stoliczka bequest*) (10♀, 3 Juv.).

Besides the above mentioned localities, specimens from the following places are also present in the named collection of the Zoological Survey of India :

INDIA—Malabar Coast : Tellicherry (*T. Clapton*). Madras State : Ganjam dist., Gopalpur (*Maj. Bennett*). Orissa : Barkul, 0-1,000 ft. (*F. H. Gravely*) ; Bhubaneshwar (*F. H. Gravely*) ; Barkuda Island (*F. H. Gravely*). Bihar : Siripur (*Mackenzie*) ; Kierpur (*C. Paiva*) ; Pusa (*F. H. Gravely*). Bengal : Darjiling dist., Kalimpong, 2,000-4,500 ft. (*F. H. Gravely*), 4,000 ft. (*S. W. Sutherland*), 4,100 ft. (*S. W. Sutherland*), Pashok, 3,500 ft. (*F. H. Gravely*), Singla, 1,500 ft. (*Carmichael's Coll.*), Tindharia (*Mrs. Drake*). Assam : Samagooting (*Godwin-Austin*) ; Sibsagar (*S. S. Peal*). BURMA—Lashio, 3,000 ft. (*T. B. Fletcher*) ; Pegu ; Thayetmyo (*Oates*). MALAYA PENINSULA—Perak. ANDAMAN ISLANDS, LACCADIVE ISLAND, Kiltan Island. SINGAPORE.

It seems that with the age the bands on the legs get faint and indistinct.

Measurements.—Body 10.9-19.5 mm. long. carapace 5.2-6.4 mm. long.

Distribution.—The species is known from Ceylon, India, Burma, Andaman and Laccadive Islands, Malaya Peninsula and Singapore.

***Argiope undulata* Thorell.**

1877. *Argiope undulata*, Thorell, *Ann. Mus. Stor. Nat. Genova*, XXV, p. 154
(*Type-locality* : Shevegoo-myo, Burma).
 1900. *Argiope undulata*, Pocock, *Faun. Brit. Ind.*, Arach. p. 222.

Material examined—

MALAYA PENINSULA—Perak : Taipeng, 27 xii. 1915 (*N. Annandale*) (♀).

Measurements.—Body 27 mm. long ; carapace 4.5 mm. long.

Distribution.—The species is already known from Burma, Andaman Islands and Malaya Peninsula.

Argiope anasuja Thorell.

1877. *Argiope anasuja* Thorell, *Ann. Mus. Stor. Nat. Genova* XXV, p. 162
(Type-locality : Burma).
1900. *Argyope anasuja*, Pocock, *Faun. Brit. Ind.*, Arach. p. 222.
1921. *Argiope anasuja*, Gravely, *Rec. Ind. Mus.* XXII, pp. 412, 413, text-
fig. 3a.

Material examined—

CEYLON—Colombo : Colepetty, 26. xi. 1914 (*Henry Coll.*) (1♀).
INDIA—Madras State : Ennur, 30-31. i. 1922 (*F. H. Gravely*) (over 25♀) ;
Tuticorin, near Yagoon and Tuticorin proper, 15. iii. 1926 (*R. B. S. Sewell*) (7♀, 3 Juv.) ; Bimlipatam, 22. ii. 1937 (*H. A. Hafiz.*) (2♀).

Besides the above mentioned localities, named specimens from the following places are also present in the Zoological Survey of India :

INDIA—Bombay State : Nasik. Madras State : Vizagapatam (*S. W. Kemp*). Orissa : Barkuda Islands (*F. H. Gravely*) ; Gheria Island (*Chilka Survey*). Bihar : Chota Nagpur, Chakardharpur (*E. P. Stebbing*). Bengal : Calcutta.

The median ventral plate of the vulva in the single specimen from Colpetty is slightly bigger than the normal and in this respect shows some resemblance to that of *A. pulchella* Thor.

Measurements.—Body 10.9-12 mm. long ; carapace 2.9-5.5 mm. long.

Distribution.—The species is known from Ceylon, India and Pakistan.

Argiope catenulata (Doleschall).

1859. *Epeira catenulata*, Doleschall, *Verh. Nat. Vereen Nederland. Indie* V, No. 5, p. 30, t. ix, fig. 1 (Type-locality : Java).
1900. *Argyope catenulata*, Pocock, *Faun. Brit. Ind.*, Arach. p. 223.

Material examined—

CEYLON—Kandy, 22. ix. 1925 (*S. L. Hora*) (1♀). INDIA—Foot of Nallamalai Hills, Mahanadi, 800 ft., 12-15. viii. 1929 (*H. S. Pruthi*) (1♀). Bengal : Salt lakes, near Durgapur, ii. 1919 (*F. H. Gravely*) (11♀, 6 Juv.), 27. x. 1912 (*F. H. Gravely*) (2♀), (1♀), Salt lakes, below Chingrighta, 12. ii. 1915 (*F. H. Gravely*) (2♂, 10♀), Salt lakes, Dhappa, 8. xii. 1912 (*F. H. Gravely*) (1♂, 1♀).

Specimens from Durgapur are interesting because the thoracic region is slightly wider than twice the width of the cephalic region. The outer base of maxillae is black while the femora, tibiae and tarsi of the 2nd pair of legs are with transverse bands.

Measurements.—Body 11.9-15 mm. long ; abdomen 7.6-9.5 mm. long and 4.3-6 mm. broad.

Distribution.—The species is known from Ceylon, India, Burma, Nicobar Island and Austro-Malaysia.

Argiope lalita Sherriiffs.

1928. *Argiope lalita*, Sherriiffs, *Ann. Mag. Nat. Hist.* (10) II, p. 18, figs. 3-7
(Type-locality : Charlotte Estate, Sidapur, S. Coorg, India).

Material examined—

INDIA—Mysore State : Shimoga dist., Kalurkatte Road, near Sagar, xii. 1928 (*H. S. Rao*) (1♀, with Cocoon). Bengal : Salt lakes, near Durgapur, 30. xii. 1913 (*F. H. Gravely*) (1♀).

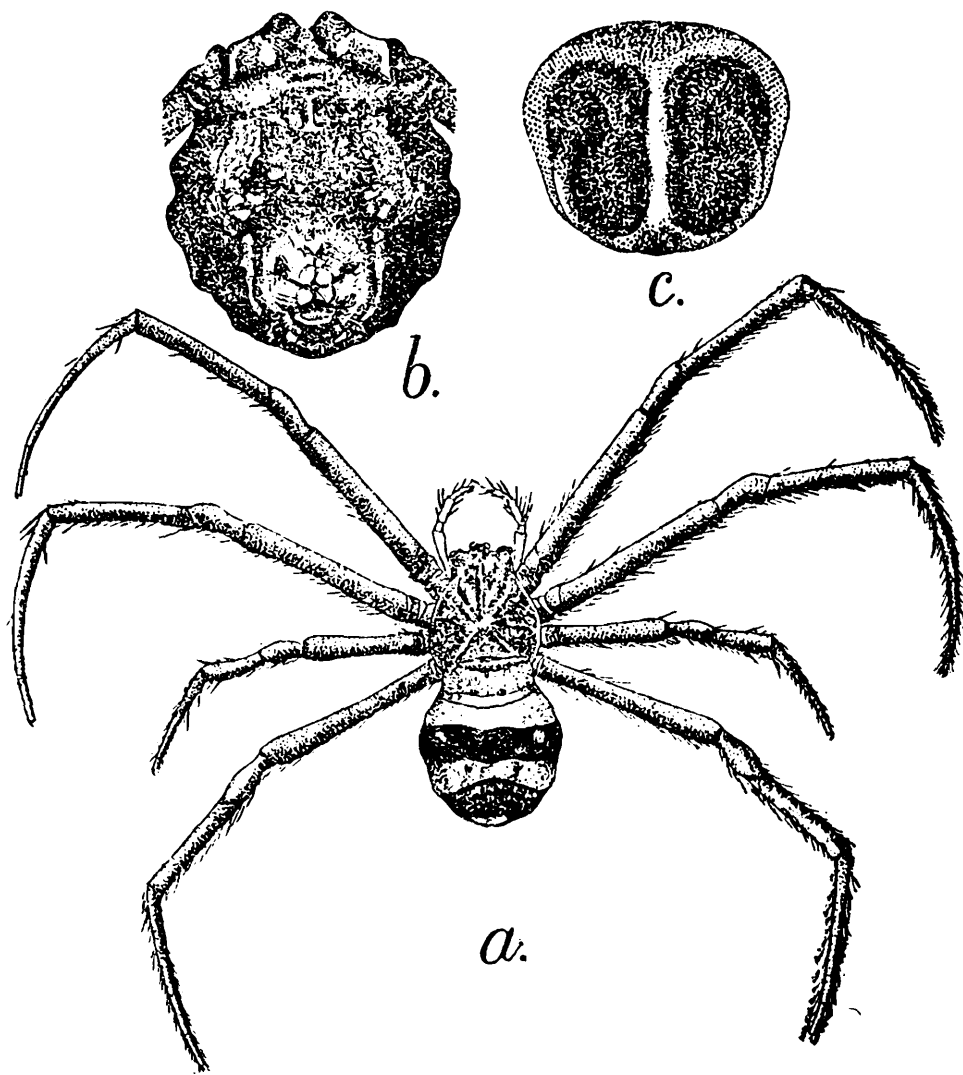
The South Indian specimen has the body tawny in coloration with a circular white band on the third femur and the white and bluish hairs on the cephalic region. The body in the only specimen from Durgapur is black while femora have white annulations and the area between the epigynum and the spinners is devoid of white spots.

Measurements.—Body 9.4-10 mm. long ; abdomen 6.6-7 mm. long and 4.3-5 mm. broad.

Distribution.—Hitherto known from Charlotte Estate, Sidapur, Coorg ; the species is now being recorded from Durgapur, Bengal.

***Argiope shillongensis*, sp. nov.**

Abdomen is pentagonal and is anteriorly truncated. The dorsum (text-fig. 1a) is marked with one very broad and a few transverse brownish black bands and alternating with two broad and rest narrow transverse yellowish bands. The last brownish black band is incompletely divided by a transverse narrow yellow streak. There are four yellowish cup-shaped spots, one on either side of the centre on the broad black band. The venter of the abdomen (text-fig. 1b.) is brown with a pair of



TEXT-FIG. 1.—*Argiope shillongensis*, sp. nov. a. Dorsal view : $\times 2\frac{2}{3}$; b. ventral view of the abdomen : $\times 5\frac{1}{3}$; c. Vulva : $\times 26\frac{2}{3}$.

broken longitudinal band, one on either side of the epigyneal plate, extending posteriorly upto the extremity of the abdomen. The spinners are brownish yellow in colour.

The cephalothorax is brownish yellow in coloration and the thoracic part is nearly thrice as long as the cephalic part. Sternum is yellow and is bordered with black. The palpi, maxillae and labium are yellow.

Median piece of the epigyneal plate (text-fig. 1c) is not much rounded and the vertical septum is neither very narrow nor very broad with almost straight or slightly sinuate lateral margins.

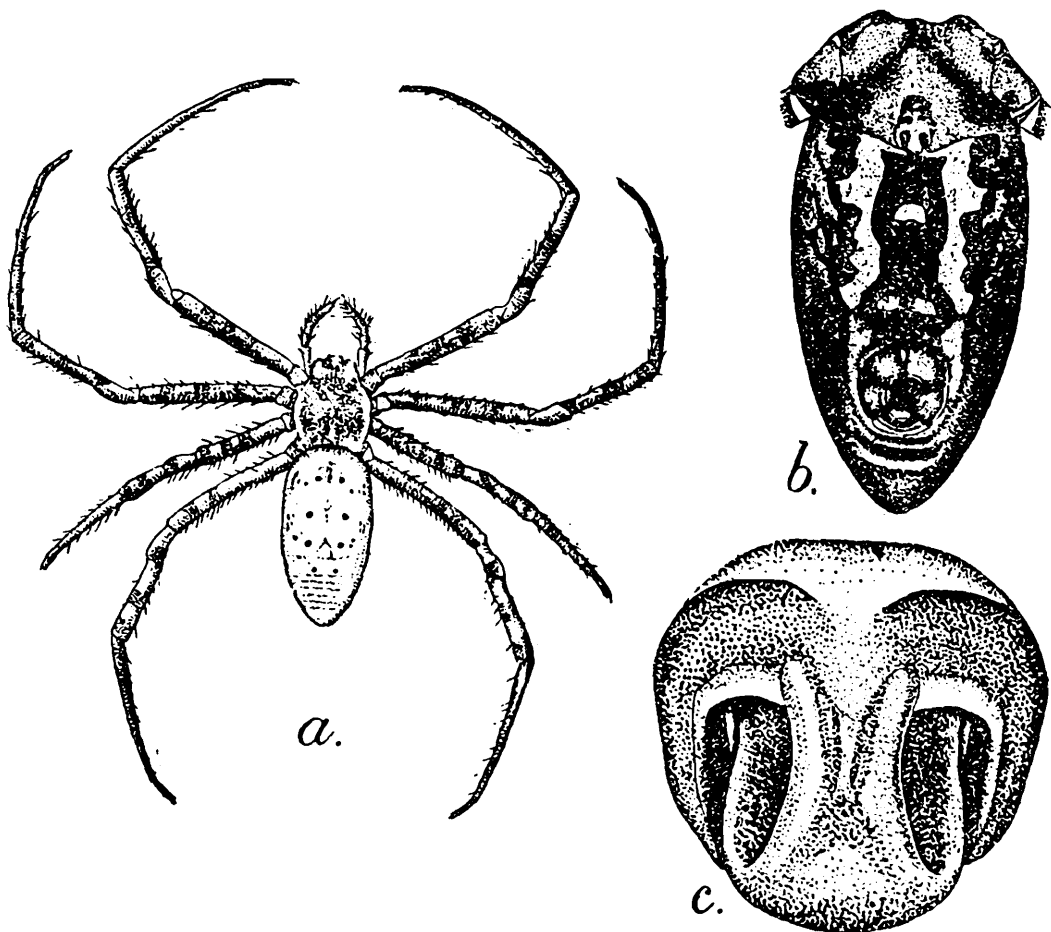
The species is close to *A. undulata* Thorell, from which it differs in size, being much smaller than *A. undulata*, and in the character of the vulva. The median piece of the epigyneal plate is not much rounded.

Measurements.—Body 9.7 mm. long; carapace 4.3 mm. long.

Material examined.—*Holotype*. Reg. No. 2277/18, Zoological Survey of India (Assam, Shillong, x. 1920 (*F. H. Gravely*) (♀).

***Argiope pradhani*, sp. nov.**

Abdomen is oval (text. fig. 2a) in outline with its dorsal side extending anteriorly over the carapace, and with silky hairs (seen in spirit). Prominent spots are seen on the dorsum of the abdomen. The ventral surface is marked with two yellow slightly broken, longitudinal bands, one on either side of the epigynum extending from the anterior of the epigynum backwards upto the extremity of the abdomen (text fig. 2b.). The



TEXT-FIG. 2.—*Argiope pradhani*, sp. nov. a. Dorsal view : $\times 1$; b. ventral view of the abdomen : $\times 2\frac{2}{3}$; c. Vulva : $\times 22\frac{1}{2}$.

area between the epigynum and spinners is marked with 3 spots as seen in the text-fig. 2b. Cephalothorax is clothed with hairs like the dorsum of

the abdomen. Sternum is black with a mid-longitudinal yellow band. Yellow tubercles are present on the sternum before the bases of the coxae 1-3. Yellowish bands extend from the base of the third pair of tubercles inwards to meet the mid-yellow longitudinal band.

Vulva (text-fig. 2c.) is T-shaped and the mid-ventral plate is fairly broad and of uniform breadth.

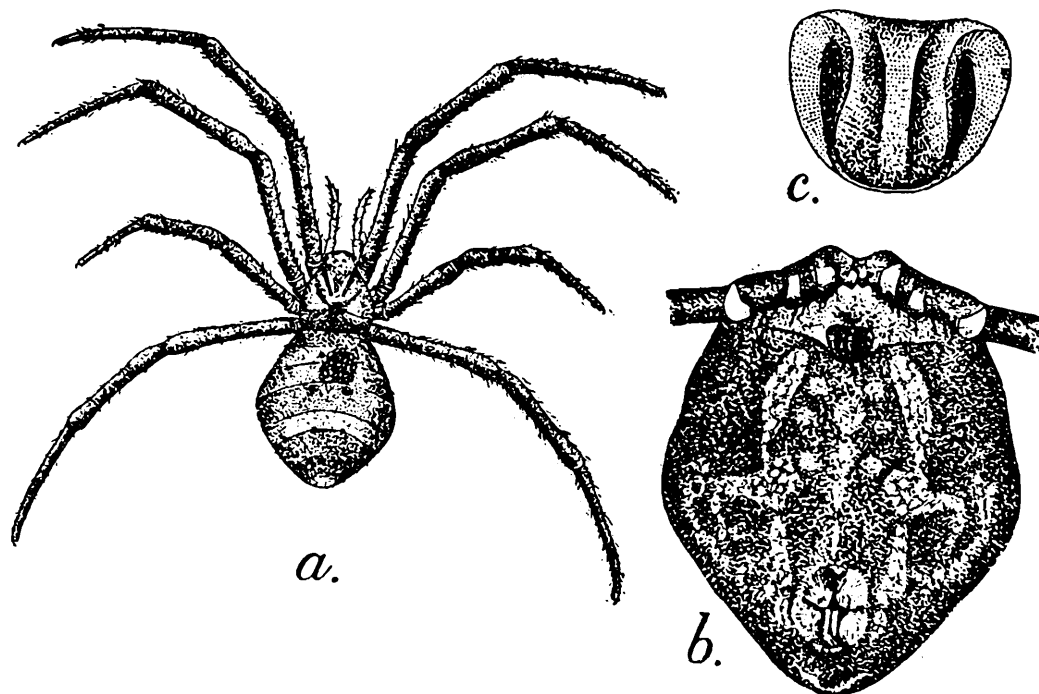
The species is close to *A. catenulata* (Doleschall) from which it differs in the absence of a band of silky hairs on the dorsum of the abdomen and in having a very broad T-shaped mid-ventral plate.

Measurements.—Body 16.5-25.8 mm. ; carapace 5.5-9 mm. long.

Material examined.—*Holotype*. Reg. No. $\frac{2287}{18}$, Zoological Survey of India. (Bihar : Saran (*Mackenzie*) (♀). *Paratypes*. Reg. No. $\frac{2288}{18}$, Assam : Shillong, x. 1920 (2♀). Reg. No. $\frac{2291}{18}$, Assam : Jaintia Hills ; Jowai-Chongpung bridge-path, 24. xi. 1930 (*H. S. Rao*) (1♀). Reg. No. $\frac{2290}{18}$ Pakistan.—Near Peshawar, Bank of Kabul River, 18. xi. 1914 (*T. B Fletcher*) (2♀), Zoological Survey of India.

***Argiope kalimpongensis*, sp. nov.**

Abdomen is pentagonal. Dorsum of the abdomen (text-fig. 3a.) has yellow and black bands and also two pairs of prominent and a few smaller indistinct spots scattered over the anterior region. Venter of the abdomen is mottled with yellow spots and has two yellowish longitudinal



TEXT-FIG. 3.—*Argiope kalimpongensis*, sp. nov. a. Dorsal view : $\times 1$; b. ventral view of the abdomen : $\times 2\frac{2}{3}$; c. Vulva : $\times 13\frac{1}{2}$.

stripes (text-fig. 3b.) A transverse, somewhat irregular band tends to join the stripes near about the middle of their length. In the space

between the vulva and the spinners, but much nearer to the latter, are six small yellow spots. Cephalothorax is covered with hairs and is emarginated posteriorly. The thoracic part is slightly longer than the cephalic part.

Sternum is black with a mid-longitudinal yellow band. Palpi are yellow and the apical segment is brownish with black hairs. Labium and maxillae are yellow with brownish-black sides. Femora of all the legs are marked with black incomplete rings, that of the fourth femur very faintly and of the first two strongly. The annulations of the third femur are intermediate in coloration between the first, second and fourth legs. Coxae are with yellow spots. Median piece of vulva (text-fig. 3c.) is broad and rounded posteriorly.

The species is close to *A. anasuja*, from which it can be easily differentiated on the character of the size. This species is always longer than 13 mm., while *A. anasuja* seldom reaches 13 mm. in length. The median piece of vulva is also much rounded posteriorly.

Measurements.—Body 22-25.5 mm. long; carapace 8.5-10 mm. long.

Material examined.—*Holotype*. Reg. No. $\frac{2279}{18}$, Zoological Survey of India. (Bengal: Darjiling dist., Kalimpong, 4,100 ft., 5. viii. 1916 (S. W. Sutherland) (♀). *Paratypes*. Reg. No. $\frac{2289}{18}$, Zoological Survey of India. (Bengal: Darjiling dist. Gopaldhara, 1916 (H. Stevens) (3♀) Reg. No. $\frac{2292}{18}$ Lebong, ix. 1912 (W. Bennett) (1♀). Reg. No. $\frac{2293}{18}$, Assam: Sibsagar (S. S. Peal) (1♀). Coorg (2♀). Bengal: Darjiling dist., Kalimpong, 600-4,500 ft. (S. W. Sutherland) (1♂, over 50♀, 4 Juv.), 29. viii. 1916 (S. W. Sutherland) (1♀), 4,100 ft. (S. W. Sutherland) (1♀), 2,000-4,500 ft. (S. W. Sutherland) (over 10♀), Pashok, 3,500 ft., 1-12.x. 1917 (F. H. Gravely) (1♀), Soom, 4,000-5,000 ft., 9. vii. 1914 (Carmichael's Coll.) (1♀), Ghumti, 1,500-5,000 ft., vi. 1914 (Carmichael's Coll.) (1♀).

Genus *Tetragnatha* Latreille.

(Type, *T. extensa* (Latreille), Paris, France.)

1804. *Tetragnatha*, Latreille, *Nouv. Dict. d' Hist. Nat.* XXIV, p. 135.

1900. *Tetragnatha*, Pocock, *Faun. Brit. Ind.*, Arach. p. 215.

1921. *Tetragnatha*, Gravely, *Rec. Ind. Mus.* XXII, pp. 411, 424.

Distribution.—Tropical, temperate and subarctic countries.

Teragnatha gracilis (Stoliczka).

1869. *Meta gracilis*, Stoliczka, *Journ. Asiat. Soc. Bengal*, XXXVIII (II), p. 244, pl. XIX, fig. 2, (*Type-locality*: Calcutta. *Type-specimen*: Reg. No. 3594/10, Zoological Survey of India).

1900. *Tetragnatha gracilis*, Pocock, *Faun. Brit. Ind.*, Arach. p. 214.

1921. *Tetragnatha gracilis*, Gravely, *Rec. Ind. Mus.* XXII, pp. 427, 436-38, text-figs. 1 a-c.

Material examined.—

INDIA—Mysore State : near Sagar, Kalurkatte Road, XII. 1932 (H. S. Rao) (1♀). Palni Hills, 6. VII. 1929 (H. S. Pruthi) (1♀).

Besides the above mentioned localities, specimens from the following localities are also present in the named collection of the Zoological Survey of India :

INDIA—Cochin State : (*F. H. Gravely*), Prambikulam, 1,700-3,200 ft. (*F. H. Gravely*). Mysore State : Bangalore, ca. 3,000 ft. (*N. Annandale*). Bombay State : Koyna Valley, Taloshi, ca. 2,000 ft. (*F. H. Gravely*). Madras State : Villivakan. Orissa State : Barkuda Island (*F. H. Gravely*) ; Bhubaneshwar (*F. H. Gravely*). Bihar : Pusa (*F. H. Gravely*). Bengal : Darjiling dist., Kalimpong, 2,000-4,000 ft. ; Madhupur (*C. Paiva*). Port Canning, Calcutta.

The Palni hills specimen is devoid of the ventral tooth on the basal bend of the Chelicera.

Measurements.—Body 9.3 mm. long ; carapace 1.9-2.3 mm. long.

Distribution.—The species is already known from Ceylon, India, Burma, Andaman Island and Celebes.

***Tetragnatha mackenziei* Gravely.**

1921. *Tetragnatha mackenziei*, *Rec. Ind. Mus.* XXII. pp. 438, 439, text-figs. 1 e-g. (*Type-locality* : Salt Lakes, near Calcutta, *Type-specimen* : Reg. No. 9974/17, Zoological Survey of India).

Material examined.—

INDIA—Bihar : Hazaribagh dist., Hasla village, near Ramgarh 28. x. 1928 (M. Shariff) (1♂, 4♀) ; A permanent lake near Ranchi Hill and the Town Ranchi, 18. x. 1928 (M. Shariff) (2♂, 3♀, 1 Juv.).

Besides the above-mentioned localities, named specimens from the following places are also present in the Zoological Survey of India :

INDIA—Travancore : Kulattupuzha, Western base of Western Ghats (*N. Annandale*). Bombay State : Mahabaleshwar, 4,200 ft. (*F. H. Gravely*). Madras State : Villivakkam (*R. V. S.*). Orissa : Barkul 0-1,000 ft. (*N. Annandale*). Madhya Pradesh : Hoshangabad (*F. H. Gravely*). Pachmari. Bihar : Siripur (*Mackenzie*). Bengal : Salt lakes, near Calcutta, Salt lakes near Dhappa (*S. W. Kemp*).

Measurements.—Body 7.3 mm. long ; carapace 2.3 mm. long ; abdomen 4.6 mm. long and 1.4 mm. broad.

Distribution.—The species is known from India and Burma.

***Tetragnatha fletcheri* Gravely.**

1921. *Tetragnatha fletcheri*, Gravely, *Rec. Ind. Mus.* XXII, pp. 440, 441, text-fig. 3a, (*Type-locality* : Shillong, Assam, *Type-specimen*.—Reg. No. $\frac{9972}{17}$ Cotypes, Reg. No. 9973/17, Zoological Survey of India).

Material examined.—

INDIA—Assam : Jaintia Hills, Mawlyngkeng, 1. xii. 1930 (H. S. Rao) (1♀).

On the dorsal side of the fang there are five teeth in the diminishing series instead of 4 teeth.

Measurements.—Body 7.7 mm. long ; carapace 2.1 mm. long.

Distribution.—It is not known from elsewhere, except from its type-locality.

***Tetragnatha mandibulata* Walckenaer s. str.**

1837. *Tetragnatha mandibulata*, Walckenaer, *Ins. Apt.* II, p. 211, (*Type-locality*: Monde-Maritime, Archipel des Mariannes-guam).

1900. *Tetragnatha mandibulata*, Pocock, *Faun. Brit. Ind.*, Arach. p. 215, fig. 67.

1921. *Tetragnatha mandibulata*, Gravely, *Rec. Ind., Mus.* XII, pp. 429, 430, 441, 442, text-figs. 1 d, 3d and e.

1939. *Tetragnatha mandibulata*, Sherriffs, *Hongkong Nat.* IX, 3, p. 135.

Material examined.—

INDIA—Mysore State: Kalurkatte Road, near Sagar, xii. 1928 (*H. S. Rao*) (1♀). Palni Hills, 6. vii. 1929 (*H. S. Pruthi*) (2♀). Bihar: Hazaribagh dist., Hazaribagh Lake (a big lake near the Central Jail) 4. xi. 1928 (*M. Shariff*) (1♀), Hasla village, ponds 28. x. 1928 (*M. Shariff*) (1♂, 2♀). Bengal: Darjiling dist., Kalimpong, 21. x. 1939 (1♀). BURMA—South end of the Indawgyi Lake and along its western shore near Louton, 18-31. x. 1926 (*B. Chopra*) (8♀).

Besides the above mentioned localities, named specimens from the following places are also present in the Zoological Survey of India :

CEYLON—Nuwara Eliya. INDIA—Cochin State: Ernakulam (*F H. Gravely*); Chalakudi (*F H. Gravely*). Mysore State: Bangalore, ca. 3,000 ft. (*N. Annandale*). Madras State: Villivankam (*E.V.S.*), Chinglepet. Orissa: Barkul 0-1,000 ft. (*F H. Gravely*), Barkuda Island, South end of Chilka Lake, Rambha Island (*N. Annandale*), Barkuda Island (*N. Annandale & F H. Gravely*). Bihar: Chota Nagpur, Pass between Chaibassa and Chakardharpur (*F H. Gravely*); Purulia (*N. Annandale & F H. Gravely*); Siripur (*Mackenzie*); Kierpur (*C. Paiva*). Bengal: Gmatia; Salt lakes, near Durgapur (*F H. Gravely*); Calcutta, Port Canning (*F H. Gravely*); Barisal (*Mrs. Drake*). Assam: Sibsagar (*S. S. Peal*); Selai Kuzi (*S. W. Kemp*); Nepal Terai; Bijaura (*Mus. Coll.*). BURMA—S. Shan States: Yawngphwe State, Thantaung (*F H. Gravely*). ANDAMAN ISLAND (*N. Annandale*). SIAM—Patalung: Lampam (*N. Annandale*).

Measurements.—Body 10-13 mm. long ; carapace 3-3.4 mm. long.

Distribution.—The species is known from Ceylon, India, Nepal, Burma, Andaman and Nicobar Islands, Siam and Austro-Malaysia.

***Tetragnatha listeri* Gravely.**

1921. *Tetragnatha listeri*, Gravely, *Rec. Ind. Mus.* XXII, pp. 443, 444, text-figs. 4 d, (*Type locality*: Pashok, 5,000 ft. Darjeeling Dist.).

Material examined.—

INDIA—Bengal: Darjiling dist., Kalimpong, 20. x. 1939 (2♂, 2♀).

Besides the above mentioned locality, named specimens from the following places are also present in the Zoological Survey of India :

CEYLON—Peradeniya (*E. E. Green*). INDIA—Cochin State : Ernakulam (*F. H. Gravely*), Chalakudi. Bengal : Chittagong (*N. Annandale*). NEPAL—Nara Ghats (*Mus. Coll.*). BURMA—Mougmit State : Man. Tou (*Coggin Brown*). MALAYA PENINSULA—Penang, Talok Tikus (*N. Annandale*). SIAM—Patalung : Lampam (*N. Annandale*) ; Singora (*N. Annandale*).

On the dorsal side of the chelicera in females there are six teeth in descending series and not four or five, after the second tooth as mentioned by Gravely (1921).¹

Measurements.—Body 11 mm. long ; carapace 3.2-3.4 mm. long.

Distribution.—The species is already known from Ceylon, India, Nepal, Burma, Malaya Peninsula and Siam.

Genus *Leucage* White.

(Type, *L. argyrobapta* White, near Rio de Janeiro).

1841. *Leucage*, White, *Ann. Mag. Nat. Hist.* VII, p. 473.

1900. *Argyropeira*, Pocock, *Faun. Brit. Ind.* Arch. p. 215.

1921. *Leucage*, Gravely, *Rec. Ind. Mus.* XII, pp. 412, 450.

1936. *Leucage*, Dyal, *Bull. Dept. Zool. Panjab Univ., Lahore*, 1, p. 187.

Distribution.—Tropical and subtropical countries.

Leucage celebesiana (Walckenaer).

1837. *Tetragnatha celebesiana*, Walckenaer, *Ins. Apt.* II. p. 222, (*Type-locality* : Celebes).

1921. *Leucage celebesiana*, Gravely, *Rec. Ind. Mus.* XXII, p. 454, text-figs. 8 b, c.

1936. *Leucage celebesiana*, Sherriffs, *Hong Kong Nat.* VII, no. 2, spiders III, p. 111.

Material examined.—

INDIA.—Bengal : Darjiling dist., Kalimpong, 20. x. 1939 (1♀). Assam : Shillong, Stream near Polo Ground, 22. ix. 1926 (*R. B. S. Sewell*) (1♀).

Besides the above mentioned localities, specimens from the following localities are also present in the named collection of the Zoological Survey of India :

INDIA.—Assam : Garo-Hills (*Lt. Williamson*).

Measurement.—Body 9 mm. long ; carapace 2.2-5 mm. long.

Distribution.—Ceylon, India, Burma, China and eastwards as far as Celebes.

Genus *Gasteracantha* Sundevall.

(Type, *G. cancriformis* (Linnaeus), America.)

1883. *Gasteracantha*, Sundevall, *Consp. Arachn.* p. 14.

1900. *Gasteracantha*, Pocock, *Faun. Brit. Ind.*, Arach, p. 231.

1921. *Gasteracantha*, Gravely, *Rec. Ind. Mus.* XXII, p. 416.

1940. *Gasteracantha*, Saito, *Res. Bull. Saito Ho-on kai Mus. Sendai*, XVIII, p. 10.

Distribution.—Tropical countries of the world.

¹ 1921. Gravely, F. H. Some Indian Spiders of the Sub-family Tetragnathinae. *Rec. Ind. Mus.* XXII, pp. 423-459, 8 text-figs.

Gasteracantha arcuata (Fabricius.)

1793. *Aranea arcuata*, Fabricius, *Ent. Syst.* II, p. 425, (*Type-locality* : India, Orientali).
 1900. *Gasteracantha arcuata*, Simon, *Ann. Soc. Ent. Fr.* LXXII, p. 301.
 1900. *Gasteracantha arcuata*, Pocock, *Faun. Brit. Ind.*, Arach. p. 232.

Material examined.—

BURMA—Indawgyi Lake : Nyaungbin village, 7-10. xi. 1926 (*B. Chopra*) (1♀).

Besides the above mentioned locality, specimens from the following places are also present in the Zoological Survey of India :

INDIA—Assam : Silicuri ; Sibsagar ; Sylhet Hills : Haraigaj Range, 5,500 ft. (*G. Mackrall*). SIKKIM. BURMA—Pegu (*C. G. Rogers*).

Measurements.—Body 8·5 mm. long and 10 mm. wide ; median spine 27·4 mm. long.

Distribution.—The species is known from India, Sikkim, Burma and Malaysia.

Gasteracantha remifera Butler.

1873. *Gasteracantha remifera*, Butler, *Trans. Ent. Soc. Lond.*, p. 154, t. iv, fig. 5, (*Type-locality* : Ceylon).
 1900. *Gasteracantha remifera*, Pocock, *Faun. Brit. Ind.*, Arach. p. 233, fig. 78.

Material examined.—

ANDAMAN ISLAND—(4♀). NICOBAR ISLANDS—Coco Island (3♀, 1 Juv.) ; Kamorta (2♀).

Measurements.—Body 7·9-8·9 mm. long and 7·5-8·8 mm. wide ; median spine 8·5-12·1 mm. long.

Distribution.—The species is known from Ceylon and Andaman and Nicobar Islands.

Gasteracantha hasseltii Koch.

1838. *Gasteracantha hasseltii*, Koch, *Arch.* IV, p. 29, t. cxvii, fig. 267, (*Type-locality* : Java).
 1900. *Gasteracantha hasseltii*, Pocock, *Faun. Brit. Ind.*, Arach. p. 233.
 1921. *Gasteracantha hasseltii*, Gravely, *Rec. Ind. Mus.* XXII, p. 416.

Material examined.—

BURMA—Indawgyi Lake : village Nyaungbin, 7-10. xi. 1926 (*B. Chopra*) (1♀).

Besides the above mentioned locality, named specimens from the following places are also present in the Zoological Survey of India :

INDIA—Cochin State : Kavalai, 1,300 ft. (*F. H. Gravely*), Trichur, 0-300 ft. (*F. H. Gravely*). Madras State : Ganjam dist., Gopalpur (*Maj. Bennett*). Orissa : Barkul, 0-1,000 ft. (*F. H. Gravely*), Barkuda Island (*F. H. Gravely*) ; Bengal : Darjiling dist., Kalimpong, 2,000-4,500 ft. (*S. W. Sutherland*) ; Calcutta. Assam : Sonarpur (*S. W. Middleton*). SIKKIM. BURMA—Tenasserim ; Tavoy.

Measurements.—Body 7·9 mm. long, 8 mm. wide, median spine 3·7 mm. long.

Distribution.—The species is known from India, Sikkim and Burma.

***Gasteracantha geminata* (Fabricius).**

1798. *Aranea geminata*, Fabricius, *Suppl. Ent. Syst.* p. 292 (*Type-locality* : India-Orientali).
 1900. *Gasteracantha geminata*, Pocock, *Faun. Brit. Ind.*, Arach. pp. 232, 234 fig. 79.

***Material examined.*—**

INDIA—Courtallum, xi. 1921 (*M. O. T. Iyengar*) (4♀).

Besides the above mentioned locality, specimens from the following places are also present in the named collection of the Zoological Survey of India :

CEYLON—Peradeniya ; Matale (*S. White*) ; Luduganga (*S. White*).

INDIA—Cochin State : Chalakudi (*F. H. Gravely*), Prambikulam 1,700-3,200 ft. (*F. H. Gravely*). Mysore State : Coorg (*T. B. Fletcher*).

Measurements.—Body 4.8-5.7 mm. long and 6.4-8.5 mm. broad.

The species is known from Ceylon and India.

***Gasteracantha leucomelaenas* (Doleschall).**

1859. *Plectana leucomelas*, Doleschall, *Verh. Nat. Vereen. Nederland Indië* V, no. 5, p. 42, t. xi, fig. 8 (*Type-locality* : Java).
 1900. *Gasteracantha leucomelaena*, Pocock, *Faun. Brit. Ind.*, Arach. p. 235.
 1940. *Gasteracantha leucomelaena*, Saito, *Rec. Bull. Saito Ho-on Kai Mus. Sendai*, XVIII, p. 10.

***Material examined.*—**

ANDAMAN ISLAND—Rutland Island, 17. xii. 1932 (1♀).

Besides the above mentioned locality, named specimens from the following places are also present in the Zoological Survey of India :

INDIA—Orissa : Barkul, 0-1,000 ft. (*F. H. Gravely*). Bihar : Siripur (*Mackenzie*). Bengal : Darjiling dist., Kalimpong, 2,000-4,500 ft. (*S. W. Sutherland*) ; Pashok (*F. H. Gravely*) ; Soom, 300-3,500 ft. (*F. H. Gravely*) ; Gopaldhara (*H. Stevens*) ; Sureil, 5,000 ft. (*N. Annandale & F. H. Gravely*) ; Tindharia (*Mrs. Drake*) ; Labdan, 3,000 ft. (*F. H. Gravely*) ; Calcutta (*F. H. Gravely*). Assam : Assam-Bhutan frontier (*S. Kemp*) ; Silicuri (*J. Wood-Mason*) ; Garo-Hills (*Lt. Williamson*). BURMA : Lashio, 3,000 ft. (*T. B. Fletcher*) ; Pegu ; Maymyo (*Maj. Bennett*) ; Tavoy ; Moulmein. NICOBAR ISLANDS, Camorta.

Measurements.—Body 3.6 mm. long and 5.2 mm. broad ; median spine 1.4 mm. long.

Distribution.—The species is already known from India, Burma, Andaman and Nicobar Islands, Malaysia and Japan.

***Gasteracantha brevispina* (Doleschall).**

1857. *Plectana brevispina*, Doleschall, *Nat. Tijdschr. Nederland Indië*, XIII, p. 423 (*Type-locality* : Amboina, Molucca).
 900. *Gasteracantha brevispina*, Pocock, *Faun. Brit. Ind.*, Arach. p. 235.
 1921. *Gasteracantha brevispina*, Gravely, *Rec. Ind. Mus.* XXII, p. 416, pl. xix, figs. 7-14.
 1933. *Gasteracantha brevispina*, Saito, *Trans. Sapporo Nat. Hist. Soc.* XIII, pl. 1, p. 56.

Material examined.—

INDIA—Orissa : Barkuda Island, 20. iii. 1924 (*N. Annandale*) (1♀).

Besides the above mentioned locality, named specimens from the following places are also present in the Zoological Survey of India :

CEYLON : Colpetty (*Henry Coll.*). INDIA—Bombay State : Bombay. Orissa : Barkul, 0-1,000 ft. (*F.H. Gravely*) ; Bhubaneshwar (*F H. Gravely*). Bihar : Pusa (*F H. Gravely*) ; Purulia. Bengal : Darjiling dist., Kalimpong, 600-4,500 ft. (*S. W Sutherland*), Pashok, 3,000 ft. (*F H. Gravely*), Gopaldhara (*H. Stevens*) ; Calcutta, Durgapur. SIKKIM. NICOBAR ISLAND. Kamorta (*M. Bonnig*).

Measurements.—Body 5.3 mm. long and 6.7 mm. broad, median spine 1.4 mm. long.

Distribution.—The species is already known from Ceylon, India, Pakistan, Burma, Andaman and Nicobar Islands and Austro-Malaysia and Japan.

Genus *Araneus* Clerck.

(Type, *A. diadematus* Clerck.)

- 1757. *Araneus*, Clerck, *Aranei Suecici*, p. 25.
- 1900. *Araneus*, Pocock, *Faun. Brit. Ind.*, Arach. p. 223.
- 1921. *Araneus*, Gravely, *Rec. Ind. Mus.* XXII, p. 414.
- 1936. *Araneus*, Dyal, *Bull. Dept. Zool. Panjab Univ., Lahore*, I, p. 177.

Distribution.—Tropical and temperate countries of the world.

Araneus dehaanii (Doleschall).

- 1959. *Epeira dehaanii*, Doleschall, *Verh. Nat. Vereen. Nederland Indië*, Y, no. 5, p. 33, t. ii, fig. 7 (Type-locality : Amboina, Molucca).
- 1900. *Araneus dehaanii*, Pocock, *Faun. Brit. Ind.*, Arach. p. 225, fig. 72
- 1935. *Araneus dehaanii*, Sherriffs, *Hong Kong Nat.* VI, no. 2, p. 99.
- 1938. *Araneus dehaanii*, Roewer, *Belg. Hors Ser.* 3, fas. 19, p. 38.

Material examined.—

INDIA—Bengal : Gorla, near Calcutta, 16. ii. 1950 (*Bole Gowda*) (1♀).

Besides the above mentioned locality, named specimens from the following places are also present in the Zoological Survey of India :

CEYLON. INDIA—Cochin State : Prambikulam, 1,700—3,200 ft. (*F H Gravely*). Mysore State : Coorg, Pollibetta (*T B. Fletcher*). Bengal : Darjiling dist., Kalimpong, 2,000—4,500 ft. (*S. W Sutherland*), Pashok, 3,500 ft. (*F H. Gravely*), Singla, 1,500 ft. (*Carmichael's Coll.*), Gopaldhara (*H. Stevens*) ; Serampur (*Mrs. Drake*) ; Salt lakes, Durgapur (*F H. Gravely*). Assam : Garo-Hills (*Godwin-Austin*). SIKKIM. BURMA—Moulmein. MALAYA PENINSULA—Penang.

Measurements.—Body 23 mm. long ; carapace 6.3 mm. long.

Distribution.—The species is known from Ceylon, India, Sikkim, Burma, Malaya Peninsula and Austro-Malaysia.

Genus *Cyrtophora* Simon.

(Type, *C. citricola* (Forskål), cairo, Egypt.)

- 1864. *Cyrtophora*, Simon, *Hist. Nat. Ar.* 2, p. 261.
- 1921. *Cyrtophora*, Gravely, *Rec. Ind. Mus.* XXII, p. 413.
- 1936. *Cyrtophora*, Dyal, *Bull. Dept. Zool. Punjab Univ., Lahore*, I, p. 174.

Distribution.—Tropical and sub-tropical countries of the world.

***Cyrtophora moluccensis* (Doleschall).**

1857. *Epeira moluccensis*, Doleschall, *Nat. Tijdschr. Nederland Indië* XIII, p. 418 (*Type-locality* : Amboina, Molucca).
 1900. *Araneus moluccensis*, Pocock, *Faun. Brit. Ind.*, Arach. p. 226.
 1919. *Cyrtophora moluccensis*, Strand, *Abh. Senckenb. Ges.* XXXVI, p. 217.

***Material examined.*—**

INDIA—Bengal : Darjiling dist., Kalimpong, 600-4,500 ft. (*S. W Sutherland*) (over 50♀).

Besides the above mentioned locality, named specimens from the following places are also present in the Zoological Survey of India :

INDIA—Mysore State : Coorg, Pollibetta (*T. B. Fletcher*). NEPAL—Soondrijal. ANDAMAN ISLAND. NICOBAR ISLAND (*R. D. Oldham*).

Measurements.—Body 14-24 mm. long ; carapace 4.9-7.2 mm. long.

Distribution.—The species is known from Ceylon, India, Nepal, Burma, Andaman and Nicobar Islands and Austro-Malaysia.

***Cyrtophora citricola* (Forskål).**

1775. *Aranea citricola*, Forskål *Descript. Anim. etc.* p. 86 (*Type-locality* : Cairo, Egypt).
 1900. *Araneus citricola*, Pocock, *Faun. Brit. Ind.*, Arach. pp. 226, 227, fig. 73.
 1936. *Cyrtophora citricola*, Dyal, *Bull. Dept. Zool. Panjab Univ., Lahore*, I, p. 174, pl. xiv, figs. 111-115.

***Material examined.*—**

INDIA—Bombay State : Koyna Valley, Helvak, ca. 2,000 ft., 28-30 v. 1912 (*F. H. Gravely*) (3♀). Bihar : Purulia, 15. x. 1914 (*F. H. Gravely*) (1♀).

Besides the above mentioned localities, specimens from the following localities are also present in the named collection of the Zoological Survey of India :

INDIA—Madhya Pradesh : Nagpur (*T. B. Fletcher*). Bihar : Siripur (*Mackenzie*) ; Pusa (*F. H. Gravely*). Bengal : Darjiling dist., Tindharia : Ranigunj ; Serampur (*Mrs. Drake*). BURMA—S. Shan States : Yawnghwe ; Hsamonghkam, 4,000-4,500 ft. (*F. H. Gravely*).

Measurements.—Body 8-11 mm. long ; carapace 3.3-3 mm. long.

Distribution.—The species is known from Ceylon, India, Pakistan, Burma, Australia, Madagascar, Africa and S. Europe.

***Cyrtophora cicatrosa* (Stoliczka).**

1869. *Epeira (Nephila?) cicatrosus*, Stoliczka, *Journ. As. Soc. Bengal* XXXVIII, p. 242, t. XX, fig. 5 (*Type-locality* : Calcutta).
 1900. *Araneus cicatrosus*, Pocock, *Faun. Brit. Ind.*, Arach. p. 226.
 1921. *Cyrtophora cicatrosa*, Gravely, *Rec. Ind. Mus.* XXII, p. 413.
 1936. *Cyrtophora cicatrosus*, Dyal, *Bull. Dept. Zool. Panjab Univ., Lahore*, I, p. 175.

***Material examined.*—**

INDIA—Bengal : Calcutta, Beliaghata, opposite Sealdah railway station, 8. i. 1950 (*T. B. Sinha*) (3♀).

Measurement.—Body 5.7 mm. long ; carapace 1.2-1.5 mm. long.

Distribution.—The species is known from India, Pakistan, Burma and Austro-Malaysia.

Cyrtophora exanthematicus (Doleschall).

1859. *Epeira exanthematicus*, Doleschall, *Verh. Nat. Vereen. Nederland. Indic* V, no. 5, p. 38, t. iii, fig. 3 (*Type-locality* : Amboina, Molucca).
 1900. *Araneus exanthematicus*, Pocock, *Faun. Brit. Ind.*, Arach. p. 227.

Material examined.—

INDIA—Bengal : Darjiling dist., Gopaldhara, 1916 (*H. Stevens*) (1♀).

Measurement.—Body 10 mm. long ; carapace 2.3 mm. long.

Distribution.—The species is known from India, Burma, and Austro-Malaysia.

Genus Cyclosa Menge.

(*Type, C. conica* (Pallas), Germany).

1866. *Cyclosa*. Menge, *Preusa. Spinn.* I, p. 73.
 1921. *Cyclosa*, Gravely, *Rec. Ind. Mus.* XXII, p. 413.
 1936. *Cyclosa*, Dyal, *Bull. Dept. Zool. Panjab Univ., Lahore* I, p. 191.
 1938. *Cyclosa*, Roewer, *Mem. Mus. Hist. Nat. Belg. Hors. Ser. III*, fasc. 19, p. 37.

Distribution.—Tropical and temperate countries of the world.

Cyclosa insulana (Costa).

1834. *Epeira insulans*, Costa, *Cenni. Zool. etc.* p. 65 (*Type-locality* : Island of Ischia and Procida, Italy).
 1921. *Cyclosa insulana*, Gravely, *Rec. Ind. Mus.* XXVI, p. 413.
 1938. *Cyclosa insulana*, Roewer, *Mem. Mus. Hist. Nat. Belg. Hors. Ser. III*, fasc. 19, p. 37.

Material examined.—

INDIA—Bihar : Siripur, viii. 1913 (*Mackenzie*) (over 20♀). Assam : Jaintia-Hills, Mawlyngkneng, 1. xii. 1930 (*H. S. Rao*) (3♀).

Besides the above mentioned localities, named specimens from the following places are also present in the Zoological Survey of India :

CEYLON—Colombo (*Henry Coll.*). INDIA—Cochin State : Prambikulam, 1,700—3,200 ft. (*F H. Gravely*), Trichur, 0-3,000 ft. (*F H. Gravely*). Nilgiri Hills : Coonoor. Orissa : Barkul, 0-1,000 ft. (*F H. Gravely*) Bhubaneshwar (*F H. Gravely*) ; Barkuda Island (*N. Annandale & F. H. Gravely*). Bihar : Chota Nagpur, Purulia (*N. Annandale & F. H. Gravely*) ; Pass between Chaibassa and Chakardharpur (*F H. Gravely*) ; Dinapur (*Caunter*) ; Pusa (*T B. Fletcher*). Bengal : Serampur (*Mrs. Drake*) ; Darjiling dist., Kalimpong, 2,000-4,500 ft. (*S. W Sutherland*), Argarra above Teesta, 1,000 ft. (*S. W Sutherland*), Pashok, 3,500 ft. (*F. H. Gravely*), Soom, 3,000—3,500 ft. (*F H. Gravely*), 4,000-5,000 ft. (*F H. Gravely*), Ghumti, 1,500—5,000 ft. (*Carmichael's Coll.*), Suriel, 5,000 ft. (*N. Annandale & F. H. Gravely*), Lebong, 6,000-6,600 ft. (*F H. Gravely*), Tindharia (*Mrs. Drake*), Birch Hills (*Carmichael's Coll.*) ; Salt lakes, near Durgapur (*F H. Gravely*). NEPAL VALLEY—4,500-6,500 ft. (*Manners-Smith*). BURMA—S. Shan States : Kalaw, ca. 4,000-4,500 ft. (*F H. Gravely*).

Measurements.—Body 6-7.3 mm. long ; carapace 1.8-2.2 mm. long.

Distribution.—The species is known from Ceylon, India, Nepal and Burma.

Genus **Ordgarius** Keyserling.(Type, *O. monstrosus*, Keyserling, Peak Downs, Australia).1886. *Ordgarius*, Keyserling, *Arach. Austral.* p. 114.1900. *Ordgarius*, Pocock, *Faun. Brit. Ind.*, *Arach.* p. 230.*Distribution*.—India and Australia.**Ordgarius hobsoni** (Cambridge).1877. *Cyrtarachne hobsoni*, Cambridge, *Proc. Zool. Soc. Lond.*, p. 562, pl. lvi, fig. 3 (*Type-locality* : Bombay, India).1900. *Ordgarius hobsoni*, Pocock, *Faun. Brit. Ind.*, *Arach.* p. 230, fig. 76.*Material examined*.—INDIA—Bihar : Siripur (*Mackenzie*) (1♀).*Measurements*.—Abdomen 3·9 mm. long and 4·9 mm. broad ; carapace 1·6 mm. long.*Distribution*.—The species is previously known from Ceylon and India (Bombay) and is now being recorded from Siripur, Bihar.Genus **Poltys** Koch.(Type, *P. illepidus*, Koch, Ostinsien, Singapore, Bintang).1843. *Poltys*, Koch, *Arach.* X, p. 97.1900. *Poltys*, Pocock, *Faun. Brit. Ind.*, *Arach.* p. 235.*Distribution*.—Ethiopian, Oriental, and Australian regions.**Poltys illepidus** Koch.1843. *Poltys illepidus*, Koch, *Arach.* X, p. 97, fig. 821 (*Type-locality* : Ostindien Singapore, Bintang).1900. *Poltys illepidus*, Pocock, *Faun. Brit. Ind.*, *Arach.* p. 236.*Material examined*.—INDIA—Bihar : Siripur (*Mackenzie*) (1♀). Bengal : Serampur, 1918-19 (*Mrs. Drake*) (1♀).*Measurements*.—Body 14-15 mm. long ; carapace 5·6 mm. long.*Distribution*.—The species is known from Ceylon, India and Austro-Malaysia.

REMARKS ON GEOGRAPHICAL DISTRIBUTION.

Of the thirty-four species dealt with in this paper all are found in the Indian region with the exception of *Argiope undulata* Thorell from Burma and Malaya, and *Gasteracantha remifera* Butler from the Nicobar Islands. One species, viz. *Nephila clavata* Koch, appears to be mainly palaearctic and is distributed in Persian Baluchistan, North-East India, Burma, Siam, Japan, but not in Peninsular India and Ceylon. Twenty-six species are recorded from Peninsular India and other regions as follows : *Argiope anasuja* Thorell is widely distributed in Ceylon and India (including North-Western and North-Eastern parts) ; *Argiope lobata* (Pallas) is so far recorded only from Peninsular India and *Gasteracantha geminata* (Fabricius) is known from Peninsular India as well as Ceylon. *Nephila malabarensis* (Walckenaer) and *Cyrtophora moluccensis* (Dole-schall) occur in Ceylon, Peninsular India, Burma and Austro-Malaysia

while they have not yet been recorded from other parts of India. *Argiope lalita* Sherriffs and *A. kalimpongensis* sp. nov. are common to Peninsular and North-East India. Eight other species, viz. *Tetragnatha gracilis* (Stoliczka), *T. mandibulata* Walckenaer, *Gasteracantha leucomelaena* (Doleschall), *G. brevispina* (Doleschall), *Nephila maculata* (Fabricius), *Ordgarius hobsoni* (Cambridge), *Cyclosa insulana* (Costa) and *Poltys illeptidus* Koch, occur in Peninsular as well as the Northern plains of India; of these all except *G. leucomelaena*, are also found in Ceylon, while four of them viz. *N. maculata*, *T. mandibulata*, *T. gracilis* and *G. brevispina*, are further known from Burma and Austro-Malaysia. *Tetragnatha mackenziei* Gravely and *Gasteracantha hasselti* Koch occur in Peninsular and North-East India, and Burma, but not in North-West India. *Tetragnatha listeri* Gravely, besides occurring in the foregoing three regions, also occurs in Ceylon and Malaya. Five other species, viz. *Argiope catenulata* (Doleschall), *Herennia ornatissima* (Doleschall), *Araneus dehaanii* (Doleschall), *Leucage celebesiana* (Walckenaer) and *Argiope pulchella* Thorell, have wider distribution and are common to Ceylon, Peninsular and North-East India, Burma and Austro-Malaysia, while *Argiope pulchella* also occurs in North-West India. *Cyrtophora cicatrosa* (Stoliczka) is known from the above mentioned regions excepting Ceylon.

Two species, viz. *Cyrtophora citricola* (Forskål) and *Argiope arcuata* Simon, from Ceylon, India, Burma and Austro-Malaysia have also been recorded from Cairo and Aden respectively.

Of the remaining five species *Argiope pradhani*, sp. nov., is described from Northern India; *Argiope shillongensis*, sp. nov. and *Tetragnatha fletcheri* Gravely are recorded from North-East India. *Gasteracantha arcuata* (Fabricius) and *Cyrtophora exanthematicus* (Doleschall) are found in North-East India, Burma and Malaya.

From the foregoing it is evident that most of the species under study occur in Peninsular India as well as Ceylon, Burma and Malaya. Some of the species which are known from one or more of the above mentioned localities are even more widely distributed in the east as far as the Celebes and the Australian region.

Corrigenda.

- Page 96. last line from bottom, for "audal pit" read "caudal pit".
- Page 103. in the explanation of text-fig.4, line 3 for "*guagga*" read "*quagga*".
- Page 113. in the key to families of order Rajiformes, line 12, under serial no. 9, for "without a prominent snout" read 'with a prominent snout'.
- Page 114. 5th line from top, for "Nostrials" read "Nostrils".
- Page 115. in the key to the species, under serial no 7, line 3, for "and the twice" read 'and twice'.
- Page 120. 4th line from top, for "qudrangular" read 'quadrangular'.
- Page 125. Under genus *Gymnura*, line 3, for "5 pairs gill-openings" read "5 pairs of gill-openings".
- Page 130. Under genus *Manta*, line 11, for "Pninsula" read "Peninsula".
- Page 137. in the explanation of text-fig. 25, line 1, for 'marin' read "marine" and in the map, for "cobar" read 'Nicobar'.

AN AID TO THE IDENTIFICATION OF THE FISHES OF INDIA, BURMA AND CEYLON. I. ELASMOBRANCHII AND HOLOCEPHALI.

By K. S. MISRA, D.Sc., F.Z.S., F.Z.S.I., Assistant Superintendent
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INTRODUCTION.

On the completion of the first part of the "Check List" series dealing with Elasmobranchii and Holocephali of India, Burma and Ceylon it was felt that if a suitable dichotomous key for the identification of these groups of fishes could be published it would prove immensely useful to workers on Fish and Fisheries. In recent years much attention has been paid to sharks, skates and rays on account of the large quantities of oil which their livers yield and in order to standardise the oil known for its rich vitamin contents, it is essential that the taxonomy of these groups of fish is made well known. This work, which was subsequently taken up and is now being presented as "An Aid to the identification of the Fishes of India, Burma and Ceylon. I. Elasmobranchii and Holocephali", has been modelled after Part I of the "Check List" series.¹

The preparation of the key is based on the examination of a large series of examples of cartilaginous fishes consisting of both the type and collateral specimens preserved in the collections of the Zoological Survey of India and on the observations and morphological data gathered on these groups of fishes during my five years' continuous stay in the Andaman Islands in connection with the Andaman Fisheries when I had abundant facilities to examine large fresh specimens of elasmobranchs from the catches of the local fisherman and the Japanese divers who then had the fishing license in the Andaman and Nicobar waters for the collection of button-shells. Besides, no efforts have been spared during its preparation in carefully sifting through relevant literature and comparing notes. The key, however, is purely regional in its application and deals only with species occurring in India, Burma and Ceylon.

In drawing up the key I have for the most part restricted myself only to the external and easily recognisable characters in differentiating the various Indian elasmobranchs and chimaeras. The key is thus naturally artificial and not phylogenetical.

The following explanations regarding the terms used in the paper seem necessary as the body-form and external characters of the sharks, skates, rays and chimaeras differ remarkably from one another as well as from the bony fishes.

1. *Trunk* is measured from the tip of snout to the vent.
2. *Length of disk* (in ray-like forms) is measured from the tip of snout to the hind edges of the expanded pectorals.

¹Misra, K. S., *Rec. Ind. Mus.* XLV, pp. 1-46 (1947).

3. *Length of head* is measured from the tip of snout to the anterior edge of the first gill-openings (except in the case of chimaeras in which the length of head is measured as in the bony fishes).

4. *Preoral* length is measured from tip of snout to the mouth.

5. *Internarial width* is measured from the inner edge of one nostril to that of the corresponding one on the opposite side.

In the preparation of this paper I have made use of the vast literature on the subject a complete reference to which may be had from the "Check List" Part I. Regarding illustrations those copied from other works are duly acknowledged in the legends of the figures.

The limits of the area of which the elasmobranchs and chimaeras are mentioned in the key have been defined by Dr. B. N. Chopra in the Foreword of the "Check List" Part I.

A map, however, is appended demarcating the boundaries clearly by means of dotted line.

I am very grateful to Mr. M. A. S. Menon, M.Sc., Technical Assistant, Zoological Survey of India for kindly going through the manuscripts.

Calcutta,

1st October, 1950.

K. S. MISRA.

KEY TO THE INDIAN SHARKS, SKATES, RAYS AND CHIMAERAS.

1. Single gill-opening on either side : teeth united to form grinding plates or tritors	Class HOLOCEPHALI: Order CHIMAERIFORMES (Chimaeras, p. 134).	71.
2. 5-7 gill-openings on either side : teeth distinct	Class ELASMOBRANCHII : Sub-class <i>SELACHI</i> (Sharks, p. 96, Skates, p. 113 & Rays, p. 119)	3.
3. Gill-openings ventral	Superorder BATOIDEI : Orders RAJIFORMES & TORPEDINIFORMES (Skates & Rays)	55.
4. Gill-openings lateral	Superorder SELACHOIDEI : Orders HEXANCHIFORMES, LAMNIFORMES & SQUALIFORMES (Sharks)	5.
5. One dorsal fin	Order HEXANCHIFORMES : Genus Heptranchias , p. 96 (<i>H. platycephalus</i> , text-fig. 1a-c).	
6. Two dorsal fins		7.
7. Anal fin present	Order LAMNIFORMES	9.
8. Anal fin absent	Order SQUALIFORMES	53.
9. Nictitating membrane present	Suborder <i>SCYLIORHINOIDEI</i>	23.
10. Nictitating membrane absent	Suborder <i>LAMNOIDEI</i>	11.
11. Nasoral grooves present	Family ORECTOLOBIDAE	15.
12. Nasoral grooves absent		13
13. Teeth tricuspid	Family ODONTASPIDAE : Genus Carcharias , p. 99 (<i>C. tricuspidatus</i> , text-fig. 2b-d).	
14. Teeth not tricuspid	Family LAMNIDAE	21

- | | | |
|--|---|-----|
| 15. Nasal cirri present | Subfamily <i>ORECTOLOBINI</i> | 17. |
| 16. Nasal cirri absent | Subfamily <i>RHINODONTINI</i> :
Genus Rhincodon , p. 99
(<i>R. typus</i> , text-fig. 2a). | |
| 17. First dorsal fin behind pelvics . | Genus Chiloscyllium , p. 97 | |
| 18. First dorsal fin opposite pelvics . | | 19. |
| 19. Caudal fin short | Genus Nebrius , p. 98. | |
| 20. Caudal fin elongate | Genus Stegostoma , p. 98 (<i>S. varium</i> , text-fig. 1h-n). | |
| 21. Lateral keel on tail present : upper lobe of caudal fin not produced | Subfamily <i>LAMNINI</i> : Genus Isurus , p. 100. | |
| 22. Lateral keel on tail absent : upper lobe of caudal fin extraordinarily produced | Subfamily <i>ALOPINI</i> : Genus Alopias , p. 99 (<i>A. vulpinus</i> , text-fig. 2e). | |
| 23. Head with oculonarial expansions | Family <i>SPHYRNIDAE</i> : Genus Sphyrna , p. 111. | |
| 24. Head without oculonarial expansions | | 25. |
| 25. Caudal pit absent : first dorsal fin behind or before pelvics. | Family <i>SCYLIORHINIDAE</i> | 27. |
| 26. Caudal pit present : (except in <i>Galeorhinus</i> & <i>Myrmillo</i>) : first dorsal fin before pelvics | Family <i>CARCHARHINIDAE</i> | 33. |
| 27. First dorsal fin before pelvics | Genus Proscyllium ¹ (<i>P. alcocki</i>). | |

¹ Misra, K. S., *Journ. Zool. Soc. India* II, pp. 87-90 (1950).

28. First dorsal fin behind pelvics 29.
29. With labial folds on both jaws . 31.
30. With labial fold on lower jaw only . Subgenus **Scyliorhinus**.
31. Head flatly depressed : teeth pentacuspoid or tricuspid : base of anal fin distinctly longer than the base of second dorsal fin Subgenus **Halaelurus**.
32. Head subcylindrically compressed : teeth always tricuspid : base of anal fin equal to base of second dorsal fin Genus **Atelomycterus**, p. 103.
33. Teeth triangular : single series . . 35.
34. Teeth in bands : more than one series 51.
35. Spiracles present 37.
36. Spiracles absent .. 43.
37. With pit at caudal base .. 39.
38. Without pit at caudal base Genus **Galeorhinus**, p. 110 (*G. omanensis*, text-fig. 7g-h).
39. Teeth monomorphous, serrated in both jaws.. Genus **Galeocerdo**, p. 110 (*G. arcticus*, text-fig. 8a).
40. Teeth dimorphous : smooth in lower jaw . 41.
41. Teeth erect, not curved inwards Genus **Hemigaleus**, p. 108 (*H. balfouri*, text-fig. 7f).
42. Teeth curved inwards Genus **Hemipristis**, p. 109 (*H. elongatus*).
43. Teeth with smooth edges 45.

44. Teeth with roughened edges 49.
45. Teeth with swollen bases Genus **Physodon**, p. 104 (*P. mulleri*).
46. Teeth without swollen bases 47.
47. Teeth with oblique cusps Genus **Scoliodon**, p. 105.
48. Teeth with erect cusps. Genus **Aprionodon**, p. 106 (*A. acutidens*, text-fig. 5f).
49. Teeth serrated at bases and cusps (in the upper jaw) Genus **Carcharhinus**, p. 107.
50. Teeth serrated on bases only (in the upper jaw). Genus **Hypoprion**, p. 106.
51. Subcaudal produced : spiracles absent : snout short, rounded Genus **Triænodon**, p. 111 (*T. obesus*, text-fig. 8f-g).
52. Subcaudal not produced : spiracles present : snout produced, pointed Genus **Myrmillo**, p. 111 (*M. manazo*, text-fig. 8b-c).
53. Teeth unicuspid Genus **Centrophorus**, p. 112 (*C. rossi*, text-fig. 9c-f).
54. Teeth multicuspid Genus **Centroscyllium**, p. 113 (*C. ornatum*-text, fig. 9g).
55. Electric organs present. Order **TORPEDINIFORMES** :
Family **TORPEDINIDAE**.
56. Electric organs absent. Order **RAJIFORMES** 57.
57. Disk narrow and elongate 59.
58. Disk broad and expanded 63.
59. Rostrum very much produced and saw-like. . Family **PRISTIDAE**.

60. Rostrum very short and not saw-like . 61.
61. Pectorals extending to end of snout: disk broader and more rounded Family DISCOBATIDAE.
62. Pectorals not extending to end of snout: disk narrow and elongate Family RHINOBATIDAE.
63. Tail whip-like, dorsal fins reduced to spines . . . 65.
64. Tail not whip-like, without spines and with 2 small dorsal fins Family RAJIDAE.
65. Head distinct from disk and with a prominent snout . 67.
66. Head not distinct from disk and without prominent snout Family TRYGONIDAE.
67. With horn-like cephalic flippers Family MOBULIDAE.
68. Without horn-like cephalic flippers. . 69.
69. Head bilobed or notched between the rostral fins: rostral fins separate Family RHINOPTERIDAE.
70. Head neither bilobed nor notched between the rostral fins: rostral fins united to form one lobe Family MYLIOBATIDAE.
71. Claspers simple: head with proboscis or beak. Family RHINOCHIMAERIDAE 73.
72. Claspers trifid or bifid: head without proboscis or beak Family CHIMAERIDAE: Genus **Chimaera**, p. 135 (*C. monstrosa*, text-fig. 24c).
73. Snout compressed: upper caudal edge spinose: egg-capsule black, patch of byssus large (14.0 sq. mm.) . Genus **Rhinochimæra**, p. 135 (*Rhinochimæra* sp.).

74. Snout depressed : upper
caudal edge not
spinose : egg-capsule
pale bottle-green,
patch of byssus small
(7.5 sq. mm.)

Genus **Harriotta**, p. 135 (*Harriotta* (?) *indica*).

Class ELASMOBRANCHII.

Subclass *SELACHII*.

Key to superorders of subclass SELACHII.

1. Gill-openings on ventral side.. Superorder BATOIDEI.
2. Gill-openings on lateral side.. Superorder SELACHOIDEI.

Key to orders of superorder BATOIDEI.

1. Electric organs present Order TORPEDINIFORMES.
2. Electric organs absent Order RAJIFORMES.

Key to orders of superorder SELACHOIDEI.

1. One dorsal fin .. Order HEXANCHIFORMES.
2. Two dorsal fins 3.
3. Anal fin absent .. Order SQUALIFORMES.
4. Anal fin present .. Order LAMNIFORMES.

Key to suborders of order LAMNIFORMES.

1. Nictitating membrane present Suborder SCYLIORHINOIDEI.
2. Nictitating membrane absent Suborder LAMNOIDEI.

Order HEXANCHIFORMES.

Family HEXANCHIDAE.

Genus **Heptranchias** Rafinesque.

Body elongate. Snout rounded and obtuse. Eyes without nictitating membrane. Spiracles small. 7 pairs of gill-openings. A single spineless dorsal fin opposite the anal. Lower caudal lobe well developed. No caudal pit. Teeth dimorphic, jagged and cusped in the upper and comb-like in the lower.

Distribution.—Atlantic, Indian and Pacific Oceans.

Heptranchias platycephalus (Tenore), text-fig. 1a-c, is the only species of the genus recorded from India.

Order LAMNIFORMES.

Suborder *LAMNOIDAE*.

Family ORECTOLOBIDAE.

Key to subfamilies of family ORECTOLOBIDAE.

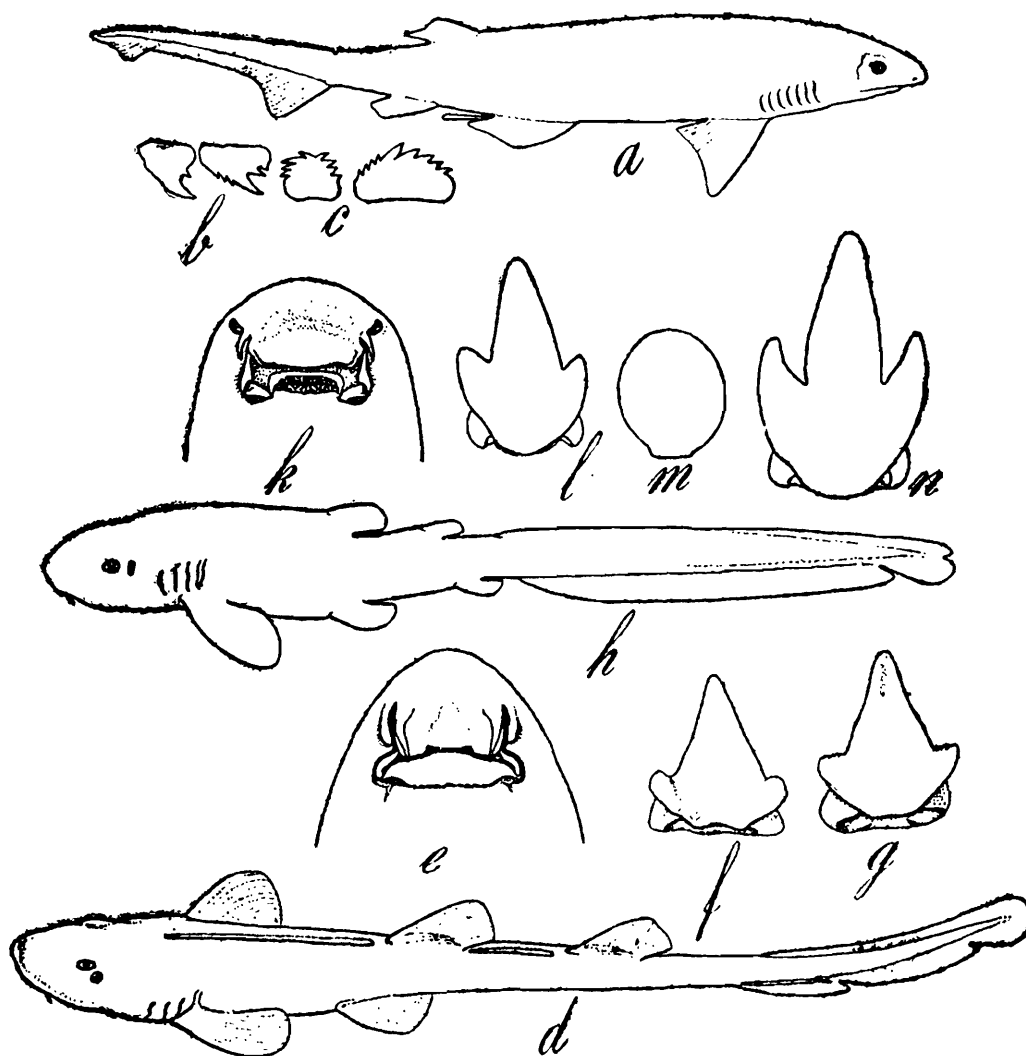
1. Nasal cirri present : body not massive : tail without lateral keels : caudal pit absent.. Subfamily *ORECTOLOBINI*.
2. Nasal cirri absent : body massive : tail with lateral keels : caudal pit present .. Subfamily *RHINEODONTINI*.

Subfamily *ORECTOLOBINI*.*Key to genera of subfamily ORECTOLOBINI.*

1. First dorsal fin behind the pelvics: 1-3 dermal ridges on the back .. Genus **Chiloscyllium** M. H.
2. First dorsal fin opposite the pelvics: without dermal ridges on the back 3.
3. Caudal fin short Genus **Nebrius** Rüpp.
4. Caudal fin long Genus **Stegostoma** M.H.

Subfamily *ORECTOLOBINI*.Genus **Chiloscyllium** M. H.

Body elongate. Trunk shorter than tail. Eyes without nictitating membrane. Nasoral grooves and cirri present. Spiracles below eyes.



TEXT-FIG. 1.—a. Lateral view of *Heptanchias platycephalus* (after Day); b. Upper teeth of same; c. Lower teeth of same; d. *Chiloscyllium griseum*: X $\frac{1}{4}$; e. Ventral view of head of same: X $\frac{3}{4}$; f. Upper teeth of same: X $\frac{1}{4}$; g. Lower teeth of same: X $\frac{1}{4}$; h. Lateral view of *Stegostoma varium*: X $\frac{1}{4}$; i. Ventral view of head of same: X $\frac{1}{2}$; j. Upper teeth of same: X $\frac{1}{4}$; k. Lower teeth of same: X $\frac{1}{4}$; l. Upper teeth of same: X $\frac{1}{4}$; m. Scale of same: X $\frac{1}{4}$; n. Lower teeth of same: X $\frac{1}{4}$.

5 pairs of gill-openings. Two spineless dorsal fins ; first dorsal behind the pelvics. Anal fin present. 1-3 dermal ridges on the back. Teeth small, triangular, with or without lateral cusps.

Distribution.—S. Africa, Red Sea, India, Ceylon, Singapore, East Indies, Indo-China, Formosa, Japan, Philippines, Australia, Melanesia.

Key to the species.

- | | |
|--|---|
| 1. Mouth nearer snout and than the vertical from front eye-edge : a clear large black ocellus just above pectoral fin | <i>C. ocellatum</i> (Bonn.). |
| 2. Mouth nearer the vertical from front eye-edge than snout end : no clear large black ocellus just above pectoral fin | 3. |
| 3. With one dermal ridge on back | 5. |
| 4. With 3 dermal ridges on back | <i>C. indicum</i> (Gmelin). |
| 5. Origin of first dorsal above middle of ventral bases ; body with white spots | <i>C. plagiosum</i> (Benn.). |
| 6. Origin of first dorsal above ends of ventral bases : body with dark spots | <i>C. griseum</i> M. H. (text-fig. 1d-g). |

Genus **Nebrius** Rüpp.

Body elongate with the trunk region spindle-shaped. Snout short. Eyes small without nictitating membrane. Nasoral grooves and cirri present. Spiracles minute, behind eyes. 5 pairs of gill-openings. Two spineless dorsal fins ; the first dorsal fin opposite the pelvics. Anal fin present. Teeth multicuspid.

Distribution.—Madagascar, Red Sea, India, Ceylon, Malay Peninsula, Malay Archipelago, Indo-China, Melanesia, Polynesia.

Key to the species.

- | | |
|---|---------------------------------|
| 1. Teeth in 3 rows : second dorsal fin longer than the anal | <i>N. concolor</i> Rüpp. |
| 2. Teeth more than 3 rows : second dorsal fin smaller than the anal | <i>N. ferrugineum</i> (Lesson). |

Genus **Stegostoma** M. H.

Body slender and elongate. Tail longer than the trunk. Snout obtuse. Eyes small without nictitating membrane. Nasoral grooves and cirri present. Labial folds well developed. Spiracles behind eyes. 5 pairs of gill-openings. Two spineless dorsal fins. Anal fin present. Caudal fin very elongate. Teeth trilobed.

Distribution.—Indian and western Pacific Oceans.

Stegostoma varium (Seba), text-fig. 1h-n, is the only species of the genus found in India and Ceylon.

Subfamily *RHINEODONTINI*.Genus *Rhincodon* Smith.

Body fusiform and massive. Snout broad, flat and short. Eyes very small without nictitating membrane and just behind the mouth. Nasoral grooves and cirri absent. Spiracle small. 5 pairs of gill-openings. Two spineless dorsal fins. Anal fin present. Subcaudal lobe well developed. Several keels along the sides. Caudal pit present. Teeth very small, pointed and numerous.

Distribution.—Tropical Atlantic, S. Africa, Seychelles, India, Ceylon, East Indies, Philippines, Japan, Australia, East Pacific Ocean.

Rhincodon typus Smith, text-fig. 2a, is the only species of the genus found in India and Ceylon. It is the largest shark in the world growing upto 45 feet in length.

Family ODONTASPIDAE.

Genus *Carcharias* Rafinesque.

Body fusiform. Trunk about more than twice the tail. Eyes small without nictitating membrane. Nasoral grooves and cirri absent. Spiracles small, behind eyes. 5 pairs of gill-openings. Two spineless, dorsal fins. Anal fin present. Caudal pit present. Teeth very large awl-shaped, smooth except at base where there exists a basal cusp on either side.

Distribution.—Atlantic Ocean, S. Africa, India, East Indies, Indo-China, Japan, Australia, Tasmania.

Carcharias tricuspidatus Day, text-fig. 2b-l, is the only species of the genus recorded from India.

Family LAMNIDAE.

Key to subfamilies of family LAMNIDAE.

- | | |
|--|----------------------------|
| 1. Lateral keel on tail absent : caudal fin nearly $\frac{1}{2}$ the total length .. | Subfamily <i>ALOPINI</i> . |
| 2. Lateral keel on tail present : caudal fin much less than $\frac{1}{2}$ the total length | Subfamily <i>LAMNINI</i> . |

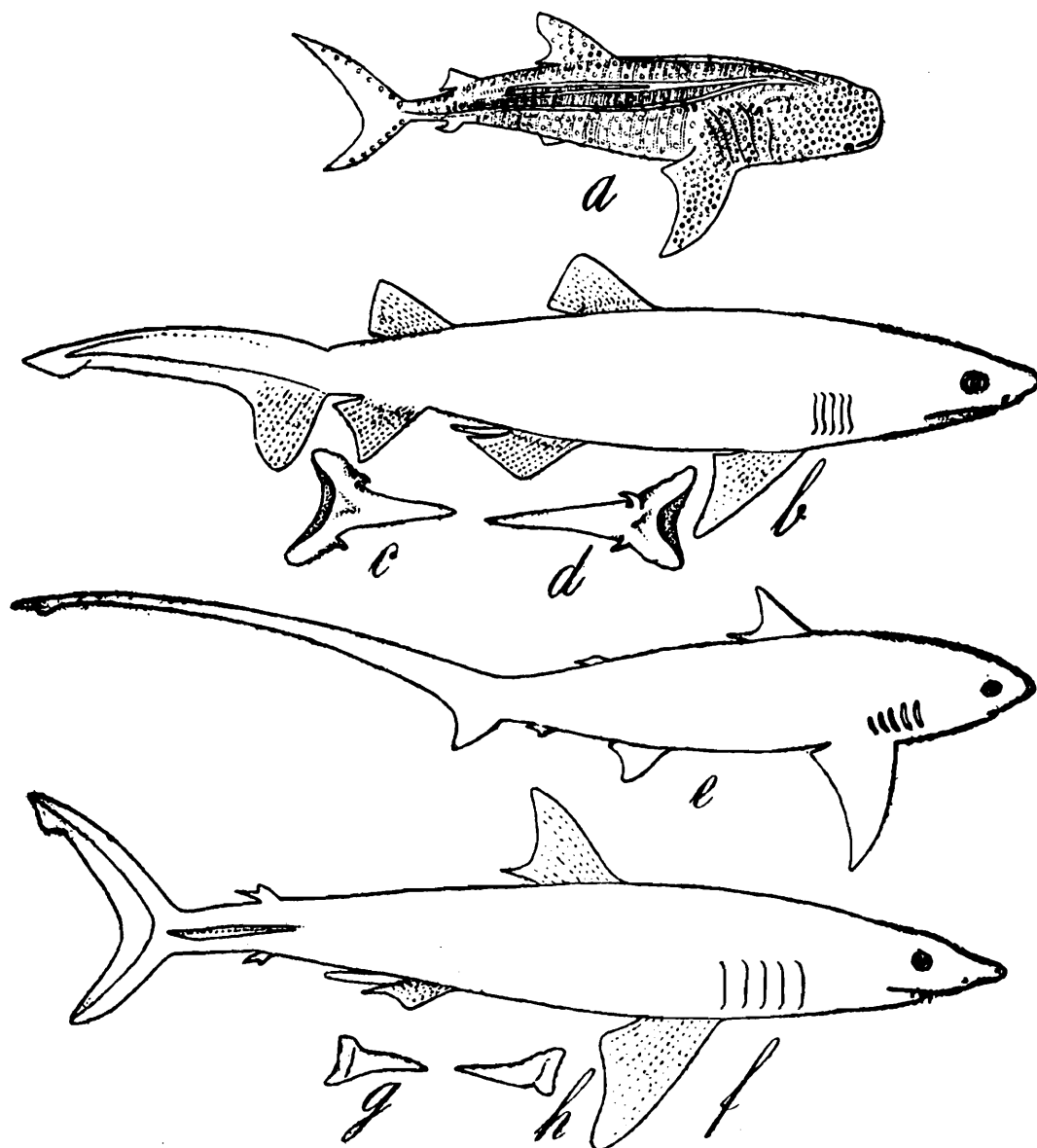
Subfamily *ALOPINI*.Genus *Alopias* Rafinesque.

Body fusiform. Trunk equal to the extraordinarily elongated upper lobe of the caudal fin. Eyes large, without nictitating membrane. Nasoral grooves and cirri absent. Spiracles minute, behind the eyes. 5 pairs of gill-openings. Two spineless dorsal fins; the second dorsal

very small and equal to the anal fin. Caudal pit present. Lateral keel on tail absent. Teeth simple, smooth and sharp-edged.

Distribution.—Atlantic Ocean, Arabia, S. Africa, India, Ceylon, China, Korea, Japan, Australia, New Zealand, Hawaii, Eastern Pacific Ocean.

Alopias vulpinus (Bonn.), text-fig. 2e, is the only species of the genus found in Ceylon.



TEXT-FIG. 2.—a. Lateral view of *Rhincodon typus* (after Smith); b. Lateral view of *Charcharias tricuspidatus*; c. Upper teeth of same; d. Lower teeth of same (after Day); e. Lateral view of *Alopias vulpinus* (after Day); f. *Isurus glauca*; g. Upper teeth of same; h. Lower teeth of same (after Day).

Subfamily LAMNINI.

Genus *Isurus* Rafinesque.

Body fusiform. Snout pointed. Eyes without nictitating membrane. Nasoral grooves and cirri absent. Spiracles minute, above mouth angle.

5 pairs of gill-openings. Two spineless dorsal fins; the second dorsal very small and equal to anal fin. Caudal pit present. Lateral keel on tail present. Teeth long, awl-like, lanceolate, smooth and without basal cusps.

Distribution.—St. Helena, Cape of Good Hope, Red Sea, Arabia, India, East Indies, Indo-China, Japan, Australia, Tasmania, New Zealand, Hawaii, Chile.

Key to the species.

1. Teeth in 24 rows above and 22 below : lateral line keeled only along the side of tail .. *I. glauca* M. H. (text-fig. 2f-h).
2. Teeth in 44 rows above and 56 below : lateral line keeled from behind eye over gill-openings to side of tail *I. guntheri* (Murray).

Suborder SCYLIORHINOIDEI.

Key to families of suborder SCYLIORHINOIDEI.

1. Head with lateral (oculonarial) expansion .. Family SPHYRNIDAE.
2. Head without lateral (oculonarial) expansion 3.
3. Anal fin before second dorsal fin Family SCYLIORHINIDAE.
4. Anal fin opposite second dorsal fin Family CARCHARHINIDAE.

Family SCYLIORHINIDAE.

Key to genera of family SCYLIORHINIDAE.

1. Origin of first dorsal fin before pelvics Genus *Proscyllium* Hilgendorf.
2. Origin of first dorsal fin above or behind pelvics 3.
3. Head depressed : teeth tri-pentacuspoid : base of anal distinctly longer than the base of second dorsal.. Genus *Scyliorhinus* Blainville.
4. Head subcylindrically compressed : teeth tricuspoid : base of anal equal to the base of second dorsal .. Genus *Atelomycterus* Garman.

Genus *Scyliorhinus* Blainville.

Body elongate. Head depressed. Trunk slightly shorter than tail. Snout obtuse, short or elongate. Eyes large with nictitating membrane. Nasoral grooves absent or rudimentary. Nasal cirri absent or present. Mouth wide. Labial folds on both jaws or on lower jaw only. Spiracles present. 5 pairs of gill-openings, narrow, not so wide as the orbit. Two spineless dorsal fins; first dorsal fin behind or above the pelvics. Base of anal fin distinctly longer than the base of second dorsal. Caudal pit absent. Teeth in numerous rows, tri-pentacuspoid.

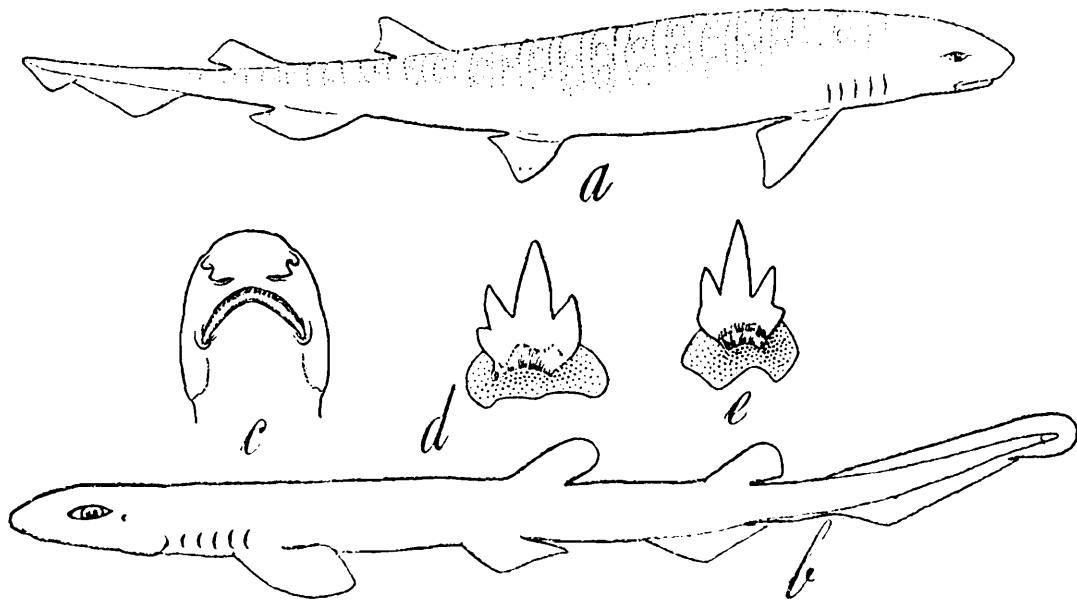
Distribution.—S. and E. Africa, Gulf of Aden, Arabia, Gulf of Oman, India, Andamans, Malay Archipelago, Philippines, Korea, Japan, Australia, S. E. Pacific.

Key to subgenera of genus *Scyliorhinus*.

1. Base of anal fin longer than base of second dorsal fin : labial fold on lower jaw only Subgenus ***Scyliorhinus***
Blainville.
2. Base of anal fin equal to base of second dorsal fin : labial folds on both jaws Subgenus ***Haelurus***
Gill.

Subgenus *Scyliorhinus* Blainville.

Scyliorhinus (*Scyliorhinus*) *capensis* (M. H.), text-fig. 3a, is the only species of the subgenus found in India.



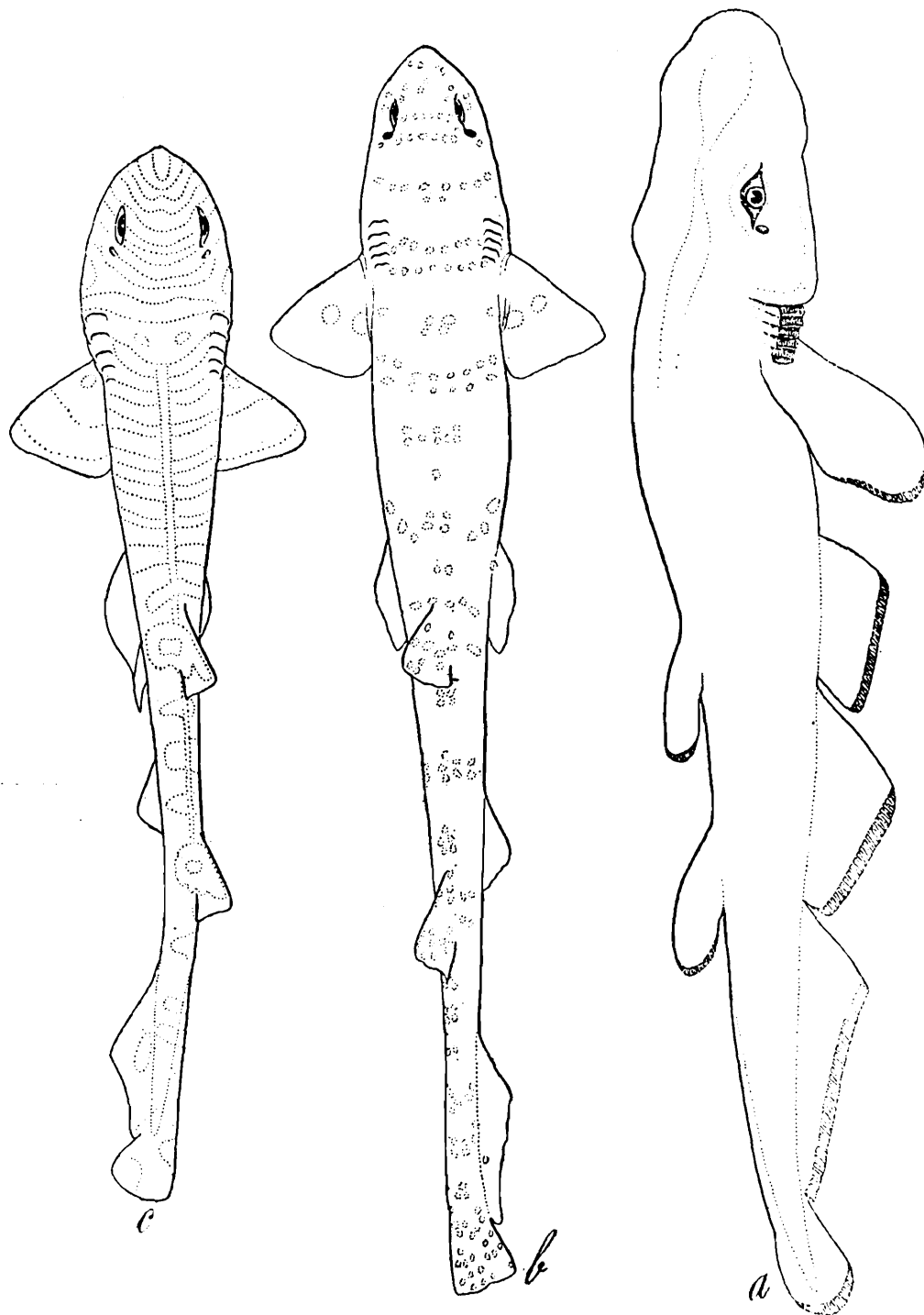
TEXT-FIG. 3.—a. Lateral view of *Scyliorhinus* (*Scyliorhinus*) *capensis* (after Day
b. Lateral view of *Scyliorhinus* (*Haelurus*) *hispidum* : X $\frac{1}{2}$; c. Ventral view of head of
same : X $\frac{1}{2}$; d. Upper teeth of same : X 31 ; e. Lower teeth of same : X 26.

Subgenus *Hemigaleus* Gill.**Key to the species.**

1. First dorsal larger than the second dorsal *Scyliorhinus* (*Haelurus*)
hispidum Alc. (text-fig.
3b-e).
2. First dorsal not larger than the second dorsal 3.
3. First dorsal smaller than the second dorsal : nasal
cirri well developed *Scyliorhinus* (*Haelurus*)
indicus Br. (text-fig. 4a).
4. First dorsal and second dorsal subequal : nasal
cirri absent or rudimentary 5.
5. Origin of first dorsal above the middle of the ventral
bases : transverse bands spotted with black *Scyliorhinus* (*Haelurus*)
burgeri (M. H.) (text-fig.
4b).
6. Origin of first dorsal a little in advance of the hind
ends of ventral bases : transverse bands 20 or
more, not spotted with black *Scyliorhinus* (*Haelurus*)
quagga (Alc.) (text-fig.
4c).

Genus **Atelomycterus** Garman.

Body elongate and slender. Trunk shorter than tail. Eyes large : orbit oblong ; nictitating membrane present. Nasoral grooves present ; cirri absent. Spiracles small, close behind eyes. Labial folds



TEXT-FIG. 4.—*a.* Lateral view of *Scyliorhinus* (*Haelurus*) *indicus* (after Lloyd); *b.* Lateral view of *Scyliorhinus* (*Haelurus*) *burgeri* (after Müller & Henle); *c.* Lateral view of *Scyliorhinus* (*Haelurus*) *guagga* (after Alcock).

well developed. 5 pairs of gill-openings. Two spineless dorsal fins ; first dorsal fin behind the ventrals. Base of anal fin equal to the base of second dorsal. Caudal pit absent. Teeth small, tricuspid, median cusp the longest.

Distribution.—Ceylon, India, Malay Peninsula, Malay Archipelago, Siam, Indo-China, Philippines.

Atelomycterus marmoratum (Benn.), text-fig. 5a, is the only species of the genus found in India and Ceylon.

Genus *Proscyllium* Hilgendorf.

Body slender and elongate. Trunk shorter than tail. Snout rounded. Eyes large with rudimentary nictitating membrane. Nasoral grooves and cirri absent. Labial folds rudimentary. Spiracles small, close behind eyes. 5 pairs of gill-openings. Two spineless dorsal fins; first dorsal fin before the pelvics. Anal fin long. Caudal pit absent. Teeth dimorphous on the upper jaw; tetramorphous on the lower jaw.

Distribution.—India, Formosa, Japan.

Proscyllium alcocki Misra, is the only species of the genus found in India.

Family CARCHARHINIDAE.

Key to genera of family CARCHARHINIDAE.

- | | |
|---|---------------------------------------|
| 1. Spiracles present | 3. |
| 2. Spiracles absent | 11. |
| 3. Caudal pit absent | 5. |
| 4. Caudal pit present | 7. |
| 5. Teeth polyserial, pavement-like | Genus <i>Myrmillo</i> Gistel. |
| 6. Teeth neither polyserial nor pavement-like | Genus <i>Galeorhinus</i> Blainville. |
| 7. Teeth dimorphous: lower smooth .. | 9. |
| 8. Teeth monomorphous: lower serrated on both edges | Genus <i>Galeocerdo</i> M.H. |
| 9. Lower teeth erect, not curved inwards | Genus <i>Hemigaleus</i> Blkr. |
| 10. Lower teeth curved inwards | Genus <i>Hemipristis</i> Agassiz |
| 11. Teeth polyserial, in bands | Genus <i>Triaenodon</i> M.H. |
| 12. Teeth monoserial, not in bands | 13. |
| 13. Teeth with smooth edges | 15. |
| 14. Teeth with roughened edges | 19. |
| 15. Teeth with swollen bases | Genus <i>Physodon</i> M.H. |
| 16. Teeth without swollen bases | 17. |
| 17. Teeth with oblique cusps | Genus <i>Scoliodon</i> M. H. |
| 18. Teeth with erect cusps | Genus <i>Aprionodon</i> Gill. |
| 19. Teeth serrated both on bases and cusps (in the upper jaw) | Genus <i>Carcharhinus</i> Blainville. |
| 20. Teeth serrated at their bases only (in the upper jaw) | Genus <i>Hypoprion</i> M. H. |

Genus *Physodon* M.H.

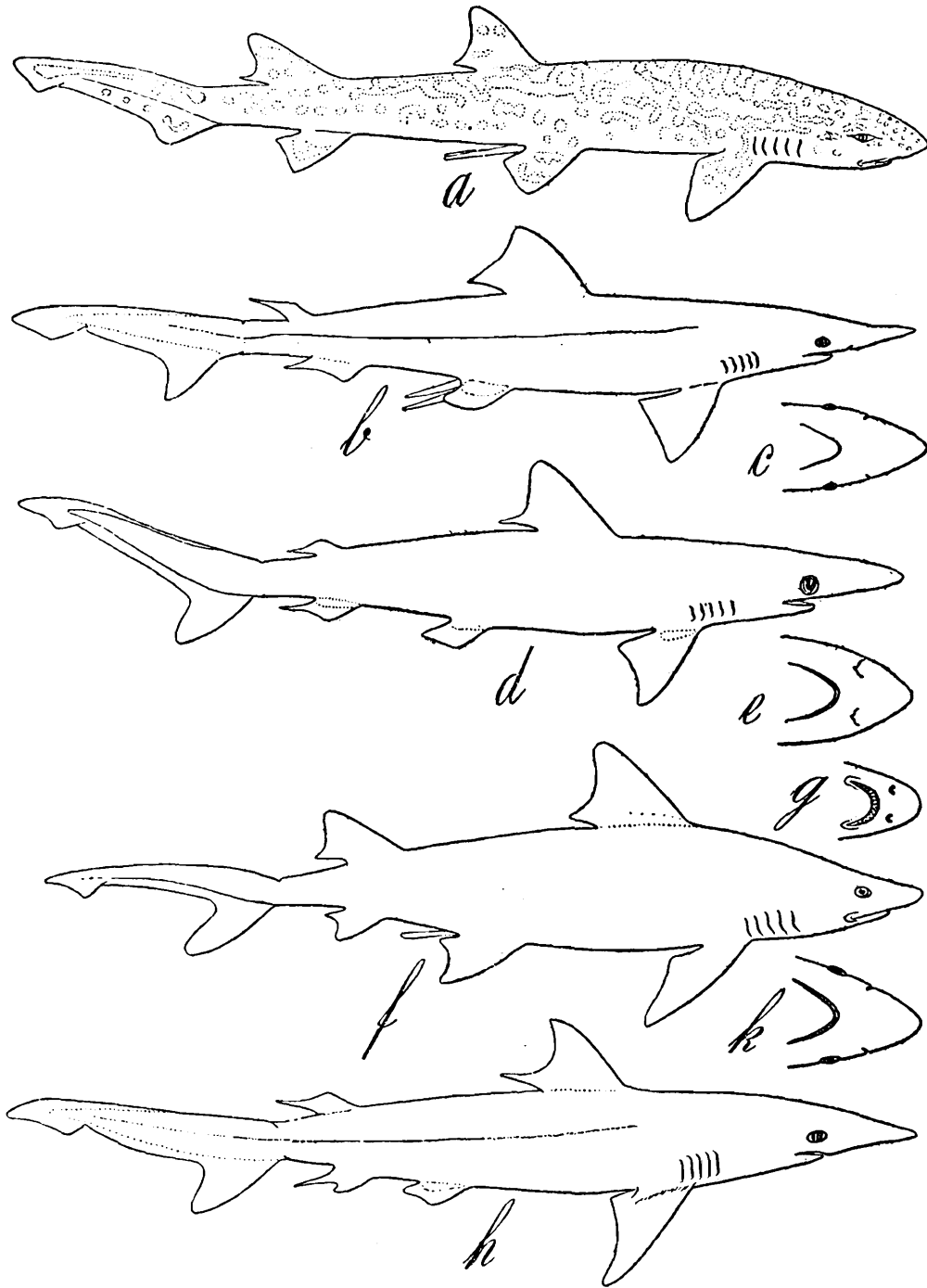
Body elongate and slender. Trunk nearly equal to tail. Snout elongate and pointed. Eyes small with nictitating membrane. Labial folds only on the lower jaw. Nasoral grooves and cirri absent. Spiracles absent. 5 pairs of gill-openings. Two spineless dorsal fins. Anal fin present. Caudal pit present. Teeth smooth, the central ones smaller than those at the side, which bear swollen bases with oblique and narrow cusps.

Distribution.—India, China, Australia.

Physodon mulleri M. H., is the only species of the genus found in India.

Genus **Scoliodon** M.H.

Body elongate and slender. Trunk nearly equal to tail. Snout elongate and pointed. Eyes moderate with nictitating membrane.



TEXT-FIG. 5.—a. Lateral view of *Atelomycterus marmoratum* (after Day) ; b. Lateral view of *Scoliodon sorokowah* ; c. Ventral view of head of same (after Day) ; d. Lateral view of *Scoliodon palasorrah* ; e. Ventral view of head of same (after Day) ; f. Lateral view of *Aprionodon acutidens* ; g. Ventral view of head of same (after Day) ; h. Lateral view of *Hypoprion macloiti* M. H. ; k. Ventral view of head of same (after Day).

Nasoral grooves and cirri absent. Labial folds on both the jaws. Spiracles absent. 5 pairs of gill-openings. Two spineless dorsal fins.

Anal fin present. Caudal pit present. Teeth with smooth edges; all oblique and without swollen bases.

Distribution.—South Africa, Red Sea, Arabia, Mekran, India, Ceylon, Burma, Malay Peninsula, Java, Indo-China, Formosa, Japan, Philippines

Key to the species.

1. Labial fold extending to the upper jaw :
 $\begin{array}{c} 25 \\ \text{D. F. } \text{---} \end{array}$ *S. walbee hmi* Blkr.
 $\begin{array}{c} 24 \\ \text{D. F. } \text{---} \end{array}$
2. Labial fold not extending to the upper jaw :
 $\begin{array}{c} 23-31 \\ \text{D. F. } \text{---} \end{array}$ 3.
 $\begin{array}{c} 22-30 \\ \text{D. F. } \text{---} \end{array}$
3. Second dorsal fin posterior to base of anal :
 $\begin{array}{c} 31 \\ \text{D. F. } \text{---} \end{array}$ *S. sorrakowah* (C.) (text-fig. 5b-c).
 $\begin{array}{c} 28-30 \\ \text{D. F. } \text{---} \end{array}$
4. Second dorsal fin over end of base of anal :
 $\begin{array}{c} 23 \\ \text{D. F. } \text{---} \end{array}$ *S. palasorrah* (C.) (text-fig. 5d-e).
 $\begin{array}{c} 22 \\ \text{D. F. } \text{---} \end{array}$

Genus *Aprionodon* Gill.

Body fusiform. Trunk slightly longer than tail. Snout pointed. Eyes moderate with nictitating membrane. Nasoral grooves and cirri absent. Short labial fold at the corner of the mouth in the lower jaw. Spiracles absent. 5 pairs of gill-openings. Two spineless dorsal fins. Anal fin present. Caudal pit present. Teeth small, narrow, with broad bases; the lower erect, the upper erect or slightly oblique.

Distribution.—Western Atlantic, Red Sea, Seychelles, Arabia, India, Indo-China, Japan, Australia, Micronesia.

Aprionodon acutidens (Rüpp.), text-fig. 5f-g, is the only species of the genus found in India.

Genus *Hypoprion* M.H.

Body elongate and fusiform. Trunk slightly longer than tail. Snout acutely pointed or rounded. Eyes moderate with nictitating membrane. Nasoral grooves and cirri absent. Short labial fold at the corner of the mouth present or absent. Spiracles absent. 5 pairs of gill-openings. Two spineless dorsal fins. Anal fin present. Caudal pit present. Teeth smooth except at the bases of the upper ones which are serrated.

Distribution.—Atlantic, Indo-Pacific.

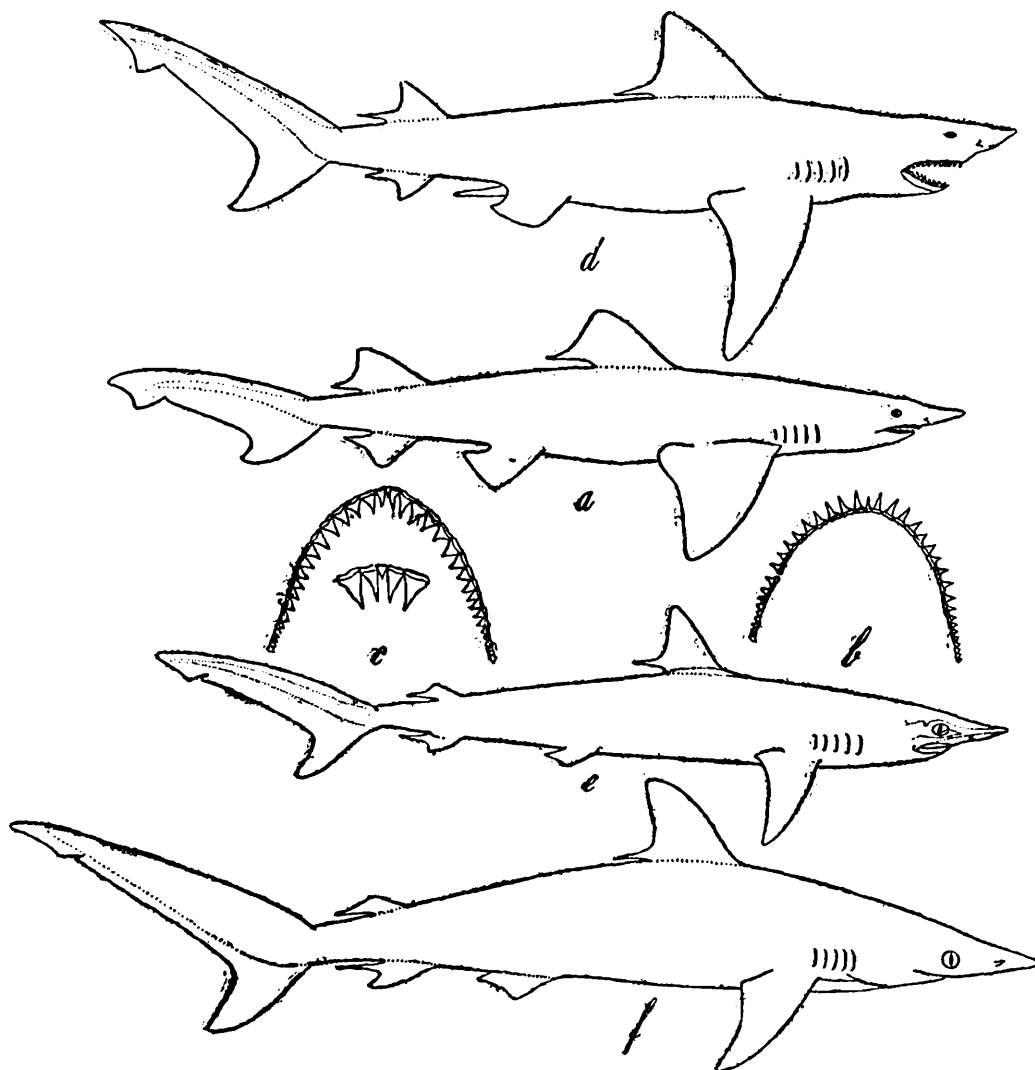
Key to the species.

1. Snout pointed : labial folds present : both sides of
 $\begin{array}{c} 27 \\ \text{bases of upper teeth serrated : D. F. } \text{---} \end{array}$ *H. maculata* M. H. (text-fig. 5h).
 $\begin{array}{c} 27 \\ \text{D. F. } \text{---} \end{array}$
2. Snout rounded : labial folds absent : only outer
sides of bases or upper teeth serrated : D. F.
 $\begin{array}{c} 29-32 \\ \text{---} \end{array}$ *H. hemiodon* M. H.
 $\begin{array}{c} 27-29 \\ \text{---} \end{array}$

Genus **Carcharhinus** Blainville.

Body elongate and fusiform. Trunk shorter or longer than tail. Snout pointed or rounded. Eyes moderate with well developed nictitating membrane. Nasoral grooves and cirri absent. Labial folds rudimentary or short. Spiracles absent. 5 pairs of gill-openings. Two spineless dorsal fins. Anal fin present. Caudal pit present. Teeth serrated at both bases and cusps; teeth in lower jaw non-serrated in some.

Distribution.—Tropical Atlantic, Red Sea, Natal, Seychelles, Madagascar, India, Ceylon, Singapore, East Indies, Philippines, Indo-China, Australia, Micronesia, China, Melanesia, Hawaii.



TEXT-FIG. 6.—a. Lateral view of *Carcharhinus temminckii*; b. Lower jaw of same; c. Upper jaw of same (after Müller & Henle); d. Lateral view of *Carcharhinus gengeticus* (after Müller & Henle); e. Lateral view of *Carcharhinus menisorrh* (after Müller & Henle); f. Lateral view of *Carcharhinus sorrah* (after Müller & Henle).

Key to the species.

- | | | |
|---|----|---------------------------------|
| 1. Second dorsal fin larger than anal fin | .. | 3. |
| 2. Second dorsal fin not larger than anal fin | .. | 9. |
| 3. Teeth in lower jaw distinctly non-serrated | | |
| 37-40 | | |
| D. F. ——— | .. | .. |
| 33-39 | | .. <i>C. temminckii</i> (M. H.) |
| | | (text-fig. 6a-c). |

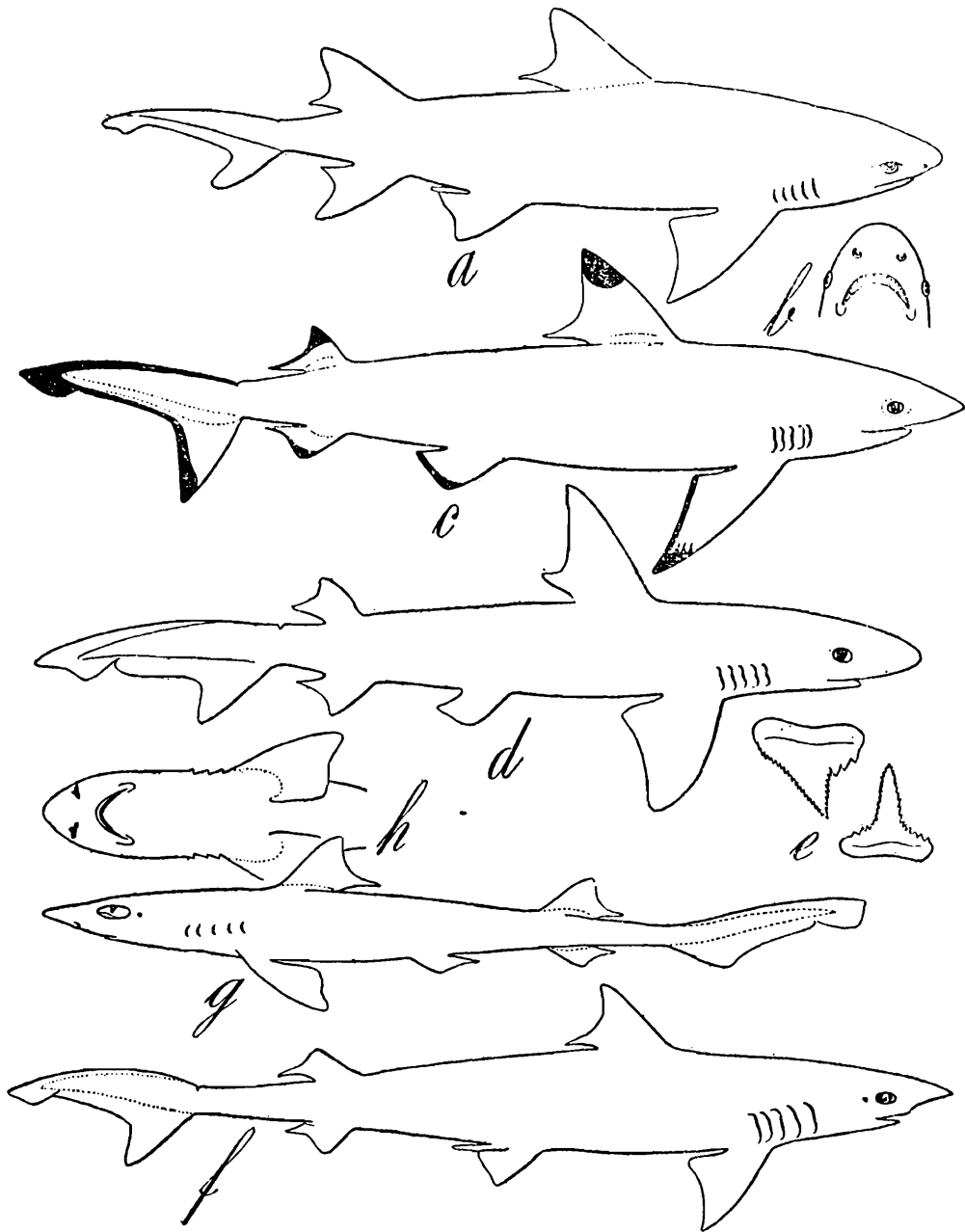
4. Teeth in lower jaw serrated 5.
5. Teeth distinctly awl-shaped : only the outer edge of cusp serrated .. *C. ellioti* (Day) (text-fig. 7a-b).
6. Teeth though narrow not awl-shaped : serrated entirely 7.
7. Snout very short : eye 8 times in snout : depth of body to subcaudal origin 6 times .. *C. gangeticus* (M. H.) (text-fig. 6d).
8. Snout moderate : eye $4\frac{2}{3}$ to $4\frac{1}{2}$ times in snout : depth of body to subcaudal origin $4\frac{1}{2}$ to 5 times : *C. lamia* (Blainville).
9. Teeth in lower jaw serrated : D. F. $\frac{24-34}{24-31}$.. 11.
10. Teeth in lower jaw not serrated : D. F. $\frac{28-32}{27-28}$.. *C. menisorrah* (M. H.) (text-fig. 6e).
11. Second dorsal distinctly smaller than anal .. 13.
12. Second dorsal and anal subequal .. 15.
13. Second dorsal and anal origins opposite :
D. F. $\frac{34}{31}$ *C. limbatus* (M. H.).
14. Second dorsal origin behind anal origin :
D. F. $\frac{25}{25}$ *C. sorrah* (M. H.) (text-fig. 6f).
15. Preoral length distinctly less than width of mouth 17.
16. Preoral length more than or equal to the width of mouth .. 19.
17. All the fins tipped with black : tail shorter than trunk : D. F. $\frac{25}{25}$ *C. melanopterus* (Q. G.) (text-fig. 7c).
18. All the fins not tipped with black : tail longer than trunk : D. F. $\frac{24-26}{24-26}$ *C. pleurotaenia* (Blkr.).
19. Preoral length more than width of mouth :
D. F. $\frac{24-25}{24-25}$ *C. dussumieri* (M. H.) (text-fig. 7d-e).
20. Preoral length equal to width of mouth .. 21.
21. D. F. $\frac{29}{26}$ *C. bleekeri* (Duméril).
22. D. F. $\frac{31}{28}$ *C. watu* (Setna & Sarang-dhar).

Genus *Hemigaleus* Blkr.

Body slender and elongate. Trunk shorter than tail. Snout pointed. Eyes moderate with nictitating membrane. Nasoral grooves and cirri absent. Labial folds present. Spiracles minute, behind eyes. 5 pairs of gill-openings. Two spineless dorsal fins. Anal fin present. Caudal pits present. Teeth dimorphous ; upper inclined, with denticles on basal part of outer edge, lower erect and smooth.

Distribution.—Tropical Indian and Western Pacific Oceans.

Hemigaleus balfouri Day, text-fig. 7f, is the only species of the genus found in India.



TEXT-FIG. 7.—a. Lateral view of *Carcharhinus ellioti*; b. Ventral view of head of same (after Day); c. Lateral view of *Carcharhinus melanopterus* (after Day); d. Lateral view of *Carcharhinus dussumieri* (after Day); e. Upper and lower teeth of same (after Müller & Henle); f. Lateral view of *Hemigaleus balfouri* (after Day); g. Lateral view of *Galeorhinus omanensis*; h. Ventral view of head of same (after Norman).

Genus **Hemipristis** Agassiz.

Body elongate and slender. Trunk shorter than tail. Snout rounded. Eyes moderate with nictitating membrane. Nasoral grooves and cirri absent. Labial folds present. Spiracles small, close behind eyes. 5 pairs of gill-openings. Two spineless dorsal fins. Anal fin present. Caudal pit present. Teeth dimorphous; upper teeth large, broad, flat and serrated; the lower smooth, slender and curved inwards.

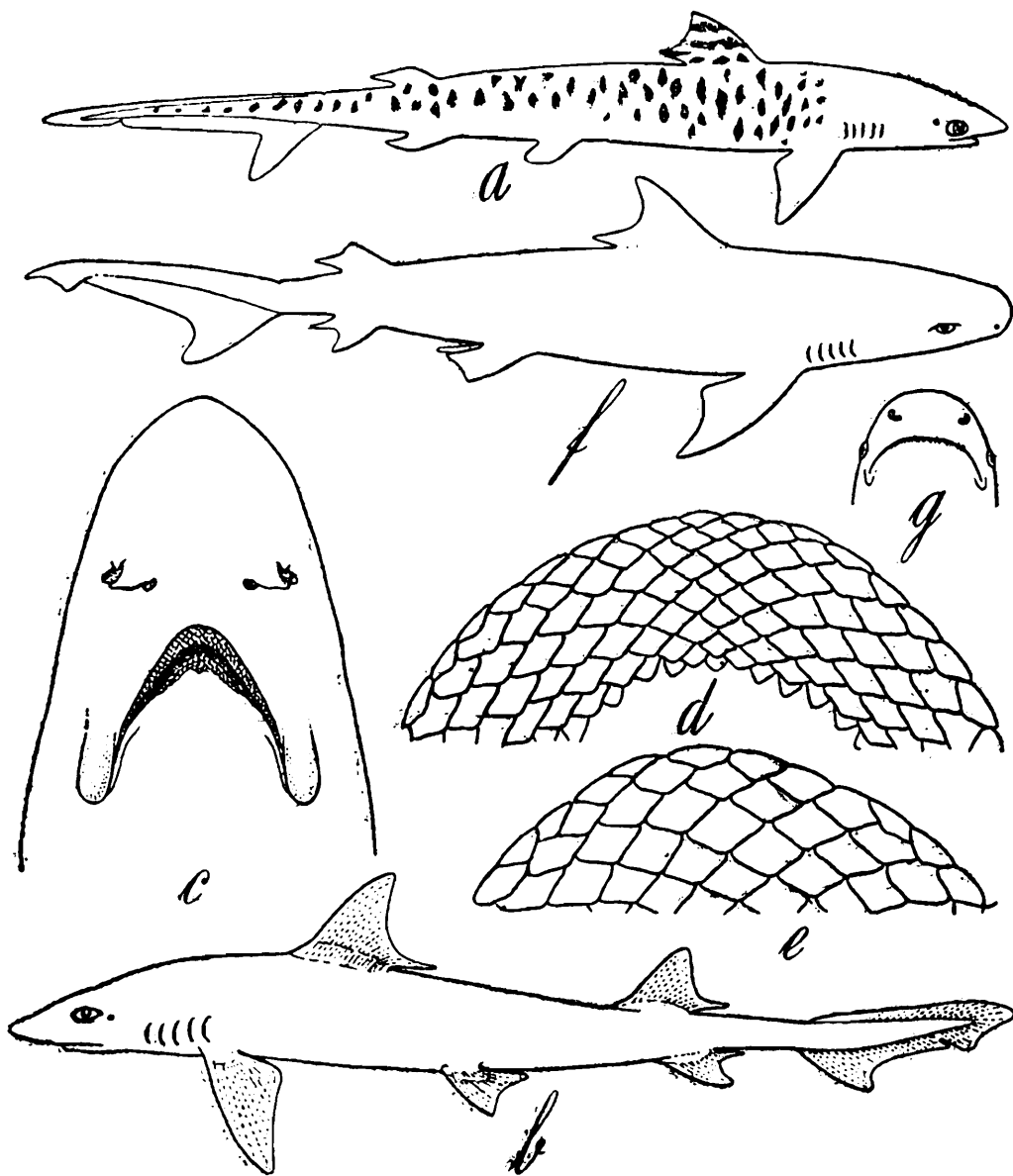
Distribution.—Red Sea, Ceylon, India.

Hemipristis elongatus Klunzinger is the only species of the genus found in India.

Genus *Galeorhinus* Blainville.

Body long and slender. Trunk equal to tail. Snout obtuse, depressed. Eyes moderate with nictitating membrane. Nasoral grooves and cirri absent. Labial folds present. Spiracles minute, behind eyes. 5 pairs of gill-openings. Two spineless dorsal fins. Anal fin present. Caudal pit absent. Teeth monomorphous, oblique, notched and smooth.

Distribution.—Atlantic Ocean, S. Africa, Gulf of Oman, Formosa, Japan, Philippines, Australia, New Zealand, Melanesia, Polynesia, Hawaii, California.



TEXT-FIG. 8.—a. Lateral view of *Galeocerdo arcticus* (after Day); b. Lateral view of *Myrmlomanazo*: $\times \frac{1}{7}$; c. Ventral view of head of same: $\times \frac{1}{4}$; d. Upper jaw of same: $\times 7\frac{1}{7}$; e. Lower jaw of same: $\times 4$; f. Lateral view of *Triaenodon obesus*; g. Ventral view of head of same (after Day).

Galeorhinus omanensis Norman, text-fig. 7g-h, is the only species of the genus found in India.

Genus *Galeocerdo* M. H.

Body elongate. Head depressed. Trunk more or less equal to tail. Snout wide, short. Eyes moderate with nictitating membrane. Nasoral grooves and cirri absent. Labial folds present on both jaws.

Spiracles small, behind eyes. 5 pairs of gill-openings. Two spineless dorsal fins. Anal fin present. Teeth large, flat, triangular, notched, oblique and serrated on both edges.

Distribution.—Arctic, Temperate and Tropical Seas.

Galeocerdo arcticus (Faber), text-fig. 8a, is the only species of the genus found in India and Ceylon.

Genus **Myrmillo** Gistel.

Body elongate and fusiform. Trunk more or less equal to tail. Snout produced and pointed. Eyes moderate with nictitating membrane. Nasoral grooves and cirri absent. Well developed labial fold at each angle of mouth. Spiracles small, behind eyes. 5 pairs of gill-openings. Two spineless dorsal fins. Anal fin present. Caudal pit absent. Teeth monomorphous, polyserial, pavement-like, smooth, obtuse, devoid of distinct cusps.

Distribution.—Atlantic, S. Africa, Red Sea, India, Indo-China, Korea, Japan, Australia, Tasmania, New Zealand.

Myrmillo manazo Blkr., text-fig. 8b-e, is the only species of the genus found in India and Ceylon.

Genus **Triaenodon** M. H.

Body elongate. Trunk longer than tail. Snout short and rounded. Eyes moderate with nictitating membrane. Nasoral grooves and cirri absent. Labial folds short, not extending along the jaws. Spiracles absent. 5 pairs of gill-openings. Two spineless dorsal fins. Anal fin present. Caudal pit present. Subcaudal well developed. Teeth minute, numerous in both jaws, with central and lateral cusps.

Distribution.—Red Sea, Arabia, India, Ceylon, East Indies, Philippines, Melanesia, Polynesia, Hawaii.

Triaenodon obesus (Rüpp.), text-fig. 8f-g, is the only species of the genus found in India and Ceylon.

Family **SPHYRNIDAE**.

Genus **Sphyrna** Rafinesque.

Body elongate, head T-shaped forming ocularianial expansions on either side. Trunk behind head compressed. Eyes moderate with nictitating membrane; situated at the ocularianial extremities. Nasoral grooves and cirri absent. Labial folds rudimentary. Spiracles absent. 5 pairs of gill-openings. Two spineless dorsal fins. Anal fin present. Caudal pit present. Subcaudal lobe produced. Teeth monomorphic, oblique and notched, serrated or non-serrated.

Distribution.—Atlantic Ocean, Mediterranean Sea, Indian Ocean, Malay Archipelago.

Key to the species.

- | | | |
|--|----|--|
| 1. A groove along the front edge of head | .. | 3. |
| 2. No groove along the front edge of head | .. | <i>S. mokarran</i> (Rüpp.). |
| 3. Eyes and nostrils not widely separated (oculonarial expansions short) | .. | 5. |
| 4. Eyes and nostrils widely separated (oculonarial expansions long) | .. | <i>S. blochii</i> (C.) (text-fig. 9a). |
| 5. Anterior edge of oculonarial expansions curved | .. | <i>S. tudes</i> (V.). |
| 6. Anterior edge of oculonarial expansions straight | .. | <i>S. zygaena</i> (L.) (text-fig. 9b). |

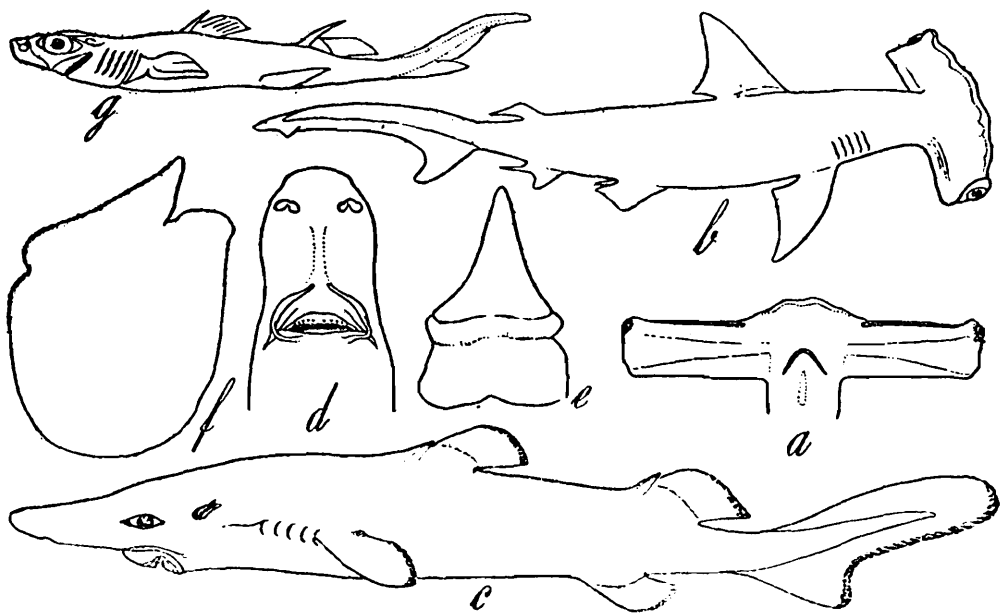
Order SQUALIFORMES.

Suborder SQUALOIDEI.

Family SQUALIDAE.

Key to genera of family SQUALIDAE.

- | | | |
|--|----|-----------------------------------|
| 1. Teeth unicuspid : snout spatulate | .. | Genus Centrophorus M.H. |
| 2. Teeth multicuspid : snout depressed | .. | Genus Centroscyllium M. H. |



TEXT-FIG. 9.—a. Ventral view of head of *Sphyrna blochii*; b. Lateral view of *Sphyrna zygaena* (after Day); c. *Centrophorus rossi*: X 2; d. Ventral view of head of same: X $\frac{2}{3}$; e. Upper tooth of same: X 20; f. Lower teeth of same: X 20; g. Lateral view of *Centroscyllium* (*Paracentroscyllium*) *ornatum* (after Alcock).

Genus **Centrophorus** M. H.

Body elongate, partly cylindrical. Trunk longer than tail. Snout spatulate and much produced. Eyes large without nictitating membranes; orbit elongate. Nasoral grooves and cirri absent. Labial folds well developed in both jaws. Spiracles large, nearly equal to eye and slightly larger than gill-slits. 5 pairs of gill-openings. Two dorsal fins each with a spine anteriorly. Anal fin absent. Caudal pit absent. Teeth unicuspid, those of upper jaw acute, triangular, in two series; those of the lower jaw oblique, in single series.

Distribution.—Eastern Atlantic, Mediterranean, S. Africa, Arabian Sea, Japan, Philippines, New Zealand.

Centrophorus rossi Alc., text-fig. 9-c-f, is the only species of the genus found off Travancore Coast, India.

Genus **Centroscyllium** M.H.

Body elongate, fusiform. Trunk longer than tail. Snout depressed. Eyes large with nictitating membrane; orbit elongate. Nasoral grooves and cirri absent. Labial folds well developed in both jaws. Spiracles large, behind eyes, higher, superior. 5 pairs of gill-openings. Two dorsal fins each with a well developed spine anteriorly. Anal fin absent. Caudal pit absent. Caudal fin truncated or pointed. Teeth small, raptorial, multicuspid.

Key to subgenera of genus Centroscyllium.

1. Caudal truncated posteriorly: lower edge of fin with distinct posterior notch Subgenus **Centroscyllium** M. H.
2. Caudal not truncated posteriorly: lower edge of fin without distinct posterior notch Subgenus **Paracentroscyllium** Alc.

Distribution.—Arabian Sea, Bay of Bengal, Japan, Hawaii Islands.

Centroscyllium (Paracentroscyllium) ornatum Alc., text-fig. 9g, is the only species of the genus found in Bay of Bengal and Arabian Sea.

Superorder BATOIDEI.

Order RAJIFORMES.

Key to families of order RAJIFORMES.

1. Disk narrow and elongate 3.
2. Disk broad and expanded 7.
3. Rostrum very much produced and saw-like Family PRISTIDAE.
4. Rostrum very short and not saw-like 5.
5. Pectorals extending to end of snout: disk broader and more rounded Family DISCOBATIDAE.
6. Pectorals not extending to end of snout: disk narrow and elongated Family RHINOBATIDAE.
7. Tail whip-like, dorsals reduced to spines 9.
8. Tail not whip-like, without spines: 2 small dorsals Family RAJIDAE.
9. Head distinct from disk, without a prominent snout. 11.
10. Head not distinct from disk, without prominent snout Family TETAGONIDAE.
11. With horn-like cephalic flippers Family MOIULIDAE.
12. Without horn-like cephalic flippers 13.
13. Head bilobed or notched between the rostral fins: rostral fins separate Family RHINOPTERIDAE.
14. Head neither bilobed nor notched between the rostral fins: rostral fins united into one lobe Family MYLIOBATIDAE.

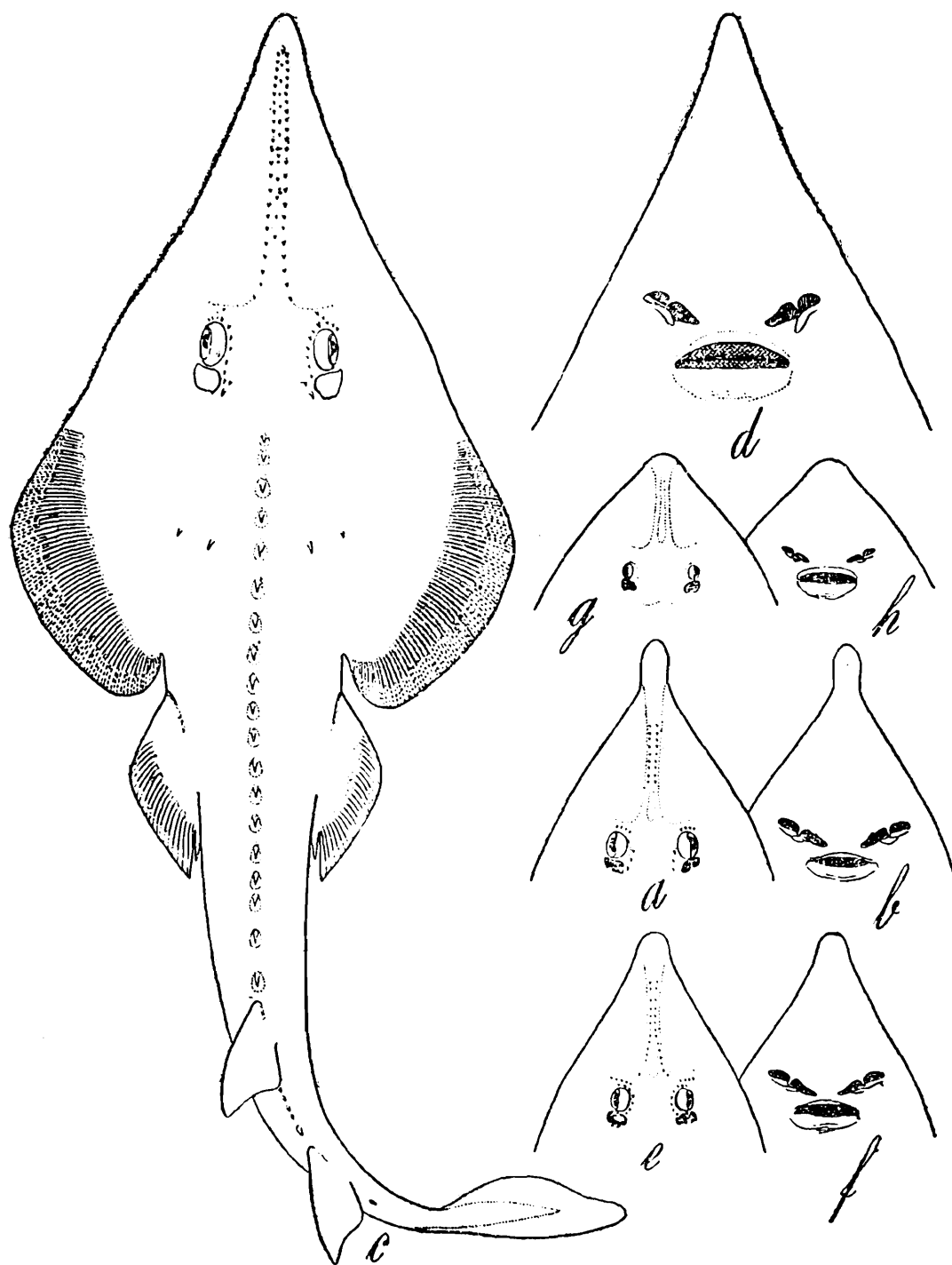
Family RHINOBATIDAE.

Key to genera of family RHINOBATIDAE.

1. Snout triangularly pointed: spiracles with folds on hind edge 3.
2. Snout blunt, broad and rounded: spiracles without folds on hind edge Genus **Rhina** Schn.
3. Origin of first dorsal distinctly nearer to the tip of the snout than to the tip of the caudal Genus **Rhynchobatus** M. H.
4. Origin of first dorsal distinctly nearer to the tip of the caudal than to the tip of the snout Genus **Rhinobatos** Linck.

Genus **Rhinobatos** Linck.

Body depressed and elongated. Disk triangular, slightly rounded and wider behind. Tail depressed, nearly equal to trunk. Snout triangularly pointed. Nostrials oblique and wide. Spiracles wide, just behind the eyes, with folds on hind edge. 5 pairs of gill-openings



TEXT-FIG. 10.—*a*. Dorsal view of head of *Rhinobatos thouniana*; *b*. Ventral view of head of same (after Norman); *c*. Dorsal view of *Rhinobatos granulatus*:X nat. size; *d*. Ventral view of head of same: X nat. size; *e*. Dorsal view of head of *Rhinobatos armatus*; *f*. Ventral view of head of same (after Norman); *g*. Dorsal view of head of *Rhinobatos obesus*; *h*. Ventral view of head of same (after Norman).

on the ventral side. Two spineless dorsal fins behind the pelvics and closer to caudal than to snout end: pelvics closer to the pectorals than to the dorsals. The rayed portion of the pectoral fins not continued

on to the snout. Anal fin absent. Teeth obtuse with indistinct, transverse ridges.

Distribution.—W and S. Africa, Red Sea, Arabia, India, Ceylon, Andamans, Burma, Malay Peninsula, Malay Archipelago, Siam, Cochin-China, Formosa, Philippines, Japan, Australia.

Key to the species.

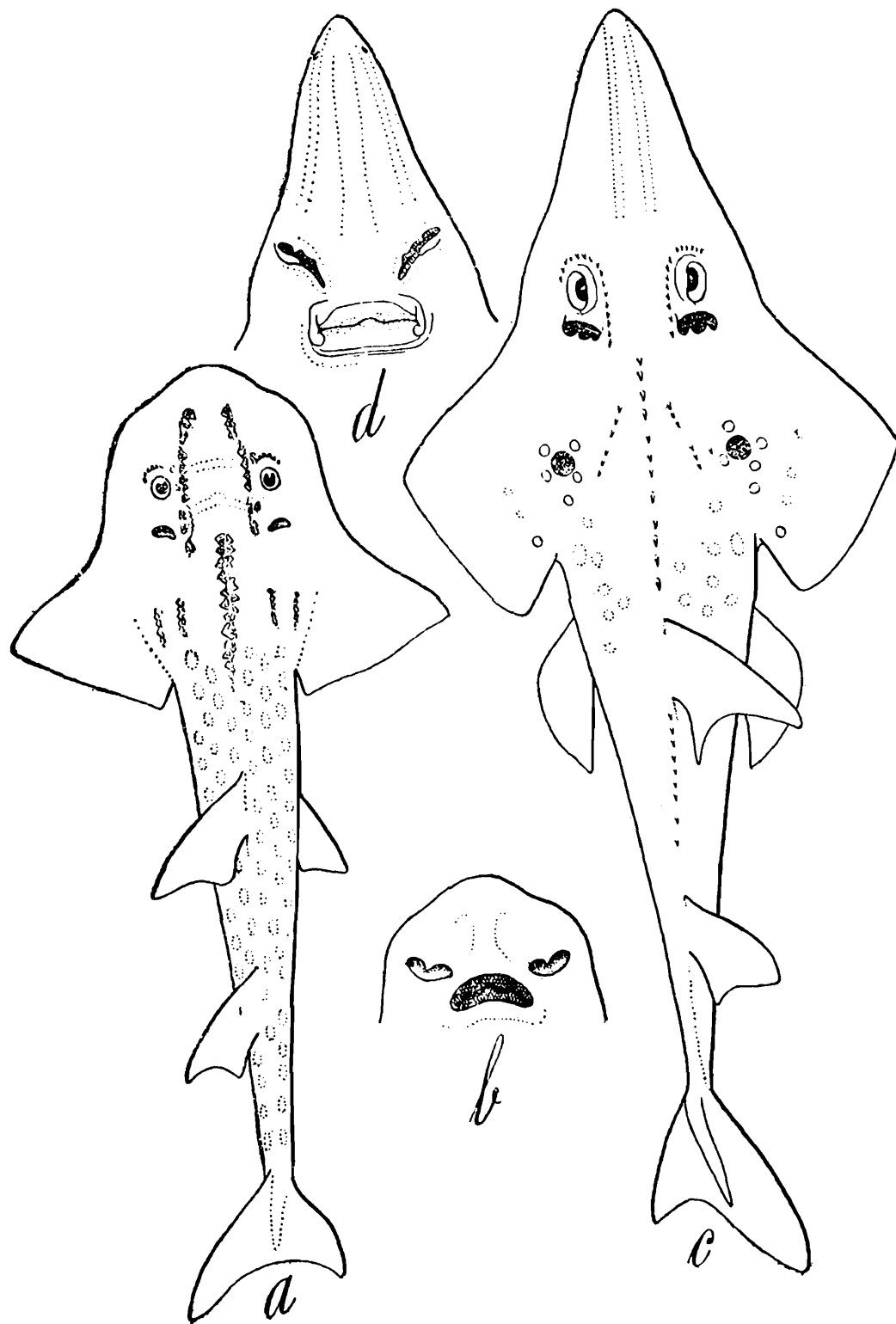
1. Snout long and pointed: preorbital length $3-3\frac{3}{5}$ times the distance between the spiracles .. 3.
2. Snout short bluntly or obtusely pointed: preorbital length $2\frac{1}{5}-2\frac{1}{2}$ times the distance between the spiracles. 7.
3. Snout expanded at the tip *R. thouniniana* (Shaw) (text-fig. 10a-b).
4. Snout not expanded at the tip 5.
5. Length of nostril equal to internarial space and twice the width of mouth: preorbital length $3\frac{1}{2}-3\frac{2}{3}$ times the distance between the spiracles *R. granulatus* (C.) (text-fig. 10 c-d).
6. Length of nostril greater than internarial space and less than twice the width of mouth: preorbital length $3-3\frac{1}{5}$ times the distance between the spiracles *R. armatus* (Gray) (text-fig. 10 c-f).
7. Snout obtusely pointed: preorbital length $2\frac{1}{2}$ times the distance between the spiracles: length of nostril equal to internarial space and the twice the width of mouth *R. obtusus* (M. H.) (text-fig. 10 g-h).
8. Snout not obtusely pointed: preorbital length $2\frac{1}{3}-2\frac{1}{2}$ times the distance between the spiracles: length of nostril greater than internarial space and less than twice the width of mouth 9.
9. Base of first dorsal fin $2\frac{1}{4}-2\frac{2}{5}$ the distance between the dorsals: space between rostral ridges rather narrow: series of spines in the middle line of back .. *R. annandalei* (Norman).
10. Base of first dorsal $2\frac{2}{5}$ times the distance between the dorsals: space between rostral ridges broader: minute tubercles in the middle line of back .. *R. lionotus* (Norman).

Genus *Rhina* Schn.

Body depressed and elongated. Disk subtriangular, obtusely rounded in front. Tail depressed, nearly equal to trunk. Snout broad, obtusely rounded. Nostrils slightly oblique and wide. Spiracles large, without posterior folds and about an eye diameter and a half behind the eyes.

5 pairs of gill-openings on the ventral side. Two spineless dorsal fins ; first dorsal fin opposite pelvics and nearer to snout end than to caudal end. The rayed portion of pectoral extends only upto spiracles. Anal fin absent. Teeth obtusely rounded, each with several longitudinal ridges.

Distribution.—Red Sea, Arabia, E. Africa, Seychelles, India, Ceylon, Penang, East Indies, Philippines, Cochin-China, China, Japan, Australia.



TEXT-FIG. 11.—*a*. Dorsal view of *Rhina ancylostoma* ; *b*. Ventral view of head of same (after Day) ; *c*. Dorsal view of *Rhynchobatus djiddensis* ; *d*. Ventral view of head of same (after Day).

Rhina ancylostoma Schn., text-fig, 11 *a-b*, is the only species of genus found in India and Ceylon.

Genus **Rhynchobatus** M. H.

Body depressed and elongated. Disk triangular, longer than wide. Tail depressed, nearly equal to trunk. Snout triangularly pointed. Nostrils oblique. Spiracles large, close behind eyes and with two small folds on hind edge. 5 pairs of gill-openings on the ventral side. Two spineless dorsal fins; first dorsal opposite pelvics and nearer to snout end than to caudal end. The rayed portion of pectorals extends only upto spiracles. Anal fin absent. Teeth obtuse, pavement-like, dental surfaces undulated.

Distribution.—E. Africa, Madagascar, Seychelles, Zanzibar, Red Sea, Arabia, India, Ceylon, Andamans, Malay Peninsula, Malay Archipelago, Cochin-China, China, Japan, Melanesia.

Rhynchobatus djiddensis (Forsk.), text-fig. 11 *c-d*, is the only species of the genus recorded from India and Ceylon.

Genus **Pristis** Linck.

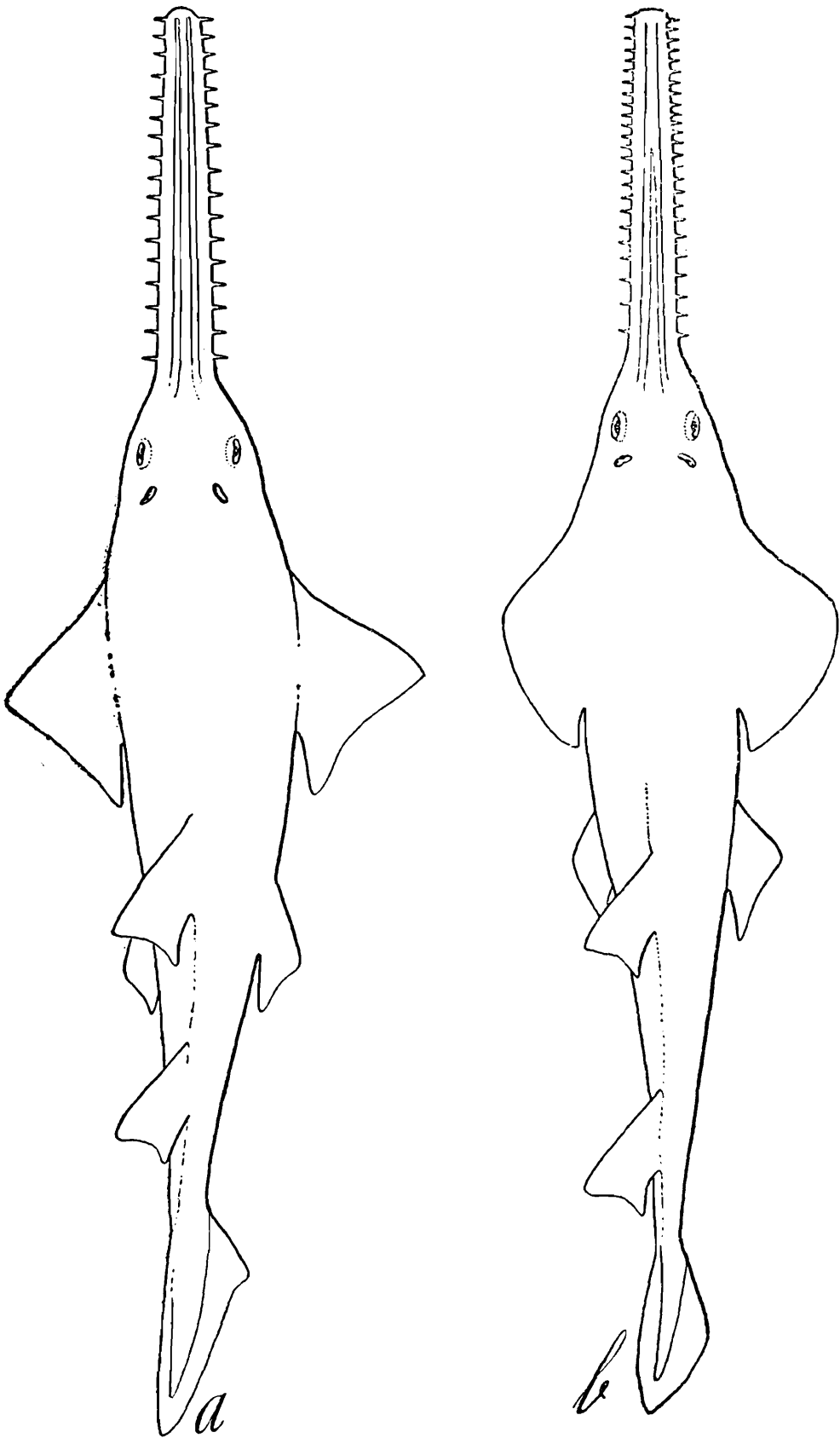
Body elongated and moderately depressed. Rostrum very much produced and saw-like. Nostrils oblique. Eyes without nictitating membrane. Spiracles large, behind the eyes. 5 pairs of gill-openings on the ventral side. Two spineless dorsal fins. Pectorals moderate, front edge quite free neither joining with head nor reaching snout. Anal fin absent. Rostral teeth strong and large, set in sockets on either edges of the blade-like snout. Oral teeth small, pavement-like.

Distribution.—E. Africa, Madagascar, Seychelles, Zanzibar, Red Sea, Arabia, India, Burma, Ceylon, Andamans, Malay Peninsula, Malay Archipelago, Siam, Cochin-China, Philippines, Japan, Melanesia, Queensland, Tropical Atlantic.

Key to the species.

1. First dorsal origin distinctly behind or opposite pelvics : rostral teeth more in number, 23-35 on either side 3.
2. First dorsal origin clearly in front of pelvics : rostral teeth less in number, 17-20 on either side .. *P. microdon* Lath. (text-fig. 12a).
3. First dorsal origin behind pelvics 5.
4. First dorsal origin opposite pelvics *P. pectinatus* Lath.
5. Upper margins of the dorsals deeply concave with the posterior lobes produced : subcaudal lobe well developed *P. cuspidatus* Lath.

6. Upper margins of the dorsals slightly concave with
their posterior lobes not produced : subcaudal lobe
not well developed *P. zijnsron* Blkr. (text-
fig. 12*b*).

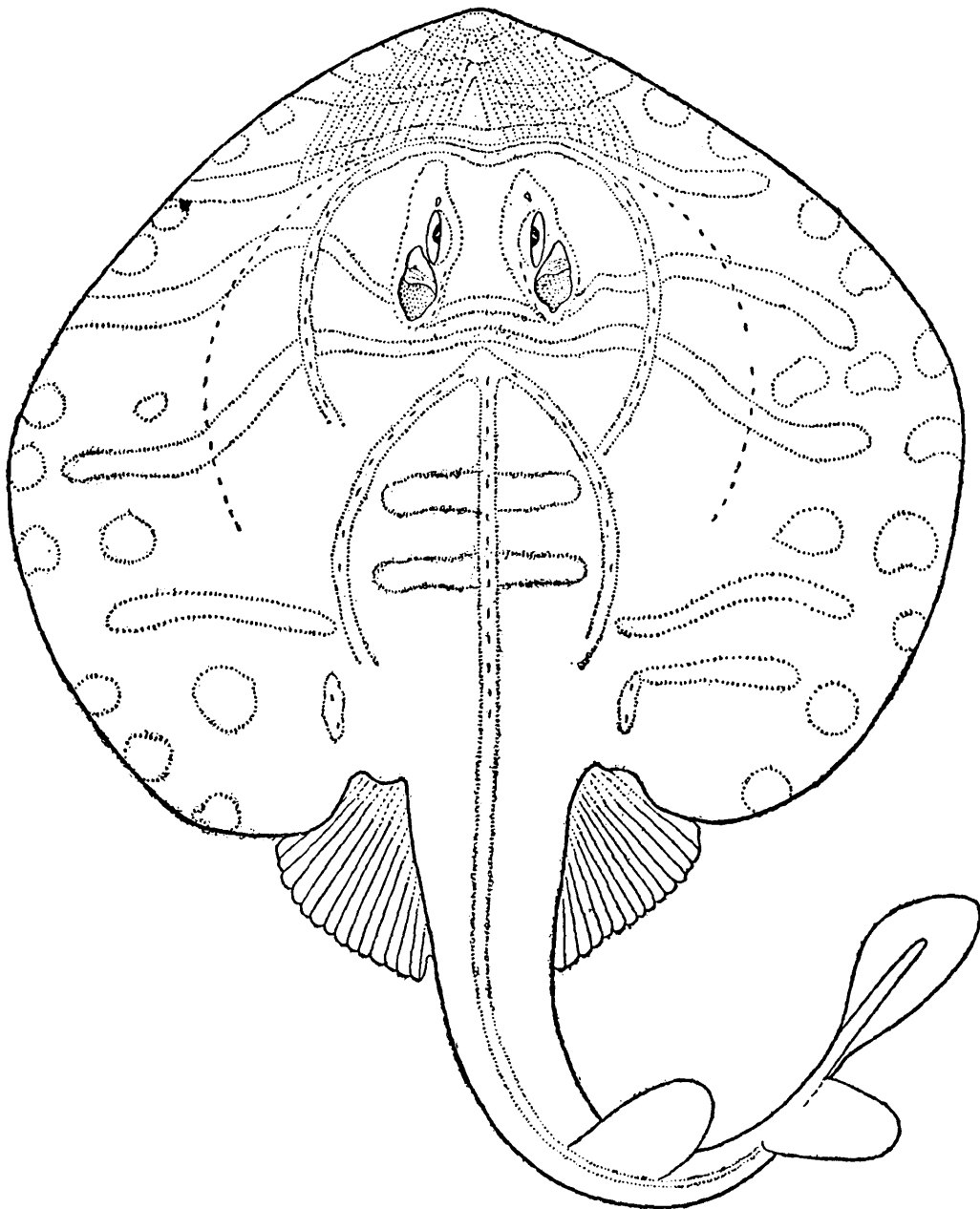


TEXT-FIG. 12.—*a*. Dorsal view of *Pristis microdon* (after Day); *b*. Dorsal view of *Pristis zijnsron* (after Day).

Family DISCOBATIDAE.

Genus **Zanobatus** Garman.

Disk wider than long, partly rounded. Tail depressed, slender, nearly half total length. Rostral cartilage small. Snout short, obtuse, Nasoral grooves rudimentary. Nostrils transverse; internarial space about $\frac{2}{3}$ mouth width. Spiracles close behind eyes. 5 pairs of gill-openings on ventral side. Two spineless dorsal fins. The rayed portion



TEXT-FIG. 13.—Dorsal view of *Zanobatus schoenleinii* (after Müller & Henle).

of the pectorals continued to the snout to form a subcircular disk. Anal fin absent. Teeth very small.

Distribution.—Africa, India.

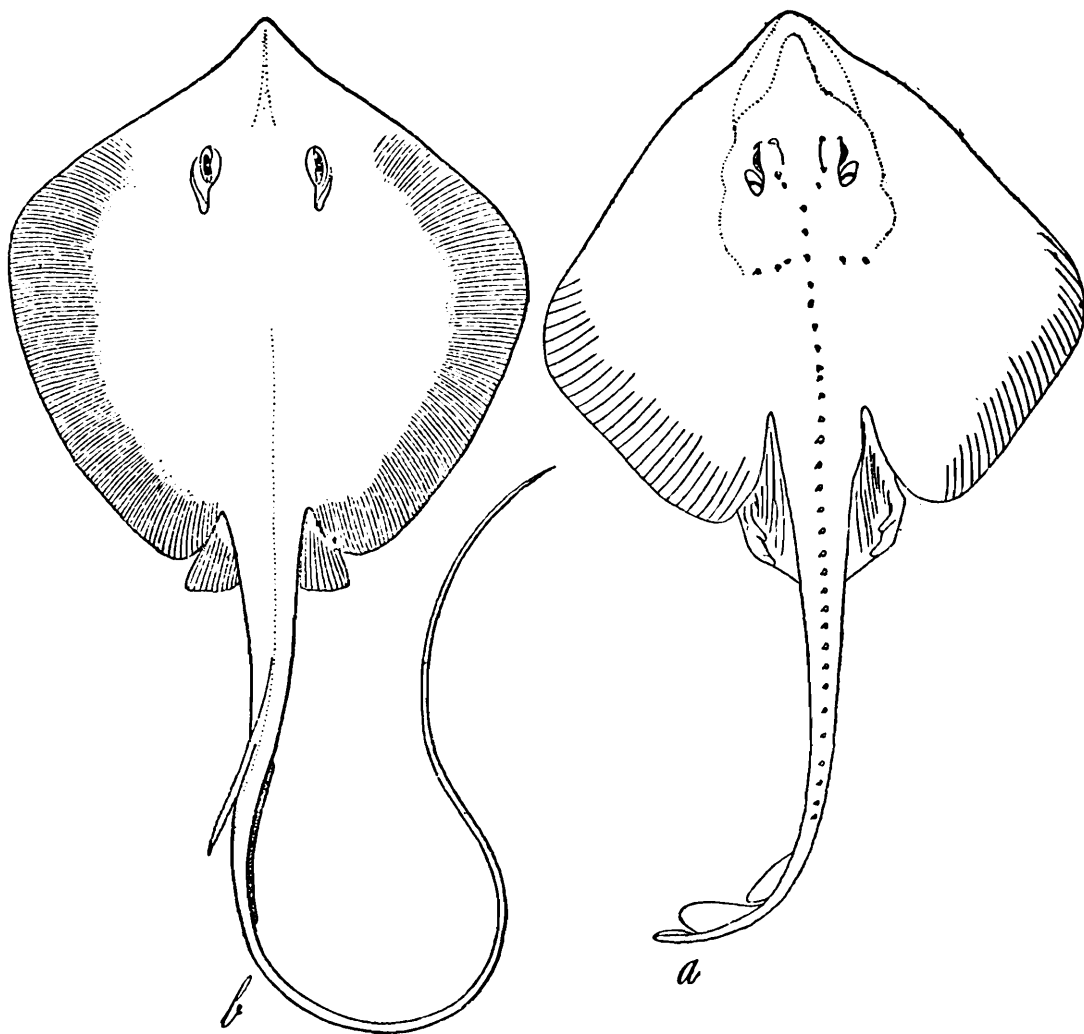
Zanobatus schoenleinii (M. H.), text-fig. 13, is found in India.

Family RAJIDAE.

Genus **Raja** L.

Disk subcircular to quadrangular. Tail not whip-like, without spines and without fold along either side. Snout produced and pointed. Eyes prominent. Nasoral grooves present. 5 pairs of gill-openings on the ventral side. Two spineless dorsal fins. The rayed portion of the pectorals reaches beyond the eyes but not up to the snout. Anal fin absent. Teeth small, tessellate, flat to sharply pointed.

Distribution.—Atlantic Ocean, Mediterranean Sea, Gulf of Aden, S. Africa, Arabian Sea, India, Andamans, East Indies, Formosa,



TEXT-FIG. 14.—*a*. Dorsal view of *Raja mamallidens* (after Alcock) *b*. Dorsal view of *Dasyatis* (*Pastinachus*) *bennetti* (after Müller & Henle).

Philippines, Korea, Japan, China, Manchuria, Kamchatka, Alaska, Australia, New Zealand, California, Washington.

Key to the species.

1. Snout about 3-3.5 times the interiorbital distance :
dorsals very close together .. 3.
2. Snout about 4-5 times the interiorbital distance :
dorsals widely separated (by a distance about the
length of the base of the first dorsal fin) .. 5.

3. A single row of prominent spines on tail .. *R. mamillidens* Alc. (text-fig. 14a).
4. More than one row (i.e., 3) of prominent spines on tail *R. reversa* (Lloyd).
5. A single row of spines on tail: second dorsal fin situated away from the tip of the caudal fin by a distance equal to bases of both the dorsals .. *R. johannis-davisi* Alc. (text-fig. 15a)
6. More than one row of spines on tail (i.e., 3): second dorsal fin situated nearer to tip of caudal fin by a distance equal to or less than the base of the first dorsal fin 7.
7. Interdorsal space equal to base of first dorsal fin: no prominent rostral spine *R. powelli* Alc.
8. Interdorsal space half of the base of first dorsal fin: prominent rostral spine present *R. andamanica* (Lloyd).

Family TRYGONIDAE.

Key to genera of family TRYGONIDAE.

1. Tail shorter than the length of disk: disk twice as broad as long Genus **Gymnura** Kuhl.
2. Tail as long as or much longer than the length of disk: disk not twice as broad as long 3.
3. Serrated caudal spine present: body not profusely covered with tubercles 5.
4. Serrated caudal spine absent: body profusely covered with tubercles Genus **Urogymnus** M. H.
5. Disk oval Genus **Taeniura** M. H.
6. Disk quadrangular Genus **Dasyatis** Raf. nesque.

Genus **Taeniura** M. H.

Disk rounded with head not distinct from it. Tail compressed, longer than body, with midcaudal serrated spines and without any lateral folds. Mouth with buccal processes¹. No rostral cartilage. Nostrils slightly oblique. Spiracles wide, behind the eyes. 5 pairs of gill-openings on the ventral side. Dorsal fins absent. Rayed portion of the pectoral fins united anteriorly. Anal fin absent. Subcaudal rayless, below terminal end of tail. Teeth small, tessellate, grooved transversely.

Distribution.—Zanzibar, Mozambique, Mauritius, Red Sea, Arabia, India, Ceylon, Malay Peninsula, East Indies, Siam, Philippines, Australia, Melanesia, Polynesia.

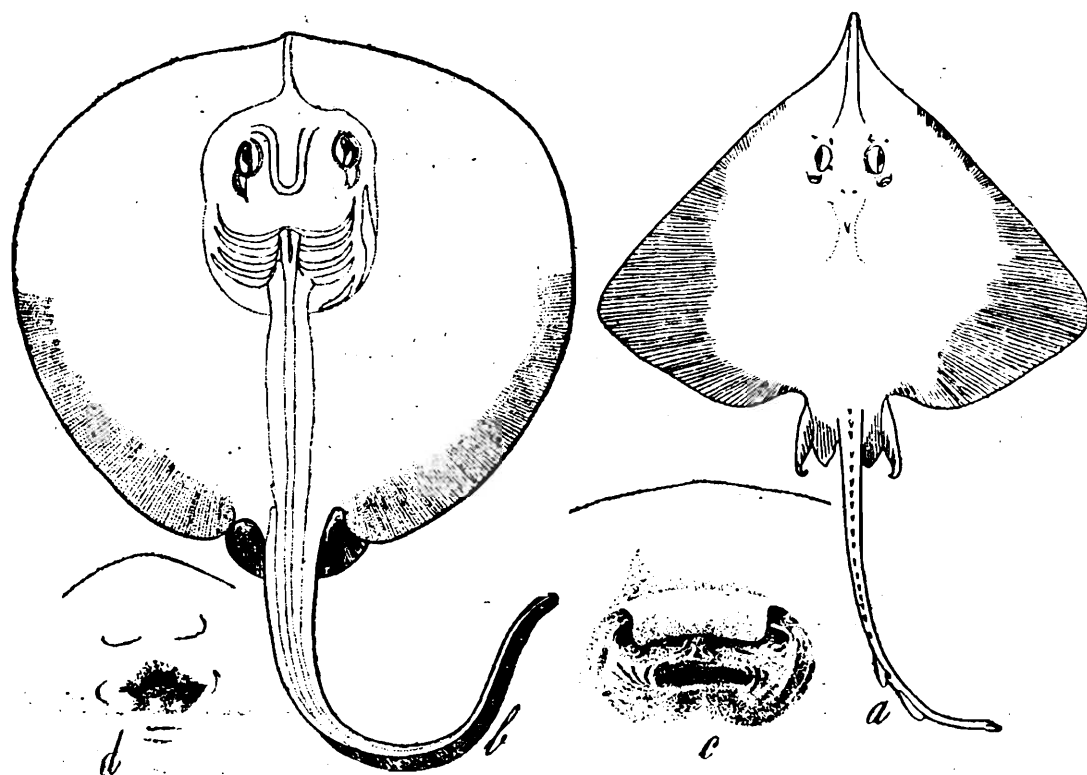
Key to the species.

1. Mouth straight: 5 buccal processes *T. meyeri* M. H. (text-fig. 15b-c).
2. Mouth curved: 2 buccal processes *T. lyman* (Forsk.) (text-fig. 15d.)

¹ There are small flaps of skin across the floor of the mouth of sting rays.

Genus **Dasyatis** Rafinesque.

Disk oval to rhomboidal. Tail elongate, whip-like, with serrated caudal spines, with or without dermal fin folds, not terminal in position but behind spines; without lateral folds on caudal base. No rostral cartilage. Nasoral grooves present. Nostrils slightly oblique. Spiracles large, behind the eyes. 5 pairs of gill-openings on the ventral side. Rayed dorsal fins absent. Rayed portion of the pectoral fins



TEXT-FIG. 15.—a. Dorsal view of *Raja johannis-davisi* (after Alcock); b. Dorsal view of *Taeniura meyeri*; c. Mouth of same (after Müller & Henle); d. Mouth of *Taeniura lymma* (after Müller & Henle).

united anteriorly. Anal fin absent. Teeth flattened, or with a central point or transverse ridge.

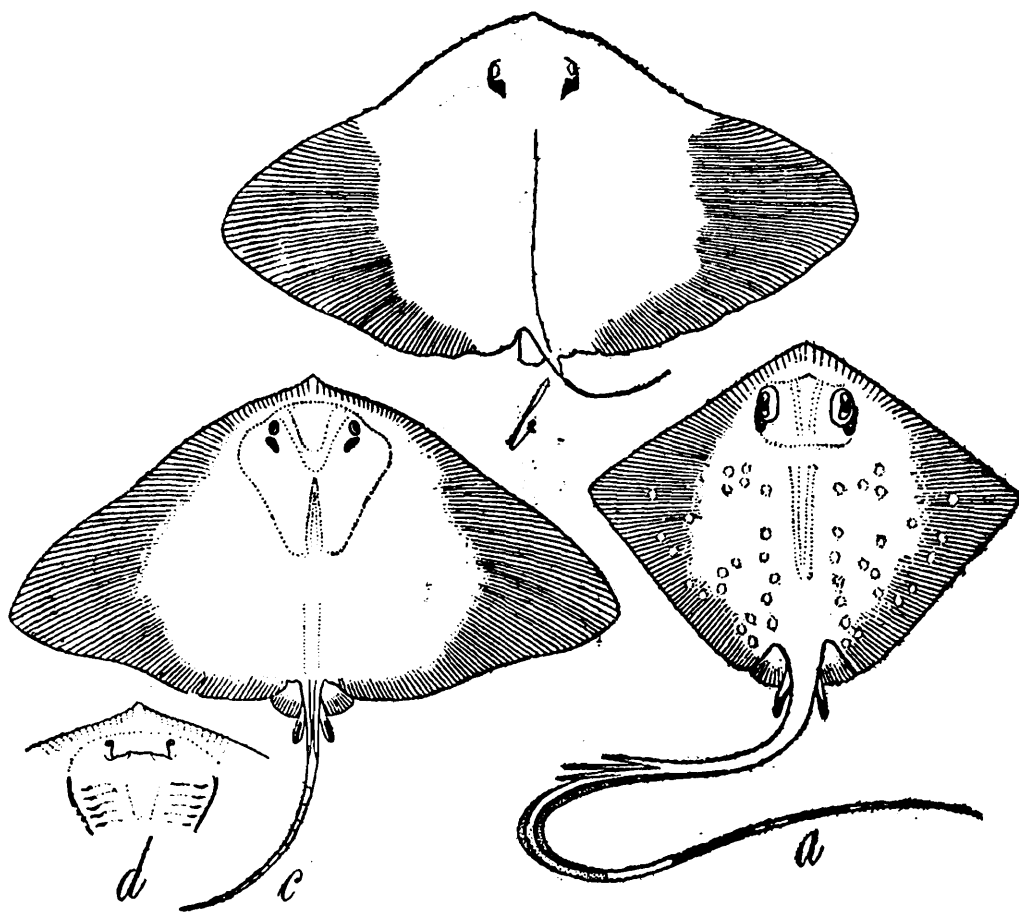
Distribution.—Atlantic Ocean, Cape of Good Hope, Natal, Zanzibar, Red Sea, Arabia, India, Ceylon, Burma, Malay Peninsula, Malay Archipelago, Siam, Cochin-China, China, Formosa, Japan, Philippines, Australia, Melanesia, Micronesia, Polynesia, Hawaii.

Key to subgenera of genus **Dasyatis**.

- | | |
|--|--------------------------------------|
| 1. Cutaneous folds on tail present | 3. |
| 2. Cutaneous folds on tail absent | Subgenus Himantura M.H. |
| 3. Cutaneous fold either above or below tail | 5. |
| 4. Cutaneous folds both above and below tail | Subgenus Amphotistius Garman. |
| 5. Cutaneous fold above tail | Subgenus Dasyatis Rafinesque. |
| 6. Cutaneous fold below tail | Subgenus Pastinachus Rupp. |

Key to the species.

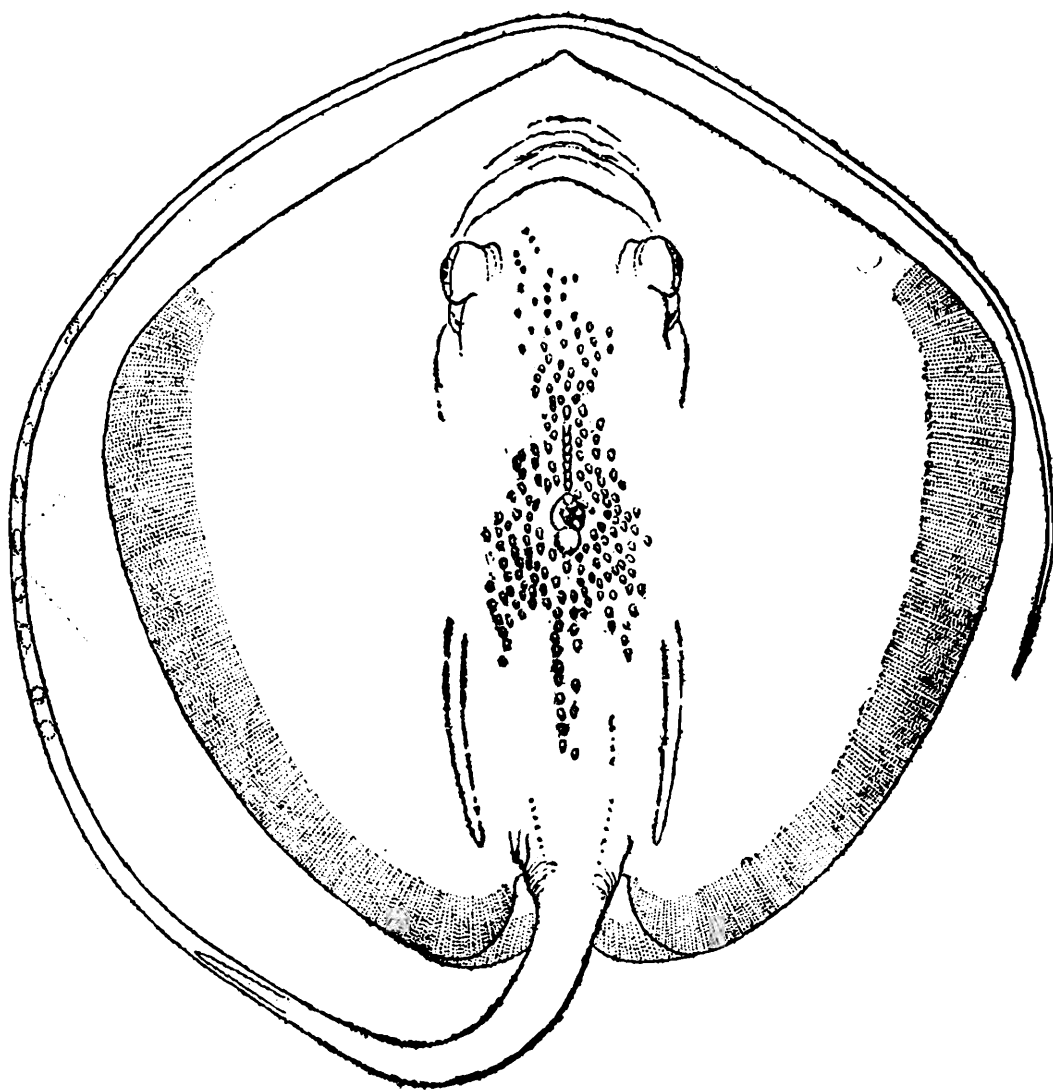
- | | |
|--|---|
| 1. Tail with cutaneous folds | 3. |
| 2. Tail without cutaneous folds | 17. |
| 3. With either dorsal or ventral cutaneous fold on tail .. | 5. |
| 4. With dorsal and ventral cutaneous folds on tail .. | 9. |
| 5. With a ventral cutaneous fold on tail | 7. |
| 6. With a dorsal cutaneous fold on tail | <i>D. (Dasyatis) pastinaca</i>
(L.). |



TEXT-FIG. 16.—a. Dorsal view of *Dasyatis* (*Amphotistius*) *kuhlii* (after Day); b. Dorsal view of *Gymnura* (*Aetoplatea*) *tentaculata* (after Annandale); c. Dorsal view of *Gymnura* (*Gymnura*) *poecilura*; d. Ventral view of head of same (after Day).

- | | |
|--|--|
| 7. Cutaneous fold on tail well developed (broad and 4 times the length of caudal spine) | <i>D. (Pastinachus) sephen</i>
(Forsk.). |
| 8. Cutaneous fold on tail not well developed (narrow and about as long as caudal spine). | <i>D. (Pastinachus) bennetti</i>
(M.H.). (text-fig. 14b). |
| 9. With 2-4 buccal processes | 11. |
| 10. Without buccal processes | <i>D. (Amphotistius) zugei</i>
(M. H.). |

- | | |
|--|--|
| 11. With 4 buccal processes | <i>D. (Amphotistius) jenkinsii</i> (Ann.). |
| 12. With 2 buccal processes .. | 13. |
| 13. Tail short, scarcely as long as length of disk | <i>D. (Amphotistius) imbricata</i> (Schn.). |
| 14. Tail long, exceeding the length of disk .. | 15. |
| 15. Without ocelli on dorsal surface of disk | <i>D. (Amphotistius) marginatus</i> (Blyth). |
| 16. Blue ocelli on dorsal surface of disk .. | <i>D. (Amphotistius) kuhlii</i> (M. H.) (text-fig. 16a). |



TEXT-FIG. 17.—Dorsal view of *Dasyatis (Himantura) uarnak* : X $\frac{1}{2}$.

- | | |
|--|---|
| 17. With 2 buccal processes .. | 19. |
| 18. With 4 buccal processes | 21. |
| 19. Tail more than 3 times the length of disk .. | <i>D. (Himantura) bleekeri</i> (Blyth). |
| 20. Tail less than twice the length of disk .. | <i>D. (Himantura) favius</i> (Ann.). |
| 21. Tail short, nearly as long as length of disk | <i>D. (Himantura) microps</i> (Ann.). |

- | | | |
|---|----|--|
| 22. Tail long, exceeding the length of disk | .. | 23. |
| 23. Tail banded | .. | 25. |
| 24. Tail not banded .. | .. | <i>D. (Himantura) alcocki</i>
(Ann.). |
| 25. Teeth 25-38 rows in both jaws .. | .. | <i>D. (Himantura) uarnak</i>
(Forsk.) (text-fig. 17). |
| 26. Teeth 13 rows in upper and 23 in lower jaw .. | .. | <i>D. (Himantura) gerrardi</i>
(Gray). |

Genus *Urogymnus* M. H.

Disk subcircular and profusely tuberculated. Tail feeble, about as long as disk length ; without caudal spine. Nasoral grooves rudimentary; cirri present. Rostral cartilage absent. Spiracles large, close behind eyes. 5 pairs of gill-openings on the ventral side. Rayed dorsal fins absent. Rayed portion of the pectoral fins united anteriorly. Anal fin absent. Teeth tessellated, flattened, rhomboid.

Distribution.—E. Africa, Seychelles, Red Sea, Arabia, India, Ceylon, Malay Peninsula, Siam, Indo-China, Borneo, Java, Philippines, Melanesia.

Urogymnus africana (Schn.), text-fig., 18a, is found in India and Ceylon.

Genus *Gymnura* Kuhl.

Disk much wider than long. Tail short, slender, with serrated spine. Rostral cartilage absent. Nasoral grooves present. Spiracles large, close behind eyes. 5 pairs gill-openings on the ventral side. Rayed dorsal fins absent. Rayed portion of the pectoral fins united anteriorly. Anal fin absent. Teeth, minute, numerous, in broad bands, each tooth with one to three cusps.

Distribution.—S. Africa Natal, Red Sea, India, Ceylon, Burma, Singapore, Malay Archipelago, Siam, China, Japan, Korea, Philippines, Australia, Polynesia.

Key to subgenera of genus Gymnura Kuhl.

- | | | |
|---|----|-------------------------------------|
| 1. A small dorsal cutaneous fold on tail .. | .. | Subgenus Aetoplatea
M. H. |
| 2. No dorsal cutaneous fold on tail .. | .. | Subgenus Gymnura Kuhl. |

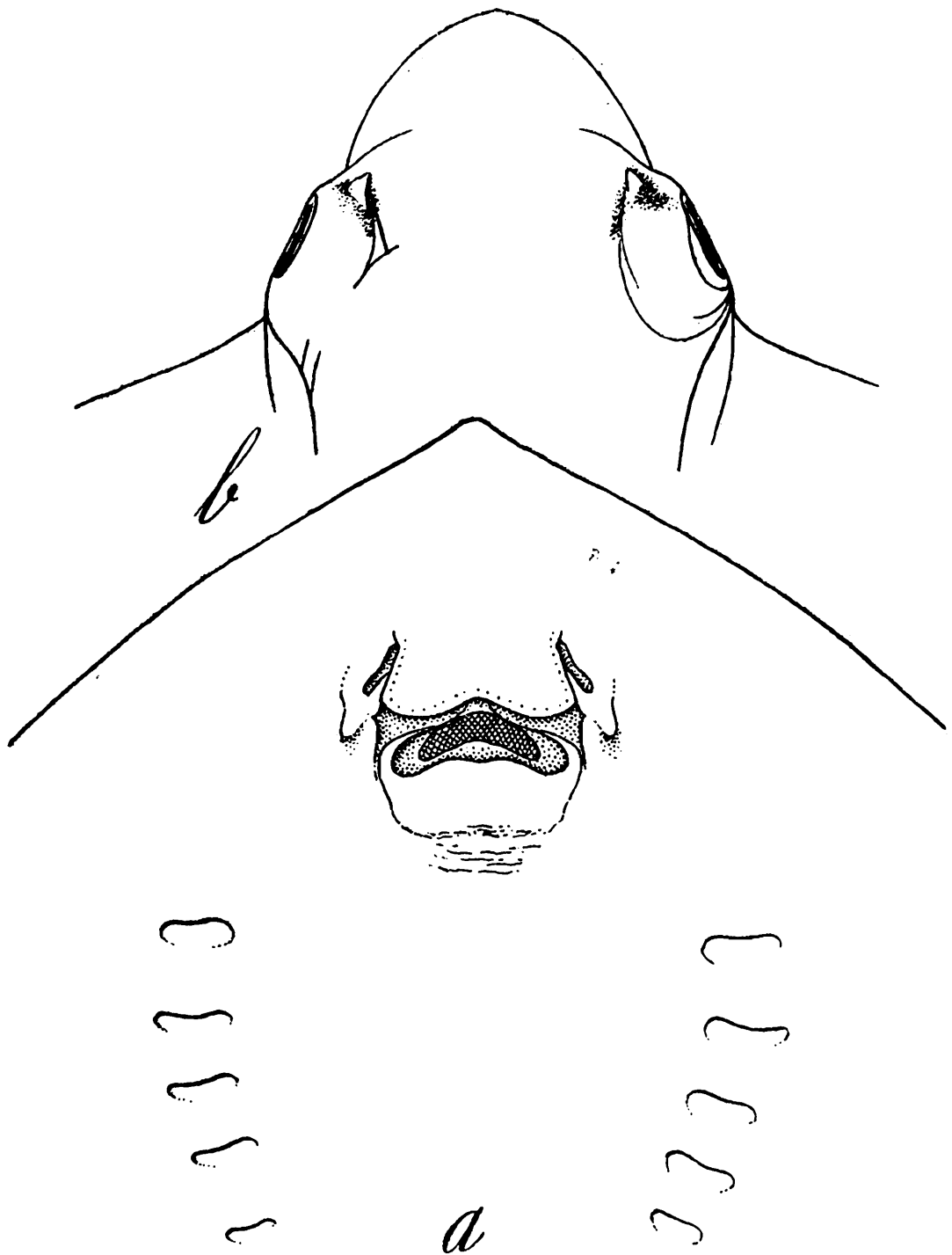
Key to the species.

- | | | |
|--|----|--|
| 1. A small dorsal cutaneous fold on tail .. | .. | 3. |
| 2. No dorsal cutaneous fold on tail .. | .. | 5. |
| 3. Tentacles behind spiracles .. | .. | <i>G. (Aetoplatea) tentaculata</i>
M. H. (text-fig. 16b). |
| 4. No tentacles behind spiracles .. | .. | <i>G. (Aetoplatea) zonurus</i>
Blkr. |
| 5. Tail about as long as length of disk .. | .. | <i>G. (Gymnura) peocilura</i>
(Shaw) (text-fig 16c-d). |
| 6. Tail less than half the length of disk .. | .. | <i>G. (Gymnura) micrura</i>
(Schn.). |

Family MYLIOBATIDAE.

Key to genera of family MYLIOBATIDAE.

1. Teeth on several rows of which the lateral ones are narrower than the central : caudal spine absent .. Genus **Aetomylaeus** Garman.



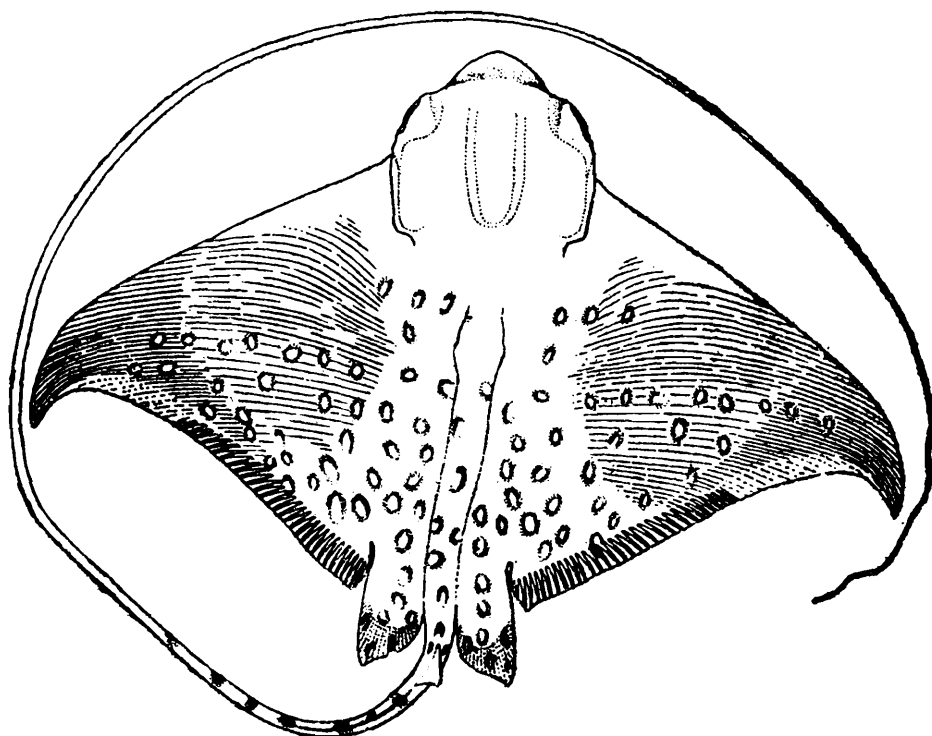
TEXT-FIG. 18.—*a*. Ventral view of head of *Urogymnus africana* : $\times \frac{2}{5}$; *b*. Dorsal view of head of *Aetomylaeus nichofii cornifera* (after Annandale).

2. Teeth in single broad series : caudal spine present .. Genus **Aetobatus** Blainville.

Genus *Aetomylaeus* Garman.

Disk lozenge-shaped about twice as broad as long. Tail whip-like, much longer than disk and without caudal spine. Head moderately conspicuous, rostral fins forming a unilobed snout. Eyes lateral. Nasoral grooves present. Spiracles large, behind eyes. 5 pairs of gill-openings on the ventral side. First dorsal fin small, situated at basal part of tail; the second dorsal and anal fins absent. Rayed portion of the pectorals, falciform and extending only upto the posterior region of the orbit. Teeth in 3 rows of which the lateral narrower than the central ones.

Distribution.—Red Sea, India, Ceylon, Burma, Malay Peninsula, Malay Archipelago, Siam, Cochin-China, China, Japan, Philippines, Australia.



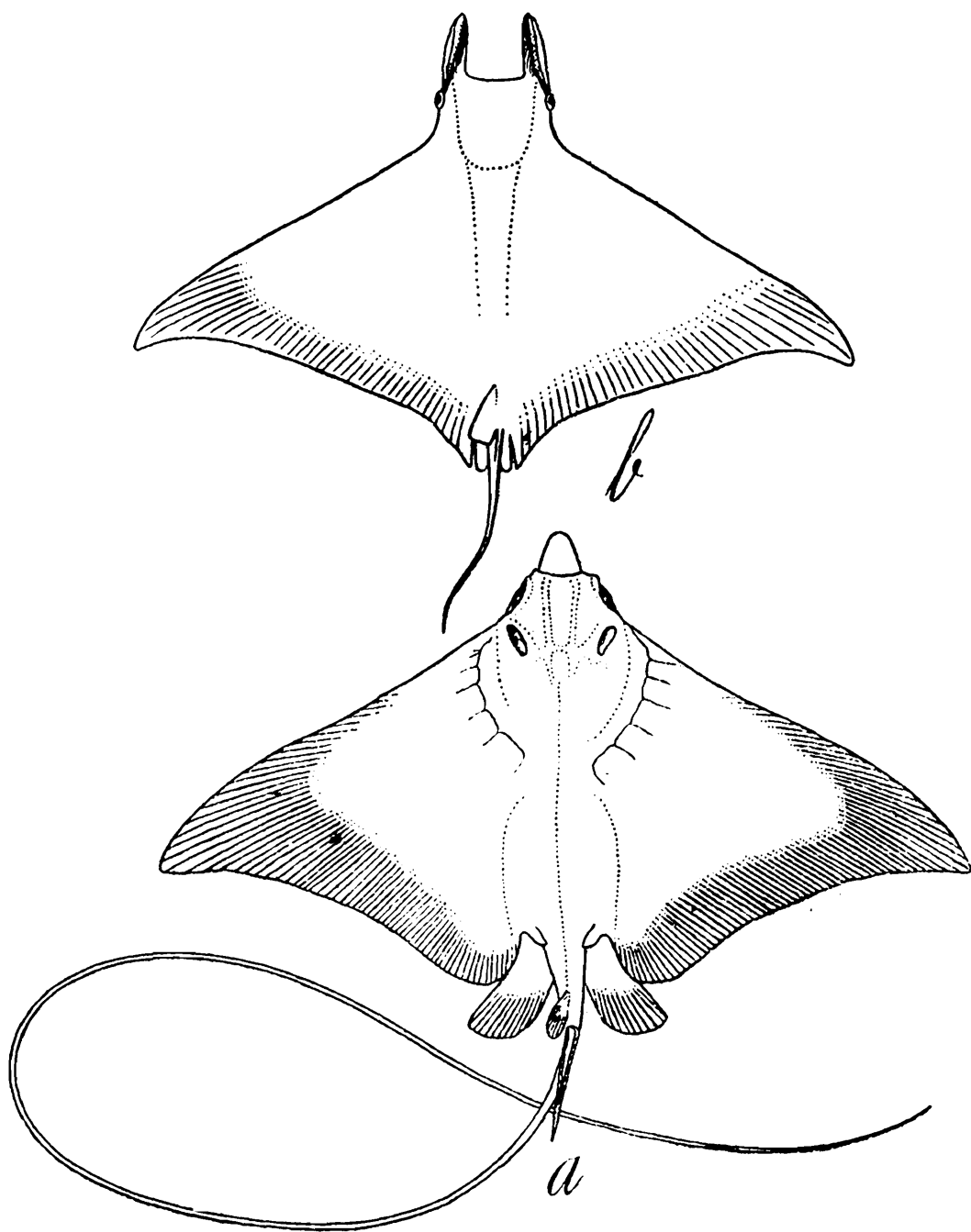
TEXT-FIG. 19.—Dorsal view of *Aetomylaeus milvus*: X $\frac{7}{5}$.

Key to the species.

- | | |
|--|---|
| 1. Origin of dorsal fin behind ends of pelvic bases | <i>A. maculatus</i> (Gray). |
| 2. Origin of dorsal fin opposite ends of pelvic bases | 3. |
| 3. Orbital horns present | <i>A. nichofii cornifera</i>
(Ann.) (text-fig. 18b). |
| 4. Orbital horns absent | 5. |
| 5. About 5 blue cross bands on disk : spiracles twice eye | <i>A. nichofii</i> (Schn.). |
| 6. Green brown-edged ocelli on hind part of disk : spiracles about the size of eye | <i>A. milvus</i> (M.H.) (text-fig. 19). |

Genus **Aetobatus** Blainville.

Disk lozenge-shaped about twice as broad as long. Tail whip-like, larger than the length of the disk and with a serrated caudal spine. Head conspicuous, rostral fins forming a unilobed pointed snout. Eyes lateral. Nasoral grooves present. Spiracles large about twice eye diameter and laterally situated about an eye-diameter and a half behind eyes. 5 pairs of gill-openings on the ventral side. First dorsal fin small, situated at basal part of tail; second dorsal and anal fins absent. Rayed portion of the pectorals falciform extending upto the anterior margin of the spiracles. Teeth in a single row.



TEXT-FIG. 20.—*a*. Dorsal view of *Aetobatus narinari* (after Day); *b*. Dorsal view of *Mobula diabolus* (after Day).

Distribution.—Tropical Atlantic Ocean, Natal, Red Sea, Arabia, Seychelles, India, Ceylon, Burma, Malay Peninsula, Malay Archipelago, Siam, Cochin-China, China, Philippines, Melanesia, Polynesia, Micronesia, Hawaiian groups.

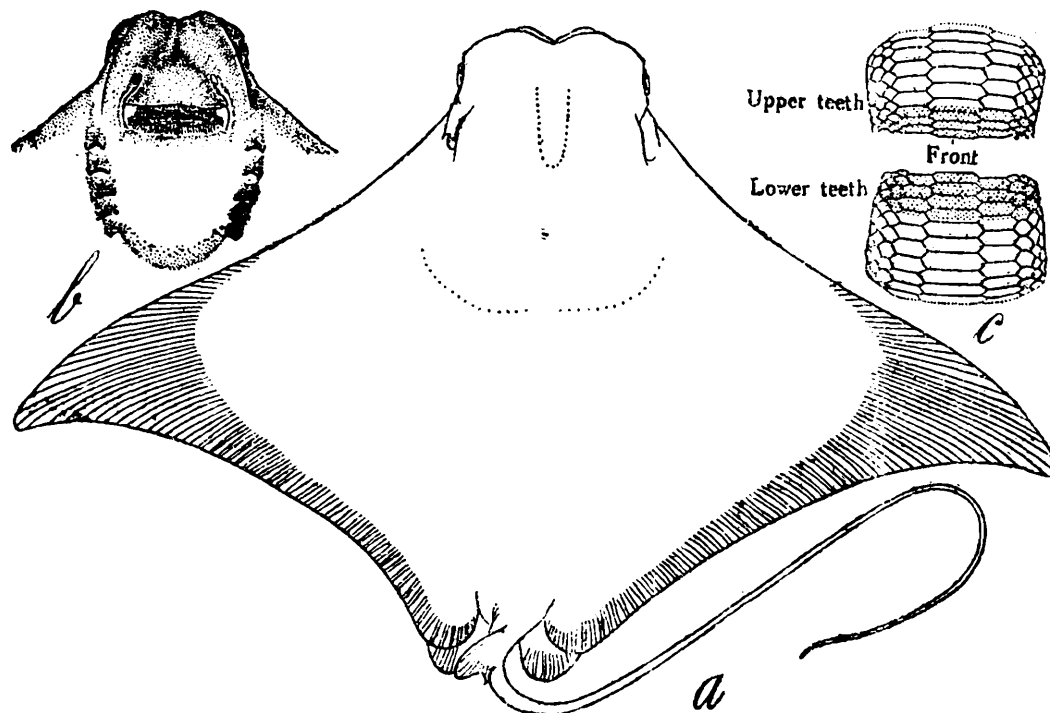
Aetobatus narinari (Euphrasen), text-fig. 20a, is the only species of the genus found in India, Burma and Ceylon.

Family RHINOPTERIDAE.

Genus *Rhinoptera* C.

Disk lozenge-shaped about twice as broad as long. Tail whip-like, longer than disk, with basal serrated spine. Head somewhat conspicuous, rostral fins forming a bilobed snout. Eyes prominent, lateral. Nasoral grooves present. Spiracles large, behind eyes, open laterally. 5 pairs of gill-openings on ventral side. First dorsal fin above basal part of the tail. Second dorsal and anal fins absent. Rayed portion of the pectorals falciform and not joined with the rostral fins in the front. Teeth wide, angular, flat, in pavement, median row widest.

Distribution.—Mediterranean, Africa, Arabian Sea, Muscat, India, Ceylon, Malay Peninsula, Java, Siam, China, Philippines, Australia, Brazil, Lower California.



TEXT-FIG. 21.—a. Dorsal view of *Rhinoptera sewelli*; b. Ventral view of head of same; c. Dentition of same (after Misra).

Key to the species.

- | | |
|--|---|
| 1. Teeth in 9 rows in upper jaw | 3. |
| 2. Teeth in 7 rows in upper jaw | <i>R. javanica</i> M. H. |
| 3. Teeth in 9 rows in lower jaw | .. <i>R. sewelli</i> Misra. text, fig. 21 a-c). |
| 4. Teeth in 7 rows in lower jaw | 5. |
| 5. Teeth in median row 8 times as wide as long | <i>R. jayakari</i> Blgr. |
| 6. Teeth in median row 3 times as wide as long | <i>R. adpersa</i> M H. |

Family MOBULIDÆ.

Key to genera of family MOBULIDÆ.

1. Mouth inferior well behind the head : dental plate in both jaws or at least in the upper jaw : cephalic horns curled Genus **Mobula** Rafinesque.
2. Mouth terminal in front of head : dental plate usually on lower jaw and sometimes in both jaws : cephalic horns rarely curled Genus **Manta** Bancroft.

Genus **Mobula** Rafinesque.

Disk, lozenge-shaped about twice as broad as long. Tail short whip-like, in the young $1\frac{1}{2}$ times the length of the disk, and in the adults a little more than half the disk length ; with or without serrated spine. Head conspicuous, broad and flat with two, curled, cephalic horns. Mouth inferior, well behind the head, Eyes large, lateral. Nasoral grooves persent. Spiracles moderate, behind eyes. 5 pairs of gill-openings on the ventral side. First dorsal fin small, triangular above and between pelvics. Second dorsal and anal fins absent. Rayed portion of the pectorals falciform extending upto the postorbital region. Teeth small, numerous in both jaws or at least in the upper jaw.

Distribution.—Red Sea, Arabia, India, Ceylon, Penang, Malay Archipelago, Philippines, Queensland.

Mobula diabolus (Shaw), text-fig. 20*b*, is the only species of the genus found in India and Ceylon.

Genus **Manta** Bancroft.

Disk lozenge-shaped about twice as broad as long. Tail whip-like about as long as disk length ; without serrated caudal spine. Head greatly depressed, broad and flat with two cephalic horns, rarely curled. Mouth large, terminal in front of head. Eyes prominent, lateral. Nasoral grooves present. Spiracles moderate, behind eyes. 5 pairs of gill-openings on ventral side. First dorsal fin small, above and between pelvics. Second dorsal and anal fins absent. Rayed portion of pectorals flaciform extending upto the postorbital region. Teeth small, numerous, in pavement usually on lower jaw and sometimes on both jaws.

Distribution.—Atlantic Ocean, S. Africa, Red Sea, India, Malay Peninsula, Malay Archipelago, Melanesia, N. and S. America, Galapagoes Islands, West Indies.

Manta birostris (Walbaum), is the only species of the genus found in India.

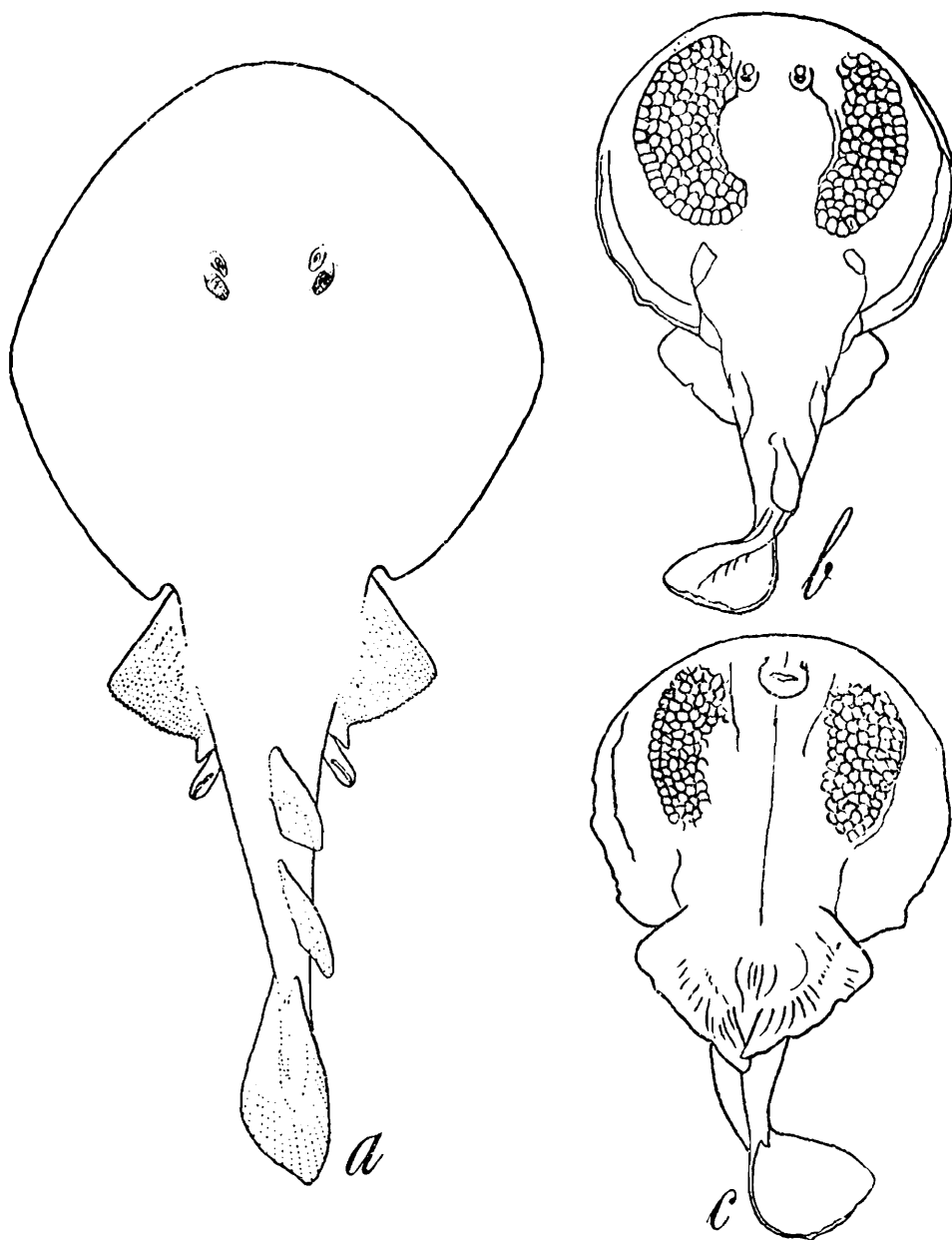
Order TORPEDINIFORMES.

Family TORPEDINIDÆ.

Key to genera of family TORPEDINIDÆ.

1. Two dorsal fins 5.
2. One dorsal fin 3.

- | | |
|---|------------------------------------|
| 3. Pectorals, pelvics and eyes poorly developed | .. Genus Bengalichthys Ann. |
| 4. Pectorals, pelvics and eyes well developed | .. Genus Narke Kaup. |
| 5. Origin of first dorsal fin opposite pelvics | .. 7. |
| 6. Origin of first dorsal fin distinctly behind pelvics | .. Genus Narcine Henle. |
| 7. Disk elongate : eyes rudimentary | .. Genus Benthobatis Alc. |
| 8. Disk broad and subcircular : eyes well developed | Genus Torpedo Houttuyn. |



TEXT-FIG. 22.—a. Dorsal view of *Narcine brunnea* : X $\frac{3}{4}$; b. Dorsal view of *Narke cipterygia* ; c. Ventral view of same (after Prashad).

Genus **Narcine** Henle.

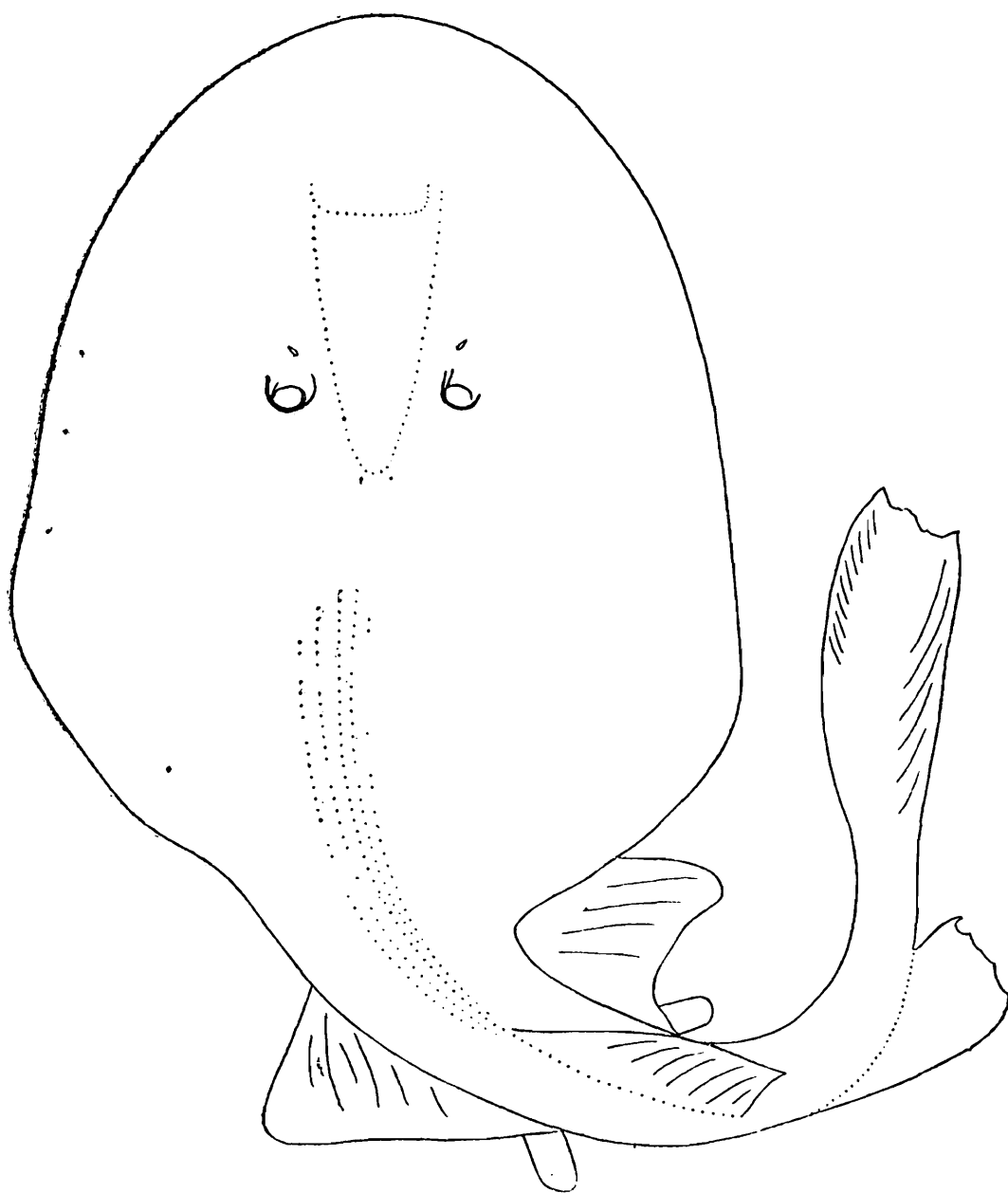
Disk subcircular with head not distinct from it. Tail with lateral folds, slightly shorter than the length of disk and without serrated caudal spine. Snout broadly rounded, twice the interorbital distance. Rostral cartilage present. Nasoral grooves present. Spiracles large, situated

close behind the small eyes. 5 pairs of gill-openings on the ventral side between the electric organs. Two spineless dorsal fins on tail. Anal absent. Pelvics well developed. The rayed portion of the pectorals continued to the orbital region. Teeth in narrow bands.

Distribution.—India, Ceylon, Malay Archipelago, China, Japan, Philippines, Australia, Tasmania.

Key to the species.

- | | | | |
|--|--|---|--|
| 1. Brown-spotted above | | 3. | |
| 2. Uniform brown above | | <i>N. brunnea</i> Ann. (text-fig. 22a.) | |
| 3. Teeth in 27 rows in upper jaw and 26 in the lower jaw | | <i>N. indica</i> Henle. | |
| 4. Teeth in 23 in upper jaw and 21 in the lower jaw | | <i>N. timlei</i> (Schn.). | |



TEXT-FIG. 23.— Dorsal view of *Benthobatis moresbyi* (after Alcock).

Genus **Benthobatis** Alc.

Disk oval with head not distinct from it. Tail without lateral folds, slightly longer than disk length and without serrated caudal spine. Snout

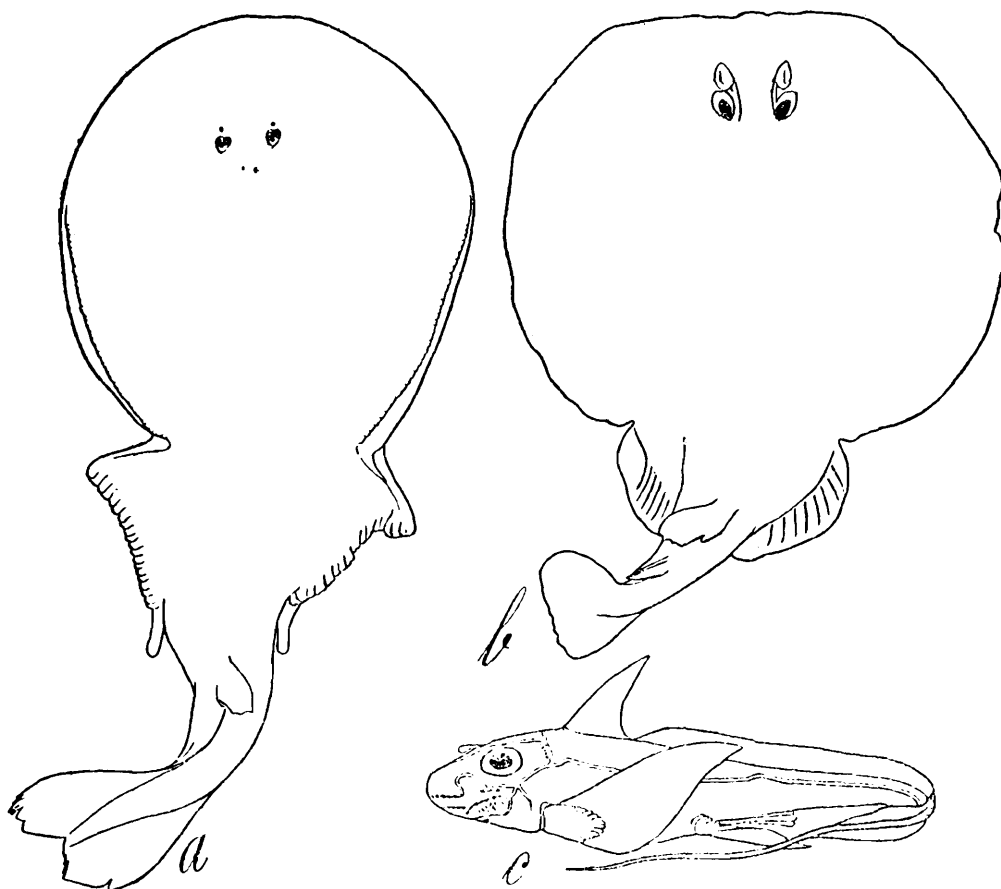
broadly rounded, about twice the interorbital distance. Rostral cartilage present. Nasoral grooves present. Eyes obsolete, as two unpigmented spots. Spiracles moderate, close behind the eye spots. 5 pairs of large gill-openings on the ventral side between the electric organs. Two spineless dorsal fins on tail. Pelvics well developed. The rayed portion of the pectorals extends only to the orbital region. Anal fin absent. Teeth small as rhomboidal plate with the crown strongly and acutely produced.

Distribution.—Arabian Sea, India.

Benthobatis moresbyi Alc., text-fig. 23, is found in India.

Genus **Torpedo** Houttuyn.

Disk widely circular with head not distinct from it. Tail very short with lateral folds and without serrated caudal spine. Snout broadly rounded and equal to interorbital distance. Rostral cartilage present, but reduced. Nasoral grooves present. Eyes well developed. Spiracles moderate, close behind eyes. 5 pairs of gill-openings on the ventral side between the electric organs. Two spineless dorsal fins on tail. Pelvics well developed. The rayed portion of the pectorals extends to the orbital region. Anal fin absent. Teeth small, in pavement, irregularly rhomboidal with the crown obliquely pointed.



TEXT-FIG. 24.—a. Dorsal view of *Bengalichthys impennis*: X 4; b. Dorsal view of *Torpedo marmorata* (after Annandale); c. Lateral view of *Chimaera monstrosa* (after Boulenger).

Distribution.—E. Africa, Madagascar, Mauritius, Seychelles, Red Sea, India, Philippines.

Key to the species.

1. Body speckled with small, light blotches : teeth in 18 rows .. *T. marmoratus* Risso (text-fig 24b).
2. Body variably speckled with irregular large and small, dark spots : teeth in 20 rows .. *T. sinus-persici* Olfers.

Genus **Narke** Kaup.

Disk circular with head not distinct from it. Tail slightly shorter than the disk length, with lateral folds and without serrated caudal spine. Snout broadly rounded and about one and a quarter times the interorbital distance. Rostral cartilage present, but reduced. Nasoral grooves present. Spiracles large, close behind eyes. 5 pairs of gill-openings on the ventral side. One spineless dorsal fin. Pelvic and pectoral fins well developed. The rayed portion of the pectorals extends to the orbital region. Anal fin absent. Teeth in narrow band, small, quadrangular, with the crown not strongly produced.

Distribution.—Arabian Sea, India, Ceylon, Malay Peninsula, Indo-China, Japan, Philippines.

Narke dipterygia (Schn.), text-fig. 22b-c, is found in India and Ceylon.

Genus **Bengalichthys** Ann.

Disk oblong. Tail slightly shorter than the disk length, with lateral folds and without serrated caudal spine. Snout broadly rounded and one and a quarter times in the interorbital distance. Rostral cartilage present, but reduced. Nasoral grooves present. Eyes minute. Spiracles moderate, close behind eyes. 5 pairs of small gill-openings between the electric organs. One spineless dorsal fin. Pectoral and pelvic fins not well developed. The rayed portion of the pectorals extends only up to the orbital region. Anal fin absent. Teeth roughly quadrangular, small, with the crown not much produced.

Distribution.—India.

Bengalichthys impennis Ann., text-fig. 24a, is found in India.

Class HOLOCEPHALI.

Subclass CHIMAERAE.

Order CHIMAERIFORMES.

Key to families of order CHIMAERIFORMES.

1. Claspers simple : with proboscis or beak Family RHINOCHIMAERIDAE.
2. Claspers trifid or bifid without proboscis or beak Family CHIMAERIDAE.

Family CHIMAERIDAE.

Genus **Chimaera** L.

Body elongate and shark-like in form tapering posteriorly to a point at tail. Head large, compressed and without proboscis or beak. Eyes large or moderate, lateral. Mouth inferior. Nasoral grooves present. Spiracles absent. One gill-opening on either side of pharynx containing four gill-slits and four gills covered over by a skinny operculum. Two dorsal fins, the first dorsal with a strong spine anteriorly; the second dorsal long and low. Pectorals large, free and low. Pelvics abdominal, many rayed. Anal fin small, distinct or not distinct from subcaudal. Mature males with trifold or rarely bifid claspers. Skin naked, devoid of placoid scales. Teeth united to form bony plates, laminae or tritors; 4 tritors in the upper jaw; 2 tritors in lower jaw.

Distribution.—S. Africa, India, Sumatra, China, Korea, Japan, Philippines, Australia, Hawaiian groups, North and middle Atlantic Ocean.

Chimaera monstrosa L., text-fig. 24c, is the only species of the genus found in India.

Family RHINOCHIMAERIDAE.

Key to genera of family RHINOCHIMAERIDAE.

1. Snout compressed: upper caudal edge spinose egg-capsule black, patch of byssus large (14.0 sq. mm.) .. Genus **Rhinochimaera** Garman.
2. Snout depressed: upper caudal edge not spinose: egg-capsule, pale bottle-green, patch of byssus small (7.5 sq. mm.) .. Genus **Harriotta** G. B.

Genus **Harriotta** G. B.

Body elongate tapering to a long tail with a filamentous tip. Head with long rostral proboscis. Snout depressed. Eyes moderate, lateral. Mouth inferior. Spiracles absent. One gill-opening on either side of pharynx, containing four gill-slits and four gills covered over by a skinny operculum. Two dorsal fins with a spine anteriorly; second dorsal low. Pectorals large, free. Anal small and distinct from subcaudal. Supracaudal moderately high, upper edge without spines. Mature male with a simple clasper. Teeth with tritors.

Distribution.—Gulf of Aden, Bay of Bengal, Japan, Atlantic Ocean.

Harriotta (?) *indica* (Garman), is the only species of the genus found in India.

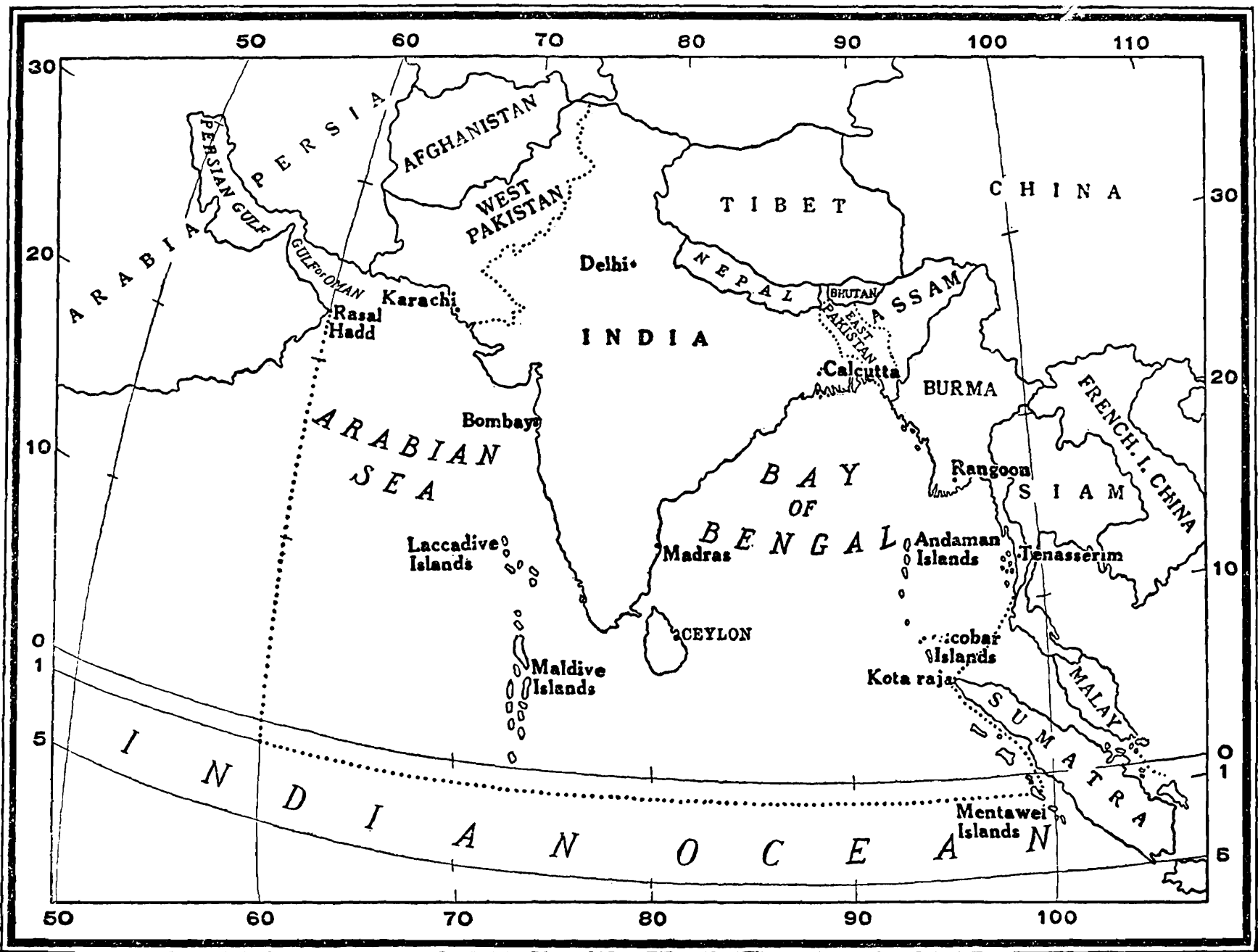
Genus **Rhinochimaera** Garman.

Body elongate tapering posteriorly to the long tail with a filamentous tip. Head with long rostral proboscis. Snout compressed. Eyes moderate. Mouth inferior. Spiracles absent. One gill-opening on either side of pharynx containing four gill-slits and four gills covered over by a skinny operculum. Two dorsal fins; first dorsal with spine

anteriorly ; second dorsal low. Pectorals large, free. Anal small not distinct from subcaudal. Supracaudal low, upper edge armed with spines. Mature male with a simple clasper. Teeth united to form grinding plate.

Distribution.—India, Japan.

Rhinochimaera sp. has been recorded from Arabian Sea, off Travancore Coast.



TEXT-FIG. 25.—Map demarcating the boundaries of India, Burma and Ceylon by dotted line for marine fishes.

