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PARASITIC NEMATODES OBTAINED FROM ANIMALS DYING IN THE CALCUTTA ZOOLOGICAL GARDENS.¹

PARTS 9—11.

By P. A. MAPLESTONE, D.S.O., M.B., Ch.B., D.T.M.

(From the Hookworm Research Laboratory, School of Tropical Medicine and Hygiene,
Calcutta.)

PART 9.—A COLLECTION OF FOUR NEW GENERA.

Physocephaloides, gen. nov.

This worm was found in the intestine of a Hoolock (*Hylobates hoolock*).

There is a slight, fairly long cephalic inflation, which is overlapped posteriorly by the commencement of the lateral flanges. The flanges are single on each side. The cervical papillae are asymmetrical both in size and position, one short and stout near the posterior portion of the cephalic inflation, and the other just behind the nerve ring, the latter is longer and more conical (fig. 1). There are three rounded lips on either side of the mouth opening; each one of these bears a papilla (fig. 2). The long chitinous vestibule is surrounded by irregular thickened ridges (fig. 1). The oesophagus is divided into two portions, and the nerve ring surrounds it a little distance behind its commencement (fig. 1). *Male*:—There are four pairs of pedunculate precloacal papillae and a group of about six small papillae near the tip of the tail. The caudal alae are relatively broad and symmetrical. The spicules are unequal, tapering to sharp points and there is a short but stout gubernaculum (fig. 3). *Female*:—The vulva is hard to find as it is only an oblique slit in the cuticle, without any lips. In the single specimen in which it was observed and which was 21 mm. in length, the vulva was 5.2 mm. from the tip of the tail. The tail ends in a short blunt mucronate tip (fig. 4). The eggs have a thick shell and each contains an embryo in the uterus:

This worm agrees with the genus *Physocephalus* in all particulars except that it has a single flange on either side of the body instead of three as in that genus. This may seem a small point on which to erect a new genus, but *Physocephalus* has been established since 1861 and it contains at least five species. In my opinion it is better to erect a new genus to accommodate the species under discussion rather than to change the definition of an old established genus to make it conform

The earlier parts of this series were published in *Rec. Ind. Mus.* XXXII, pp. 385-412 (1930) and *Rec. Ind. Mus.* XXXIII, pp. 71-171 (1931).

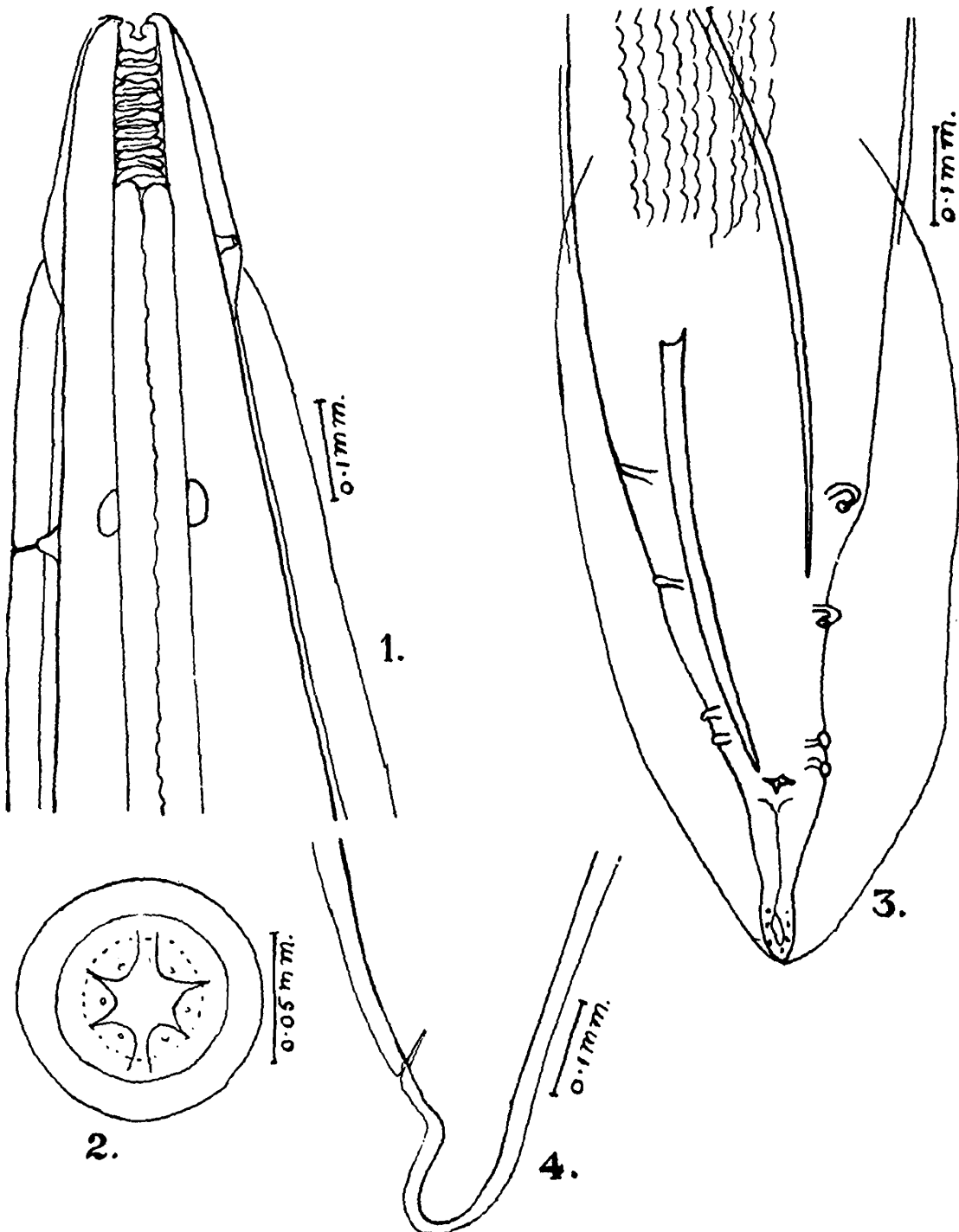
to the new worm. It is accordingly proposed to name this worm *Physocephaloides primus* gen. et. sp. nov.

Generic definition. *Arduenninae*; identical with *Physocephalus* except that there is a single lateral flange on either side of the body, instead of the triple flange characteristic of that genus.

Type species. *Physocephaloides primus*, sp. nov.

Host. *Hylobates hoolock*.

Type-specimens are in the Indian Museum, Calcutta.



TEXT-FIG. 1.—*Physocephaloides primus*. Anterior end, dorso-ventral view.

TEXT-FIG. 2.—*Physocephaloides primus*. Anterior end, end-on view.

TEXT-FIG. 3.—*Physocephaloides primus*. Male tail, ventral view.

TEXT-FIG. 4.—*Physocephaloides primus*. Female tail, lateral view.

Table of measurements (in millimetres).

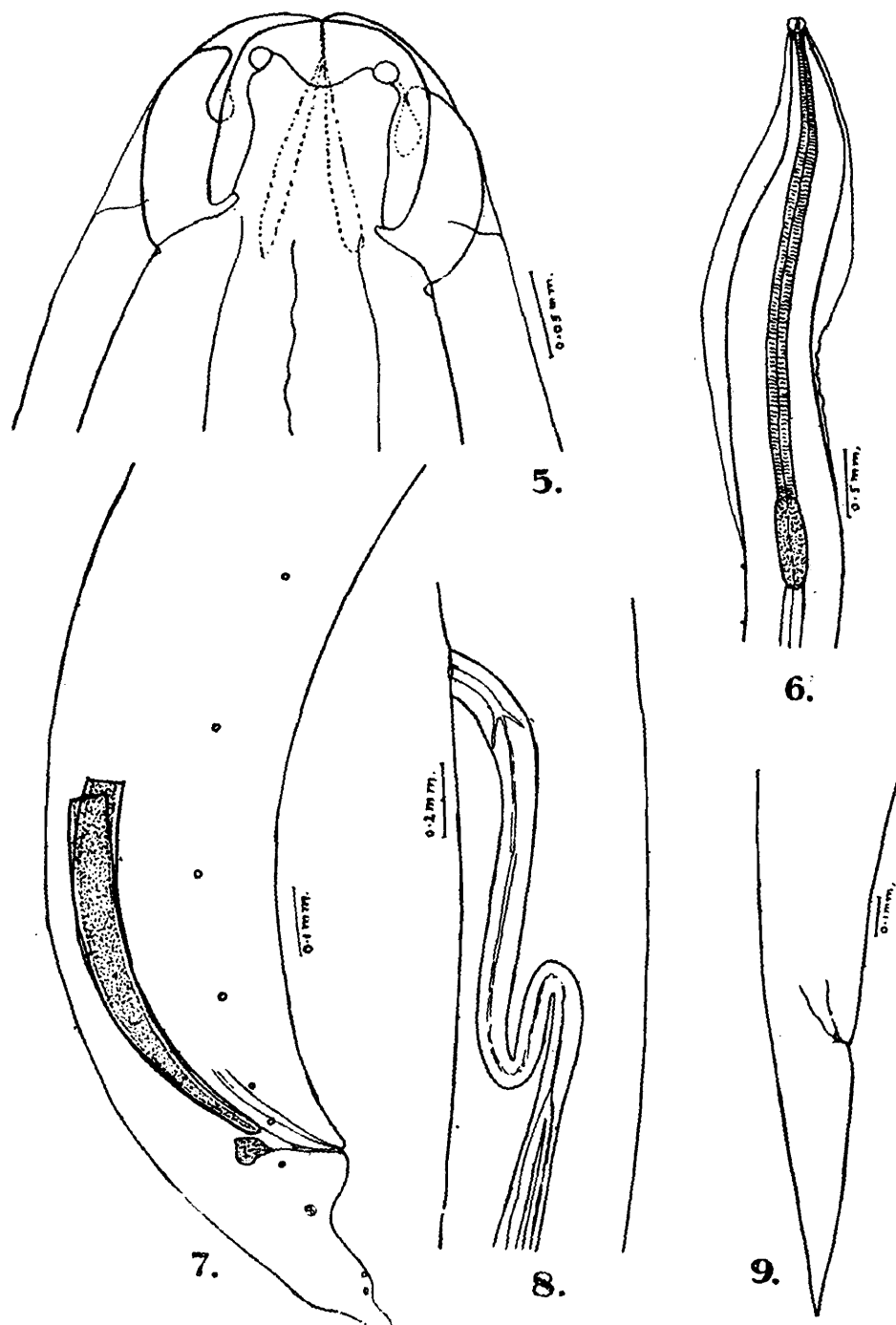
	Male.	Female.
Length	11.5—15	18—21
Diameter (maximum)	0.37—0.39	0.4—0.42
Nerve ring from ant. end	0.36—0.47	0.5
Cervical papillae from (1)	0.18—0.2	0.22—0.26
ant. end (2)	0.44—0.5	0.54
Pharynx, length	0.16—0.18	0.18
Oesophagus, length 1st part	0.475	0.5
2nd part	3.4	3.5
Spicules, length (1)	0.45—0.5	..
(2)	1.8—2.5	..
Gubernaculum, length	0.06	..
Vulva to tail	..	5.2
Anus to tail	0.14	0.12
Eggs	..	0.028—0.030 × 0.012—0.014

Belanisakis ibidis, gen. et sp. nov.

A collection of these worms was obtained from the intestine of a Black-headed ibis (*Ibis melanocephalus*).

The mouth is surrounded by three large lips separated from each other by conical interlabia. The dorsal lip has two papillae and the two sub-ventral lips have one papilla each. There are no dentigerous ridges on the inner surfaces of the lips (fig. 5). There are broad cervical alae about the same length as the oesophagus (fig. 6). On account of these alae the anterior end of the worms in the fixed state is always sharply curved. The oesophagus is without a posterior bulb, but it has a clearly defined oblong ventriculus. There are no oesophageal or intestinal diverticula (fig. 6). *Male* :—The posterior end of the male is slightly curved towards the ventral surface. The tail becomes suddenly narrower behind the cloaca, and is slightly swollen again just anterior to its tip. There is a pair of double papillae a little distance posterior to the cloaca, and two pairs of smaller papillae towards the tip of the tail (fig. 7). Beginning opposite the cloaca there is a sub-ventral row of papillae running forwards on each side; they are eighteen in number, and become gradually further apart from behind forwards ending about four millimetres from the tip of the tail. The spicules are stout and equal and end in rounded points. A short stout gubernaculum is present (fig. 7). *Female* :—The vulva is anterior to the middle of the body; it is an inconspicuous opening without lips. The vagina

is a muscular tube running posteriorly from the valva for a distance of about two millimetres. A short portion of the vagina at its commencement is divided off from the rest of the organ by a valvular structure, and posteriorly, just before dividing into the two uteri, it takes a close S-shaped curve (fig. 8). The uteri run parallel towards the posterior end of the worm, and pass into the ovaries a short distance



TEXT-FIG. 5.—*Belanisakis ibidis*. Anterior end, dorsal view.

TEXT-FIG. 6.—*Belanisakis ibidis*. Anterior end, ventral view, showing oesophagus and alae.

TEXT-FIG. 7.—*Belanisakis ibidis*. Male tail, lateral view.

TEXT-FIG. 8.—*Belanisakis ibidis*. Female, vulval region.

TEXT-FIG. 9.—*Belanisakis ibidis*. Female tail, lateral view.

anterior to the anus. The ovaries pursue a very convoluted course towards the anterior end of the worm and come to an end a short distance posterior to the vulva. The tail is straight and tapering (fig. 9).

This worm resembles the genus *Paranisakis* in possessing interlabia, and it has an oesophagus similar to that of *Anisakis*, but it differs from this and all other genera in the possession of cervical alae combined with the above characters. It is therefore necessary to create a new genus for this worm, and for this the name *Belanisakis* is proposed, the name of the species being *Belanisakis ibidis*, sp. nov.

Host. *Ibis melanocephalus*.

Type-specimens are in the Indian Museum, Calcutta.

Belanisakis, gen. nov.

Definition :—*Anisakinae*. Interlabia present; dentigerous ridges absent. Oesophagus with an anterior muscular portion and a posterior oblong ventriculus; oesophageal appendix and intestinal caeca absent. Broad cervical alae present. *Male* :—Spicules stout and equal; gubernaculum present. *Female* :—Vulva anterior to the middle of the body, oviparous. Parasites of birds.

Type-species. *B. ibidis*, sp. nov., in *Ibis melanocephalus*.

Table of measurements (in millimetres).

	Male.	Female.
Length .	23	34
Diameter .	0.535	0.71
Oesophagus, length	2.7	3.1
Ventriculus, length .	0.79	1.0
Tail, length	0.24	0.79
Spicules, length	0.5	..
Gubernaculum, length	0.06	..
Vulva from anterior end . .	..	11.7
Eggs	..	0.06 × 0.048
Cervical alae, maximum width . .	0.16	..

Quasithelazia tenuis, gen. et sp. nov.

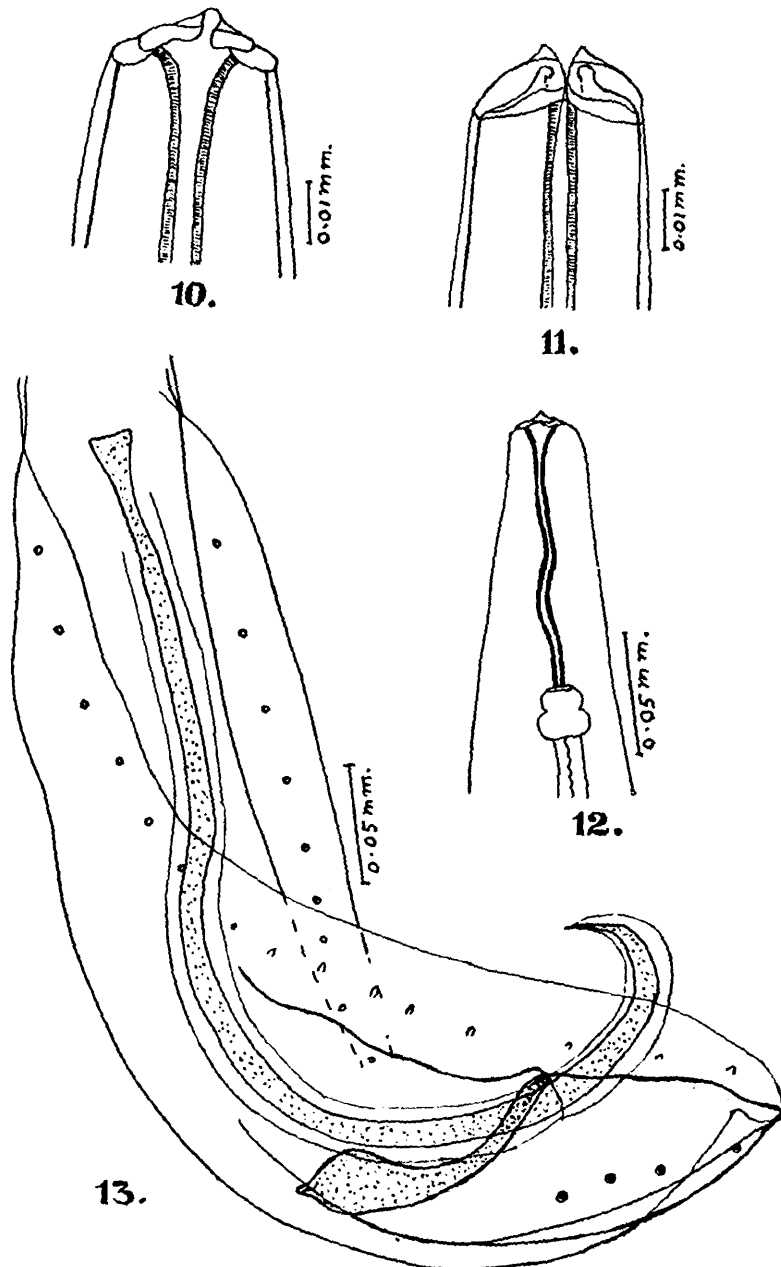
A single male specimen was found in the gizzard of a kingfisher (*Ceryle smyrnensis*), in company with a female of the species *Rusguniella brevis*.

The mouth is bounded by two conical lateral lips which appear to be surmounted by chitinous caps (figs. 10 and 11). There are no cervical cordons or other ornamentation. Cervical papillae are apparently absent, as they could not be found even after prolonged search. The mouth leads directly into a long chitinous vestibule which has thick striated walls (figs. 10 and 11). The walls of the vestibule curve dorsally and ventrally at the anterior end, so that the opening is probably oval. (fig. 10). Between the vestibule and oesophagus there

is a swollen, slightly lobulate structure, which is probably glandular in function. (fig. 12). The oesophagus is divided into two parts.

Male :—The tail is strongly curved ventrally, and is furnished with long stout caudal alae. There are twelve pairs of pedunculate papillae anterior to the cloaca, and four pairs posterior to it. The spicules are dissimilar and unequal, and there is no gubernaculum (fig. 13).

Female :—Unknown.



TEXT-FIG. 10.—*Quasithelazia tenuis*. Anterior end, lateral view.

TEXT-FIG. 11.—*Quasithelazia tenuis*. Anterior end, dorso-ventral view.

TEXT-FIG. 12.—*Quasithelazia tenuis*. Anterior end, showing vestibule and bulb.

TEXT-FIG. 13.—*Quasithelazia tenuis*. Male tail, semi-ventral view.

This worm resembles *Acuariinae* in the possession of two conical lateral lips and a long thick-walled vestibule, while the numerous pre-anal papillae bring it much nearer to *Thelaziinae*. The sub-family *Schistorophinae* is not accepted by all authorities, the genera contained in it being variously scattered among the *Acuariinae* *Spirurinae*, and

Thelaziinae. It is thus clear that Schistorophinae is a somewhat heterogeneous group of genera, having affinities with all the above sub-families. In the present stage of classification it is a useful dumping-ground for doubtful genera. The species under discussion is a good example, and it is proposed to create a new genus for it and to place it in the sub-family Schistorophinae. The name *Quasithelazia tenuis*, gen. et sp. nov. is proposed for this worm.

Host.—*Ceryle smyrnensis*.
The type-specimen is in the Indian Museum, Calcutta.

Quasithelazia, gen. nov.

Definition.—*Schistorophinae*. Mouth with conical lateral lips surmounted by chitinous caps. Cervical cordons absent. Long thick-walled vestibule present. *Male* :—Tail furnished with well-marked caudal alae, and numerous preanal papillae. Spicules unequal and dissimilar. Gubernaculum absent. *Female*.—Unknown.

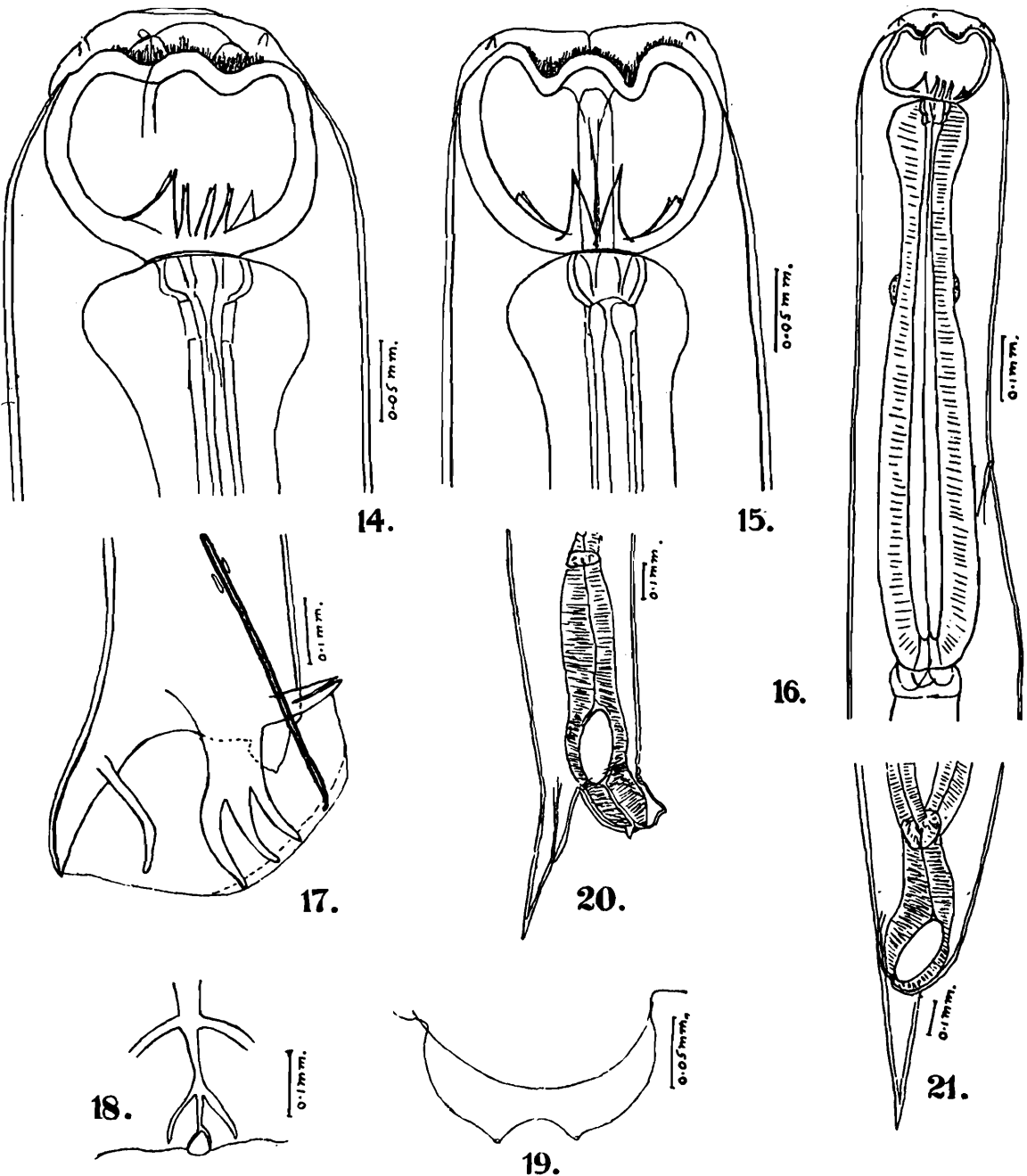
Type species.—*Q. tenuis*, sp. nov.

Table of measurements (in millimetres).										
										Male.
Length	.	.	.	.	.	.	.	.	.	8.48
Diameter	.	.	.	.	.	.	.	.	.	0.120
Vestibule, length	.	.	.	.	.	.	.	.	.	0.160
Oesophagus, length, 1st part						.				0.396
						2nd part	.	.	.	0.931
Spicules, length	.	.	.	.	.	.	.	.	.	0.54 0.11
Tail, length	.	.	.	.	.	.	.	.	.	0.1

Quasistrongylus rhea, gen. et sp. nov.

This worm was found in the intestine of an American ostrich (*Rhea americana*).
The mouth is directed straight forwards and there is a lateral and two submedian papillae on either side. There is a leaf-crown consisting of numerous very fine elements arising from the anterior border of the buccal capsule (figs. 14 and 15). The buccal capsule is large and subglobular and its anterior border has an undulating contour (figs. 14 and 15). Arising from the base of the capsule and surrounding the oesophageal opening, there are several pairs of large teeth. The pair on the dorsal side are larger than the others and they end in a simple point, and the remaining three or four pairs on the lateral and subventral aspects are somewhat shorter and end in bifid points (fig. 14). The oesophagus is slightly expanded anteriorly, and from a narrower portion immediately behind this it gradually increases in diameter to the posterior end (fig. 16). The lining of the oesophagus is heavily chitinized and anteriorly it expands into a funnel-shaped cavity furnished

with longitudinal ridges in its walls (figs. 14 and 15). *Male*.—The bursa is relatively short, but it is broad antero-posteriorly, and there is no distinct dorsal lobe (figs. 17 and 18). Prebursal papillae are absent. The ventral rays are cleft; the lateral rays arise from a common trunk and are approximately equal; the externo-dorsal rays arise from a common trunk with the dorsal; the dorsal gives off a branch on either side about two-thirds of its length from the origin of the externo-dorsal rays and its tip and it ends in two points (figs. 17 and 18). The spicules are equal and similar, with recurved tips, and the gubernaculum is in the form of a chitinized tube (fig. 17). The genital cone consists of two broad mammillate papillae (fig. 19). *Female*.—The vulva opens



TEXT-FIG. 14.—*Quasistrongylus rheae*. Anterior end, lateral view.

TEXT-FIG. 15.—*Quasistrongylus rheae*. Anterior end, lateral view.

TEXT-FIG. 16.—*Quasistrongylus rheae*. Anterior end, lateral view showing oesophagus.

TEXT-FIG. 17.—*Quasistrongylus rheae*. Male bursa, lateral view.

TEXT-FIG. 18.—*Quasistrongylus rheae*. Male bursa, dorsal ray.

TEXT-FIG. 19.—*Quasistrongylus rheae*. Male, genital cone.

TEXT-FIG. 20.—*Quasistrongylus rheae*. Female tail, lateral view.

TEXT-FIG. 21.—*Quasistrongylus rheae*. Female tail, lateral view.

just anterior to the anus on a large prominence (fig. 20). There is a very muscular vagina running forwards which divides into two muscular tubes; these pursue an anterior parallel course for about 2 mm. when they merge into the thinner-walled uteri. (fig. 21). The tail ends in a sharp point. The eggs are large and oval and they contain a segmented morula.

This worm shows many affinities to several genera of the sub-family Strongylinae but it differs distinctly from all of them, it is, therefore, proposed to create for it a new genus and to name this worm *Quasistrongylus rheae*, gen. et. sp. nov.

Quasistrongylus, gen. nov.

Definition.—*Strongylinae* :—Mouth directed straight forwards with an internal leaf-crown arising from the anterior border of the buccal capsule. Buccal capsule large and subglobular with an undulating anterior border; several pairs of stout teeth arise from the depth of the capsule. *Male* :—Bursal formula—Prebursal papillae absent; ventral rays cleft; lateral rays arise from a common trunk; externo-dorsal ray arises from a common trunk with the dorsal; dorsal gives off a lateral branch on each side and ends in a forked tip. Spicules equal, gubernaculum present. *Female* :—Vulva opens near anus on a large prominence. Parasites of birds.

Type species.—*Quasistrongylus, rheae*, sp. nov.

Host.—*Rhea americana*.

Type-specimens are in the Indian Museum, Calcutta.

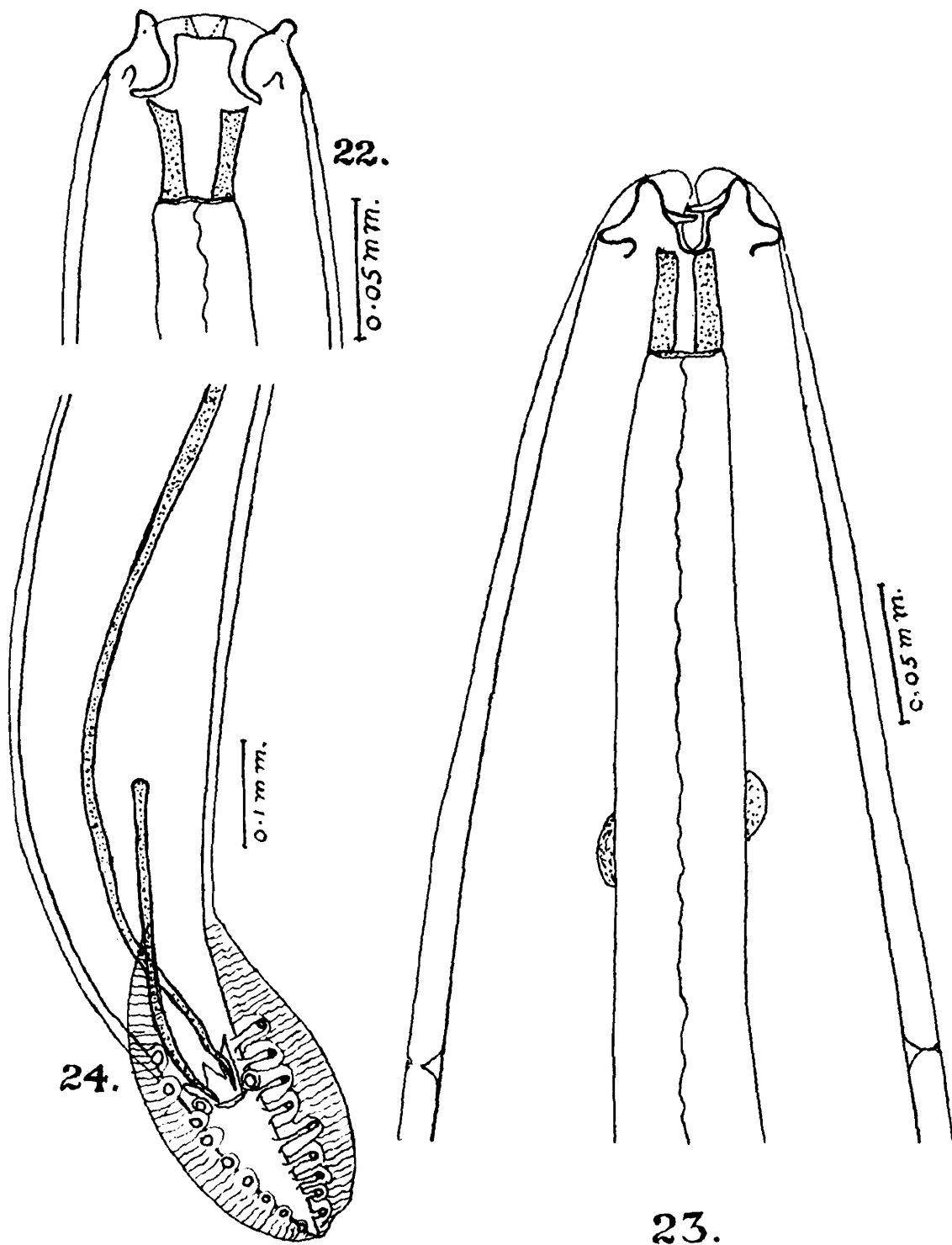
Table of measurements (in millimetres).

	Male.	Female.
Length	8.5—10.0	13.5—14.5
Diameter (maximum)	0.495	0.495
Buccal capsule (depth)	0.125	0.130
(diameter)	0.140	0.144
Excretory pore from ant. end	0.535	0.693
Nerve ring from ant. end	0.336	0.356
Cervical papillae from ant. end	..	0.693
Oesophagus (length)	0.75—0.8	0.85
Spicules (length)	1.0	..
Gubernaculum	0.06	..
Vulva to anus	..	0.4
Anus to tip of tail	..	0.27—0.36
Vagina (length)	..	0.39—0.42
Eggs	..	0.16—0.17 × 0.7—0.8

PART 10.—SPIRURIDS FROM BIRDS.

Habronema diesingi, sp. nov.

One male and one female of this species was found in the gizzard of a Vulturine guinea-fowl (*Acryllium vulturinum*).



TEXT-FIG. 22.—*Habronema diesingi*. Anterior end, lateral view.

TEXT-FIG. 23.—*Habronema diesingi*. Anterior end, dorso-ventral view.

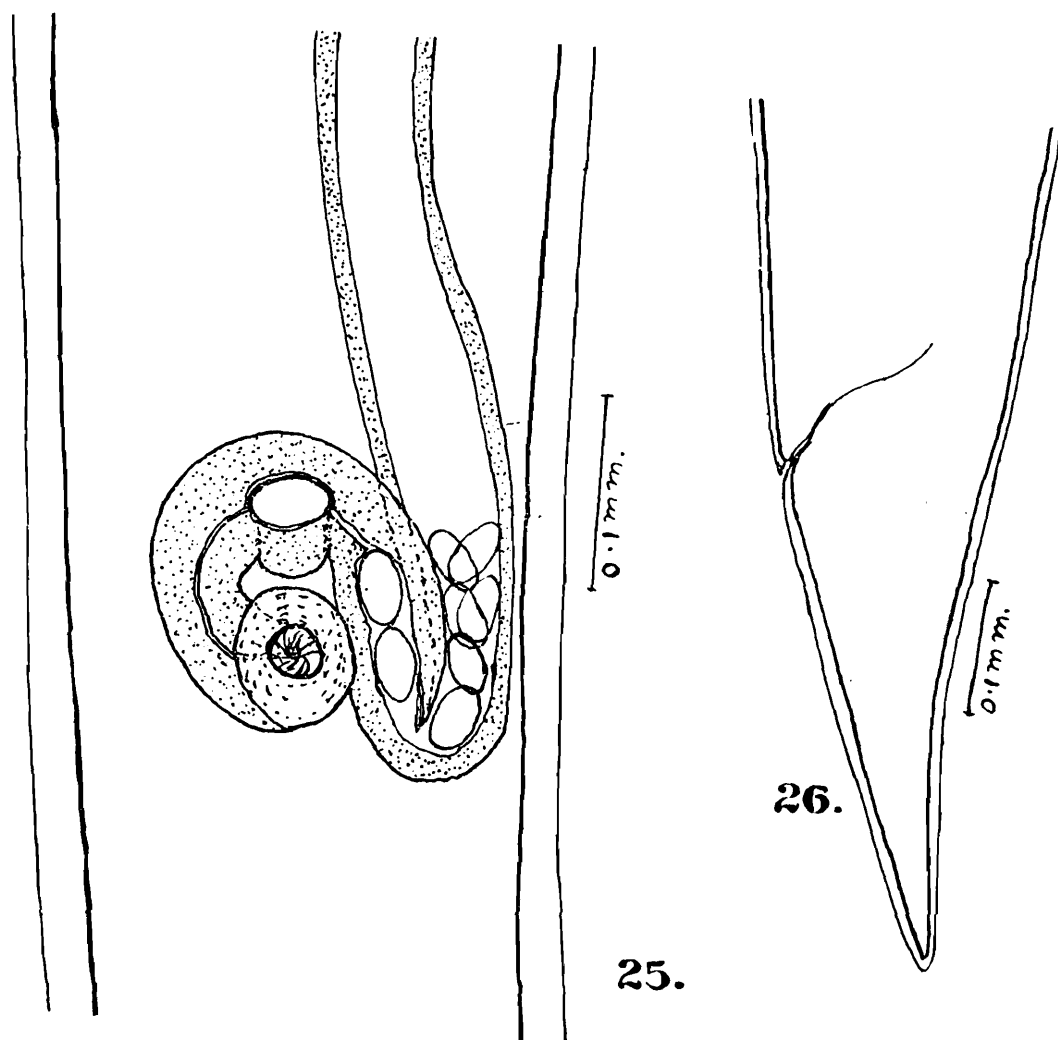
TEXT-FIG. 24.—*Habronema diesingi*. Male tail, ventral view.

There are narrow lateral alae on either side of the body. The cervical papillae and excretory pore are relatively far back, being some

distance posterior to the nerve ring. The mouth is bounded by two large lateral lips, which have a central quadrangular papilla and two prominent submedian papillae on each side (fig. 22). The submedian papillae have prominently projecting posterior angles (fig. 23). There is no dorsal or ventral cuticular lip such as is present in many species of the genus, but a pointed process arises from the inner surface of each submedian papilla, and running inwards it overlaps that arising from the opposite lip (fig. 23). The vestibule is stout and cylindrical (figs. 22 and 23), and the oesophagus is divided into two parts.

Male.—There are well-developed caudal alae supported by nine pairs of pedunculate papillae two of which are precloacal, and there is an additional pair of sessile papillae, one on either side of the cloaca (fig. 24). The spicules are markedly unequal and there is a broad gubernaculum.

Female.—The vulva opens in the posterior half of the body, dividing the body length into the proportions of 7.3 : 1. The vulva is slightly prominent and it leads directly into a thick-walled muscular ovejector, which describes almost a complete circle before turning forwards into



TEXT-FIG. 25.—*Habronema diesingi*. Vulval region, female, ventral view.

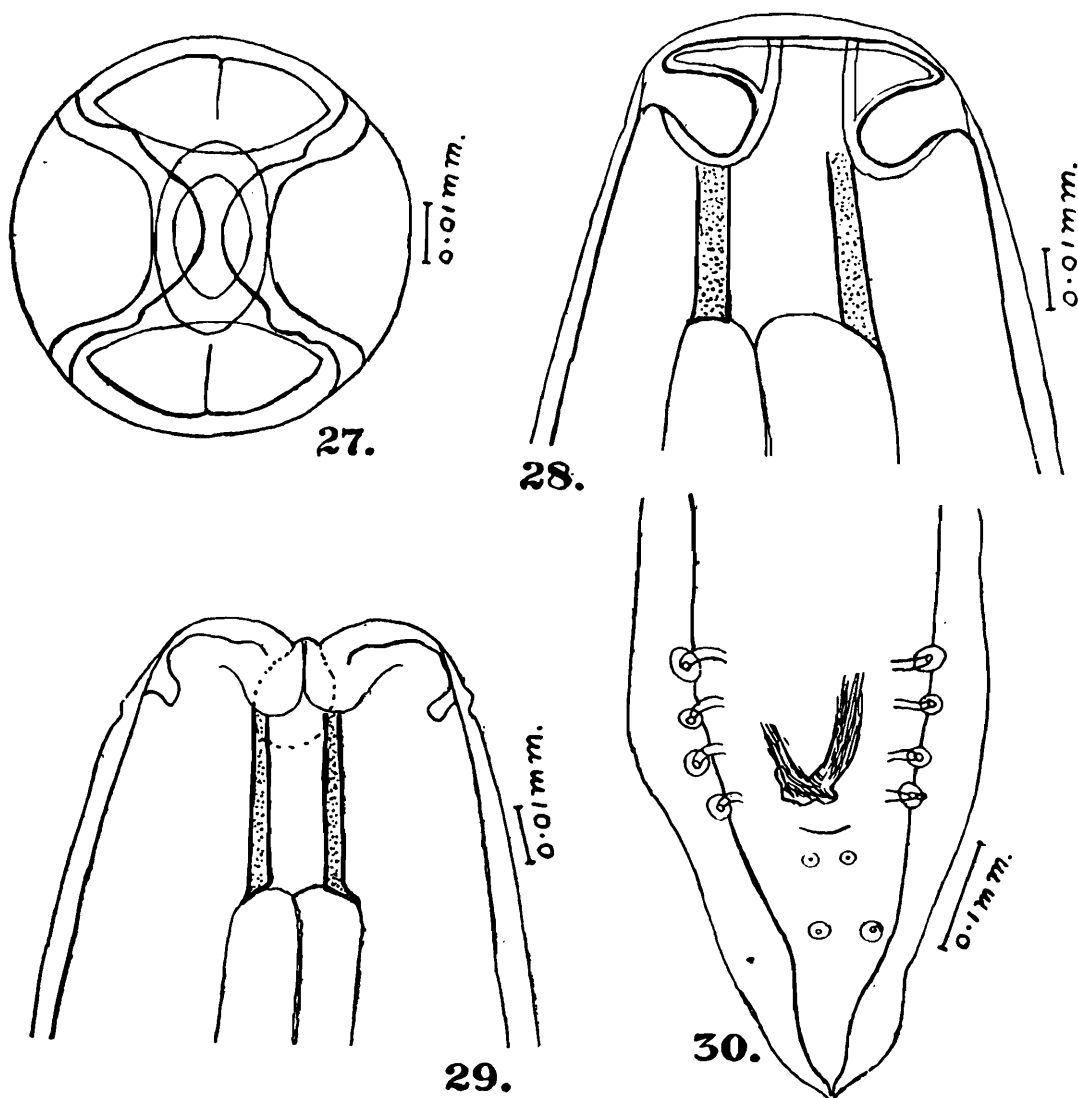
TEXT-FIG. 26.—*Habronema diesingi*. Female tail, lateral view.

a thinner-walled unpaired trunk (fig. 25). This single uterine stem pursues an undulating course to a point about one millimetre anterior

***Habronema magnilabiata*, sp. nov.**

This worm was found in the gizzard of an Indian eagle (*Polioaetus plumbeus*).

There are two large lateral lips and large dorsal and ventral lips^s (fig. 27). The external surface of the lateral lips have a central prominent mass with large papillae running dorsally and ventrally from it. It differs from most species of *Habronema*, which usually have a broad rectangular central portion separated off from the large subdorsal and subventral papillae on the external surface of the lateral lips (fig. 28). The dorsal and ventral lips are rounded and partially divided by a longitudinal groove (fig. 27). The vestibule is of the usual type, being oval with the long diameter dorso-ventral. There is a lateral



- TEXT-FIG. 27.—*Habronema magnilabiata*. Anterior end, end-on view.
 TEXT-FIG. 28.—*Habronema magnilabiata*. Anterior end, lateral view.
 TEXT-FIG. 29.—*Habronema magnilabiata*. Anterior end, dorso-ventral view.
 TEXT-FIG. 30.—*Habronema magnilabiata*. Male tail, ventral view.

flange on one side of the body only, which begins about 0.24 mm. from the anterior end and runs posteriorly for a distance of about 1.3 mm.

Male.—The tail of the male is strongly curved ventrally and it has relatively narrow asymmetrical alae. The ventral surface of the alae and the portion of the worm immediately anterior to the cloaca is marked with longitudinal grooves and ridges. There are four pairs of long pre-cloacal papillae and two pairs of shorter papillae posterior to the cloaca (fig. 30). The spicules are curved and they both end in simple points, and there is a rugged asymmetrical gubernaculum.

Female.—The tail is short and tapers to a point. The vulva opens just anterior to the middle of the body length, and the eggs are thick-shelled.

The character of the lateral lips alone is sufficient to separate this worm from other species of *Habronema*, and the name *Habronema magnilabiata*, sp. nov. is proposed for it.

Host.—*Polioaetus plumbeus*.

Type-specimens are in the Indian Museum, Calcutta.

Table of measurements (in millimetres).

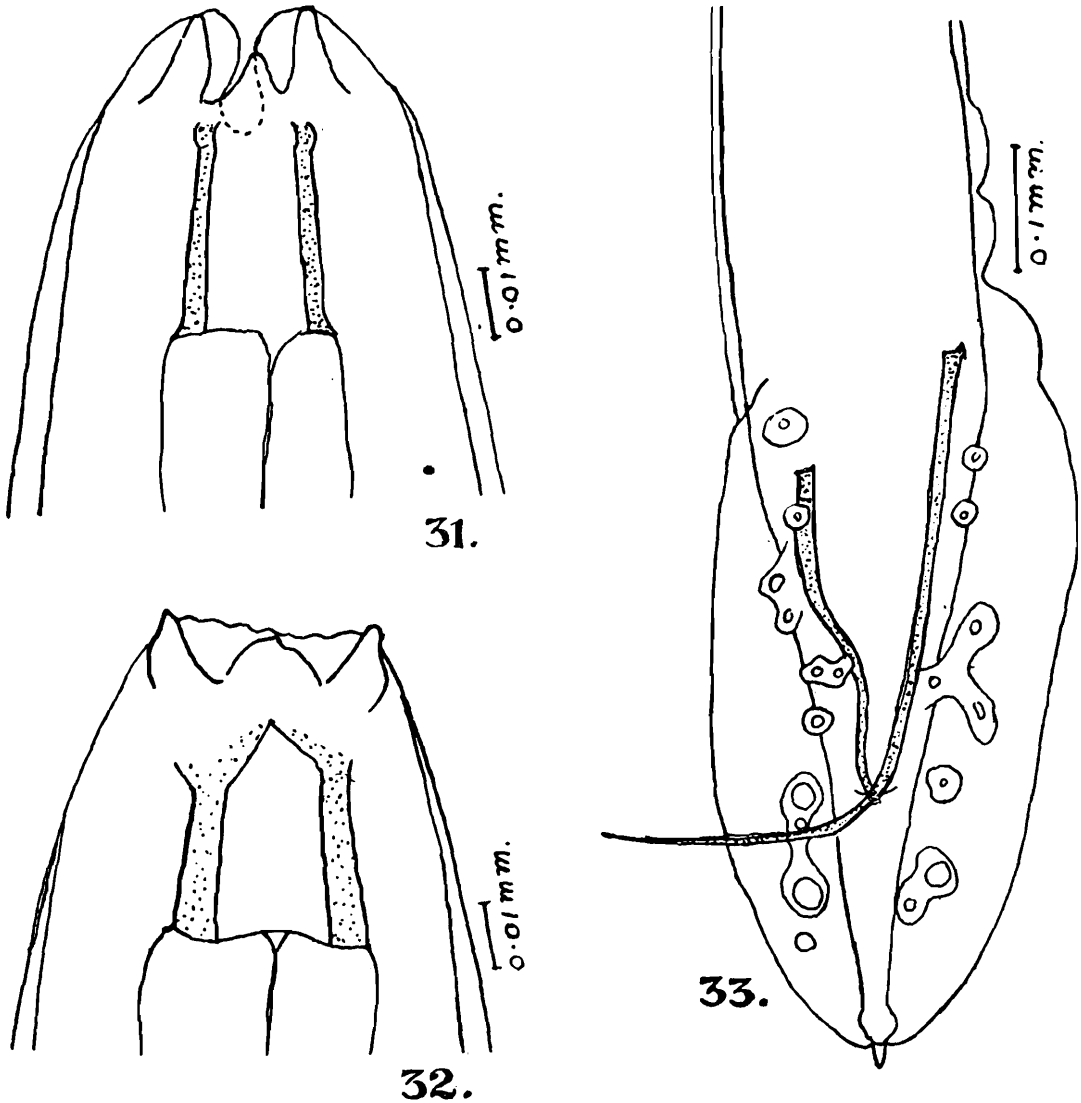
	Male.	Female.
Length	9.1	15.6
Diameter (maximum)	0.26	0.39
Vestibule, length	0.028	..
Oesophagus, length, 1st part	0.396	0.396
2nd part	2.63	3.6
Nerve ring from ant. end	0.297	..
Ex. pore from ant. end	0.327	0.356
Cervical papillae from ant. end	0.198	..
Spicules 1	1.78	..
2	0.554	..
Vulva to tail	..	8.1—8.5
Anus to tail	..	0.18
Eggs	..	0.040 × 0.030

Habronema asymmetrica, sp. nov.

This worm was found in the gizzard of a Pied lanier (*Circus microrurus*).

There are two broad lateral lips and a small dorsal and ventral lip (fig. 31). The central mass on the lateral lips is crescentic, the two papillae are relatively stout, and the anterior border of the lips is truncate and not rounded as it is in most species of this genus (fig. 32). There is a cuticular flange on one side of the body only. The vestibule is oval and its dorsal and ventral walls are thicker than the lateral walls,

Male.—The caudal alae are asymmetrical the longer one being on the same side as the lateral flange. The ventral portion of the worm between the alae, and the ventral surfaces of the alae are marked by longitudinal ridges interrupted by irregular transverse lines. The caudal



TEXT-FIG. 31.—*Habronema asymmetrica*. Anterior end, dorso-ventral view.

TEXT-FIG. 32.—*Habronema asymmetrica*. Anterior end, lateral view.

TEXT-FIG. 33.—*Habronema asymmetrica*. Male tail, ventral view.

papillae are quite irregularly placed, some being double, and as they differ in different specimens a detailed description of their arrangement is of no value (fig. 33). The spicules are straight, pointed and of unequal length, and no gubernaculum was seen.

Female.—The vulva opens just anterior to the middle of the body length, and the eggs are thick-shelled and oval.

The peculiar shape of the lateral lips, and in the male the asymmetrical alae with irregularly arranged papillae serve to distinguish this species from other members of the genus, and the name *Habronema asymmetrica*, sp. nov. is proposed for it.

Host.—*Circus macrurus*.

Type-specimens are in the Indian Museum, Calcutta.

Table of measurements (in millimetres).

	Male.	Female.
Length .	7.5	11
Diameter (maximum)	0.23	0.29
Depth of mouth	0.16	0.24
Depth of vestibule	0.18	0.22
Oesophagus, length, 1st part	0.178	0.29
2nd part	2.1	4.0
Nerve ring from ant. end . . .	0.2	0.28
Ex. pore from ant. end .	0.2	0.28
Cervical papillae	(not observed).	
Vulva to tail	..	5.9
Anus to tail . . .	..	0.198
Spicules 1	0.65	..
2	0.24	..

Habronema casuarii, sp. nov.

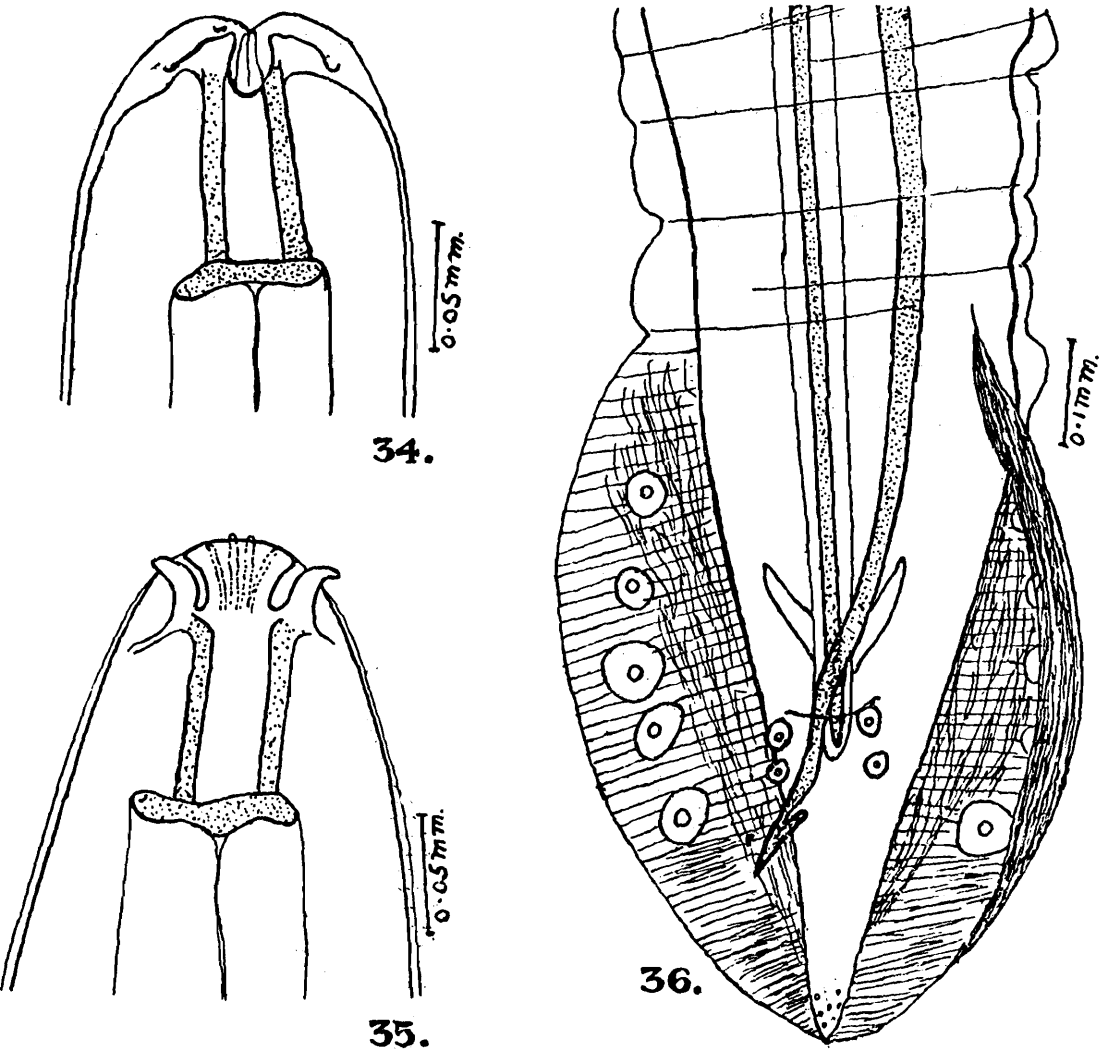
This worm was found in the gizzard of a double-wattled cassowary (*Casuaris bicarunculatus*).

There are two broad lateral lips and no dorsal and ventral lips. The lateral lips are typical, having a broad central mass separated from the large submedian papillae, and on the inner surface of the lips there are four dental ridges (fig. 35). The worm is marked by deep circular striations towards the posterior end of both sexes.

Male :—There are a pair of broad symmetrical caudal alae, which are strongly marked on their ventral surfaces by longitudinal and transverse grooves. There are five pairs of large pedunculate papillae, three pairs of which are anterior to the cloaca, one pair about opposite the cloaca, and the fifth pair posterior to it. There are also two pairs of sessile papillae more centrally placed, just posterior to the cloaca, and in addition there is a group of six or seven minute papillae on the ventral surface of the tip of the tail. The spicules are unequal, the shorter being relatively stout, with broad membranous alae and it ends in a straight rounded tip; the longer spicule is more delicate and it ends in a barb like a crochet needle, and there is a stout V-shaped gubernaculum (fig. 36).

Female :—The vulva opens well behind the middle of the body length, and an unpaired vagina runs anteriorly from it for a distance of about 0.8 mm. The uteri are divergent, the anterior ovary ending far forwards, opposite the junction of the first and second parts of the oesophagus, and the posterior ovary reaches almost to the anus. The eggs are oval with thick shells.

This worm is almost twice the size of any previously described species of *Habronema*, and is clearly a new species. It is accordingly proposed to name it *Habronema casuarii*, sp. nov.



TEXT-FIG. 34.—*Habronema casuarii*. Anterior end, dorso-ventral view.
TEXT-FIG. 35.—*Habronema casuarii*. Anterior end, lateral view.
TEXT-FIG. 36.—*Habronema casuarii*. Male tail, ventral view.

Host.—*Casuaris bicarunculatus*.
Type-specimens are in the Indian Museum, Calcutta.

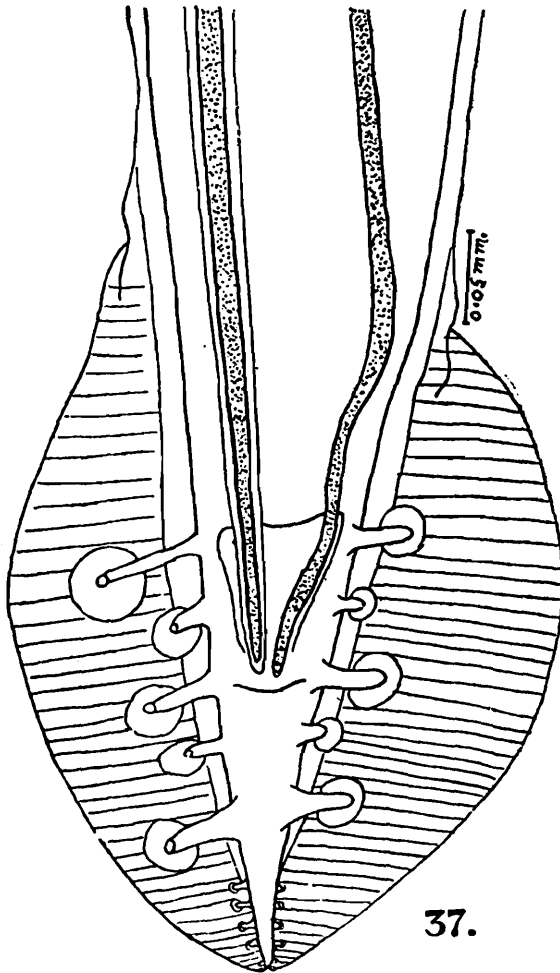
Table of measurements (in millimetres).

	Male.	Female.
Length	26.5	53
Diameter (maximum)	0.554	0.89
Vestibule, length	0.1	0.15
Ex. pore from ant. end	0.574	0.693
Nerve ring from ant. end	0.436	..
Cervical papillae from ant. end	0.495	..
Oesophagus, length, 1st part	0.695	0.832
2nd part	8.3	11.5
Spicules, length 1	1—1.3	..
2	3.1—3.9	..
Vulva to tail	..	8.3—9.2
Anus to tail	..	0.39—0.44

The male of *Habronema euplocami* Maplestone, 1930.

The female of this species was described by Maplestone (1930) from a Kalij pheasant (*Euplocamus leucomelanus*), and since that time both males and females of this worm have been found in the gizzard of the Peacock pheasant (*Polyplectrum bicalcaratum*) on three occasions.

Male.—The caudal alae are broad and symmetrical, and there are nine pairs of pedunculate papillae. Two pairs are precloacal, and one pair (the longest) are opposite the cloaca. The remaining six pairs are posterior to the cloaca and they are of regularly diminishing length from before backwards, except in the case of the fifth pair, which is slightly longer than the fourth. The spicules are thin and tapering and are markedly unequal in length. There is a well-developed gubernaculum, which appears trident-shaped when viewed from the ventral surface (fig. 37).



37.

TEXT-FIG. 37.—*Habronema euplocami*. Male tail, ventral view.

Examination of the females of the later collections showed that the dimensions may be slightly larger than I gave in my original description. For instance the vulva may be 1.6 mm. from the tip of the tail and the anus 0.45 mm. from the same point. The ovejector is 0.237 mm. in length and the unpaired trunk runs forward from it for a distance of 0.396 mm. The two uterine tubes run forwards to about the centre of the worm, and at this point one of them bends backwards and the other pursues a course towards the anterior, to end as previously described.

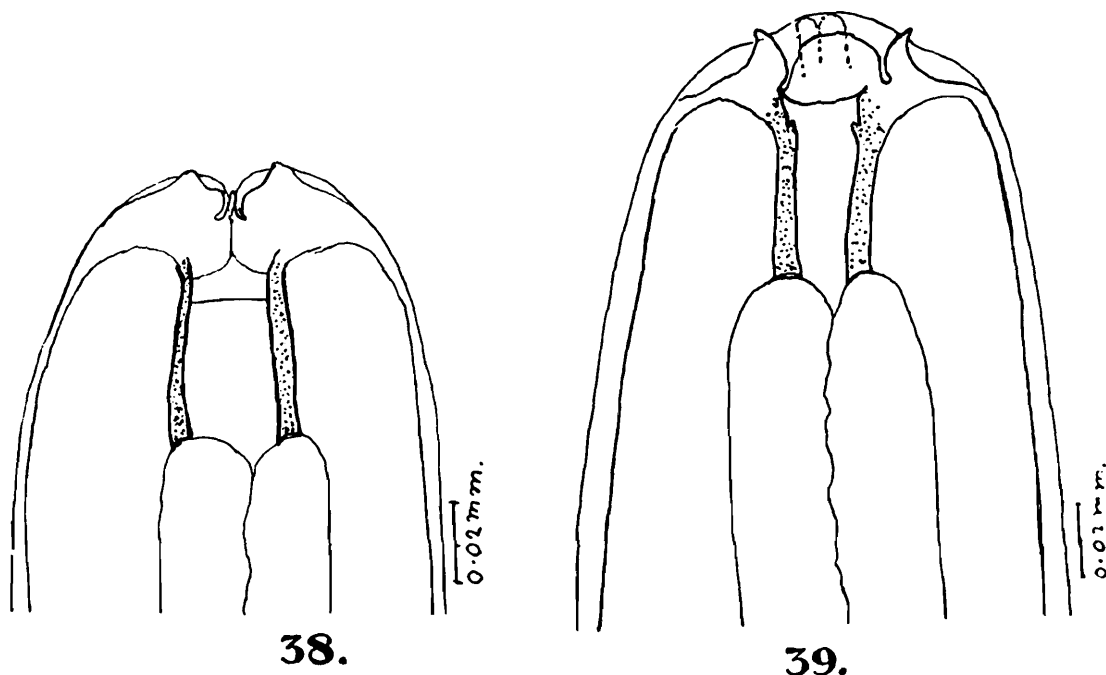
The type-specimen of the male is deposited with that of the female in the Indian Museum, Calcutta.

Table of measurements (in millimetres).

	Male.
Length	10.4
Diameter	0.257
Caudal alae, length	0.336
breadth	0.297
Distance of cloaca from tip of tail	0.136
Spioules, length	1.0 & 0.436

***Habronema bulbosa* (v. Linstow, 1906).**

This worm was originally described by von Linstow (1906) under the name *Physaloptera bulbosa* from *Pavo specifer*. Ortlepp (1922) obtained collections of worms from *Pavo cristatus* and *Pavo muticus*, which only differed from Linstow's description in minor details, so that he assigned them to the same species, but he transferred the worm to the genus *Cyrnea*; this genus I regard as a synonym of *Habronema*.



TEXT-FIG. 38.—*Habronema bulbosa*. Anterior end, dorso-ventral view.

TEXT-FIG. 39.—*Habronema bulbosa*. Anterior end, lateral view.

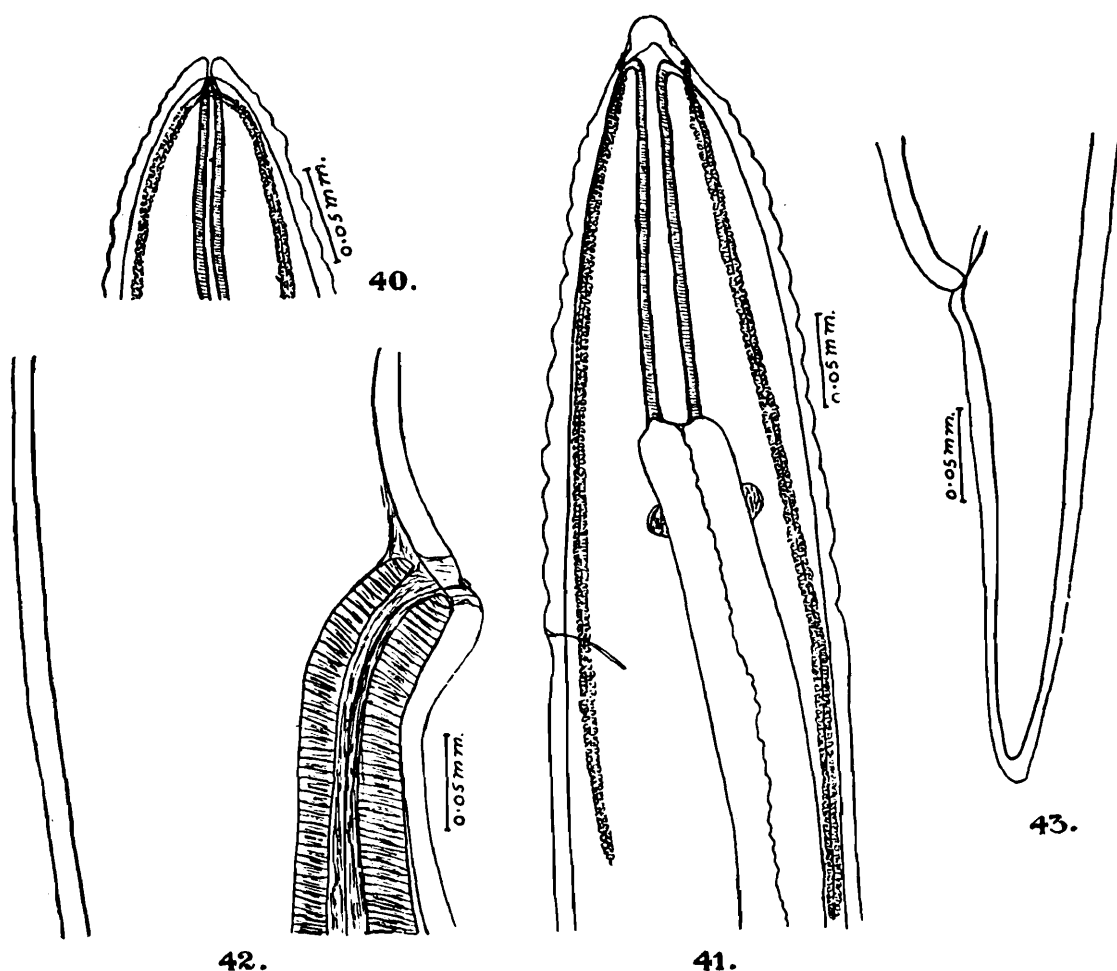
I have obtained a collection of this species of worm from a Burmese peafowl (*Pavo muticus*), one of the hosts from which Ortlepp obtained his material. These worms agree in measurements and in practically all anatomical details with Ortlepp's material and apparently belong to the same species. Ortlepp's drawing of the anterior end of the worm

is completely lacking in detail and gives no idea of the true appearance of this portion of the animal, I have accordingly drawn the anterior end as seen in lateral and dorsal views (figs. 38 and 39). These drawings show that the lateral lips are typical and that there are small dorsal and ventral cuticular "lips" between the submedian papillae.

In the male, Ortlepp (1925) describes two pairs of precloacal and three pairs of postcloacal papillae. In the males of my collection I have one male with three pairs of precloacal and four pairs of postcloacal papillae, another one with three pairs of precloacal and three pairs of postcloacal papillae and two others with papillae according to Ortlepp's description. These worms, both male and female, are apparently identical with Ortlepp's in all other particulars, so it seems that the number of papillae in relation with the male cloaca is not a constant character in this species.

***Acuaria indica*, sp. nov.**

Three female worms of this species were found in the gizzard of a shrike (*Astur badius*).



- TEXT-FIG. 40.—*Acuaria indica*. Anterior end, dorso-ventral view.
 TEXT-FIG. 41.—*Acuaria indica*. Anterior end, lateral view.
 TEXT-FIG. 42.—*Acuaria indica*. Vulval region, female, lateral view.
 TEXT-FIG. 43.—*Acuaria indica*. Female tail, lateral view.

There are two conical lateral lips each bearing two submedian papillae. The four cordons arise in pairs on the dorsal and ventral sur-

faces of the head; curving outwards and backwards they run posteriorly in the submedian fields and they come to an end without anastomosing or turning forwards (figs. 40, 41). There is a long narrow vestibule with thick walls (fig. 41). The cervical papillae are short and relatively stout. The oesophagus is divided into two parts and the nerve ring surrounds the first part very near its commencement (fig. 41).

Male :—Unknown.

Female :—The vulva opens posterior to the middle of the body length, and a long muscular vagina runs directly posteriorly from it (fig. 42). The anus is surrounded by relatively prominent lips and the tail ends in a bluntly rounded tip (fig. 43). The eggs are thick-shelled and contain embryos in the uterus.

At first sight this worm appears similar to *Acuaria conica* Maplestone 1931, except that it is considerably longer. Closer comparison of the species, however, reveals more distinct differences. In the present species the lips are not so conical, the vulva is more salient, and the lips of the anus are more marked than they are in *A. conica*. Another difference is that in *A. conica* the vagina runs dorsally until it reaches the centre of the body cavity before it turns posteriorly, and in the present species the vagina runs directly backwards from the vulva along the ventral surface of the body cavity. It is therefore proposed to name this species *Acuaria (Acuaria) indica*, sp. nov.

Host.—*Astur badius*.

The type-specimen is in the Indian Museum, Calcutta.

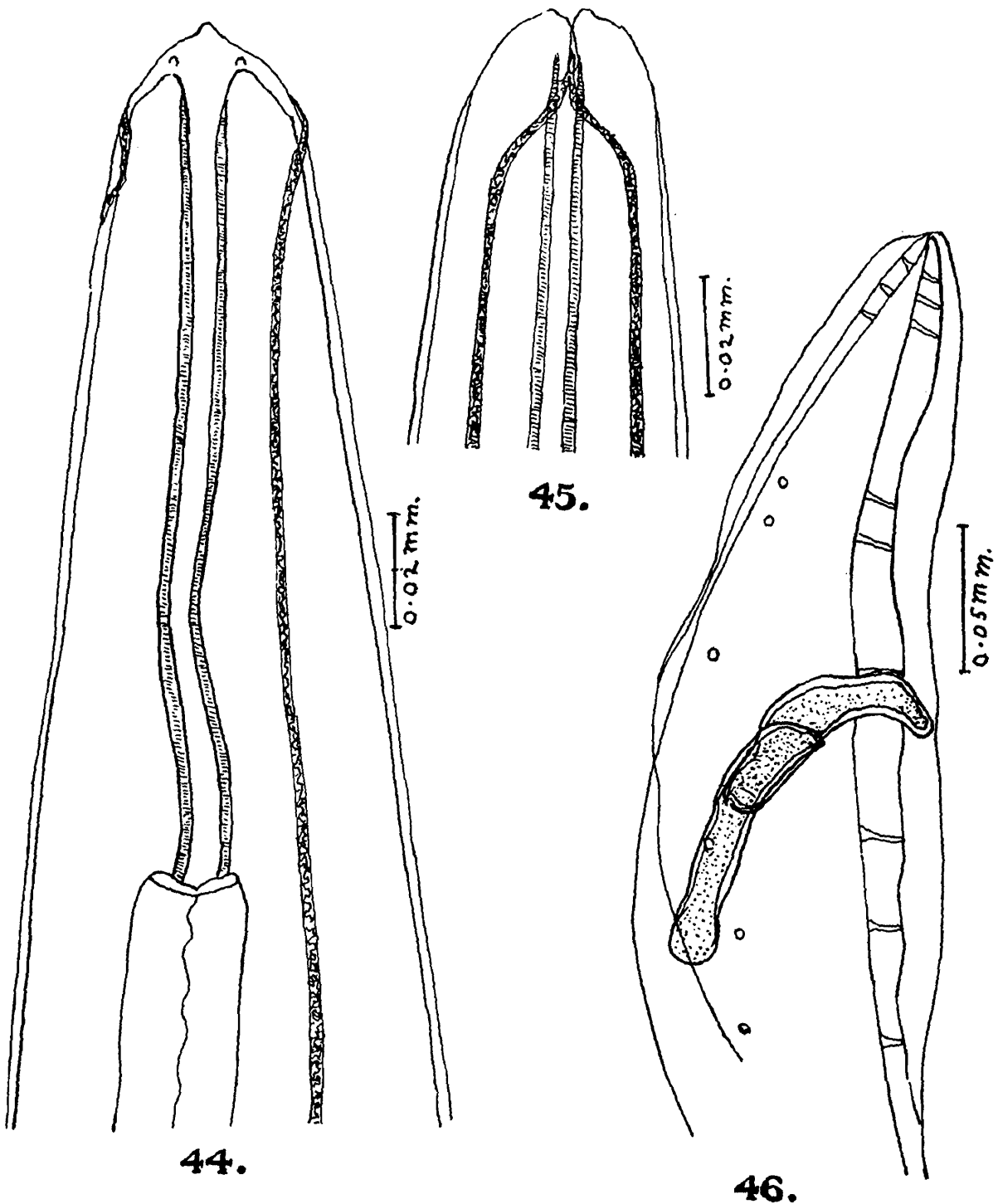
Table of measurements (in millimetres).

	Female.
Length	22-26
Diameter, maximum	0.18—0.2
Cordons, length	0.44
Vestibule, length	0.2—0.21
Ex. pore from ant. end	0.36
Cervical papillae from ant. end	0.25
Nerve ring from ant. end	0.26
Oesophagus, length, 1st part	0.55—0.61
„ 2nd part	1.3—1.4
Vulva to tail	9.8—12.6
Anus to tail	0.24—0.25

***Acuaria brevispicula*, sp. nov.**

A single male of this species was found in the gizzard of a Magpie robin (*Copsychus saularis*).

The worm is small with lateral conical lips each bearing two papillae (fig. 44). The cordons are typical in form, and they arise in pairs on the dorsal and ventral surfaces of the head, from which point they curve outwards and backwards to pursue a posterior course in the sublateral areas, and they end a little distance anterior to the end of the oesophagus (fig. 45). The vestibule is long with thick striated walls, and the oesophagus is divided into two parts.



TEXT-FIG. 44.—*Acuaria brevispicula*. Anterior end, lateral view.

TEXT-FIG. 45.—*Acuaria brevispicula*. Anterior end, end-on view.

TEXT-FIG. 46.—*Acuaria brevispicula*. Male tail, ventral view.

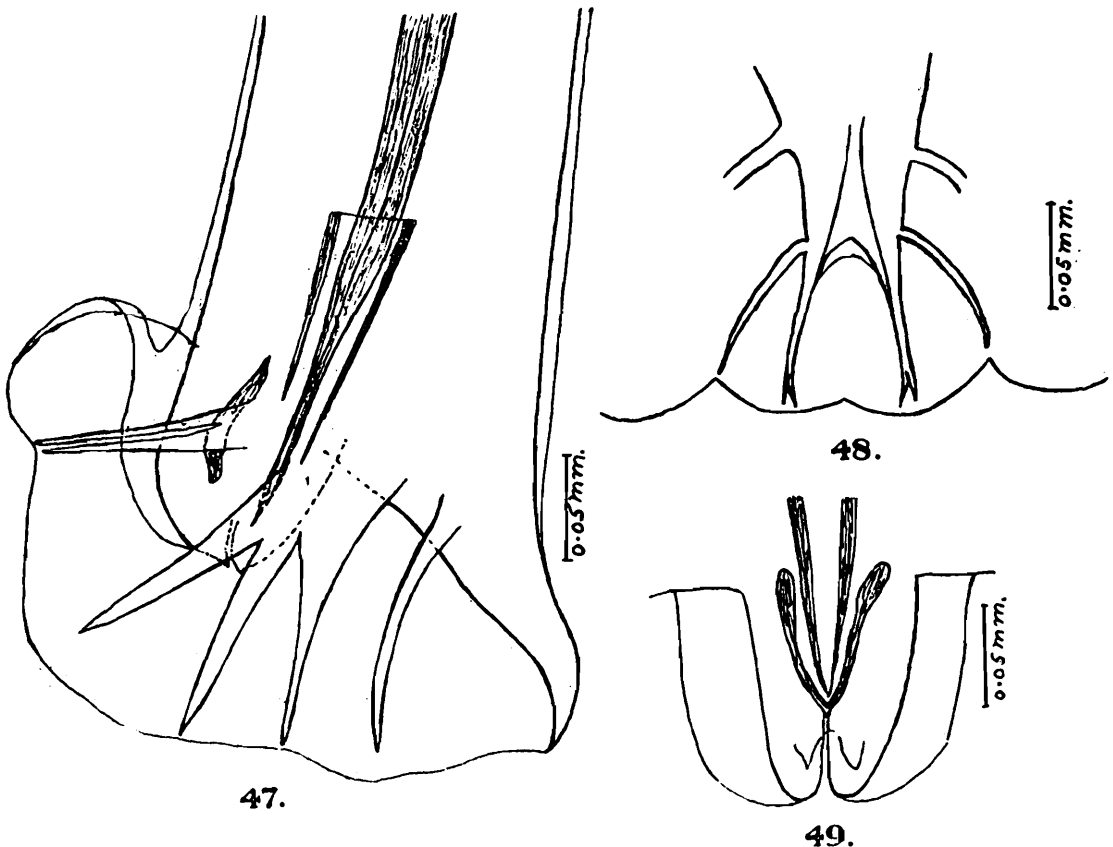
Male.—The caudal alae are relatively long and they are divided into inner and outer areas. There are nine pairs of pedunculate papillae, which fall into three natural groups of three pairs each, viz., a

REFERENCES.

especially to the spicules and gubernaculum, which seem to be the last structures to reach full size in most nematodes.

The general description and that of the female will be found in Maplestone (1931).

Male.—The bursa consists of two lateral lobes and a small dorsal lobe (figs. 47, 48). The ventral rays are cleft for practically their whole length; the three lateral rays arise from a common trunk and are well separated from each other, the externo-lateral does not approach so near the edge of the bursa as do the other two (fig. 47); the externo-dorsal ray arises from a common trunk with the dorsal; the trunk of the dorsal ray is relatively stout, and at about one-third the distance



TEXT-FIG. 47.—*Kalicephalus brachycephalus*. Male bursa, lateral view.

TEXT-FIG. 48.—*Kalicephalus brachycephalus*. Male bursa, dorsal ray.

TEXT-FIG. 49.—*Kalicephalus brachycephalus*. Male, genital cone.

of the origin of the externo-dorsal rays from the edge of the bursa it divides into four slender branches, the inner two of which end in two points (fig. 48). The spicules are equal and straight, tapering from stout bases to fine points. The dorsal and ventral walls of the spicule canal are chitinized, and in addition there is a slightly curved chitinous structure in the genital cone, which is V-shaped on ventral view (fig. 49). This last structure with the chitinous ventral wall of the spicule canal are possibly the representatives of a telamon, which is only partly developed in the present specimen. The genital cone is a simple straight rounded eminence surrounded by a cuticular inflation (fig. 49).

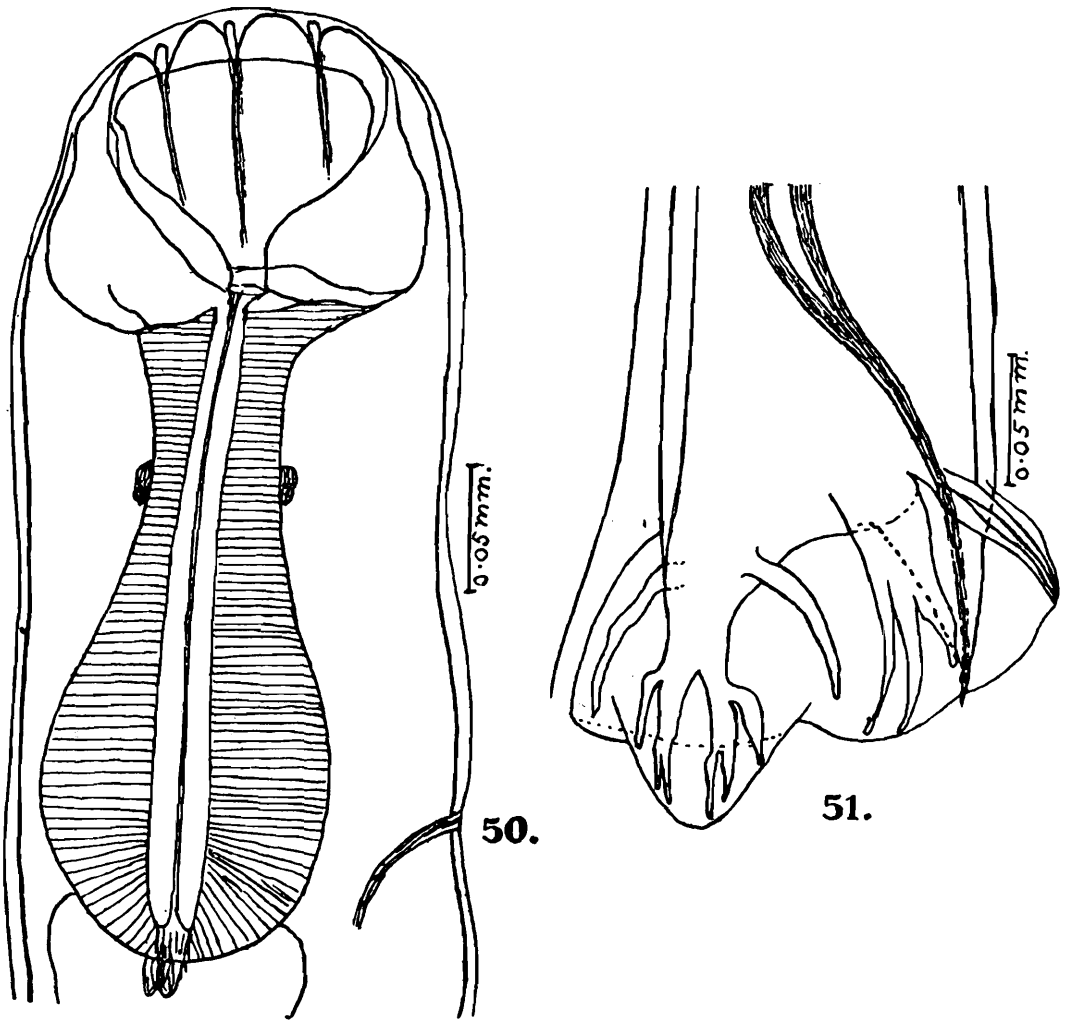
This specimen is deposited in the Indian Museum, Calcutta.

Kalicephalus parvus, sp. nov.

Three male specimens of this worm were found in the intestine of a cobra (*Naia tripudians*).

This worm is typical in its general characters and therefore it needs no detailed description (fig. 50).

Male.—The bursa is relatively short and is distinctly divided into three lobes (fig. 51). The ventral rays are cleft almost to their bases; the three lateral rays arise from a common trunk, the externo-lateral being somewhat shorter than the other two; the externo-dorsal rays arise from a common trunk with the dorsal; the dorsal ray gives off two lateral branches opposite the point of bifurcation, and the two inner branches end in two points (fig. 51). The genital cone is a simple rounded eminence without accessory papillae. The spicules are equal and taper evenly to end in sharp points; the spicule canal is chititized for a distance of about 0.08 mm., forming a gubernaculum.



TEXT-FIG. 50.—*Kalicephalus parvus*. Anterior extremity, lateral view.

TEXT-FIG. 51.—*Kalicephalus parvus*. Male bursa, semi-dorsal view.

This worm is smaller than *K. minutus* Baylis, and Daubney, 1922, and *K. naiae* Maplestone, 1931, the other two small species found in the cobra. In addition to size there are other points of difference, viz., the spicules are longer in this species than in *K. minutus*, while in *K. naiae* the spicules are unequal. The excretory pore in *K. naiae* opens further forward in relation to the oesophageal bulb than it does

in this species. The lateral branches of the dorsal ray are given off quite close to the externo-dorsal rays in both *K. naja* and *K. minutus*, whereas in this species the lateral branches of the dorsal ray are opposite the point of final bifurcation. It is very like *K. indicus* Ortlepp, 1923, but this species is larger and the excretory pore opens relatively further forward than in my worm. Also in *K. indicus* the bursa is longer than in my species, and there is no genital cone. It is accordingly proposed to name this worm *Kalicephalus parvus*, sp. nov.

Host.—*Naja tripudians*.

The type-specimen is in the Indian Museum, Calcutta.

Table of measurements (in millimetres).

	<i>K. brachycephalus</i> (male).	<i>K. parvus</i> (male).
Length . . .	7.2	3.2—3.6
Diameter, maximum . . .	0.336	0.2—0.22
Head, dorso-ventral diameter . . .	0.376	0.156
Lips, width . . .	0.317	0.128
Buccal capsule, depth . . .	0.297	0.108
Oesophagus, length . . .	0.515	0.24—0.26
Oesophageal bulb, diameter . . .	0.237	0.12
Nerve ring from ant. end oesophagus . . .	0.12	0.076—0.08
Ex. pore from ant. end of oesophagus . . .	0.18	0.22
Genital cone, length . . .	0.1	0.06
Spicules, length . . .	0.4	0.32
Gubernaculum, length . . .	0.16	0.08

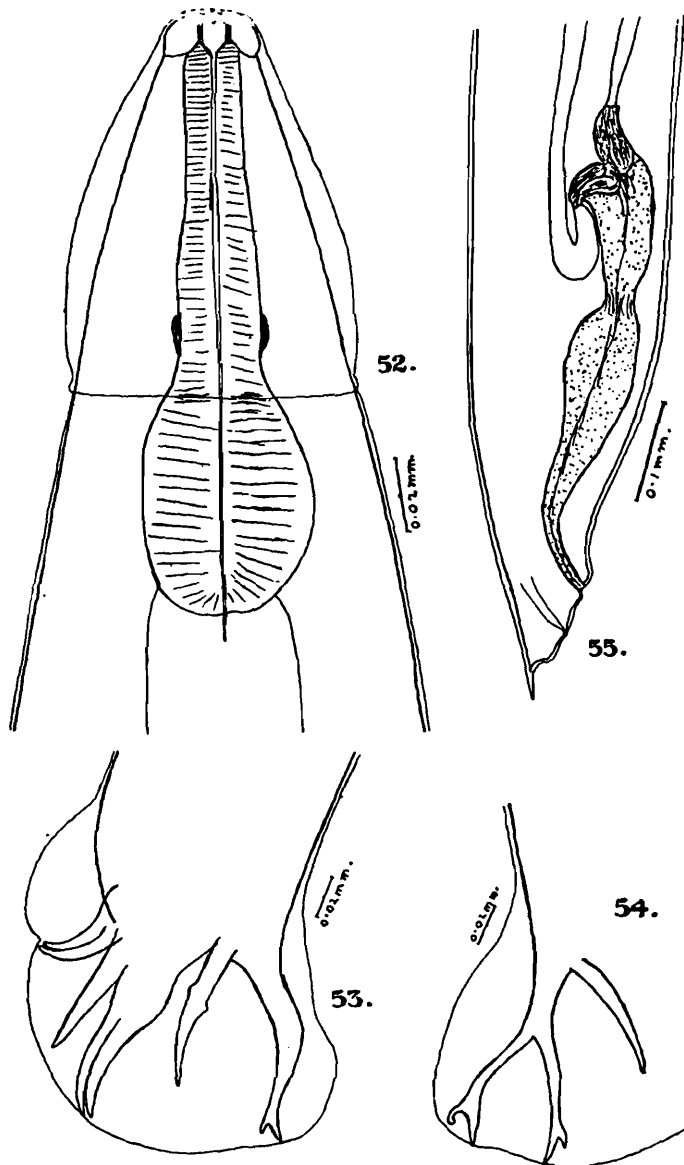
Oesophagostomoides traguli, sp. nov.

This worm was found in the intestine of a Java mouse deer (*Tragulus javanicus*).

The worms are very small. The mouth looks straight forwards and is surrounded by eight (? ten) coarse rounded elements. These arise from the anterior border of the buccal capsule, and curving outwards they become continuous with the body pulp, so they may be regarded as a leaf crown. There is no ventral cervical groove, but there is a distinct cephalic inflation which is marked posteriorly by a projecting ridge followed by a groove in the cuticle which completely encircles the body (fig. 52). On account of their poor state of preservation the worms could not be manipulated sufficiently to discover the excretory pore and the cervical papillae. There appear to be two pairs of submedian and one pair of lateral papillae which project slightly beyond the anterior end. There is a small cylindrical buccal capsule. The oesophagus is club-shaped, the anterior portion is of about the same

thickness for two-thirds of its length, at which point it expands into a slightly elongate bulb. The nerve ring is just anterior to the commencement of the bulb (fig. 52).

Male.—The bursa is of the same type as that seen in the genus *Oesophagostomum* (figs. 53, 54). The spicules are relatively long and



TEXT-FIG. 52.—*Oesophagostomoides traguli*. Anterior end.

TEXT-FIG. 53.—*Oesophagostomoides traguli*. Male bursa, lateral view.

TEXT-FIG. 54.—*Oesophagostomoides traguli*. Male bursa, dorsal ray.

TEXT-FIG. 55.—*Oesophagostomoides traguli*. Female tail, lateral view.

equal, they taper from base to tip and end in sharp points, and they are furnished with narrow striated membranous alae. A gubernaculum is present.

Female.—The tail ends in a sharp point, becoming suddenly narrower about half-way between the anus and the tip of the tail. The vulva is close to the anus, and a long muscular vagina with a constriction near its centre runs anteriorly from it. It divides into two very muscular ovejectors, from the ends of which the uteri arise. The uteri are parallel (fig. 55).

This worm resembles *Oesophagostomoides giltneri* Schwartz, 1928, in most of its characters, although the female genital apparatus appears

to be slightly different, but as these differences do not appear to be very great it is not considered justifiable to create a new genus on this single point, so it is proposed to name this worm *Oesophagostomoides traguli*, sp. nov.

Host.—*Tragulus javanicus*.

Type-specimens are in the Indian Museum, Calcutta.

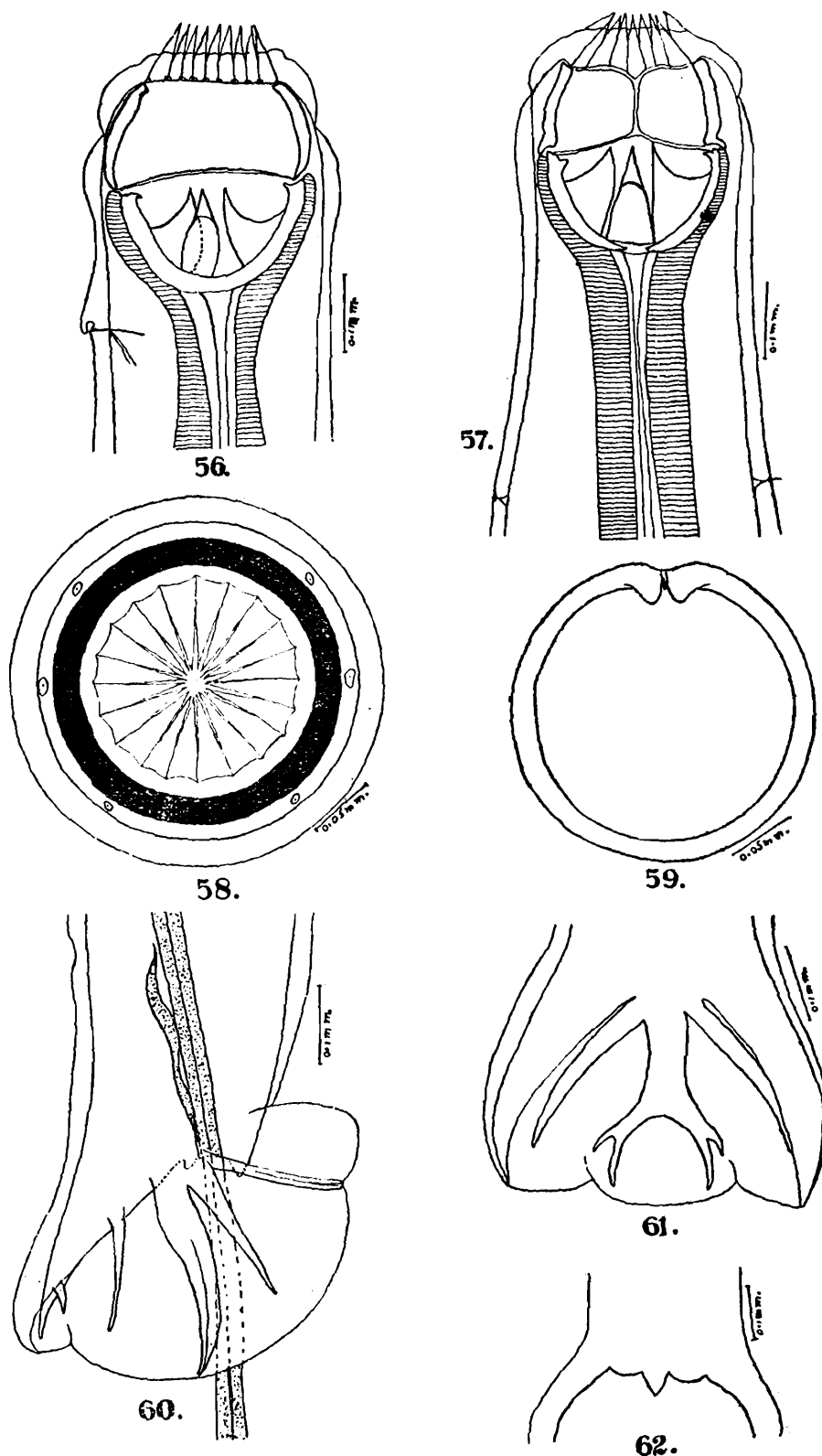
Table of measurements (in millimetres).

	Male.	Female.
Length	2.9	3.0
Diameter	0.218	0.218
Buccal capsule, depth	0.006	0.006
breadth	0.004	0.004
Oesophagus, length	..	0.164
Nerve ring from anterior end	..	0.009
Spicules, length	0.872	..
Distance of vulva to anus	..	0.040
Dist. of anus to tip of tail	..	0.084
Vagina, length	..	0.396
Eggs	..	0.056—0.052 × 0.030—0.036

Remarks :—The position of this genus is at present doubtful as Schwartz (1928) merely assigned it to Strongylidae without attempting to define its sub-family position. This was because it closely resembles *Oesophagostomum* in most respects, but the cervical groove is absent. Sandground (1929) expresses the same difficulty regarding the position of the genus *Colobostrongylus*. In his discussion Sandground suggests that the ventral cervical groove, which is the distinguishing character of *Oesophagostominae*, is only artificial and hence unsatisfactory from an taxonomic point of view, as it has led to the separation of otherwise closely allied genera. But if one passes in review the genera included in the sub-families Strongylinae and Trichoneminae it is at once evident that their definition is also founded on artificial characters, and that genera exhibiting exceptions or great variations from the type genera are accepted in both sub-families. However unsatisfactory it may be, the use of the ventral cervical groove in defining *Oesophagostominae* is the most definite character employed in the classification of the sub-families in Strongylidae, and its suppression would render the classification of this group even more unsatisfactory than it is at present. Therefore it is my opinion that both *Colobostrongylus* and *Oesophagostomoides* should be placed in *Trichoneminae*, where they may be quite as readily accommodated with such genera as *Bourgelatia* and *Gyalocephalus* which are accepted as members of this sub-family.

Oesophagostomum tridentatum, sp. nov.

This worm was found on three occasions in the stomach of a Dusky langur (*Semnopithecus obscurus*).



TEXT-FIG. 56.—*Oesophagostomum tridentatum*.

Anterior end, lateral view.

TEXT-FIG. 57.—*Oesophagostomum tridentatum*.

Anterior end, dorsal view.

TEXT-FIG. 58.—*Oesophagostomum tridentatum*.

Buccal capsule, end-on view.

TEXT-FIG. 59.—*Oesophagostomum tridentatum*.

Buccal capsule, optical section about middle of depth.

TEXT-FIG. 60.—*Oesophagostomum tridentatum*.

Male bursa, lateral view.

TEXT-FIG. 61.—*Oesophagostomum tridentatum*.

Male bursa, dorsal ray.

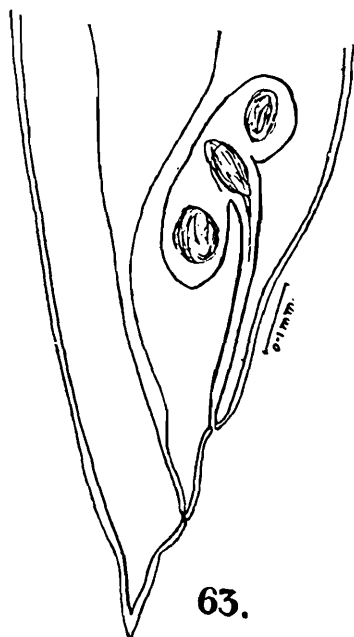
TEXT-FIG. 62.—*Oesophagostomum tridentatum*.

Male, genital cone.

The mouth looks directly forwards and there is a distinct cuticular mouth collar. The ventral cervical groove, into which the excretory pore opens, is clearly defined (fig. 56). The cervical papillae are some distance posterior to the cervical groove (fig. 57). There is an external leaf crown arising from the anterior border of the buccal capsule, it consists of twenty broad pointed elements which project beyond the mouth collar (figs. 56, 57). There is no internal leaf crown, but on each side of the base of the leaves of the external leaf crown there is a small knob-like thickening which, probably represents a rudimentary internal leaf crown (fig. 56). The buccal capsule is circular (fig. 58) with slightly curving walls. Its dorsal wall is slightly shorter than the rest of the capsule and the duct of the dorsal gland is marked by two longitudinal ridges internally and by a slight groove externally (figs. 57, 59). The anterior portion of the oesophagus is greatly expanded forming a cup-shaped cavity lined by a thick chitinous layer. One dorsal and two subventral teeth arise from the interior of the oesophageal cup, they are relatively large with sharp points, broad bases, and curved borders (figs. 56, 57).

In the male prebursal papillae are present.

All the other characters, both of the male and the female are typical of the genus *Oesophagostomum*, therefore the accompanying figures



TEXT-FIG. 63.—*Oesophagostomum tridentatum*. Female tail, lateral view.

60, 61, 62, 63, and the table of dimensions will supply a sufficient description, and a detailed written account is omitted.

This worm differs from all other members of the genus by the presence of the very large cup-shaped cavity in the anterior end of the oesophagus furnished with three large teeth, so it is proposed to name it *Oesophagostomum tridentatum*, sp. nov.

Host.—*Semnopithecus obscurus*.

Type-specimens are in the Indian Museum, Calcutta.

Table of measurements (in millimetres).

	Male.	Female.
Length	12.08—14.04	14.14—16.9
Diameter	0.475—0.594	0.654—0.713
Cervical groove from ant. end	0.356—0.396	0.396—0.494
Excretory pore from ant. end	0.356—0.396	0.396—0.494
Cervical papillae from ant. end	0.535—0.614	0.614
Buccal capsule, diameter	0.198—0.237	0.257—0.297
Buccal capsule, depth	0.108—0.120	0.160—0.162
Oesophagus, length	0.99—1.036	1.04—1.09
Oesophageal funnel, depth	0.120—0.128	0.160
Teeth, length	0.108—0.112	0.124—0.128
Spicules, length	1.6	....
Gubernaculum, length	0.175—0.180	....
Distance of vulva to anus . . . . .	....	0.160—0.204
Tail, length . . . . .	....	0.164—0.200
Vagina, length . . . . .	....	0.297—0.336
Ovejectors, length . . . . .	....	[0.277—0.297
Eggs . . . . .	....	0.072—0.080 × 0.040—0.044.

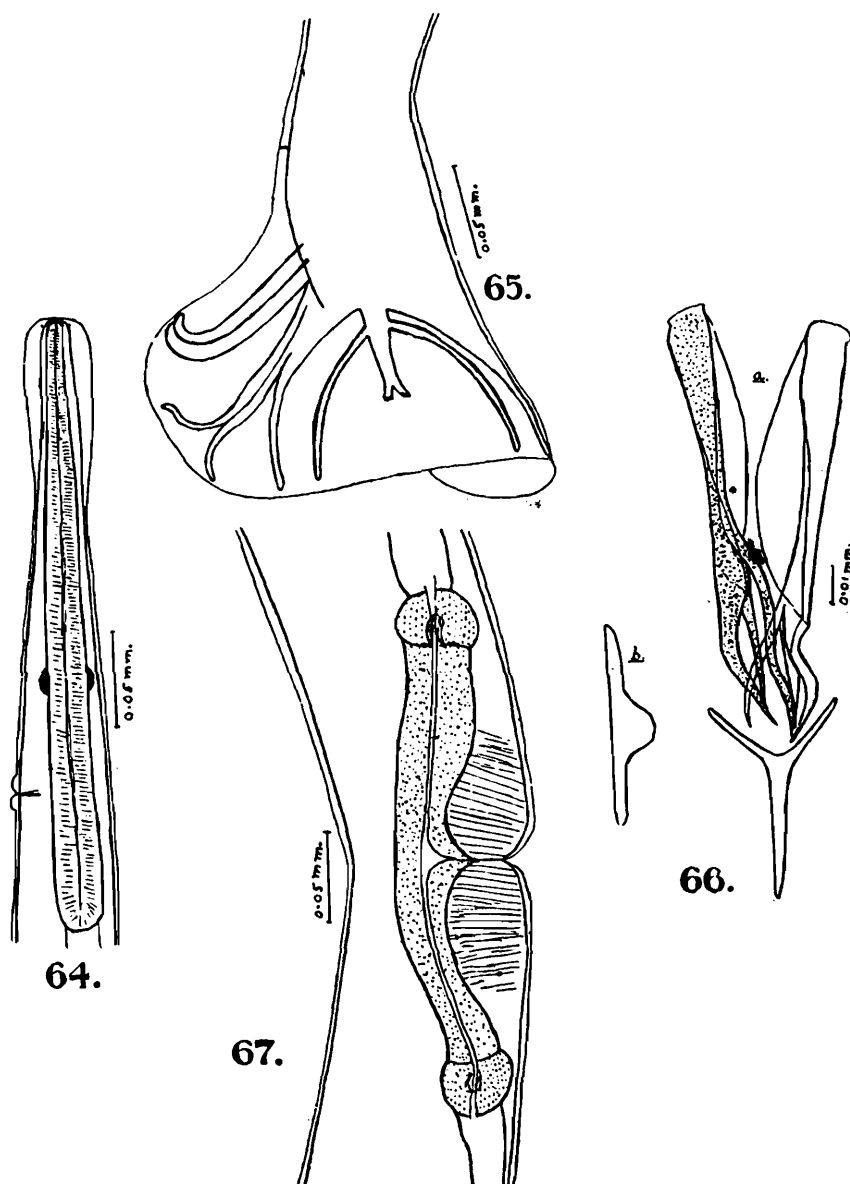
***Ornithostrongylus travassosi* sp. nov.**

This worm has been found three times in the gizzard of the coral-billed pigeon (*Chalcophaps indica*).

There is a distinct cephalic inflation of the cuticle, which gives the anterior end a club-shaped appearance (fig. 64). The mouth is simple and it leads directly into the oesophagus, without the intervention of a buccal capsule. The oesophagus is very slightly swollen towards the posterior end. The nerve ring is a little behind the middle of the oesophagus. The excretory pore is posterior to the nerve ring and it is conspicuous as it is surrounded by a cuticular inflation (fig. 64).

Male :—The bursa consists of two broad lateral lobes, without any indication of an intervening dorsal lobe (fig. 65). Prebursal papillae are present. The ventral rays are equal and parallel and they lie close together for their whole length. The lateral rays arise from a common trunk, the externo-lateral and medio-lateral lie close together for about two-thirds of their length and they diverge at the extremities, the postero-lateral curves away from the other laterals. The externo-dorsal rays arise from the dorsal ray near its base, they are

long and thin and almost reach the edge of the bursa. The dorsal ray is short with a bifurcate tip and each branch ends in three small points (fig. 65). The spicules are stout and equal, with trifurcate tips, and broad mambraneous alae along their inner borders (fig. 66a). The gubernaculum is Y-shaped when seen dorso-ventrally (fig. 66a), and when seen from the side it appears as a straight rod with a rounded prominence running ventrally from about its centre (fig. 66b).



TEXT-FIG. 64.—*Ornithostrongylus travassosi*. Anterior end, lateral view.

TEXT-FIG. 65.—*Ornithostrongylus travassosi*. Male bursa, semi-dorsal view.

TEXT-FIG. 66.—*Ornithostrongylus travassosi*. a. Spicules and gubernaculum.
b. Gubernaculum lateral view.

TEXT-FIG. 67.—*Ornithostrongylus travassosi*. Female, vulval region.

Female.—The vulva is well behind the middle of the body. The vagina is short and surrounded by thick muscle. It runs directly inwards to enter the double ovejector (fig. 67). The uteri are divergent.

This species comes near to *O. papillatus* in size but it is clearly distinguished from it by the disposition of the bursal rays. It is accordingly proposed to name this worm *Ornithostrongylus travassosi*, sp. nov.

Host.—*Chalcophaps indica*.

Type-specimens are in the Indian Museum, Calcutta.

Table of measurements (in millimetres).

	Male.	Female.
Length	5.7	7.8
Diameter	0.88	0.116
Excretory pore from ant. end	0.28	....
Head, diameter	0.24	0.24
Head and cephalic inflation, diameter	0.040	0.040
Nerve ring from anterior end	0.20	....
Oesophagus, length	0.356	0.356
Spicules, length	0.144	....
Gubernaculum, length	0.048	....
Distance of vulva to anus	..	1.87
Tail, length	..	0.120
Mucronate tip of tail, length	..	0.009
Caudal papillae from tip of tail	..	0.024
Ovejectors, length	..	0.3
Eggs	..	0.050—0.052 × 0.027—0.028

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A NEW SPECIES OF SPINITECTUS, A NEMATODE, FROM INDIA.

By S. C. VERMA, M.Sc., LL.B. and M. P. AGARWALA, M.Sc., Department of Zoology, University of Allahabad, India.

Spinitectus indicus, sp. nov.

Locality.—Allahabad.

Host.—*Pseudotropius garua* and *Eutropiichthys vacha*.

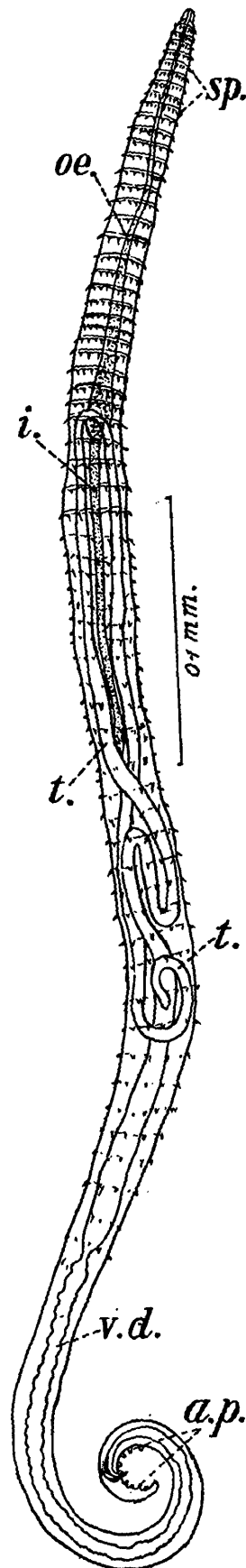
Time.—September 1930 to January 1931.

Ten Siluroid fishes of the two species noted above, obtained from the fish market at Allahabad were examined from time to time, during September 1930 to January 1931. Of these only three of each kind were found infected with the nematode described below. The total number of worms obtained on different dates consisted of thirteen females and eight males. The incidence of infection is not heavy; less than 30 per cent. of the fishes examined were infected, and the number of parasites in a single host varied from one to three or four.

Owing to the presence of characteristic spines on its body the nematode is clearly referable to the genus *Spinitectus* Fourment 1883, a number of new species of which have been described during the last five years. Morishita (5) in 1926 described a new species from an amphibian—all the previous ones having been recorded from fishes only—and published a useful key to the five species of the genus then known. In 1927 Lemaire (6) furnished a detailed account of *S. inermis* (Zeder 1800), and the same year a new form was described by Fujita (3) from a Japanese fish. A year later, two more species were added to the genus by Travassos and his colleagues (7) from Brazil in South America. At present, eight well defined species of the genus are known from widely separated areas of the earth's surface. The present species, the first found in India, is the ninth member of this cosmopolitan genus, and is designated *S. indicus*.

The worms belonging to this species are nearly straight, of moderate length, slender and tapering towards the posterior extremity in both sexes. The female is larger than the male. In the living condition, they are often attached to the wall of the intestine and usually occur in its hinder part only. The cuticle is thick and spiny throughout. Transverse cuticular striations are clearly visible, in the last half of the body, only in specimens which were not well extended at the time of fixation. The spines are arranged in transverse circles, twenty to thirty of which are quite distinct under the low power of a microscope. The following fifteen or twenty rows can also be made out easily, but the succeeding ones become more and more inconspicuous until they disappear near the anus. The distance between successive rows of prominent spines gradually increases from before backwards, but after the anterior third of the body, the rings are more or less equidistant. The first spinous ring begins, in the male, at a distance of 0.4 mm. from the front end and, in the female, at 0.1 mm. The total number of circles in both cases exceeds 150, and the number of spines in each prominent row

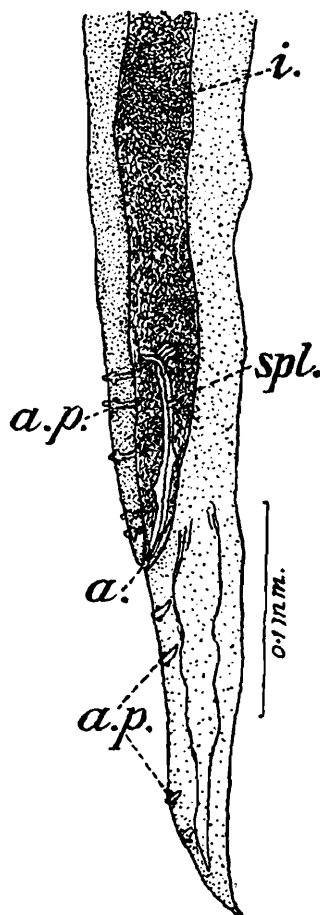
varies from 22 to 28. The average length of the larger spines in the male is 25 and in the female 23.5 μ .



TEXT-FIG 1.—*Spinitectus indicus*, sp. nov. Camera lucida drawing of a male specimen.
a. p. anal papillae; v. d. vas deferens; t. testis; i. intestine; oe. oesophagus;
sp. spines.

The head is not distinctly marked off from the body, which narrows down gradually towards the blunt anterior extremity.

The mouth is terminal and bounded by four inconspicuous papillae or valves as in *S. gigi*. It is followed by a narrow tubular vestibule 0.3 mm. in length. The oesophagus is very long (1.5 mm.) and not marked off into an anterior and a posterior portion. Its anterior part, near the vestibule, is narrow, but the posterior part is fairly thick, being 0.12 mm. wide near the extremity. The intestine is straight, less than



TEXT-FIG. 2.—*Spinitectus indicus*, sp. nov. Camera lucida drawing of posterior part of male, showing papillae and spicules. *a. p.* anal papillae; *a.* anus; *spl.* spicules; *i.* intestine.

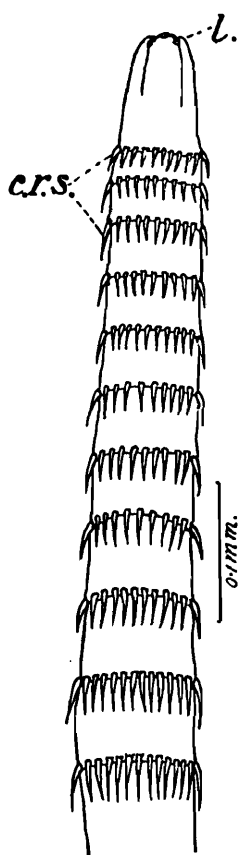
half as wide as the oesophagus, and of a nearly uniform thickness throughout. It ends in the anus which is situated, in the male, 0.16 mm. and in the female, 0.2—0.3 mm. ahead of the posterior extremity.

The nerve ring, in the female, lies at a distance of 0.19 mm. from the front end, and is easily visible under the high power of a microscope. It was not observed in the male specimens.

The excretory pore is not conspicuous.

Male.—An average-sized male individual measures 6.0 mm. in length and 0.11 mm. in breadth. The tail is 0.16 mm. long and is slightly bent. It bears nine, paired, papillae, five anterior and four posterior to the anal aperture as indicated in fig. 2. The papillae are symmetrically placed and unequal in size, (largest 0.022 mm. ; smallest 0.0154 mm.): the anterior ones are larger than the posterior ; their exact shape is indicated in fig. 2. The alae are absent. The spicules are equal in length, 0.11 mm. and similar in shape. The anterior part is rod-like and outwardly inclined, almost at right angles to the main axis ; but the main body is somewhat depressed and bears, about its middle, a minute tubercle

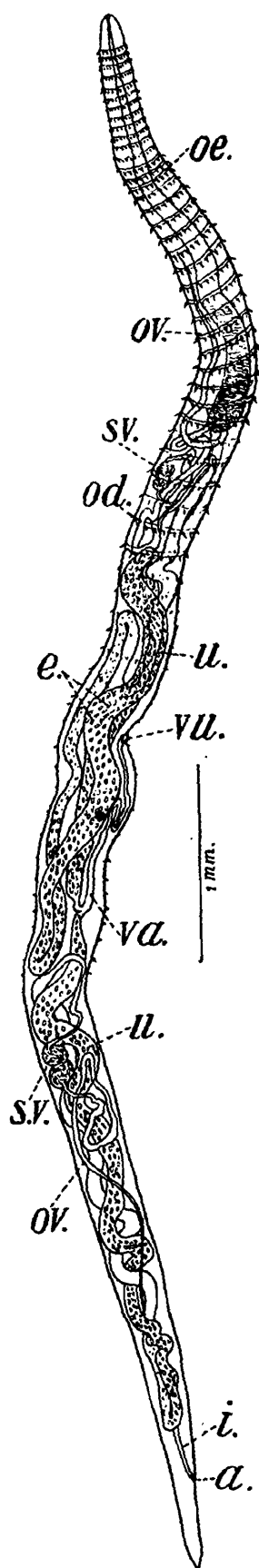
along the outer margin. The testis is, as usual, tubular, coiled, as shown in fig. 1, and extends from before the termination of the oesophagus to about the middle of the body. It then continues imperceptibly into a somewhat dilated but straight vesicula seminalis. The latter, at about one third the distance of the body from the posterior end, leads by a short, narrow, duct-like portion into the vas deferens which has somewhat crenulated walls and runs to the anus as a more or less straight tube.



TEXT-FIG. 3.—*Spinitectus indicus*, sp. nov. Camera lucida drawing of anterior end of male; showing arrangements of spines in circular rings. *c. r. s.* circular rows of spines; *l.* lip.

Female.—An average-sized individual measures 9.0 mm. in length and 0.39 mm. in greatest breadth. The tail is short, pointed, and has a length of about 0.28 mm. The ovaries are two in number. The anterior ovary commences as a narrow tube, a little behind the middle of the oesophagus, and is coiled in the manner indicated in fig. 4. It passes imperceptibly into the oviduct which opens into a receptaculum seminalis, situated a short distance behind the origin of the intestine. The receptacle is very clearly visible, in the living condition, and often appears constricted in the middle. A short narrow tube passes out of the seminal receptacle and dilates into the uterus. The latter runs backwards, as a nearly straight tube, and after passing behind the vulva to some distance forms an anteriorly directed loop before joining the vagina. The posterior ovary lies at about one third the distance of the body from the hind extremity, runs anteriorly, before it is coiled like the first one, and continues into the oviduct and seminal receptacle. The uterus runs backwards to within a short distance of the extremity, before it doubles upon itself, and takes a foreward course. Just after

crossing the receptacle, from which it originated, it is usually thrown into a short loop before joining its fellow to form the vagina. The



TEXT-FIG. 4.—*Spinitectus indicus*, sp. nov. Camera lucida drawing of a female specimen. *a.* anus; *i.* intestine; *ov.* ovary; *s. v.* seminal vesicle; *u.* uterus; *va.* vagina; *vu.* vulva; *e.* eggs; *u.* uterus; *od.* oviduct; *s. v.* seminal vesicle; *ov.* ovary; *oe.* oesophagus.

latter is a narrow muscular tube, which is fairly long and runs anteriorly to open into the vulva. The vulva is a slit-like aperture, surrounded with muscle fibres, situated a very short distance in front of the middle of the body.

The present species differs from all the known ones in the position of the vulva, the length and nature of oesophagus, in the number and arrangement of the spiny rings, in the form and arrangement of the papillae and the spicules and in size, etc.

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NOTES ON INDIAN BLEPHAROCERIDAE, III.

By A. L. TONNOIR, *Canberra.*

During the last eighteen months an important collection of this family was kindly submitted to me by the authorities of the Indian Museum. I am very much indebted to them for the opportunity of studying it and especially to Dr. S. L. Hora who has collected the greater part of the material. This collection, which mainly consists of a large number of larvae and pupae, has been obtained from four widely distant localities as follows :—

- | | |
|--|---|
| 1. Khasi hills, Assam : Shillong and vicinity of Dumptep | <i>Apistomyia</i> N., <i>Horaia montana</i> Tonn. (all stages). |
| 2. Darjiling district : various localities in the vicinity of Tista Bridge | <i>Blepharocera</i> F., <i>Apistomyia</i> M.,
<i>Horaia longipes</i> , sp. nov.,
<i>Horaia montana</i> ?, <i>Horaia</i> sp. |
| 3. United Provinces : Dehra Dun | <i>Blepharocera indica</i> ? |
| 4. Punjab : Simla | <i>Apistomyia</i> O. |

This collection does not advance our knowledge of the Blepharocerid fauna of India to any great extent, except perhaps in the genus *Horaia*, because of the scarcity of imaginal forms which would have allowed to connect the early stages previously described by me¹ to quite definite species. As it is, I shall note here the progresses made in the genera *Blepharocera*, *Apistomyia* and *Horaia*.

Genus *Blepharocera*.

LARVA E.

A number of larvae and pupae from Dehra Dun (United Provinces) collected by C. Dover, 22nd October 1930 and 29th September 1930, correspond well to my larva and pupa E described from Chamba (Punjab), but in this new material there are a couple of pupae with fully formed male imagines inside and a few with less advanced females. From these specimens it could be ascertained that the peculiar process on the inner side of the mid coxae of *B. indica*² is also present here ; it is found in both sexes, but in the male it is much smaller and can easily escape notice. The genitalia and other characters are not sufficiently defined in these immature imagines to ascertain definitely if they belong to *B. indica*, but the presence of the mid coxal process seems to point that way, unless of course it is present in all species of *Blepharocera* and has so far been overlooked.

The difference in size together with the difference in shape of the pupal sheath of the mouth parts, which I have mentioned previously

¹ Tonnoir, A. L., *Rec. Ind. Mus.*, XXXII, pp. 161-214 (1930).

Tonnoir, A. L., *Rec. Ind. Mus.*, XXXIII, p. 285, fig. 2 (1931).

(*l.c.*, p. 170), is, as is confirmed by an examination of a larger amount of material, certainly due to sexual dimorphism.

LARVA F.

Amongst the material collected in Darjiling there are a number of *Blepharocera* larvae similar to my Larva F originally described from Kawngmu (Burma). The warts on the dorsum of the divisions are sometimes less prominent ; a trace of them may be found on the abdominal tergites of the pupa as is the case of Pupa E.

In this species (F) the pupa is sometimes of very small size, scarcely reaching 3 mm. in length, the fly must therefore be unusually small for a *Blepharocera*. The male imagines are not sufficiently advanced in the pupae to allow the identification of the species by imaginal characters. The mid coxae are provided with hairy processes which are very much smaller than in *B. indica* ; as no other characters are discernible it is not possible to ascertain if this form is specifically distinct from *B. indica* or whether it is merely a small race of it. Besides Burma, it is so far known to extend to the Darjiling district ; it will probably be found in the whole of the Eastern Himalayan region.

Genus *Apistomyia*.

Some new material of this genus was collected in Assam and Darjiling, the larvae from the former locality correspond to my Larva N, and those from the latter correspond to my Larva M. The pupa of species M, which was not present in the material previously examined by me, is abundantly represented. It does not materially differ from the already described Pupa O except in the form of the anterior internal lamella whose outside corner is not rounded but angular.

Some male and female imagines are well developed inside the pupae and by dissection it could be seen that the females belong to two types, one of which has the second antennal segment flattened and provided with an inner finger-like projection pointing forward and extending further than the base of the fourth segment. The other form has normal antennae. Although no difference can be detected in the lamellae of the pupae, it is clear that two species are found living in close association. As most of these pupae scarcely reach 3 mm. in length the fly must be remarkably small.

I do not think it proper to describe these species from the immature imagines extracted from the pupae, because in this genus the characters of the genitalia in both the sexes are almost uniform all through the species¹ and because accurate characters such as the wing venation and the structure of the legs are not available on account of the crumpled condition of these organs in the dissected specimens. Incomplete descriptions would unnecessarily increase the confusion in a genus, which, as noted already, must be represented in India by a large number of species.

¹ See Tonnoir, A. L. *Notes on the genus Apistomyia. Proc. Lin. Soc. N. S. Wales*, LV, p. 139 (1930).

Some larvae of *Apistomyia* whose locality is uncertain owing to some of the tubes having been broken in transit and the locality labels getting mixed up, are peculiar in having a yellowish colouration and a broad, dark, dorsal vitta ; all *Apistomyia* larvae known so far are of uniform more or less dark brown colour.

Genus *Horaia*.

The examination of the material of this genus confirms my previous opinion as to the multiplicity of species and also shows that several species may inhabit the same locality ; however, it is not yet possible to distinguish, with certainty, between the larvae of the various species.

Horaia montana Tonnoir.

Three female flies were collected by J. Bhaduri at Pun-wa-sherra stream near Dumpep, Khasi hills (1st April 1930) ; they are the first imagines of this genus ever captured and evidently belong to the genotype *H. montana* which I have described from the Khasi hills (Lashdat stream). This species was described from nearly mature but crumpled imagines dissected out from some pupae, and I, therefore, had no clear idea of the general habitus of these flies.

The three female specimens were, therefore, a surprise to me as they have such a very robust appearance, quite unusual among the Blepharoceridae ; they could, at first sight, easily be taken for some Empididae, on account of the rather short and thick body and especially on account of the robust short-legs.

These specimens correspond well with the type, the genitalia being identical, as also the venation in which the little stump of a vein on Rs is also sometimes present. The antennae, however, differ from that shown in my Fig. 57. The second segment of the flagellum is only half the length of the first instead of being subequal to it ; besides there is a remarkable irregularity in the antennal segmentation of these specimens ; one has 9 segmented antennae, the other 8 segmented, with, on one side, an incomplete division of the penultimate or of the last segment. This observation induced me to make a re-examination of the material from the type-locality ; several imagines were dissected out of their pupae and were found to have either 8 or 9 segmented antennae ; sometimes the antennae were 8 segmented on one side and 10 on the other, and the relative length of the basal segments proved to be rather variable.

Other characters exhibited by the specimens from Pun-wa-sherra stream and which were not in evidence in the type are the rather strong infuscation of the wing and the following relative measurements of the legs :

	Femora.	Tibiae.	t_1	t_2	t_3	t_4	t_5	Claws.
I	20	35	7	4	4	4	10	3.5
II	28	32	4	4	4	4	9	3.5
III	54	47	19	5	5	5	10	3.5

The front femora are very much incrassate in all their length, while the mid femora are more club-shaped; front and mid tibiae gradually tapering distally; the two hind tibial spurs subequal. The claws are conspicuously stout on all the legs, which are testaceous, with front and mid knees as well as 4 last tarsal segments of all pairs infuscated. The front and mid femora carry a conspicuous antero-dorsal row of hairs.

Length of body 5 mm.; wing 5.5 mm.

The larvae associated with these flies in the Pun-wa-sherra stream as well as those of the type-locality are characterized by their uniform dark brown colouration, their lateral appendages being ferrugineous, very seldom brownish. All those seen in the last instar were provided with dorsal spines and also those of the 3rd instar, but they were absent in the earlier instars. There do not seem to be any clearly defined morphological features to differentiate these larvae from those of other species except 2 or 3 conspicuous erect spinulose bristles on the dorsum of the lateral appendages in addition to the ordinary bristles. These stout bristles are usually less well developed in the other species.

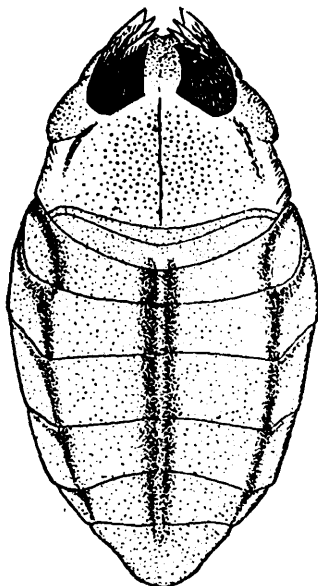
The length of the full-grown larva is 5 mm., that of the pupa 4 mm. The anterior lamellae of the latter are not corrugated as in Pupa R1.

Horaia spp.

Numerous larvae were collected by Dr. Hora in various localities in the vicinity of the Tista Bridge in May, June and February. The most interesting are those obtained at Pashoke Jhora, as many as 3 species were found there in association as follows:—

1. A large larva corresponding to Larva R1 and a large pupa with the characteristic corrugations of the anterior lamellae of Pupa R1. The imago inside the pupa was not sufficiently mature to ascertain characters but it does not seem different from the imago of Pupa R1 which is a species with 9-10 segmented antennae.
2. A medium-sized species represented by larvae in 3rd and 4th instars, with or without dorsal spines which are rather weak, the posterior part of the head sterites red and the lateral appendages pale as in Larva R3.
3. A number of very characteristic pupae with a peculiar sculpture of the dorsum. I give here a figure of this type of pupa, which is quite exceptional in the family; all pupae so far known having a perfectly rounded and smooth dorsum. It has not been possible to ascertain if these pupae correspond to the larvae with partly reddish head 9. Some of these larvae had the pupa rather well formed under their skin but when dissected out these prepupae showed no trace of the corrugation of the pupa now figured and as the breathing lamellae have no characteristic morphological features no conclusion could be reached on that point. One male and one female are sufficiently advanced in two of these pupae to allow the study of some of the imaginal characters. The antennae are eleven segmented, the eyes of the female undivided and all the tarsal claws small;

the genitalia of both sexes do not seem to differ from those of *H. montana*.



TEXT-FIG. 1. Pupa of *Horaia* sp.

4. A small species represented by a female fly only which differs conspicuously from *H. montana* in the elongate hind legs and for which I propose the name of *Horaia longipes*, sp. nov.

As the specimen was preserved in spirit its colouration is somewhat altered, however, the main features are discernible as follows :—

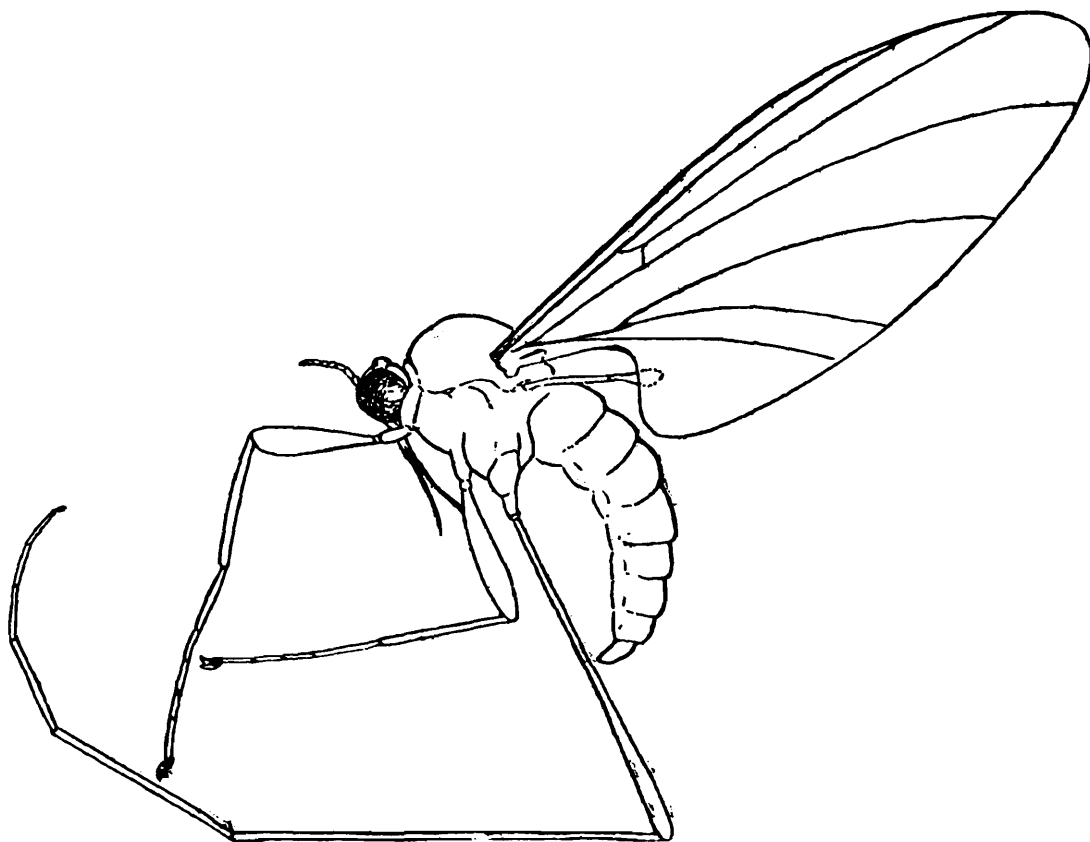
***Horaia longipes*, sp. nov.**

Female.—Head blackish brown, disc of mesonotum velvety brown black, a trifurcate marking in front of the scutellum and the disc of the latter ferrugineous as well as most of the pleurae, sternum brownish, abdomen ferrugineous brown, posterior margin of the tergites darker; halteres brown. Legs ochraceous, distal half of front and mid tibiae infuscated.

Wing length 4.5 mm. body 3.5 mm.

Head transverse, eyes rounded, hairy undivided, relatively small, the frons being broad in consequence; ocellar tubercle moderately developed. Antennae 8 segmented, the 2nd segment larger than the first, rather thick, the 3rd elongate cylindrical four times as long as broad, 4th and 5th together equal to 3rd, the others about as long as wide. Proboscis equal to three times the height of the head, the labellae are thin and cylindrical and more than twice the length of the labrum; palpi very small, one segmented; mandibles absent. Venation as shown in fig. 2; Rs simple, straight reaching the costa well before the tip of the wing and the costa prolonged only slightly past the tip of Rs; An almost reaching the wing margin. Front and mid legs short, their

femora, especially the front ones, much incrassate, club shaped with multiple antero-dorsal rows of black hairs; tibiae spurless, tarsal claws



TEXT-FIG. 2. *Horaia longipes* sp. nov.

simple very stout. Hind legs much elongate, femora thin, tibiae with two spurs. Claws simple, normal, not incrassate. Leg measurements :—

	Femora.	Tibiae.	t_1	t_2	t_3	t_4	t_5	Claws.
I	18	21	8	4	4	4	10	4
II	18	20	5	4	3	3	9	4
III	53	62	30	12	8	6	7	2

Genitalia as in *H. montana*, the end lamellae are provided with an upturned ventral distal process.

Type. Pashoke Johra, collected by Dr. S. L. Hora.

Among the larvae and pupae mentioned above from the same locality as this fly, none could be connected to this species with certainty.

Horaia sp.

From various other localities in the Tista Bridge district Dr. Hora obtained numerous larvae and pupae very similar to those of *H. montana* from Assam, but the colouration of the body of the larva is not so dark, the colour of the appendages, however, is on the contrary much darker. There seems, however, to be a certain amount of variation in this respect. The imagines dissected out from the pupae all have nine-segmented antennae, otherwise they do not seem to differ from *H. montana*, so far as the crumpled condition of legs and wings allows to judge; all the claws of the female are also very stout.

Now that several species of the genus *Horaia* are more or less well known, the definition of the genus should be amended as follows :—

Eyes either divided or undivided (at least in female), contiguous in male, far apart in female. Antennae 8 to 11 segmented. The proboscis may be twice as long as the head. Legs usually stout and short in female with claws of most pairs strongly developed. Venation as in *Paltostoma*, anal vein either complete or interrupted.

This modified diagnosis shows that this genus comes extremely near *Peritheates* from which, however, it differs widely in its early stages.

In conclusion I should like to point out that, as these notes have abundantly shown, no further important progress in the knowledge of the Blepharocerid fauna of India can be made unless collectors concentrate more on obtaining the adult stages rather than the early ones. From the latter one can only conclude that an important number of genera and species are represented in India but it is not possible to define them with any precision, and it is, therefore, impossible to satisfactorily establish their identity, which is after all the ultimate aim of a systematic study.

A NEW GENUS AND SPECIES OF THYSANOPTERA FROM SOUTH INDIA.

By T. V. RAMAKRISHNA AYYAR, B.A., Ph.D., F.Z.S.

Since the publication of his memoir¹ on Indian Thysanoptera and of a recent supplementary paper² on the same subject, the author has come across a very interesting Thysanopteron which appears to be not only a new species but exhibits characters that have not been noted in any of the genera known to the author. The insect belongs to the Tubuliferous section of the Order and the strongly developed forelegs appear to be unique in this form. It is described below under the name "*Vēērabahuthrips*".³ This genus must be placed in the subfamily Megathripinae erected by Priesner⁴ in 1926. In having all the three distal joints of the fore limb-femur, tibia and tarsus distinctly armed it approaches the genus *Ischyrothrips*, Sch., but the femoral and tibial teeth in *Ischyrothrips* are very small and feeble compared to the distinct and sharp armature in the new genus. In this feature the latter also differs from the allied genera *Machtaetothrips*, B., *Diceratothrips*, B. and other genera of the group Macrothripinae Karny. In Karny's synoptical table of the Macrothripinae⁵ this new genus will occupy the position as the type of a new section, viz., 1" Fore-femur at the inner margin with more than one tooth.

***Vēērabahuthrips*, gen. nov.**

♀ ♂. Macropterous. Body elongate. Head narrow, very long, more than twice as long as broad, and more than one and a half times the length of prothorax. Antennae 8 jointed. Vertex very slightly drawn forwards in front of the large and elongate eyes. Ocelli distinct; cheeks on either side behind the eye are suddenly constricted, while beyond the constriction they are slightly convex and run almost parallel to meet the prothorax. No conspicuous bristles on cheeks or head. Prothorax comparatively small, rhomboidal, very feebly armed. Front legs remarkably developed, quite disproportionate to the size of the body; fore-femur very stout, almost as long and just as broad as the head; along the inner margin towards its apex it bears four very strong teeth of which the first is the longest and very conspicuous; the fore tibia is broad, stoutly built and possesses along its distal inner margin a series of four short but distinct tubercles; the fore-tarsus has also

¹ Ayyar, T. V. Ramakrishna. A Contribution to our Knowledge of the Thysanoptera of India. *Mem. Dept. Agricul. India*, X, pp. 217-316 (1928).

² Ayyar, T. V. Ramakrishna and V. Margabandhu. Notes on Indian *Thysanoptera* with brief descriptions of new species. *Journ. Bombay Nat. Hist. Soc.* XXXIV, pp. 1029-1040 (1931).

³ *Vēērabahu* in Sanskrit means "Powerful hands"

⁴ Priesner, H. *Thysanoptera of Europe* (1928).

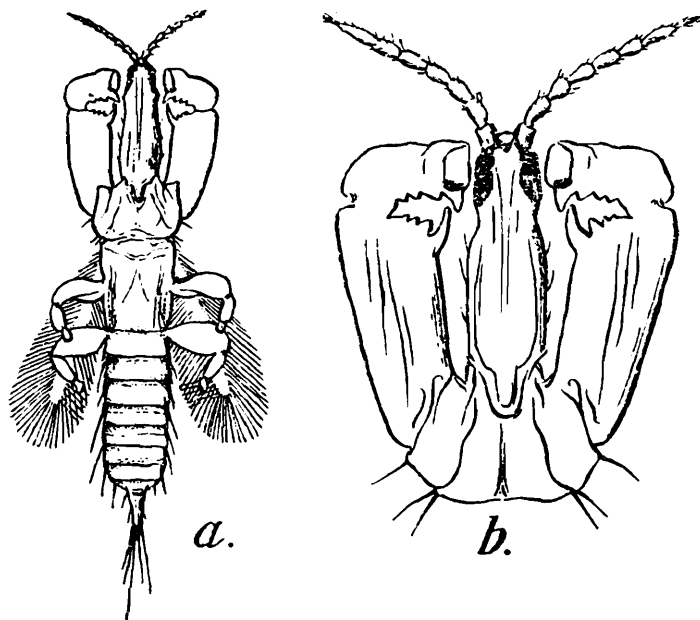
⁵ Karny, H. H. Beiträge zur Malayischen Thysanopterenfauna, *Treubia*, I, pp. 275-291 (1921).

a prominent broad and stout tooth at its base. Of all the teeth the first femoral and the tarsal are the biggest. In the natural resting posture of the insect the femoral teeth remain interlocked with the tibial tubercles and the tarsal tooth, and the arrangement looks more or less as in the pedipalpi of some crabs. The other legs are short, but have the normal form and structure. Wings are well developed and not narrowed at the middle and the anterior ones have four to six duplicate hairs at their tips. The abdomen is just as long as the head and thorax together, though in some specimens it is a little shorter ; in breadth it is as broad as or very slightly broader than the pterothorax. The tube short, less than a third of the length of head, and shorter than prothorax.

Genotype.—*Vēerabahuthrips bambusae*, sp. nov.

***Vēerabahuthrips bambusae*, sp. nov.**

Macropterous. Length about 2 mm. (Fig. 1, *a*). General colour light yellow, major portion of the head, prothorax and legs of a brighter hue. Vertex of head between and in front of eyes, constricted portion of the cheek on each side, piercing tip of the mouth-cone, tarsal tips of the limbs and whole tube except the base dark brown. Eyes black ; ocelli with reddish pigment cups. Antennal joints 1-5 of the same colour as the body, 6 suffused with grey brown ; 7 and 8 almost entirely dark brown. Wings nearly transparent with a very light infumation ; fringes grey brown.



TEXT-FIG. 1.—*Vēerabahuthrips bambusae*, sp. nov. *a*. Whole animal, dorsal view.
b. Head.

Head (Fig. 1, *b*) very elongated, narrow, more than twice as long as broad ; from the front margin of head to tip of mouth cone twice as long as prothorax ; vertex projects very slightly beyond the eyes. Eyes large, boat-shaped, inner margin convex, outer almost straight. Ocelli conspicuous, situated towards the anterior margin of the eyes. Head surface smooth, with very few minute, isolated setae. Cheeks with four or five very inconspicuous transparent bristles at intervals, of these the one just behind the eye is the largest. Mouth-cone short,

bluntly rounded, with the piercing apparatus inside the cone sharply pointed ; cone not reaching the middle of the prosternum. Antennae elongate, almost as long as head, 8 jointed ; 1st joint short, cup-shaped, as broad as long, unarmed ; 2nd ovoid, slightly crenate at apex, with a distinct sense cone on inner margin, slightly constricted at base, longer than 1st, broadest at the apex ; 3 to 6 almost of the same shape and length, narrowed at base, ovoid, broadest towards apex, third longest of the four ; 7th elongate, cylindrical, very slightly narrowed at base, as long as or slightly longer than the 3rd ; 8th narrow, elongated cone-shaped, a little longer than 1st joint ; joints 3 to 8 have sense cones on each. Prothorax broader than head though only about half its length ; very feebly armed with two medium sized, pointed, transparent bristles in postero-lateral region on either side. Fore legs, as noted in the description of the genus above, remarkably developed. Front femur as broad as and about three fourths the length of the head ; four distinct pointed teeth situated at its inner margin towards the apex. Tibia stout, curved inwards ; the four tubercular teeth are situated along its inner margin towards the apex ; these are shorter than the femoral teeth. Tarsus with a distinct, broad-based, curved tooth at its base ; this is shorter and stouter and only slightly smaller than the big tooth of the femur. No conspicuous bristles or hairs on the limb surface, middle and hind legs short and stout. Pterothorax longer than prothorax, as broad as long, with the sides more or less parallel. Wings well developed, not narrowed in the middle. Anterior wings with six duplicated hairs at apex ; the three basal bristles short though distinct.

Abdomen elongate, never longer than head and thorax together and not broader than pterothorax ; middle segments show two pairs of curved wing retaining spines of which the posterior is much the larger ; there are one or two short and pointed bristles at each posterior angle of the abdominal segments, those on the 9th segment almost as long as the tube. Tube less than $\frac{1}{3}$ the length of head ; two or three bristles at its apex dark and longer than the tube itself.

Measurements.—Total length of Type ♀ 1.980 mm. ; head length .352 mm. ; breadth .154 mm. ; prothorax, length .220 mm. ; abdomen length .924 mm. ; breadth .286 mm. ; tube length .110 mm. Antennal length .330 mm. ; length of antennal joints :—1st joint 45μ , 2nd 60μ , 3rd 60μ , 4th 45μ , 5th 45μ , 6th 50μ , 7th 65μ , and 8th 40μ .

A few males examined ; these resemble the females but are shorter, and their abdomen is distinctly shorter than the head and thorax together. Described from numerous female and a few male specimens discovered on bamboo leaves on the Coimbatore farm by Mr. N. Krishna Menon during July-August 1931. The specimens were found in company with some Coccids of the genus *Asterolecanium* which are usually found on bamboos. It is not yet clear whether the thrips are merely Cocciphilous or Coccidophagous, but in view of the strong armature of the fore legs it is not unlikely that they are Coccidophagus ; this view also gains force from the previous records in America of the habits of the species *Aleurodothrips fasciatus*, F. which has a few teeth on the front tibiae, and which feeds on Coccids and Mealy wings.

Type No. $\frac{423}{H3}$ in the collection of the Zoological Survey of India.

ON A COLLECTION OF FISH FROM LOWER BURMA.

By D. D. MUKERJI, M.Sc., Zoological Survey of India, Indian Museum, Calcutta.

Mr. K. Biswas, Curator of the Herbarium, Royal Botanical Gardens, Bengal, made two collections of fish from the Kyenchaung river in the Mergui district, Lower Burma, during his tours in the Cinchona Reserve in May, 1930, and in February, 1931. The entire collection, which has been presented to the Zoological Survey of India, is of considerable interest in that it is from a river the fish fauna of which has not been studied previously and includes several interesting species.

The first part of Mr. Biswas's collection has already been reported on by Dr. S. L. Hora.¹ The second lot which forms the basis of this paper consists of seven species, viz., *Glyptothorax prashadi*, sp. nov., *Mastacembelus oatesi* Blgr., *Botia histrionica* Blyth, *Pristolepis fasciatus* (Bleek.), *Crossochilus latius* (Ham. Buch.), *Mystacoleucus marginatus* (Cuv. & Val.) and *Osteochilus vittatus* (Cuv. & Val.) Bleek. The fishes are in excellent state of preservation, though unfortunately all the species are represented by single specimens.

The genus *Mystacoleucus* and the form *Osteochilus vittatus* were hitherto known chiefly from the Indo-Australian waters and their occurrence in Lower Burma is recorded here for the first time. Similar distributions of genera and species of fresh-water fishes in Lower Burma and in the Archipelago, although not very rare, are of considerable interest in connection with our knowledge of the geographical distribution of these fishes.

My sincere thanks are due to Dr. S. L. Hora for kindly handing over the present collection to me for study and to Dr. B. Prashad, Superintendent, Zoological Survey of India, for his kindness in reading through the manuscript. I have also to record my thanks to Mr. R. C. Bagchi who prepared the accompanying illustrations.

***Glyptothorax prashadi*, sp. nov.**

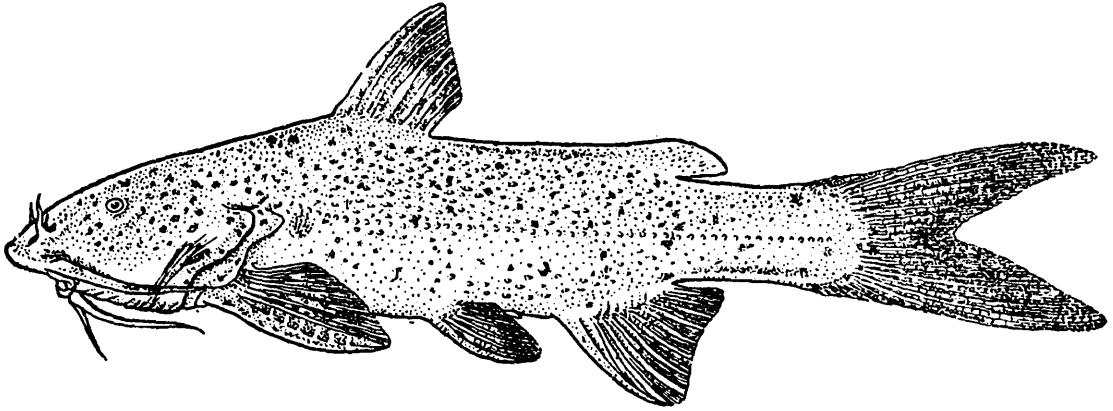
D. 1/6 ; A. 3/10 ; P. 1/7 ; V 1/5 ; C. 17 (excluding the small compact outermost rays on either side).

The head is longer than broad and nearly twice as broad as deep. Its length is contained almost 3.6 times and the depth of the body about 4.3 times in the length of the body excluding the caudal fin. The snout is broadly rounded anteriorly and is very slightly longer than the postorbital part of the head. The eyes are small and situated nearly in the middle of the head. The interorbital space is concave in the middle and is about half as wide as the length of the snout (Fig. 1).

The nasal barbels do not extend to the anterior margin of the eyes and are $\frac{2}{3}$ as long as the distance between their bases and the anterior

¹ Hora, S. L.—Notes on Fishes in the Indian Museum, XVIII. 'On two small collections of Fishes from Burma'. *Rec. Ind. Mus.*, XXXIII, pp. 1-2, figs. 1, 2 (1931).

margin of the eyes. The maxillary pair reach to the base of the pectoral spine or extend slightly beyond it. The outer mandibulars just reach the base of the pectoral spine, while the inner ones are much shorter. The gape of the mouth is rather wide and is equal to the length of the head behind the middle of the eyes. The upper jaw is longer than the lower one. The lips are moderately fleshy and are very finely papillated. The adhesive apparatus on the chest is fairly well-developed and its length is about one and a half times its breadth ; there is no depression in its centre.



TEXT-FIG. 1. Lateral view of *Glyptothorax prashadi*, sp. nov., $\times$ ca 2.

The dorsal fin is inserted midway between the tip of the snout and the middle of the adipose dorsal ; it is not so high as the depth of the body below it. Its last osseous ray is faintly serrated at the posterior border. The outer margin of the fin is truncate. The length of the base of the adipose dorsal is contained 1.5 times in the length of the distance between its anterior margin and the posterior end of the base of the rayed dorsal. The pectorals are not pleated below and are as long as the length of the head behind the base of the nasal barbels ; they do not extend to the origin of the ventrals. The outer margins of the ventrals are more or less rounded, and when flattened they reach the anal ; the latter is almost as high as the dorsal and has slightly concave outer margin. The caudal fin is longer than the length of the head and its own height.

The skin is covered with cone-shaped sharp prickles, arranged rather irregularly and directed tailwards. The portion of the body below and behind the dorsal fin and above the insertion of the lateral line is somewhat thickly covered with these prickly structures.

The colouration of the fish in alcohol is dark brownish with a few black spots irregularly scattered all over the body and the fin membranes. The abdominal portion is yellowish white. The fins are darkish.

Relationships and Remarks : The species is allied to *G. dorsalis* Vinciguerra¹ and *G. minutus* Hora² reported from Burma and Assam, and Assam respectively and appears to be intermediate between the two species. *G. prashadi* differs from *G. dorsalis* chiefly in the composition

¹ Vinciguerra, D.—' Viaggio Di Leonardo Fea in Birmania e Regioni Vicine, Pesci.' *Ann. Mus. Civ. Stor. Nat. Genova*, (2) IX (1890).

² Hora, S. L.—' Fish and Fisheries of Manipur with some observations on those of the Naga Hills.' *Rec. Ind. Mus.*, XXII, pp.165-214, pls. ix-xii (1921).

of the pectoral fins ($1/7$ versus $1/10$) and in the shape of the head and snout, while from *G. minutus* it differs in larger size and body proportions. Hora's description of *G. minutus* is unfortunately very brief and the specimens of the species cannot be traced in the collections of the Zoological Survey of India ; it is, therefore, not possible to compare in detail the relationships of the Kyenchaung river form with *G. minutus*.

Measurements in millimetres.

Length of body without caudal	52.0
Height of body	12.0
Length of head	14.5
Depth of head	9.0
Width of head	13.0
Length of snout	7.25
Diameter of eyes	1.75
Interorbital width	4.0
Length of caudal peduncle	9.0
Length of dorsal fin	8.5
Length of pectoral fin	10.0
Length of ventral fin	7.0
Length of caudal fin	14.0

***Botia histrionica* Blyth.**

The specimen is 105 mm. long excluding the caudal fin. It has nine very distinct oblique black bands across the body.

***Pristolepis fasciatus* (Bleek.).**

Besides the abnormal young specimen from Prome, which was referred to this species by Day,¹ there is a young specimen in the collection of the Zoological Survey of India collected by Dr. Malcolm A. Smith from Bangkok, Siam, with 12 dorsal spines instead of 13. In other specimens of the species from different localities in Burma and Siam, I find that the bifurcation of both the superior and the inferior opercular spines is very variable. Vinciguerra (*op. cit.* pp. 167, 168) rightly remarked that the character of the opercular spines cannot be considered as having any specific value.

There are about eight obliquely parallel black bands across the body of the Kyenchaung river specimen. Its length excluding the caudal fin is 105 mm.

***Crossochilus latius* (Ham. Buch.).**

The specimen is 150 mm. long excluding the caudal fin. The species is very variable in respect to the shape of the head and body and lepidosis. The Burmese forms are narrower than those from India. The specimen under report agrees in all respects with Vinciguerra's description (*op. cit.* pp. 280, 281).

¹ Day, F.—Fishes of India (1876).

Mystacoleucus Günther.

Mystacoleucus is essentially an Indo-Australian genus. Recently its range has been extended by Smith¹ to Siam where *M. marginatus* (Cuv. & Val.) "is a common, widely distributed species ranging over almost the entire length of the country from north to south." In 1919, Oshima² created a genus, *Spinibarbus* from Formosa which is closely allied to *Mystacoleucus*, but differs from it in having (i) "unserrated dorsal spine," (ii) "a less number of divided anal rays" (5 against 9) and (iii) "pharyngeal teeth of 5-3-2—2-3-5 instead of 4-3-2—2-3-4," etc. Subsequently in 1926 he³ described another Formosan genus, *Spinibarbichthys* which differs from *Spinibarbus* chiefly in having the dorsal spine serrated like *Mystacoleucus*. In the same year Rendahl⁴ described a species from China as *Mystacoleucus mandarinus* which appears to be closely allied to Oshima's *Spinibarbus hollandi*, and differs from it mainly in having the number and the arrangement of the pharyngeal teeth like those in *Mystacoleucus*. In view of these affinities of *Spinibarbus* and *Spinibarbichthys* with *Mystacoleucus*, Rendahl⁵ in 1928 proposed to consider Oshima's genera as subgenera of *Mystacoleucus* which differ in the nature of the last osseous spine of the dorsal fin and the number of the branched rays of the anal. In the state of our present knowledge, however, of the genera *Mystacoleucus*, *Spinibarbus* and *Spinibarbichthys*, the acceptance of Rendahl's scheme of classification is rather difficult. The characteristics of the three genera under consideration and of the species *M. mandarinus* are tabulated below :—

<i>Mystacoleucus.</i>	<i>Spinibarbus.</i>	<i>Spinibarbichthys.</i>	<i>M. mandarinus.</i>
1. Dorsal opposite to origin of ventrals.	Dorsal in advance of ventrals.	....	Dorsal in advance of ventrals.
2. Dorsal spine serrated behind.	Dorsal spine simple behind.	Dorsal spine serrated behind.	Dorsal spine simple behind.
3. Anal with 8—9 branched rays.	Anal with 5 branched rays.	Anal with 5 branched rays.	Anal with 5 branched rays.
4. Ph. teeth 4-3-2—2-3-4.	Ph. teeth 5-3-2—2-3-5.	....	Ph. teeth 4-3-2—2-3-4.

It is clear from the above table that *Spinibarbus* is sufficiently distinct from *Mystacoleucus* and it cannot be considered a natural subgenus of the latter. Unfortunately I have no access to the original description of *Spinibarbichthys* and the two characters noted in the table are taken

¹ Smith, H. M.—'Notes on Siamese Fishes.' *Journ. Siam Soc. Nat. Hist. Suppl.*, VIII, No. 3, pp. 177-190 (1931).

² Oshima, M.—'Contributions to the Study of the Freshwater Fishes of the Island Formosa.' *Ann. Carnegie Mus.*, XII, pp. 169-328, pls. xlviii-liii (1919).

³ Oshima, M.—'Notes on a Collection of Fishes from Hainan,' etc. *Annot. Zool. Japon.*, XI, pp. 1-25 (1926).

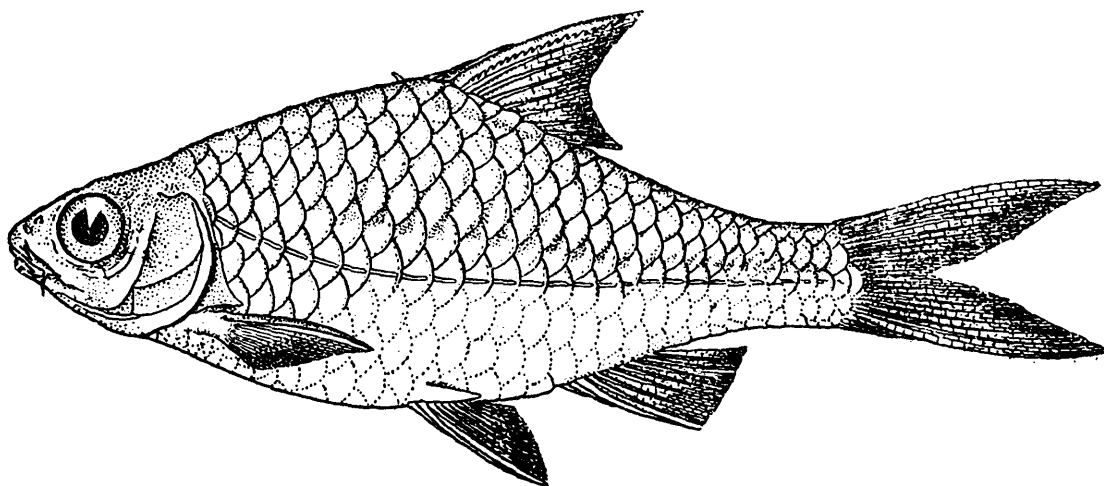
⁴ Rendahl, H.—'*Mystacoleucus mandarinus* eine neue Barbi aus China nebst einigen Bemerkungen über die Gattung *Spinibarbus* Oshima.' *Arkiv. f. Zool.*, XVIII (B) 11, pp. 1-3, (1926).

⁵ Rendahl, H.—'Beiträge zur Kenntnis der Chinesischen Süßwasser Fische.' *Arkiv. f. Zool.*, XX (A) 1, pp. 1-194 (1928).

from Rendahl's account. It is, therefore, not possible to indicate its relationships with either *Mystacoleucus* or *Spinibarbus*. In view of the character of the anal rays, *Spinibarbichthys*, however, cannot be considered a subgenus of *Mystacoleucus*. In regard to the form *M. mandarinus*, it seems hardly possible to refer it to the genus *Mystacoleucus* without making allowance for such dissimilar characters as are tabulated above. I am inclined to hold,¹ therefore, that Rendahl's species from China should be referred to the genus *Spinibarbus* and not to *Mystacoleucus*, while Oshima's *Spinibarbus* should be maintained as a distinct genus. *Spinibarbichthys* may ultimately prove to be congeneric with *Spinibarbus*.

***Mystacoleucus marginatus* (Cuv. & Val.).**

A specimen of the species about 75 mm. long from the Kyenchaung river is the first record of the occurrence of *Mystacoleucus* in Lower Burma. The specimen agrees in all essential details with the description of the species given by Weber and de Beaufort² and does not call for any special remarks. The following additional notes based on examination of the Burmese form and a Siamese specimen³ may, however, prove useful. So far as I am aware, no good figure of *M. marginatus* is available except for the one published by Bleeker⁴ in his *Atlas* under the name *Puntius (Barbodes) obtusirostris*; but since this figure does not agree with the specimens before me, a figure of the side view of the Burmese example is reproduced here (Fig. 2).



TEXT-FIG. 2. Lateral view of *Mystacoleucus marginatus* from Burma. Slightly enlarged.

The eyes are more anteriorly situated than in the middle of the head. The pores on the snout are not discernible. The insertion of

¹ Just before sending this note to the press Dr. G. S. Myers' paper 'On the Fishes described by Koller from Hainan' etc. (*Lingnan Sci. Journ., China*, X, Nos. 2 & 3, pp. 255-262, 1931) was available for reference. Dr. Myers has briefly discussed the points under consideration and his views are in agreement with those of mine.

² Weber, M. and de Beaufort, L. F.—*Fishes of the Indo-Australian Archipelago*, III (1916).

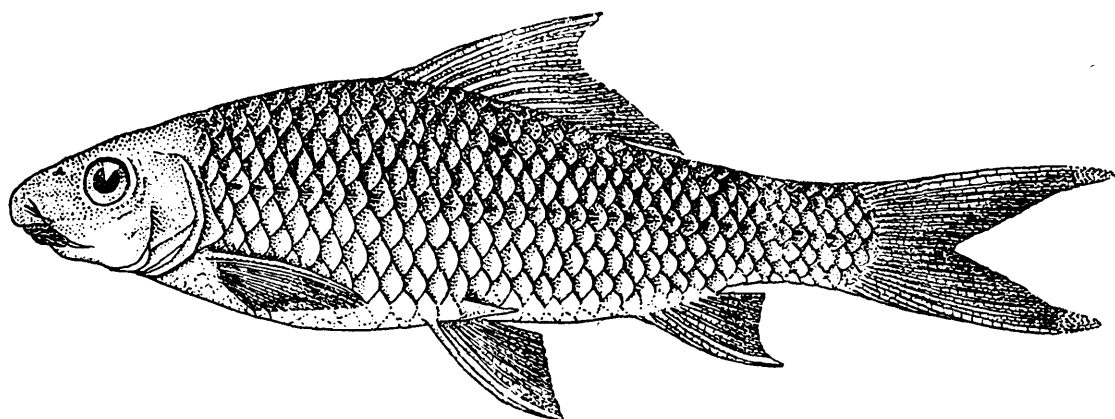
³ Dr. Hugh M. Smith, Adviser, Fisheries Department, Bangkok, Siam, has very kindly presented a specimen to the Zoological Survey of India, out of a fine series collected by him at Klong Tadi in Siam.

⁴ Bleeker, P.—*Atlas Ichth. Cypr.*, III (1863).

the dorsal fin is nearer the tip of the snout than to the base of the caudal fin. It is as high as the body below it up to the level of the lateral line. It has a moderately concave margin; in young specimens the concavity is more pronounced than in a full-grown individual. In the Burmese specimen the procumbent spine projects outwards and pierces the first predorsal scale, while in the specimen from Siam it lies hidden below the scales and pierces the third scale. In the Burmese specimen the ventral fins reach the opening of the vent, which is situated just in front of the insertion of the anal fin, while in Siamese example, which is nearly twice the size of the Burmese individual, the ventrals are separated from the vent by about two scales. The pectoral fins are shorter than the length of the head.

***Osteochilus vittatus* (Cuv. & Val.) Bleek.**

This species has so far been recorded from Sumatra, Java, Borneo, Malacca and Tonkin in Indo-China. Its occurrence in Burmese waters is recorded here for the first time. The specimen collected by Mr. Biswas from the Kyenchaung river is 118 mm. long excluding the caudal fin.



TEXT-FIG. 3. Lateral view of *Osteochilus vittatus* from Burma. $\times$ ca $\frac{3}{4}$.

For confirmation of its identity the specimen under report was sent to Dr. L. F. de Beaufort of the Amsterdam Museum, Holland, who very kindly informed me: "I have compared it with specimens of the same length of *O. vittatus* from Sumatra and come to the conclusion that your specimen certainly belongs to that species. The occurrence of the same species of freshwater fish in Lower Burma and in the Indo-Australian Archipelago is not so rare"

The specimen corresponds in every detail with the description of the species in the *Fishes of the Indo-Australian Archipelago*. I publish a figure of the lateral view of the Burmese specimen as it differs from Bleeker's figure of *Rohita (Rohita) vittata*.¹

¹ It may be pointed out here that there is an error in respect of reference to the figure of *Rohita (Rohita) vittata* in Bleeker's *Atlas*. In the text (p. 68) reference is made to "Atl. Tab. CXVIII, fig. 2, Cypr. Tab. XVII, fig. 2" which is an illustration of *Rasbora lateristriata* Bleeker. The correct reference to the figure in question is "Atl. Tab. CXIII, fig. 2, Cypr. Tab. XII, fig. 2" as given in the Index.

A NEW CHALCID WITH BRANCHED ANTENNAE FROM SOUTH INDIA. (*TETRACNEMUS INDICUS*, SP. NOV.)

By T. V. RAMAKRISHNA AYYAR, B.A., Ph.D., F.Z.S.

Very few groups of insects can approach the Hymenopterous division Chalcidoidea in numerical strength, economic importance and the possession of remarkable morphological and ecological characters. In the Encyrtine sub-division of this group seven or eight genera have so far been described as having curiously branched antennae ; all these have been discovered so far in Europe, Australia and America, and none have so far been described from India. During the course of my studies on the parasitic Hymenoptera of South India I happened to rear out an interesting form with branched antennae belonging to the above group. This insect in its generic characters agrees with *Tetracnemus*, West., but differs materially from the only known species of the genus, and is described below as *Tetracnemus indicus*, sp. nov.

The first example of an Encyrtine Chalcid with branched antennae was described as early as 1837 by Westwood under the name of *Tetracnemus diversicornis* and for nearly fifty years this was the only species known with branched antennae. Later on, other forms were discovered and at present we have eight known genera which may be brought under the tribe Tetracnemini erected by Howard¹ in his interesting paper on these insects. In this paper six genera—*Tetracnemus*, *Tanaostigma*, *Calocerinus*, *Tetraclidia*, *Pentacnemus* and *Hexaclidia* are described ; since its publication Howard² has described another new genus *Tetracnemoidea*, while Timberlake has added another new genus *Hexacnemus*. With the exception of *Hexaclidia* the other seven genera known so far are monotypic. The new species *Tetracnemus indicus* described in this paper is the second species of the genus *Tetracnemus*—the oldest genus of the Tetracnemid Chalcids.

***Tetracnemus indicus*, sp. nov.**

Male.—Length 1.1 mm. General colour grey brown with the limbs of a paler hue ; parts of mesonotum and posterior region of abdomen of a darker tinge ; eyes black ; ocelli brownish ; antennae with the scape almost white, the 2nd joint (pedicel) brownish ; other joints and branches pale grey ; mandibles light grey with brown tips ; thorax grey-brown ; legs yellowish white with hind femora and tibiae tinged with grey-brown ; wings hyaline with the veins and setae dark brownish ; abdomen grey-brown, its posterior region darker.

Head hemispherical, broader than long, broadest across the eyes ; anterior margin arched and with two conspicuous sharp projections on each side of the median line ; surface of head finely reticulate in places. Antennae almost as long as head and thorax, scape projecting far beyond anterior margin of head, of almost same breadth throughout ; second joint (pedicel) short, globular, narrower at base ; the two ring-joints very small and inconspicuous. Each of the four succeeding joints

(funicular) drawn sideways and forwards into a long branch ; each branch or ramus more or less bent forwards towards the base of the antennal club ; ramus of first funicular joint constricted at base, its basal portion broader and as long as the next joint ; base of 3rd joint longer than that of either the first or the second and shorter than that of the fourth, which is the longest of the four branched joints ; fifth funicular joint without any branch, slightly longer than the base of fourth. Club elongate, ovoid. Funicular joints, their branches and club fringed with long hairs. Thorax massive, surface faintly reticulate. Wings with the veins set with sharp short spines, surface covered with minute setae. Abdomen elongate-oval, almost as long as thorax but narrower ; segmental divisions faintly visible, lateral hair tuft (vibrissae) on 3rd abdominal segment fairly long.



TEXT-FIG. 1.—*Tetracnemus indicus*, sp. nov. Head with antennae.

Measurements of type 1.1 mm. ; head length .330 mm. ; breadth .462 mm. ; thorax length .352 mm. ; abdomen length .370 mm. ; antennal length .616 mm. ; length of antennal joints scape 176 μ , pedicel 50 μ ; funicular joints, I 30 μ , II 40 μ , III 75 μ , IV 85 μ , V 105 μ and club 140 μ .

Habitat.—Three males were bred by the author as parasites of an injurious mealy bug, *Pseudococcus citri* C., commonly noted on Agathi (*Sesbsnia aculeata*) in Coimbatore. The host, mealy bug, is also a common pest of other plants such as coffee, cocoa, etc.

This species differs from the type-species *T. diversicornis* of Westwood in colour, and in the structure and size of the antennal joints and branches.

Type No. $\frac{760}{H\ 3}$ in the collection of the Zoological Survey of India.

LITERATURE.

1. Howard, L. O. Insects of the subfamily Encyrtinae with branched antennae. *Proc. U. S. Nat. Mus.*, Vol. XV, pp. 361-369 (1892).
2. Howard, L. O. On some new parasitic insects of the subfamily Encyrtinae. *Proc. U. S. Nat. Mus.*, Vol. XXI, pp. 231-248 (1898).

OBSERVATIONS ON THE ECOLOGY OF CERTAIN FISHES AND CRUSTACEANS ALONG THE BANK OF THE MATLA RIVER AT PORT CANNING.

By A. S. PEARSE, *Duke University ; Durham, N.C., U.S.A.*

INTRODUCTION.

Through the courtesy of the Indian Museum the writer was able to work at Port Canning from June 27 to July 9, and at the Museum until July 18, 1930. It was thus possible to make observations on the animals which live in and along the shores of the Matla River in the Ganges Delta. The tide at this point had a vertical range of 10 to 12 feet. The salinity of the water at the surface in the middle of the river at low tide at 12 m. on July 6 was 27.79. At the same place, during a rain on July 8 at 7 A.M. at high tide the salinity was 26.40. At various times temperatures and humidities of the air were observed. These are given in Table I. Water temperatures were also taken (Table II) in small pools, where beach gobies lived on July 7. On that date it was cloudy until 12 m.; then rain came and continued all night. More such observations would have been made, but I made the mistake of waiting for a clear, sunny day in order to compare pool temperatures during clear and rainy weather—and there are no clear days during the rainy season at Port Canning. The soil everywhere in this locality is a fine, heavy clay brought down by the river. A cross-section of the bank of the river is shown in Figure 1.

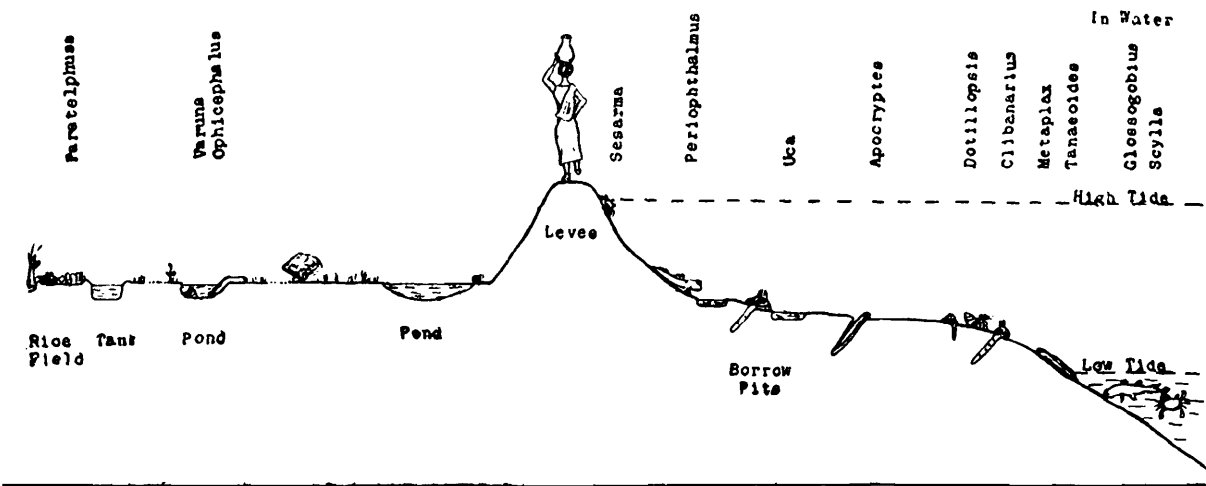


FIG. 1.—Section through the west shore of the Matla River at Port Canning. All animals of course are represented on a much larger scale than their habitats.

The writer makes grateful acknowledgment to the staff of the Indian Museum for assistance in scientific matters and for many other courtesies ; especially to the Director, Col. R. B. Seymour-Sewell, and to Dr. S. L. Hora. Two collectors, R. Hodgart and Ganoor gave excellent service at Port Canning. Dr. Hora identified all the fishes, except one goby which was sent to Bruno Eggert, Tübingen, Germany.

Dr. C. B. Wilson identified the copepods ; H. J. Van Cleave, the anthocephalans ; H. W. Manter, trematodes ; G. R. LaRue, cestodes ; M. J. Rathbun, crabs ; Waldo Schmitt, hermit crabs.

OBSERVATIONS ON FISHES AND CRABS.

In the following list constituents of foods are given as estimated percentages by volume. The first number after a parasite indicates the percentage of hosts infested ; the second, the average number of parasites per host.

PISCES.

Aoria gulio (Hamilton-Buchanan).

Four individuals of this brackish-water species were examined on July 4 ; length : 87-132 mm. ; ave. : 108 mm. A snail was found in the stomach of one fish ; the others contained no food. Parasites were abundant : on the gills was a copepod, *Ergasilus nanus* Beneden (100 : 23.3) ; larval trematodes were encysted on the gills (50 : 12.5) ; minute nematodes lurked among the gill filaments (25 : 2.0) ; peritoneal nematode cysts were present (25 : 5.0) ; and an acanthocephalan, *Acanthosentis antispinus* Verma & Datta (50 : 5.0) occurred in the intestine.

Saccobranthus fossilis (Bloch).

Ten specimens of this air-breathing fish were examined on July 14 ; length : 213-161 mm. ; ave. : 193 mm. As they had been kept overnight by a collector, they contained little or no food. All females were nearly ready to spawn. Parasites : *Trypanosoma saccobranchi* sp. nov. (40 :) ; visceral *Diplostomum* cysts (100 : 139.3) ; *Agamofilaria* sp. cysts in mesentery (100 : 4.1) ; *Gnathostoma* juv. cyst in mesentery (10 : 0.1).

Ophicephalus striatus Bloch.

Two females were examined on July 7 ; length : 246, 254 mm. One had eaten a water bug and contained a hepatic tapeworm cyst (*Tetracampos* sp. ; 50 : 0.5).

Ophicephalus gachua Hamilton-Buchanan.

A male, 120 mm. long ; examined on July 7 contained no food but was infested with 9 gill copepods, *Ergasilus gibbus* Nordmann (100 : 9), and three mesenteric nematode cysts (100 : 3).

Glossogobius giurus (Hamilton-Buchanan).

Four males and one female were examined on July 6 ; length : 108-203 mm. ; ave. : 143 mm. Two had eaten fishes. Parasites : *Agamofilaria* sp. cysts (100 : 7.5).

Apocryptes lanceolatus (Bloch & Schneider).

Twenty specimens were examined, ten on July 2 and ten on July 4. Length of first lot : 36-89 mm. ; ave. : 63.1 mm. ; second lot : 100-145 mm. ; ave. : 125 mm. The food was as follows : insect larvae, 0.5 ; filamentous algae, 46.9 ; plant remains, 65.5 ; mud, 36.1. Parasites : gill copepods, *Ergasilus nanus* Beneden (30 : 0.5).

Taenioides rubicundus (Hamilton-Buchanan).

Ten specimens were examined on July 7 ; length : 89-160 mm. ; ave. : 119.8 mm. ; 8 males, 2 females. Food : copepods, *Pseudodiaptomus annandalei* Seymour-Sewell and *P. tollingeri*, s.-s., 13.5 ; amphipods, 43.5 ; isopods, *Parapsudes* sp., 17.5 ; mysid shrimps, 12.0 ; oribatid mites, *Mesoplophora* sp., many alive, 2.5 ; plant stem, 1 ; mud, 10. No parasites.

Periophthalmus cantonensis pearsei Eggert.

Ten specimens of this little beach skipping goby were examined on July 2 ; length : 40-56 mm. ; ave. : 48.1 mm. The food was as follows : spider, 13.0 ; insects, 4.2 ; insect larvae, 2.0 ; shrimp, 25.5 ; crab, 8.5 ; isopods, 10.0 ; amphipods, 1.0 ; ostracods, 5.0 ; snails, 9.5 ; mud, 21.3. Parasites : larval cestode from duodenum (10 : 0.1) ; spiruroid from stomach, (10 : 0.1).

This fish lives high up on the bank but does not leave the river to go inland. It lives on the flats with fiddler crabs and wanders up and down with the tides ; especially where the mud is soft. It also goes in and out of the shallow puddles and swims about in the borrow pits and the little streams which trickle down the banks at low tide. On July 5 males with their dorsal fins erect were chasing females about on the flats.

•CRUSTACEA.**Clibanarius padavensis** de Man.

Ten specimens of this hermit crab were examined on July 5 ; length : 17-23 mm. ; ave. : 17.9 mm. The food consisted of algae, 12.3 ; vascular plants, 9.1 ; and mud, 78.6. No parasites.

Scylla serrata (Forsk.) de Haan.

Ten specimens (diameter of carapace : 78-133 mm. ; ave. : 101 mm.) of this portunid crab which were examined on July 3 contained the following food : crustaceans, 0.4 ; plant remains, 95 ; mud, 4.6. Barnacles (*Dichelaspis maindroni* Gruvel) were always found in the branchial chamber (100 : 34.4) ; and one crab carried an anemone on its back (10 : 0.1).

Dotillopsis brevitarsus (de Man).

Ten specimens of this little burrowing crab (diam. : 8.5-10 mm. ; ave. : 9.2 mm.) were studied on July 2. They had eaten nothing but mud. Visceral trematode cysts (*Levinseniella* sp.) were found (20 : 5.0).

Metaplex dentipes (Heller).

Ten crabs (diam. : 11.5-18.5 mm. ; ave. : 15.2 mm.) examined on July 1 had eaten vegetation (83.3), mud (10.7), and unknown substances (6.0). They contained parasites : a male isopod, *Leidyia sesarmae* Pearse, attached to a gill (10 : 0.1) ; gregarines, *Steinina metaplaxi*, sp. nov. (10 : 13) ; and also in the intestine some minute ciliates (10 :) which were probably accidental or coprophagic.

Uca mani Rathbun.

Twenty fiddler crabs were examined on July 1 and 5 ; diameter : 16-25 mm. ; ave. : 20.1 mm. ; 7-22 mm. ; ave. : 14.5 mm. Food : plant remains, 0.5 ; mud, 99.5. Nematodes, *Rhabdochona uca*, sp. nov. (10 : 0.15) were found in the intestine ; ciliates (*Epistylis* sp. ; 75 : 17.3) were common in the branchial cavity.

Sesarma taeniolatum White.

This crab lurks during the day in appropriate nooks near high tide mark. On July 1 ten specimens (diam. : 13.5-29.5 mm. ; ave. : 21.4 mm.) were examined. The food contents consisted of a beetle, 1.7 ; plants, 90 ; mud, 8.3. No parasites.

Paratelphusa (Paratelphusa) spinigera (Wood-Mason).

Ten of these crabs (diam. : 22-49 mm. ; ave. : 39.4 mm.) were collected from a pond about a mile from the river among rice fields. The pond contained many water hyacinths. Food : vegetation, 97 ; mud, 3. Encysted trematodes (80 : 48.8) occurred in the gills and among the viscera ; rotifers (30 :) were present in the branchial cavity.

Varuna litterata (Fabricius).

Eight specimens of this crab (diam. : 20-27 mm. ; ave. : 23.1 mm.) were taken from a pond in a rice field about a mile from the river on July 4. These contained only remains of vegetation as food, and no parasites.

DESCRIPTION OF NEW PARASITES.

PROTOZOA.

Trypanosoma saccobranchi, sp. nov.

Body : slender, sinuous (Fig. 2) ; length : 0.036 mm. ; width : 0.0017 mm. Length of trophonucleus : 0.005 mm. ; parabasal body : 0.002 mm. The parabasal body is very close to the posterior end of the body and far (0.02 mm.) from the trophonucleus. The flagellum is about 0.013 mm. long ; slender ; gradually tapering. The vibratile membrane is narrow. When alive on a slide these trypanosomes are very active.

Host : *Saccobranchus fossilis* (Bloch) ; Collected near Calcutta, India ; July 14, 1930. Indian Museum, Reg. No. P950.

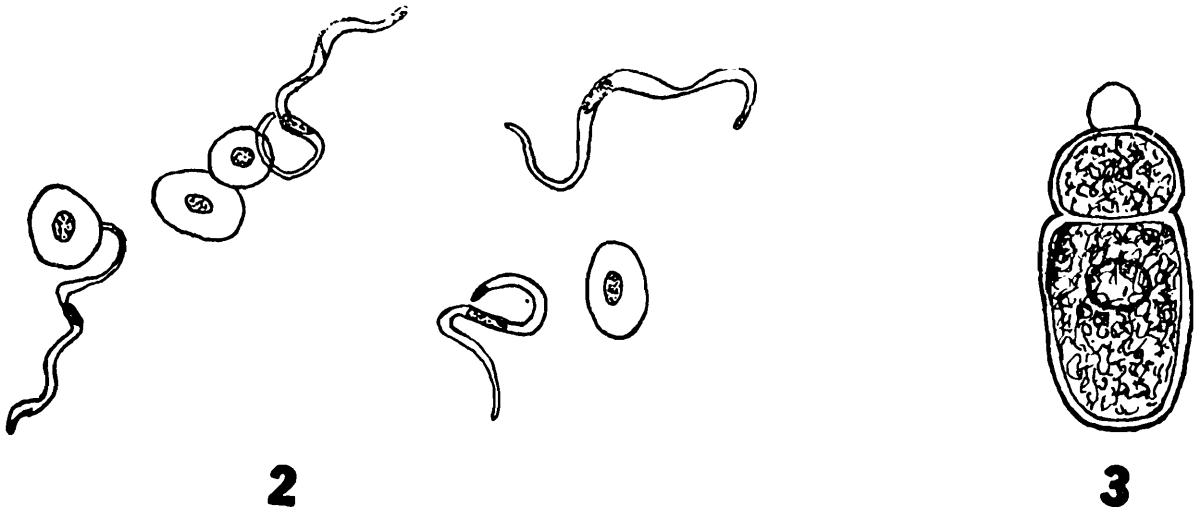


FIG. 2.—*Trypanosoma saccobranchi* and blood corpuscles from *Saccobranchus fossilis* ; from a preparation stained with Giemsa.

FIG. 3.—*Steinina metaplaxi* from *Metaplax dentipes*.

***Steinina metaplaxi*, sp. nov.**

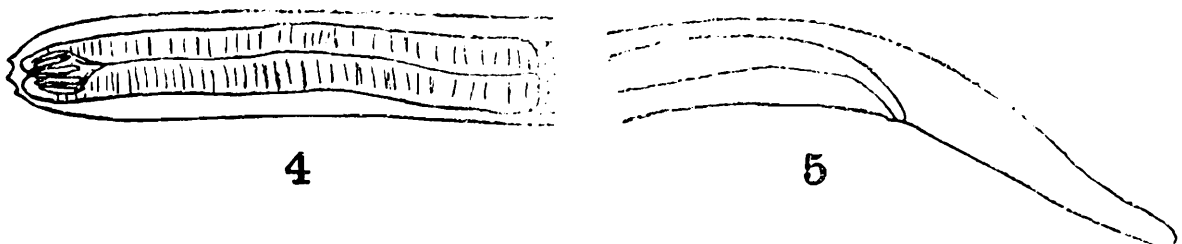
Body (Fig. 3) : robust, somewhat flattened ; length : 0.04-0.06 mm. ; width : 0.018-0.02 mm. Nucleus ellipsoidal, longest across body ; 0.006×0.007 mm. The epimerite in resting condition is nearly spherical ; diameter : 0.005 mm. The protomerite is wider (0.016 mm.) than long (0.01 mm.) and rounded anteriorly. The deutomerite is rectangular, with rounded angles, 0.025 mm. long and 0.018 mm. wide. The nucleus is situated about at the end of the anterior third of the deutomerite, though it varies somewhat in position in different individuals. Around the protomerite and the deutomerite is a heavy pellicle. Syzygy apparently does not occur.

Host : *Metaplax dentipes* Heller ; in intestine. Port Canning, India July 1, 1930. This genus has previously been reported only from beetles.

NEMATOIDEA.

***Rhabdochona uca*, sp. nov.**

Spiruroidea ; *Thelazidae*. Body length of female (Figs. 4, 5) : 1.2 mm. ; width : 0.03 mm. Lips with three teeth ; buccal cavity supported by eight longitudinal thickenings ; muscular esophagus, 0.24 mm. long ; glandular esophagus, 0.22 mm. long. Tail : 0.14 mm. long ; tapering,



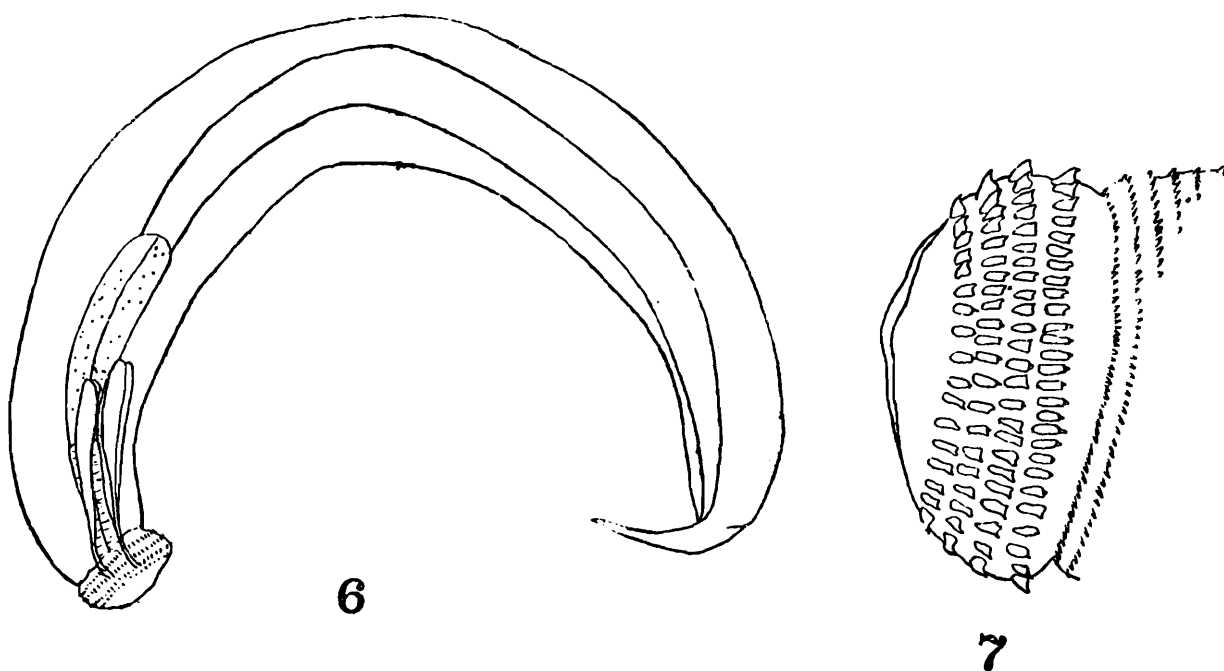
FIGS. 4, 5.—*Rhabdochona uca* ; anterior and posterior ends of female.

obtuse. Uteri apparently opposed ; anterior one showing eggs increasing in size posteriorly ; vulva near middle of body. Three specimens of this intestinal worm were collected, but two were accidentally lost. Until males are known the species is tentatively assigned to the genus *Rhabdochona*.

Host : *Uca manii* Rathbun ; Port Canning, India. July 1, 1930. Indian Museum, Reg. No. W 1666/1.

Gnathosotoma juv.

One specimen (Figs. 6, 7) of a worm belonging to this genus was taken from a cyst in the mesentery of *Saccobranhus fossilis* (Bloch) ; Calcutta, July 14, 1930. Length of body : 3.72 mm. ; diameter, 0.40 ; length of tail : 0.55 mm. ; tapering, acute. The lateral lips are indistinctly trilobed. The body bears about 211 girdles of spines, which gradually decrease in size posteriorly. The head bulb bears four rows of spines which from anterior to posterior contain the following numbers : 34, 42, 48, 52. Ballonets, slender ; 0.6 mm. long. Muscular esophagus, 0.4 mm. long ; glandular esophagus, 0.65 mm. long. The adult stage of this worm may be found in some fish-eating vertebrate. Indian Museum, Reg. No. W 1667/1.



FIGS. 6, 7.—*Gnathostoma* juv. ; body and enlarged view of anterior end.

DISCUSSION AND CONCLUSIONS.

To those who are interested in the transformations which permit animals to change their daily activities from sea to fresh-water or from aquatic to terrestrial habits, the Ganges Delta is an inspiring observation ground. The heavy rainfall, high tides and extensive tide-water areas, enormous body of water, monotonous soil, and high temperatures make a setting which offers unique opportunities for scientific work. Several talented investigators, such as Kemp, Alcock, and Annandale, have already studied the animals in the Delta and have written some excellent papers. Pelseneer (1906) and others long ago pointed out that the whole

Bay of Bengal is diluted by heavy rains and that animals there are becoming gradually adjusted to fresh water. But Annandale (1922) was surprised when he observed how often invaders from the ocean were turned back when they had their chance to invade freshwater habitats during the rainy season ; and, though the brackish waters of the delta were chiefly populated by typically marine animals, how few of these actually became established in freshwater. The invasion of freshwater from the sea is a slow, hard fought struggle. Annandale specifically mentioned a crab, *Varuna litterata*, as a species which was continually unsuccessful in such attempts to establish itself. The writer found adults of this species in a pool in the midst of a rice field, about a mile from the river. This one little colony had apparently won its battle and attained freshwater.

At Port Canning the writer had opportunity to study the foods and parasites of certain littoral crabs and fishes. Some of these are aquatic, estuarine types, some are adjusted to life in freshwater or on land, and some are amphibious types which at times wander over the land or are intermittently exposed to different media on account of fluctuating tides or floods. A few generalizations may perhaps be justified.

In regard to foods, it was at once apparent that the five species of fishes which were studied ate a far greater variety of foods than the eight species of crabs (17 : 7). Crabs ate more of plants (60.89 : 14.16) and of mud (34.40 : 12.10) than fishes. About two-thirds of the food of the crabs studied consisted of vegetation and the other third was mud ; the amounts of other foods was quite negligible. The shore crabs ate most of the mud ; those (*Varuna*, *Paratelphusa*) which lived in ponds away from the river ate little or none.

The crabs showed a better segregation into habitats than the fishes. Along the beaches they were more definitely arranged in zones, and they thus avoided interspecific competition. Though different species of fishes were often associated in the same habitats as the waters along the beaches rose and fell, they were not competing for foods to any extent. This was perhaps because they were more specialized than crabs in their food habits. Often the food of a fish may be surmised if one knows the length of its intestine. As is well known, vegetarians commonly have long intestines and carnivores have short intestines. The fishes observed at Port Canning may be arranged in the following order, according to the length of the intestine in relation to length of the body : *Aprocryptes lanceolatus*, 3.43 ; *Aoria gulia* 1.00 ; *Periophthalmus cantonensis pearsei*, 0.76 ; *Saccobranchus fossilis*, and *Taenioides rubicundus*, 0.70 ; *Ophicephalus striatus*, 0.69 ; and *Glossogobius giurus*, 0.38. The first species subsists largely on algae and the last is a fish eater.

The parasites which occur in the fishes and crabs at Port Canning are more difficult to discuss than the foods. In general there are more parasites associated with fishes than with crabs. This is perhaps correlated with the fact that fishes have larger bodies and more nutritious internal fluids. There are on the whole more parasites in aquatic than in land fishes. Some types of parasites are wholly absent from the latter ; i.e., trematode cysts, nematode cysts, and acanthocephalans.

Land crabs at Port Canning have about as many parasites as those which live in water. This agrees with observations which the writer made in a great estuary in Siam (Pearse, 1932), but does not support those made farther north on the Asiatic coast (Pearse, 1930, 1931) at Foochow, China and Misaki, Japan. At the latter localities land crabs were found to have more parasites than aquatic crabs. Mites and copepods were commonly found on the gills of land crabs, but such parasites were not observed in Siam or India. The following parasites and commensals were found associated with only one species of host: *Epistylis* (*Uca*), *Stelina* and intestinal ciliates (*Sesarma*), rotifers (*Paratelphusa*), *Dichelaspis* (*Scylla*), *Leidyia* (*Metaplar*), and *Trypanosoma* (*Ophicephalus*) and certain other parasites in fishes. Encysted nematodes were found in fishes and not in crabs. Copepods were found only on the gills of fishes. Trematode cysts occurred in several species of fishes and crabs. Of course it is not possible to generalize on the occurrence of the parasites of the crabs and fishes studied when little is known about secondary hosts, habitats, host specificities, life cycles, and other factors.

At Port Canning the crabs and fishes which live in the tidal zone or have attained life in freshwater or on land have arrived at their present habitats by gradually spreading from the ocean. Such long migrations may have involved circuitous biways in some cases. For example, bony fishes apparently originated in freshwater from more remote ancestors (Barrell, 1916; Case, 1919). The crabs which have left the estuary are vegetarians. The fishes which have become best adjusted to land life are largely eaters of arthropods; from crustaceans in the water they have turned to insects on land. Of course the land vegetation is a better source of nourishment than that which grows in water. Animals which leave the stable, dependable ocean and through long ages travel the hard route to land encounter new dangers, escape old enemies, find new difficulties which require new adjustments, and attain new rewards. Land animals eat more nutritious foods, live and move faster, depend more on sense organs which are concerned with distance perception, and reach higher psychic levels than their more primitive aquatic relatives. They have not attained these rewards by planning and striving for them. The oxygen lure, the speed lure, the breeding lure, the food lure, or the safety lure did not bring them on land; though any of these may be a contributing factor. Apparently the most important factor is habitatic segregation—the avoidance of competition by invading unused areas (Pearse, 1929). In the Ganges Delta and in many other parts of the earth animals are progressing toward land to-day.

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TABLE I.

Air temperatures and humidities at Port Canning. With one exception¹ observations were made on the porch of the rest house about 15 feet above the ground.

Date, July.	Time.	Temp., °F.	Humidity.	Conditions.
1	12-30 P.M.	86.0	73	Wind ; sun and showers.
	3-20 P.M.	88.4		
	7-30 P.M.	83.3	86	Wind.
2	7-30 A.M.	83.0	86	Scattered clouds.
4	3-30 P.M.	87.3	72	Cloudy ; previously, showers.
5	2-40 P.M.	89.5	74	Scattered clouds.
6	2-25 P.M.	87.7	83	Thunder clouds.
	2-40 P.M.	85.6	73	Strong wind.
	3-35 P.M.	79.7	91	Wind ; rain.
	5-20 P.M.	79.6	90	Wind ; rain.
	6-00 P.M.	79.0	85	Rain wind ; rain.
7	8-15 P.M.	79.5	88	Cloudy —.
	8-25 P.M.	79.2 ¹	91 ¹	Cloudy + On ground by pond.

TABLE II.

Temperatures of water in goby pools at Port Canning, July 7, between the levee and the river.

Time, P.M.	Size of pool ; ft.	Depth ; inches.	Temp., °C.
2-35	4 × 10	1	27·15
2-40	4 × 10	2	27·30
2-43	8 × 12	3	27·20
2-45	6 × 10	0·5	27·20
2-48	3 × 25	0·5	28·90
2-55	5 × 18	0·75	28·30
2-57	5 × 18	2	27·70 in bottom mud.
2-59	Stream.	1	27·40
3-10	200 × 100	18	27·50
3-21	50 × 300	36	27·90

REPORT ON THE SHALLOW-WATER MARINE SPONGES IN THE COLLECTION OF THE INDIAN MUSEUM.

PART I.

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and

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(Plate XVIII.)

The present paper is one of a series dealing with the Sponges of the Indian Museum collected at various periods in different parts of the Bay of Bengal, the Arabian Sea and connected waters. The work on the deep-sea Sponges in the collection was commenced by Dendy¹ and completed by Burton.² Kumar³ reported on some of the shallow-water Sponges collected by the Bengal Fisheries steamer "Golden Crown" and by Dr. S. W. Kemp at Kilakarai and Waltair on the Madras coast, but a great proportion of the collections of shallow-water Sponges from the coasts of India, Burma, Ceylon and the Andaman Islands had not been studied for several years. We have to thank Col. R. B. Seymour Sewell, Director of the Zoological Survey for having given us the opportunity to study the material.

The Sponge fauna of the Indian ocean, and its associated localities such as the Red sea, has been the subject of numerous memoirs in the past, the result of which is reflected in this present work in the comparatively few species it has been found necessary to describe as new. Even with such new species as it has been necessary to describe, it is not improbable that when a detailed revision of the general systematics of the group has been effected, many of these will be found to be synonymous with species already known, but which are obscured by reason of their inclusion in wrong genera.

Although this report contributes little in the way of descriptions of new species, the work done in connection with it has been of interest in affording an opportunity of assessing the real value of many of the better known species.

The present collection includes 82 species belonging to 50 genera. Of these, 12 species and 3 genera are new to science.

The following is a list of the species :—

Order Hexactinellida

Euplectella aspergillum Owen.

Aphrocallistes beatrice Gray.

Monorhaphis sp.

¹ Dendy, *Rec. Ind. Mus.*, XXVIII, pp. 225-248, (1926).

² Burton, *Rec. Ind. Mus.*, XXX, pp. 109-135, (1928).

³ Kumar, *Rec. Ind. Mus.*, XXVII, pp. 211-229, (1925).

Order Calcareo

- Leucosolenia coriacea* (Montagu).
- Leucosolenia* sp.
- Pericharax heteroraphis* Poléjaeff.
- Pericharax canaliculata*, sp. nov.
- Sycon grantioides* Dendy.
- Ute syconoides* (Carter).

Order Lithistida

- Discodermia papillata* Carter.
- Discodermia japonica* Döderlein.
- Discodermia sceptrifera* Carter.
- Theonella swinhoei* Gray.
- Theonella pulchrifolia* Dendy.
- Azorica pfeifferae* Carter.
- Seliscotho chonelleides* Döderlein.

Order Tetraxonida

Sub-order Homosclerophora

- Dercitus plicatus* var. *simplex* (Carter).

Sub-order Streptastrosclerophora

- Poecillastra tenuilaminaris* Sollas.

Sub-order Astrosclerophora

Family Stellettidae

- Stelletta validissima* Thiele.
- Stelletta purpurea* Ridley.
- Stelletta orientalis* Thiele.
- Stelletta clavosa* Ridley.
- Stelletta cavernosa* (Dendy).
- Stelletta aruensis* Hentschel.
- Stelletta* sp.
- Cryptotethya agglutinans* Dendy.
- Aurora globostellata* (Carter).
- Aurora rowi* Dendy.
- Ecionemia carteri* Dendy.
- Amphius sollasi*, sp. nov.

Family Erylidae

- Erylus lendelfeldi* Sollas.
- Erylus geodioides*, sp. nov.

Family Geodiidae

- Geodia inconspicua* (Bowerbank).
- Geodia perarmata* Bowerbank.

Family Chondrosiidae

- Chondrosia reniformis* Nardo.
- Chondrilla sacciformis* Carter.
- Chondrilla australiensis* Carter.
- Chondrilla australiensis* var. *mixta* Schulze.

Sub-order Sigmatosclerophora

Family Tetillidae

- Paratetilla bacca* (Selenka).
- Tetilla cranium* (Müller).
- Tetilla dactyloidea* (Carter).
- Cinachyra arabica* (Carter).
- Cinachyra australiensis* (Carter).
- Cinachyra simplex* (Sollas).

Family Desmacidonidae

Sub-family Mycaleae

- Biemna fortis* (Topsent).
- Biemna tubulata* (Dendy).
- Mycale indica* (Carter).
- Mycale parishii* (Bowerbank).
- Mycale monanchorata*, sp. nov.

Sub-family Myxillae

- Lissodendoryx similis* Thiele.
- Lissodendoryx ternatensis* (Thiele).
- Kirkpatrickia spiculophila*, sp. nov.
- Ectyobatzella enigmatica*, sp. nov.
- Psammochela elegans* Dendy.

Sub-family Clathriæ

- Clathria lendenfeldi* Ridley and Dendy.
- Clathria indica* Dendy.
- Tenacia frondifera* (Bowerbank).
- Tenacia robusta* (Dendy).
- Tenacia procera* (Ridley).
- Tenacia micropunctata*, sp. nov.
- Isociona tuberosa* (Hentschel).
- Raspailia viminalis* Schmidt.
- Raspailia tenuis* Ridley and Dendy.
- Protoraspailia cactoides*, Gen. et. sp. nov.
- Acanthostylotella cornuta* (Topsent).
- Microciona prolifera* Verrill.
- Microciona atrosanguinea* Bowerbank.
- Aulenella foraminifera* Gen. et. sp. nov.
- Hemectyon thurstoni* (Dendy).
- Aulospongius tubulatus* (Bowerbank).
- Echinodictyum nervosum* (Lamarck) Ridley.
- Echinodictyum asperum* Ridley and Dendy.
- Echinodictyum gorgonoides* Dendy.
- Dendrocia antyaja*, sp. nov.

Sub-family Hymedesmieae

- Hymedesmia dendyi* Burton.
- Hymedesmia crelloides*, sp. nov.
- Hymedesmia parvispicula*, sp. nov.

Sub-family Acarneae

Acarneus ternatus Ridley.*Iotrochota baculifera* Ridley.

Sub-family Tedaniae

Tedania nigrescens (Schmidt).*Histoderma fucoides* Topsent.

Sub-family Plocamiae

Plocamia manaarensis (Carter).

Sub-family Cyamonae

Cyamon vickersii (Bowerbank).

Order HEXACTINELLIDA.

Euplectella aspergillum Owen.

1887. *Euplectella aspergillum*, Schulze, *Challenger Rep. Hexactinellida*, XXI, p. 64, pls. i-iv.

The sole representative of this species is a fragment which appears to belong to this species.

Locality.—N. Andaman Is.

Aphrocallistes beatrix Gray.

1904. *Aphrocallistes beatrix*, Schulze, *Wiss. Ergebn. Deutsch. Tiefsee Exped. Valdivia*, IV, p. 39, pls. xi-xiii; xiv, figs. 1-6.

1926. *Aphrocallistes beatrix*, Dendy and Burton, *Rec. Ind. Mus.*, XXVIII, p. 226.

The species is represented by a fragment only.

Locality.—13 miles S. W North Sentinel I., Andamans.

Monorrhaphis sp.

A small portion (93 mm. long and $\times 0.5$ mm. thick) of a single large spicule, around which *Kirkpatrickia spiculophila* sp. nov. has grown may represent a species of *Monorrhaphis*.

Locality.—Port Blair, Andaman Is., (G. H. Booley, 3rd April 1890).

Order CALCAREA.

Genus **Leucosolenia** Bowerbank.

1862. *Leucosolenia*, Bowerbank, *Phil. Trans. Roy. Soc. Victoria*, p. 1094, pl. LXXII, fig. 2.

1896. *Clathrina*, Minchin, *Ann. Mag. Nat. Hist.*, Ser. 6, XVIII, p. 358.

1913. *Leucosolenia*, Dendy and Row, *Proc. Zool. Soc. London*, p. 779.

The genus *Clathrina* has been generally abandoned by systematists of recent years. This seems to be the wisest course for, although, Minchin gave excellent reasons for the retention of the genus, the arguments of Dendy and Row in favour of regarding it as a synonym of *Leucosolenia* appear at the moment, unanswerable.

Leucosolenia coriacea (Montagu).

1818. *Spongia coriacea*, Montagu, *Mem. Wernerian Nat. Hist. Soc.*, II, p. 116.
 1842. *Grantia coriacea*, Johnston, *Hist. Brit. Sponges and Lithophytes*, p. 183, pl. xxi, fig. 9.
 1866. *Leucosolenia coriacea*, Bowerbank, *Monogr. Brit. Sponges*, II, p. 34.
 1867. *Leucosolenia coriacea*, Gray, *Proc. Zool. Soc. London*, p. 556.
 1871. *Clathrina sulphurea*, Carter, *Ann. Mag. Nat. Hist.*, Ser. 4, VII, p. 278.
 1872. *Ascetta coriacea*, Hæckel, *Syst. der Kalkschwämme*, p. 24, pl. iii, pl. v, fig. 2.
 1874. *Leucosolenia coriacea*, Bowerbank, *Monogr. Brit. Sponges*, III, p. 8, pl. iii, figs. 11-14.
 1881. *Clathrina coriacea*, Ridley, *Proc. Zool. Soc. London*, p. 132.
 1882. *Ascetta coriacea*, Bowerbank (Norman), *Monogr. Brit. Sponges*, IV, p. 225.
 1885. *Ascetta coriacea*, Fristedt, *Kongl. Svens. Vet. Akad. Handl.*, XXI, p. 8.
 1886. *Ascetta coriacea*, Higgin, *Rep. Liverpool Mar. Biol. Comm.*, No. 1, p. 90, in *Proc. Lit. Phil. Soc. Liverpool*, XL, Append.
 1887. *Ascetta coriacea*, Fristedt., *Vega Exped. Vetenskap. Arb.*, IV, p. 405, pl. 22, figs. 1-2.
 1887. *Leucosolenia coriacea*, Priest, *Journ. Quekett Micr. Club*, III, p. 8.
 1890. *Ascetta coriacea*, Hanitsch, *Rep. Liverpool Mar. Biol. Comm.*, No. 3, p. 232 in *Trans. Biol. Soc. Liverpool*, IV.
 1891. *Ascetta coriacea*, Hanitsch, *Trans. Biol. Soc. Liverpool*, V, Append. p. 213.
 1891. *Leucosolenia coriacea*, Grentzenberg, *Inaugural Dissert*, Erlang. Phil. Fakult. Zool. Inst. Univ. Kiel., p. 40.
 1891. *Leucosolenia coriacea*, Topsent, *Arch. Zool. Exp. Generale*, IX, p. 530.
 1892. *Leucosolenia coriacea*, Topsent, *Res. Campag. Sci.*, II, p. 21.
 1898. *Leucosolenia coriacea*, Breitfuss, *Ann. Mus. Zool. Acad. Imp. Sci. St. Petersbourg*, pp. 9-20.
 1898. *Leucosolenia coriacea*, Breitfuss, *Mem. Acad. Imp. Sci. St. Petersbourg*, VI, p. 12.
 1900. *Ascetta coriacea*, Arnesen, *Bergens Mus. Aarbog*, No. 5, p. 10.
 1905. *Leucosolenia (Clathrina) coriacea* var. *ceylonensis*, Dendy, *Rep. Ceylon Pearl Oyster Fisheries*, Suppl. Rep. No. XVIII, p. 226, pl. xiii, fig. 8.
 1912. *Clathrina coriacea*, Stephens, *Proc. Roy. Irish Acad.*, XXXI, p. 8.
 1917. *Clathrina coriacea*, Stephens, *ibid.*, XXXIV, p. 2.
 1929. *Leucosolenia coriacea*, Burton, *Nat. Hist. Rep. Brit. Antarct. "Terra Nova" Exped. 1910, Zoology*, VI, p. 402.

The above synonymy list, though containing only the principal references, emphasises the broad distribution of the species. It is probable, moreover, that many closely related species, at present regarded as distinct, must eventually be included under the same name.

The species is represented in the collection by a small specimen enclosing a piece of a Gorgonid. The anastomosing tubes and the interstices between are slightly broader than usual.

Locality.—(Marine Survey Sta. 640)—Bay between Huludu and Heratera Islands, Maldives (Shore-collecting on reef-flat, 6th March 1923.)

Leucosolenia sp.

On the surface of *Amphius sollasi* (q.v.) are some minute growths of a *Leucosolenia* in the form of a few irregularly branching and anastomosing tubes. The largest is 1 mm. across and it is fairly clear that they represent the immediate post-larval stages of a species closely allied to *L. coriacea*. The spicules are triradiates and quadriradiates with rays about 0.06 mm. long, and oxea measuring 0.15×0.003 mm.

Locality.—'Ain Musa, Gulf of Suez. (R. B. S. Sewell, 8th January 1917).

Pericharax heteroraphis Poléjaeff.

1883. *Pericharax carteri* var. *heteroraphis*, Polejaeff, *Challenger Rep. Calcareo*, VIII, p. 66, pl. ii, fig. 5, pl. vii, fig. 8.

1913. *Pericharax heteroraphis*, Dendy, *Trans. Linn. Soc. London*, XVI, p. 13, pl. i, fig. 8; pl. 5, figs. 1, 2.

An incomplete and somewhat damaged specimen, and not unlike the figure in the Challenger Report (pl. ii, fig. 5) is referred to this species.

Locality.—Off Rutland I., Andamans ("Investigator," 35 fathoms).

Pericharax canaliculata sp. nov.

(Pl. XVIII, Fig. 1.)

Diagnosis.—Sponge small (probably young), more or less oval, with a shallow depression on one side; surface, to naked eye, even, minutely and irregularly tuberculate; without specialised vent, exhalant openings probably represented by minute pits in the shallow depression already referred to; colour, in spirit, yellow; no central cloaca, but body traversed by a few irregular, longitudinal canals; skeleton composed of small triradiates, equi-angular, or occasionally inequi-angular, closely packed to form an irregular reticulation, with a few large triradiates scattered therein; rays of smaller radiates measuring 0.15×0.012 mm., those of larger radiates about three times as large.

Holotype.—P. $\frac{782}{1}$ Zool. Surv. Ind. (*Ind. Mus.*).

Remarks.—The species differs from the only other species of the genus, *P. heterorhaphis* and *P. peziza*, in external form almost entirely. The compact structure and the conspicuous canals running through the body are also features which serve to characterise the species, but it is questionable how far these may be of taxonomic importance.

Locality.—2 miles N. W. of Torres Straits, Mergui (40 fathoms. 5th March, 1886).

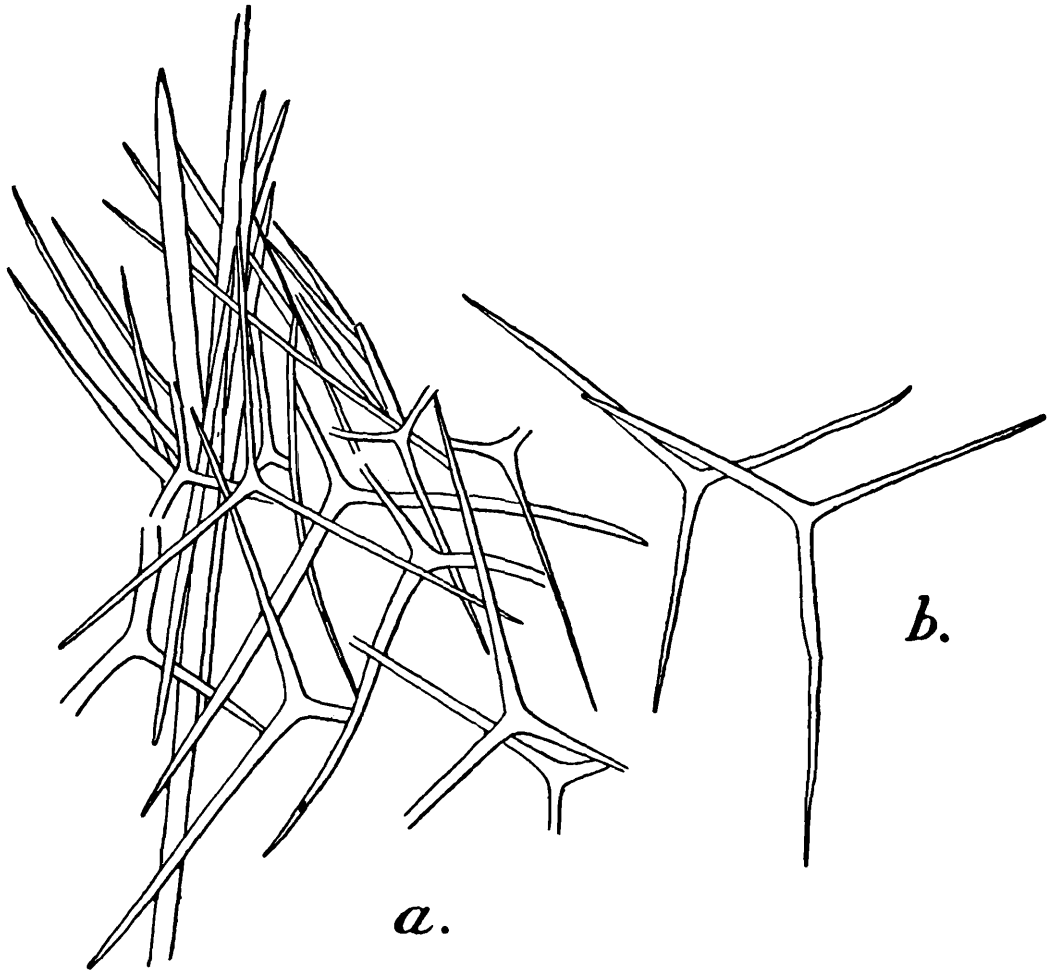
Sycon grantioides Dendy.

(Pl. XVIII, Fig. 2.)

1915. *Sycon grantioides*, Dendy, *Rep. Govt. Baroda Mar. Zool. Okhamandal, Kattiawar*, II, p. 79, pl. i, fig. 1.

The specimen undoubtedly belongs to *Sycon grantioides*. The holotype of this species was much macerated, but as our specimen is more or less complete and contains several features not mentioned in the original description we give a photograph of it. The measurements of the spicules agree closely but the oxea are fewer in number. The outer ends of the chambers bear tufts formed by the basal rays of the triradiates (fig. 1a). The gastral surface bears a similar layer of triradiates whose rays project into the central cloaca (fig. 1b). The dimensions of the triradiates of both the gastral surface and of the outer ends

of the chambers are:—basal rays 0.15×0.006 mm., and apical rays 0.195×0.006 mm.



TEXT-FIG. 1.—*Sycon grantioides*. *a.* skeleton of one of the radial chambers showing the large oxea and the triradiates; *b.* gastral triradiates (both $\times 146$).

The sponge itself is 9 mm. high, with conspicuously hirsute surface.
Locality.—Pedro shoal, Ceylon ("Investigator").

***Ute syconoides* (Carter).**

1886. *Aphroceras syconoides*, Carter, *Ann. Mag. Nat. Hist.* Ser. 5, XVIII, p. 135.

1892. *Ute syconoides*, Dendy, *Proc. Roy. Soc. Victoria*, (n. s.) V, p. 92.

Three small individuals attached to calcareous nodules from the Pearl Oyster banks, off Tuticorin (March 1926) are the only representatives of this species, which is little known in Indian waters.

Order LITHISTIDA.

***Discodermia papillata* Carter.**

1880. *Discodermia papillata*, Carter, *Ann. Mag. Nat. Hist.*, Ser. 5, VI, p. 146, pl. viii, fig. 48.

1888. *Discodermia papillata*, Sollas, *Challenger Rep. Tetractinellida*, XXV, p. 330.

1903. *Discodermia papillata*, Lendenfeld, *Das Tierreich*, XIX, p. 131.

The specimen from the Andamans ("Investigator" Coll.) here regarded as identical with Carter's species agrees very closely with the published description of the holotype of *D. papillata* in spiculation.

Its external form is irregularly massive. In addition to this specimen there are two others in the present collection which agree with the Andaman specimen in external form. Slight differences may be seen in their spiculation, however, and these differences are sufficient to justify our identifying them with *Discodermia laevidiscus* and *D. aspera* respectively. At the same time the strong resemblance all the three species bear to one another makes it probable that the two last named species are synonymous with *D. papillata*. We refrain, however, from definitely committing ourselves to this synonymy until the holotypes of all three have been re-examined.

D. sinuosa Carter also appears to be synonymous with *D. papillata*.

Sollas (*l. c.* p. 327) describes the microscleres of *D. aspera* as microxea (0.058 mm. long) and microstrongyles (0.016 mm. long). Carter does not mention the former, nor is it present in our specimen, and it is difficult to understand how Sollas should have been led to make the statement.

Locality.—(M. S. Sta. 384)—off C. Negrais, Burma (22nd February 1909). Andamans $\frac{(9059)}{6}$.

***Discodermia japonica* Döderlein.**

1884. *Discodermia japonica*, Döderlein, *Zeit. Wiss. Zool.*, XL, p. 62, pls. v-vii.

1888. *Discodermia japonica*, Sollas, *Challenger Rep. Tetractinellida*, XXV, p. 329.

1903. *Discodermia japonica*, Lendenfeld, *Das Tierreich*, XIX, p. 129.

The history of this species may be described as a series of mistakes. Döderlein, in his original description, diagnoses the species almost entirely on external form and treats later of the skeleton in a generalized way, together with the skeletons of two other species. Consequently, it is almost impossible to say to which species his illustrations belong. Sollas was able to elucidate many of the obscurities caused by Döderlein's methods, but there is no proof that the diagnosis Sollas built up is correct. Later, Lendenfeld speaks of the presence of smooth microxea although Sollas has attributed spiny microxea to the species. Under the circumstances the only safe way of dealing with the species is to re-examine the holotype. Unfortunately this cannot be done at the moment. There is, however, a specimen in this collection bearing so strong a resemblance in external form to the sponge figured by Döderlein (pl. v, fig. 1) and possessing a skeleton so like that described for the species by Sollas (*l. c.*) that there is no alternative but to regard it as possibly identical with Döderlein's species. At all events, it is so closely related as to render it quite unnecessary to give it a new name.

The desmas of this specimen are almost identical with those figured by Döderlein (on pl. vi, fig. 7; pl. vii, fig. 38), and the phyllotriaenes with those figured (on pl. vi, figs. 20-24). No discotriaenes were seen. The microscleres are minutely-roughened microxea 0.06×0.003 mm. and roughened microrhabds 0.008 mm. long.

The agreement between the present specimen and the holotype of *D. japonica* is extremely close, but the identification is based on Döderlein's figure of the external form and Sollas's description of the skeleton.

Locality.—(M. S. Sta. 384) off C. Negrais, Burma (22nd February 1909).

One or two developing desmas are found in a preparation from the specimen from Mar. Surv. Sta. 384. They lie in the position occupied by the axial lines of a disc that they are apt to be overlooked. If they actually represent axial lines they should indeed be very curious.

***Discodermia sceptrifera* Carter.**

1881. *Discodermia sceptrifera*, Carter, *Ann. Mag. Nat. Hist.*, Ser. 5, VII, p. 372, pl. xviii, fig. 2.

The species is represented by two irregularly massive sponges growing in close association with shells of *Vermetus* sp. The spiculation agrees closely with that described by Carter except that the "circular form of the disk" (*l. c.* fig. 2*a*) whose existence was "inferred" does not appear to be present.

Locality.—Ganjam Coast, Madras Precy. 20-30 fms. ("Golden Crown" Coll.) April 1909.

***Theonella swinhoei* Gray.**

1868. *Theonella swinhoei*, Gray, *Proc. Zool. Soc. London*, p. 565.

1873. *Theonella swinhoei*, Carter, *Ann. Mag. Nat. Hist.*, Ser. 4, XII, p. 437.

1878. *Theonella swinhoei*, Zittel, *Abh. K. Baier. Akad. Wiss.*, I., pp. 103, 151, pl. i, fig. 9.

1888. *Theonella swinhoei*, Sollas, *op. cit.* p. 284, pls. xxix, xxx.

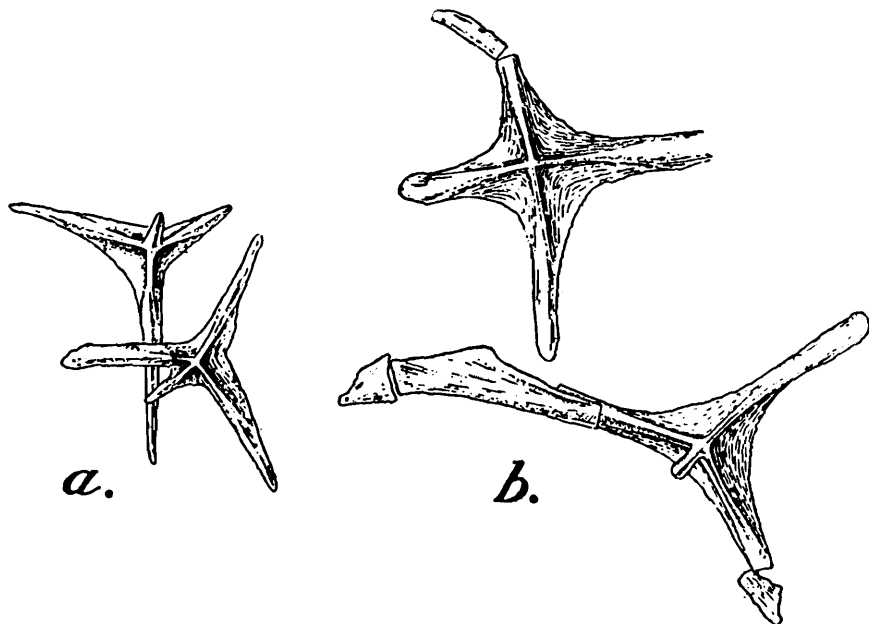
1897. *Theonella swinhoei*, Topsent, *Rev. Suisse Zool.*, IV, p. 431.

1899. *Theonella swinhoei*, Thiele, *Zoologica*, XXIV, p. 6.

1900. *Theonella swinhoei*, Thiele, *Abh. Senckenb. Naturf. Ges.*, XXV, p. 52, pl. iii, figs. 3.

1903. *Theonella swinhoei* Lendenfeld *op. cit.*, p. 126.

An interesting feature of this species is the unusual appearance of the developing desmas (fig. 2). The silica, instead of being deposited



TEXT-FIG. 2.—*Theonella swinhoei*. *a.* developing desmas; *b.* slightly abnormal form of developing desmas (both $\times 146$).

uniformly, in regular concentric layers, around the axial canals appears to be deposited in irregular, granular masses.

Localities.—(M. S. Sta. 631) Nankauri Harbour, Nicobars (Dec. 19, 1922) ; Krusadai I., Gulf of Manaar, (B. N. C. & H. S. R., Feb., 1925).

***Theonella pulchrifolia* Dendy.**

1921. *Theonella pulchrifolia*, Dendy, *op. cit.*, p. 5, pl. ix, fig. 1.

The single specimen, agreeing very closely with the holotype in spiculation, is a cup-shaped sponge, 50 mm. high and 70 mm. across the mouth of the cup. Evenly distributed over the inner surface of the cup are a number of incipiently-papillate oscules, each papilla about 0.05 mm. high and 1 mm. in diameter. The colour, in spirit, is a light brown on the outer and purplish brown on the inner surface.

Locality.—(M. S. Sta. 535) Mergui Archipelago (17th April 1913).

***Azorica pfeifferae* Carter.**

1928. *Azorica pfeifferae*, Burton, *Rec. Ind. Mus.*, XXX, p. 112.

A large typical specimen of this well known species is present.

Locality.—(M. S. Sta. 535) Mergui Archipelago, May 1913.

There are several specimens of *Lithistida* whose skeletons show signs of considerable maceration. Although the external form is well-preserved the skeleton contains only desmas, the other spicules having been lost. This is a common feature of collections of *Lithistida*, the interlocking of the desmas having served to preserve the form of the sponge, but no more. We have purposely refrained from attempting a description of these incomplete skeletons, and desire here to emphasise the desirability of such action. In the past, new species have been founded on such incomplete forms, an action calculated to lead to confusion and involve considerable loss of time to those endeavouring, subsequently, to place the species on a sound basis. Such a species is *Theonella annulata* Lendenfeld (1906). Others are *Corallistes aculeata*, *C. verrucosa* and *C. elegantissima* Carter (1880) of which the only information we possess is the form of the surface desmas. From this it is obvious that all the three species are synonymous, but apart from that they are quite unrecognisable.

***Seliscothon chonelleides* Döderlein.**

1883. *Seliscothon chonelleides*, Döderlein, *Zeit. Wiss. Zool.*, XI, p. 66, pl. v, fig. 8, pl. vii, fig. 44-49.

1888. *Azorica chonelleides*, Sollas, *op. cit.* p. 349.

1903. *Leiodermatium chonelleides*, Lendenfeld, *Das Tierreich*, XIX, p. 147.

The species ranges from ear-shaped to flabellate or sub-infundibular, the smallest specimen present being slightly smaller than the holotype, and very like it in appearance, the largest 240 mm. high and the same across.

The desmas are monorepid with shaft smooth, or bearing a few tuberculations, but markedly tuberculate at the extremities. The appearance of the skeleton, as seen in a cross section of the wall of the sponge is so striking that provisionally we propose to retain the genus *Seliscothon*. The interlocking skeleton of desmas is traversed by numerous radial bundles of oxea which pierce the dermis and project beyond.

The arrangement of these bundles recalls so strongly the radial bundles of the Stellettidae or Tetillidae that an instinctive search is made for the heads of triaenes projecting at the surface. In every case, however, the projecting ends of the spicules were broken. Here and there are bundles of fine hair-like spicules, recalling the bundles of trichotriaenes occurring occasionally, in addition to the radial bundles, in the Tetillidae. Again no cladomes were seen, perhaps because the ends of the spicules were, in every case, broken. Altogether, the appearance of the skeleton of this species, apart from the desmas, is so strongly reminiscent of that of a *Tetilla* that there is ample justification for suggesting that *Seliscotho* finds its closest allies in the Tetillidae. (Cf. Burton 1929, p. 4).

Locality.—(M. S. Sta. 549) 12° 48' N. 98° 16' E. (21st October 1913).

Order TETRAXONIDA.

Sub-order HOMOSCLEROPHORA.

Genus *Dercitus* Gray.

1867. *Dercitus*, Gray, *Proc. Zool. Soc. London*, p. 542.

1874. *Battersbyia*, Bowerbank, *Mon. Brit. Spong.*, III, p. 347.

1888. *Calcabrina*, Sollas, *op. cit.*, p. 280.

1888. *Stoebea*, Sollas, *op. cit.*, p. 102.

According to Dendy (1905, p. 70) the distinguishing feature between *Dercitus* and *Stoebea* is the presence of toxae in the former and their absence in the latter. Annandale (1915, *Rec. Ind. Mus.*, XI, p. 458) has shown *Stoebea simplex* to be a variety of *S. plicata* (Schmidt) and since the European forms of the latter are so very like *Dercitus bucklandi* (Bow.), the genotype of *Dercitus*, in all respects but the absence of toxae it seems hardly necessary to maintain the two genera on so slender a difference. Dendy's *Stoebea extensa* is probably a distinct variety of *Dercitus plicatus*, as the microxea show.

Dercitus plicatus var. *simplex* (Carter).

1915. *Stoebea plicata* var. *simplex*, Annandale, *Rec. Ind. Mus.*, XI, p. 458.

Represented by a single specimen from the Invisible Bank, Andaman Seas. In external form and colour it agrees more nearly with the description of Dendy's var. *extensa*. The microxea are 0.018-0.022 mm. long, 0.003-0.007 mm. broad. The brown cells are relatively few and confined to the ectosome.

Sub-order STREPTASTROSCLEROPHORA.

Poecillastra tenuilaminaris Sollas.

1926. *Poecillastra tenuilaminaris*, Dendy and Burton, *Rec. Ind. Mus.*, xxviii, p. 238.

Several examples are present of varying thickness and extent collected at various places in the Indian Ocean.

Locality.—Mergui Archipelago (65 fms., April 1913); off Cape Negrais, Burma (40-49 fms., Feb. and Nov. 1909); Table I, Cocos group, Andamans (10 fms., Dec. 1888); W Andamans. (Mar. Surv. Carpenter Coll.)

Sub-order ASTROSCLEROPHORA.

Family STELLETTIDAE.

Genus **Stelletta** Schmidt.

1862. *Stelletta*, Schmidt, *Spongien Adriat. Meer.*, p. 64, pl. iv.

Genotype.—*S. grubii* Schmidt.

Although Vosmaer (1887, Bronn's Klassen und Ordnung der Spongien, p. 319) at first accepted as his "Beispiel" of *Stelletta* the species *S. dorsigera*, he agreed later with Marenzeller's identification of *S. dorsigera* with *S. grubii* and *S. boglicii* (Vosmaer in *Tyds. Nederl. Dier. Vereen.* (2) III, p. 36, 1890). *S. grubii*, the first-named species of Schmidt described two years earlier than *S. dorsigera*, is, therefore, here accepted as the genotype.

Stelletta validissima Thiele.

1898. *Stelletta validissima*, Thiele, *Zoologica*, XXIV, p. 13, pl. i, fig. 5, pl. vii, fig. 1.

1926. *Stelletta trichotriaena*, Dendy and Burton, *Rec. Ind. Mus.*, XXVIII, p. 241.

The probable identity of their species with *S. validissima* was suggested by Dendy and Burton. The present specimens, also from the Indian Seas, agree in all respects with the holotype of Thiele's species, and show quite clearly the identity of *S. trichotriaena* therewith.

Locality.—Invisible Bank, Andaman Islands.

Stelletta purpurea Ridley.

1884. *Stelletta purpurea*, Ridley, *Rep. Zool. Coll. Voy. H. M. S. 'Alert'*, p. 473, pl. xl, fig. e, pl. xliii, figs. j-g.

1926. *Stelletta purpurea*, Burton, *Ann. Mag. Nat. Hist.*, Ser. 9, XVIII, p. 44.

The number of specimens in the collection assigned to this species is approximately 60. Of these, the majority have the typical form, small, spherical, with centrally placed circular vent at the apex. The spiculation of these specimens, too, calls for little comment. There are, on the other hand, several specimens worthy of more detailed consideration. Some others are subspherical or even irregularly massive, often with the vent excentrically placed. The colour varies, often in a single lot of sponges from the same station from yellow to a purplish brown.

The lot from (M. S. Sta. 622) Camorta I., Nicobars, comprises some 6 sponges, of various sizes, from 5 to 15 mm. in diameter, characterized by a greenish-yellow tinge marking the contour of the surface reticulation and forming radiating streaks around the vents. The vents are velate.

In the examples from Kilakarai, Ramnad Dt., the microscleres vary from strongylasters to oxyasters, tylasters being only occasionally present. Otherwise, the specimens are quite typical for the species.

The specimen from (M. S. Sta. 61) E. N. E. of Prepara I., Bay of Bengal, has the typical external form and megascleres, but the microscleres comprise strongylasters in addition to the tylasters. The strongylasters usually have 8 rays, which may be reduced to 4, 3, 2, or even 1,

and measure, on an average, 0.024 mm. in diameter. The one-rayed forms of the strongylasters are club-shaped, and are composed of a single ray bearing at one end the vestige of a centrum. The rays of the larger of these strongylasters are roughened.

It is a matter for debate whether the foregoing specimen belongs to *S. purpurea* or not, or whether the unusual nature of the microscleres may not furnish evidence for including in that species other closely-allied forms, whose microscleres are not necessarily tylasters. The next two specimens to be discussed provide support for the second alternative.

Those from the Tuticōrin Pearl Oyster banks are large, irregularly-massive sponges, each bearing a single apical oscule. They have the external form of *S. pachyderma*, and the spiculation of *S. purpurea*. Had they strongylasters instead of tylasters they would have been referred without hesitation to *S. pachyderma*. As it is, the fact that they combine the characteristics of *S. pachyderma* and *S. purpurea* makes it probable that these two species should be regarded as synonymous.

One of the examples from the Peal Oyster bank, Tuticorin, is of interest in that the outer layers of the ectosome are crowded with embryos. These are arranged in a single layer just beneath the surface. They appear to be of the asexual type.

***Stelletta orientalis* Thiele.**

1898. *Stelletta orientalis*, Thiele, *Zoologica*, XXIV, p. 14, pl. 1, fig. 6; pl. 7, fig. 2 a-f.

An irregularly spherical individual 30-35 mm. in diameter is present in the collection. It has on its surface scattered patches of thick pilosity.

Locality.—Andamans (shallow water).

The species was first recorded from Japanese waters; its distribution is not well known.

***Stelletta clavosa* Ridley.**

1884. *Stelletta clavosa*, Ridley, *Rep. Zool. Voy. "Alert,"* p. 474, pl. xliii, figs. i=i".

1888. *Myriastræa clavosa*, Sollas, vars. *quadrata*, *toxo donta*, Sollas, *Rep. Chall. Zool.*, XXV, pp. 116-119, pl. xii, figs. 34-43; pl. xiv, figs. 29-36.

The species is well represented in the collection by specimens from Tana Mura Besar, Singapore I. (Annandale, 22nd December 1915), in small pools between tide marks, Kabusa I., Mergui Archipelago, and the Andamans (surf-line). They are light to dark brown in colour.

***Stelletta cavernosa* (Dendy).**

1916. *Myriastræa cavernosa*, Dendy, *Trans. Linn. Soc. London*, XVII, p. 236, pl. 44, figs. 3, 3a; pl. 46, fig. 1.

A fragment of a sponge belonging to this species, with flat plate-like nullipores attached to its surface, is present in the collection. It agrees closely with the holotype in spiculation.

Locality.—Nicobar Is. (J. Woodmason).

Stelletta aruensis Hentschel.

1912. *Stelletta aruensis*, Hentschel, *Abhandl. d. Senckenb. Naturf. Gesellsch.*, XXXIV, p. 310, pl. xiii, fig. 3; pl. xvii, fig. 4.

This species is represented in the collection by a very large specimen dredged by the "Golden Crown" in comparatively shallow waters (24-30 fathoms) off the coast of Ganjam, Madras Presidency (Bay of Bengal) in March 1909.

It is much larger than the holotype from the Arafura sea, being subspherical, 160 mm. long, 130 mm. broad, and 100 mm. high. The processes on the surface are not evenly distributed, but confined to a broad ring-shaped area along the circumference. They are flattened, often branched or frayed at the extremity, and are 20-30 mm. long.

Locality.—Ganjam Coast, Madras Presidency.

Stelletta sp.

There are two dried sponges growing on an Antipatharian coral whose identity must remain a matter of doubt. They are of massive, irregular form and dark brick-red colour. The surface is much worn. The spiculation consists of oxea, a mixture of plagiotriaenes and dichotriaenes, and small strongylasters varying from 0.011 to 0.017 mm. in diameter. This spiculation recalls that of *S. aruensis*, the main difference being the absence of any sign of oxyasters. These are, however, rare in the holotype of Hentschel's species, so that their complete absence need not necessarily have a taxonomic significance. At the same time, there is no sign of the characteristic surface processes of *S. aruensis*. Whether these were originally present and have been rubbed off since the specimen was dried, it is not possible to say. Since the two sponges were obtained from the same locality as that identified above as *S. aruensis*, there is a strong probability that they too belong to the same species.

Locality.—Ganjam Coast ("Golden Crown" Coll.), 24-30 fms.

There are in the collection four specimens whose spiculation consists of oxea and small asters only, and, according to the interpretation of that genus implied in the identifications of Dendy (1905, 1916) these should be referred to the genus *Jaspis*. In our opinion, they are nothing more than reduced members of the genus *Stelletta* which have lost their triaenes and are treated accordingly. Unfortunately, it has not been possible to refer them to species already known, but since it is probable that they do not represent new species, and in view of the doubt concerning the interpretation of their spicular characters, we have preferred to dismiss them, *pro-tem.*, with a short diagnosis of their salient characters.

In order to make clear the exact nature of the genus *Jaspis* and to justify the remarks made above, a resumé of the history and characteristics of this genus is given in the following pages.

Reduced Stelletta.

Sponge irregularly massive, about 40 × 20 × 30 mm.; surface smooth, minutely hispid, delicately reticulate; pores scattered regularly

over surface, giving rise to surface reticulation ; oscules small, in groups of about 10, at various points on surface ; colour, in spirit, from yellow to pale purple ; megascleres oxea, 1.05×0.042 mm., irregularly scattered in interior, radially disposed or irregularly scattered in a dense layer at surface ; microscleres strongylasters to tylasters, with or without centrum, 0.009-0.012 mm. in diameter, forming a conspicuous dermal layer and plentifully scattered in interior.

Locality.—(M. S. Sta. 657) N. side of East end of Macpherson Straits, near Chiriyatapur (January 20, 1926), Andamans.

Sponge fragmentary, probably tubular, with exhalant openings on walls of a central cloaca ; colour, in spirit, yellow ; megascleres oxea, 1.8 by 0.042 mm., irregularly arranged in interior, and lying partly radially, partly tangentially at surface ; occasional orthotriaenes, with cladi 0.07 by 0.01 mm.¹, scattered among oxea in interior but never definitely orientated ; microscleres strongylasters to tylasters, 0.007-0.017 mm., extremely rare, only found after prolonged search.

Locality.—Andamans (17 fms.).

Sponge elongate, cylindrical, probably repent (about 30 mm. long and 4 mm. in diameter) ; surface smooth, even, minutely hispid ; oscules not apparent ; colour, in spirit, light purplish brown ; megascleres oxea, 1.6×0.072 mm., arranged more or less radially and densely aggregated at surface ; microscleres strongylasters to tylasters, with or without centrum, 0.007-0.012 mm. in diameter, especially associated with dermis, and oxyasters, 0.015 mm. in diameter, found only in choanosome.

Locality.—Andamans (9059/6).

Sponge fragmentary, probably irregularly massive ; colour, in spirit, white ; megascleres oxea, 1.1 by 0.049 mm., irregularly radial in arrangement ; microscleres strongylasters to oxyasters, 0.008-0.018 mm. in diameter, very abundant, smaller spicules confined to dermis.

Locality.—(M. S. Sta. 593) Paway I., Mergui Archipelago (February-March 1914).

Genus *Jaspis* Gray.

1867. *Jaspis*, Gray, *Proc. Zool. Soc. London*, p. 526.

1867. *Penares*, Gray, *op. cit.*, p. 542.

1868. *Papyrula*, Schmidt, *Spong. Adriat. Meeres*, Suppl. IV, p. 18.

1888. *Coppatias*, Sollas, *op. cit.*, p. 206.

1888. *Astropeplus*, Sollas, *op. cit.*, p. 422.

1888. *Dorypleres*, Sollas, *op. cit.*, p. 426.

1896. *Spongosorites*, Topsent, *Mem. Soc. Zool. France*, IX, p. 117.

1906. *Pachamphilla*, Lendenfeld, *Deut. Tiefsee Exp. "Valdivia,"* XI, p. 251.

According to Topsent (1900, p. 268) *Vioa johnstonii* Schmidt, the genotype of *Jaspis* Gray, possesses a skeleton composed of oxea of variable size ranging from 0.07-1.0 mm. in length, the larger irregularly arranged, and of asters. The smaller oxea are confined, for the most part, to the dermal layer disposed tangentially to the surface. The larger are chiefly found in the interior, arranged more or less radially. The oxea are commonly centrotylote. Topsent's var. *incrustans* differs from the typical form of this species in that the rays of the asters are usually spined, and the ends of the oxea often so with regard to this

¹ All shafts seen were broken.

variety. *Astropeplus pulcher* Sollas considered by Topsent as a synonym of *J. johnstonii* is really a synonym of var. *incrustans* which must be called var. *pulcher*. His *Jaspis johnstonii* var. *incrustans* (l. c., p. 276) is identical, not with the typical form as Topsent suggested, but with *Astropeplus pulcher* Sollas, although this would hardly be expected from Sollas's description.

The holotype of *Jaspis dendyi* (Sollas), originally placed in the genus *Dorypleres* but removed to *Jaspis* by Topsent (1904, p. 131), does not conform to the typical structure of a *Jaspis*. The skeleton consists of large oxea only irregularly arranged, and asters of two kinds, oxyspheraster from 0.02 mm. in diameter, chiefly confined to the dermal layers, and oxyasters with few rays, up to 0.105 mm. in diameter. The asters are extremely abundant. The shape and dimensions of the spicules of *J. dendyi* recall certain species of *Stelletta* and, were it not for the absence of triaenes, there would be little hesitation in assigning the species to *Stelletta*. The species of *Stelletta* referred to include *S. maxima* Thiele from Japan, *S. brevis* and its varieties *lutea* and *paupera* Hentschel from S. W. Australia, and *S. columna* from New Zealand. These five forms have so much in common, in so far as spiculation is concerned, that there seems no reason for regarding them as separate species. The spicules are oxea, orthotriaenes, large oxyasters and small asters. The differences between them rest largely in the shape of the cladi of the triaenes and the shape of the smaller asters.

The triaenes exhibit an interesting series in spicule-reduction. In *S. columna* they are large and numerous, in *S. maxima* and *S. brevis* var. *paupera* only about half the size of those of *S. columna*. In *S. brevis* var. *lutea* they are smaller still, and in the holotype of *S. brevis* as also in a specimen in the Brit. Mus. coll. (94-7-6-4) from Japan, evidently belonging to *S. maxima*, only a quarter of the size of the corresponding spicules in *S. columna*. In all these forms the triaenes are numerous. In a second specimen from the Brit. Mus. coll. from Port Philip Heads agreeing very closely in other respects with the holotype of *S. brevis*, the triaenes, with shaft similar to those found in *S. maxima* and cladi like those of *S. brevis*, are extremely rare.

From an examination of the original preparations, the smaller asters have been found to be strongylasters in B. M. (94-7-6-4), and in *S. brevis* var. *paupera*, strongylasters and oxyspherasters in *S. brevis* and *S. brevis* var. *lutea*, and oxyspherasters in *S. columna*.

Assuming that all these forms represent a single species, *S. maxima* Thiele, the following variations may be specially noted: (1) the triaenes may become much reduced in size and in numbers, (2) the smaller asters may have truncated or sharply-pointed rays, (3) the larger asters (oxyasters) may be absent (cf. *S. brevis* var. *paupera*).

Comparing *S. maxima*, as here understood, with *Jaspis dendyi* (Sollas) the outstanding differences are seen to be the absence of triaenes and of the smaller asters in the latter. The larger asters (oxyasters) are so extremely abundant in *J. dendyi* that it may be a case of suppression of the smaller asters by the abundant growth of the larger asters, or that the spherasters of 20 μ . diameter represent the smaller asters which never exceed 0.017 mm. in diameter. In any case, *J. dendyi* is almost certainly a reduced form of *Stelletta maxima*.

It is possible, also that, *S. sphaerica* Burton must be eventually regarded as a synonym of *S. maxima*.

Whatever may be the true interpretation of *Jaspis dendyi*, this much is certain, that it is a true *Stelletta* with reduced spiculation. Moreover, the same may be said of the species of *Jaspis* (including *Coppatias*) so far described.

Coppatias albescens Row (1911, p. 299) has an irregular skeleton of large oxea, becoming partly radial at the surface, a few orthotriaenes with shafts 0.009 mm. thick, and distorted cladi 0.04 mm. long, scattered very sparingly among the oxea. The "minute raphide-like" oxea are undoubtedly the developmental forms of the large oxea. The "rather long slender somal oxea" cannot be found, but there are present, long slender spicules which appear to be the shafts of ana- or pro-triaenes whose heads, projecting beyond the surface, have been broken off. The species is undoubtedly a reduced *Stelletta*.

Stellettinopsis carteri Ridley (1884, p. 476) (= *Coppatias carteri* Sollas 1888) has a few orthotriaenes and anatriaenes, both with distorted cladomes, and a fair number of larger spherasters. The species is, in fact, a form of the sponge described by Dendy (1916, p. 246) as *Aurora providentiae* in which the triaenes and large spherasters are much reduced. *Coppatias distincta* Thiele, the genotype of *Rhabdastrella*, except for the absence of triaenes, corresponds almost exactly with *A. providentiae*.

Tisiphonia penetrans Carter (1880, p. 141) and *Jaspis johnstonii* (Schmidt) Dendy (1916, p. 253) are practically identical with the European forms of *J. johnstonii* and since the range of the species includes the Indian ocean, there is no reason for regarding *Coppatias investigatrix* Annandale (1915, p. 460) as distinct from *J. johnstonii* var. *incrustans*.

Jaspis serpentinosa Wilson (1925, p. 330) appears to be a cup-shaped form of *Dorypleres biangulata* Lindgren (1898, p. 34), a typical *Jaspis*.

Coppatias solidissima Wilson (1902, p. 387) is a typical *Jaspis* with a few triaenes at the surface, and probably directly comparable to *Penares ochraceta*.

Hemiasterella affinis Carter (1879, p. 147), referred by Sollas (1888) to *Dorypleres* appears to be a true *Hemiasterella*.

Jaspis reptans (Dendy) (1905, p. 108), although no trace of triaenes can be found in it, resembles a typical *Stelletta* so closely in its skeleton and anatomy as to leave little doubt that it is a lipotriaenous species of that genus. The same may be said of *J. novae-zealandiae* Dendy (1924, p. 305). In both species the sparsely scattered cortical oxea set at right angles to the surface, are present. *Coppatias sansibarensis* Baer (1906, p. 23) appears to be of the same nature.

In a preparation made from the holotype of *Dorypleres topsenti* Thiele, two orthotriaenes were found which may be considered proper to the sponge. For the rest, the species is quite evidently a reduced *Stelletta*.

It is doubtful how far *C. baculifer* Kirkpatrick (1903, p. 239) may be considered a true *Jaspis*, but for the moment we propose to leave it.

Other genera, having the same essential structure as *Jaspis johnstonii*, must also be considered. *Penares* Gray (1867, p. 542), with *Stelletta*

helleri Schmidt as genotype, differs from *Jaspis* only in the presence of short-shafted triaenes situated just beneath the ectosome. In some examples of *Penares*, the triaenes are so few in number that it does not seem possible, or necessary, to use their presence or absence for purposes of generic diagnosis. Moreover, the genotype of *Papyrula* Schmidt (1868, p. 18) *P. candidata*, is so like *Stelletta helleri*, that there can be no question but that *Papyrula* like *Penares* is also a synonym of *Jaspis*.

Pachamphilla alata Lendenfeld from the Agulhas Bay, S. Africa, the genotype of *Pachamphilla* is a typical *Penares* but for the absence of asters, closely allied to *Penares orthotriaena* Burton from Natal. *P. dendyi* Hentschel from the Aru Is. closely resembles *Penares ochracea* Carter, and differs only in the substitution of irregular spheres for asters.

Just as *Pachamphilla* is a typical *Penares* without asters, so *Spongisorites placenta*, the genotype of *Spongisorites*, and *S. salomonensis* Dendy, and *S. suluensis* Wilson differ from *Jaspis* only in the absence of asters. The remaining species of *Spongisorites*, *S. topsenti* Dendy, *S. lamellata* Dendy, and *S. lapidiformis* Dendy are all Axinellidae.

The following table shows that *Penares*, *Pachamphilla*, *Jaspis*, and *Spongisorites* are not only very closely related but represent merely stages in the reduction of spiculation. In all the four the arrangement of the large and small oxea is the same, the only differences between them being the presence or absence of triaenes and, of asters.

Penares—oxea, microxea, triaenes, asters.

Pachamphilla—oxea, microxea, triaenes.

Jaspis—oxea, microxea, asters.

Spongisorites—oxea, microxea.

The distinguishing features of the genus *Jaspis* are, therefore, a dermal tangential layer of microxea and an irregularly radial somal skeleton of large oxea with microxea intermingled.

Sollas (1888, p. 206) established the genus *Coppatias* for *Stellettinopsis coriacea* Carter (= *Jaspis stellifera* (Carter) Shaw, 1927, p. 422) here accepted as the genotype of *Coppatias*, having apparently overlooked Gray's genus since the characters of *C. coriacea* are essentially the same as those of the typical form of *Jaspis johnstonii*. It is necessary to deal with these four genera concurrently. A number of species have since been added to both *Jaspis* and *Coppatias*, but analysis of these shows that very few of them conform to the typical structure and are, in reality, reduced *Stelletta*. An example of this is seen in *Jaspis dendyi*.

Cryptotethya agglutinans Dendy.

1905. *Cryptotethya agglutinans*, Dendy, *Rep. Ceylon Pearl Oys. Fish.*, p. 111, pl. v, figs. 4-5.

The single specimen is about 30-40 mm. in diameter, and although covered with large pieces of foreign matter bears none of the finger-like processes found in the holotype.

The skeleton differs from that of the holotype in that the asters measure only 0.005-0.007 mm. in diameter and are extremely rare, so much so that only the conviction that they should be present leads to their being found.

Locality.—N. side of Fehendu I., Goifurfehendu Atoll, Maldive group, Arabian Sea.

***Aurora globostellata* (Carter).**

1883. *Stelletta globostellata*, Carter, *Ann. Mag. Nat. Hist.*, Ser. 5, XI, p. 353, pl. xiv, fig. 5.

1888. *Aurora globostellata*, Sollas, *op. cit.*, p. 187.

1916. *Aurora providentiae*, Dendy, *Trans. Linn. Soc. London*, xvii (2), p. 246, pl. xlvi, fig. 2.

The only representative present is a dried fragment of what was evidently a large, possibly sub-caliculate sponge. The outer surface shows the same characteristic reticulation of the holotype, and the inner surface shows the sieve-like groups of vents. The colour is a light brown. The skeleton resembles that of the holotype tolerably well, the chief difference being that the oxyasters range in size from 0.04 to 0.06 mm. in total diameter. This condition is intermediate between that found in the holotype of Carter's species and that of *A. providentiae*.

Dendy (*l. c.*, p. 247) has suggested a certain number of small details wherein *A. globostellata* and *A. providentiae* differ. Comparison of the holotypes of these two species leave little doubt as to the identity of the two species. Such small differences as exist are purely those which might be expected in any two individuals of a species.

Locality.—Aberdeen Reef, Andamans (S. W. Kemp Coll., February, 24-25, 1921).

***Aurora rowi* Dendy.**

(Pl. XVIII, Fig. 3.)

1916. *Aurora rowi*, Dendy, *Trans. Linn. Soc. London*, XVII, p. 249, pl. 44, fig. 5 pl. 46, fig. 4.

1924. *Aurora rowi*, Dendy & Frederick, *Journ. Linn. Soc. London*, XXXV, p. 494.

The single specimen is a large dried, cup-shaped sponge measuring 240 mm. in height. In its present condition it is not possible to be sure whether the lateral compression is natural or due to pressure since the animal was removed from the sea. The opening of the cup measures 220 mm. by 80 mm. The walls are thick and, on the outer surface, are thrown into a number of irregular grooves and low, rounded prominences. The colour is a light brown. The small and irregular shape of the holotype makes it impossible to draw any comparison between the two specimens so far as external form is concerned. As regards the spiculation, there is little to choose between them, the main, and probably the only difference being that the irregular spheres of the holotype are replaced in the present specimen by spherasters, 0.014 mm. in diameter, with short, stout, 'nubbly' rays.

Locality.—Ganjam Coast, Madras Presidency, ("Golden Crown" coll.).

Ecionemia carteri Dendy.

1905. *Ecionemi carteri*, Dendy, *Ceylon Pearl Oyster Fish. Suppl. Rep.*, XVIII, p. 79, pl. i, fig. 5, pl. iii, fig. 1.

1916. *Ecionemia carteri*, Dendy, *Trans. Linn. Soc. London*, xvii (2), p. 242.

The spiculation of this species, as represented in the holotype, consists of oxea, orthotriaenes, prototriaenes, anatriaenes of two sizes, microrhabds and asters. The specimens in the present collection show certain variations on this which seem worthy of note. All agree well with the holotype in external form and in the salient features of the spiculation but the minor differences are as follows :—

In specimens from Kilakarai prototriaenes absent: small cortical oxea present, measuring 0.24×0.004 mm., disposed at right angles to surface; microrhabds often have a third ray. The cortical oxea are present also in the holotype, although they were not recorded by Dendy.

In the examples from the Andamans (9309/6) asters typical but measuring only 0.008-0.02 mm. in diameter.

In another lot from the Andamans (9114/6) prototriaenes not seen; cortical oxea rare.

In examples from the Andamans, Galle (Ceylon), Moscos I., and M. S. Sta. 655 prototriaenes and small anatriaenes not seen.

In a third lot from the Andamans, asters comparatively rare; microrhabds 3- or even 4-rayed, occasionally centrotylote.

In examples from Nankauri (Nicobars), Kilakarai, and (M. S. Sta. 629) N. W. side of Spiteful Bay near Leander Pt., Nicobars, prototriaenes present in small numbers only; small anatriaenes not seen.

In another lot from Kilakarai and from (M. S. Sta. 630) Burleigh Rock, Nicobars, neither prototriaenes nor small anatriaenes seen.

In addition to these variations, there are also quite noticeable differences in the size and shape of the cladi of the various triaenes.

Genus **Amphius** Sollas.

1888. *Amphius*, Sollas, *op. cit.*, p. 177.

Diagnosis (emend.).—Stellettidae with one form of megasclere, an oxeote, and microscleres in the form of euasters or some modification thereof.

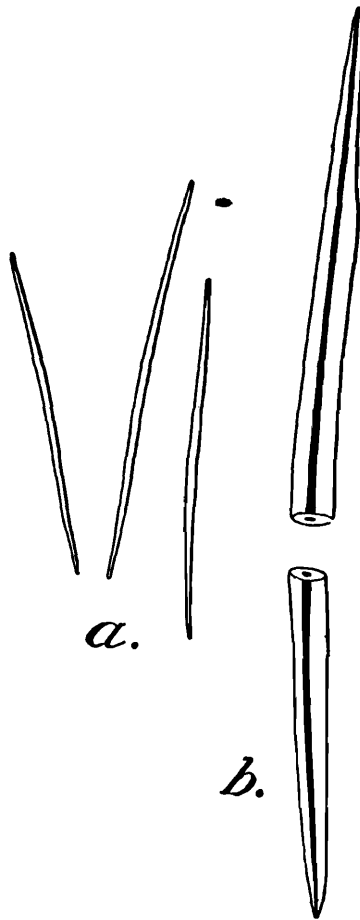
Amphius sollasi, sp. nov.

Diagnosis.—Sponge elongate, obovate; surface even, minutely hispid; texture firm, compressible; oscules few, small, colour, in spirit, yellowish white to dull grey or purple; skeleton composed of irregularly scattered oxea, more numerous immediately below surface than elsewhere, and a dermal layer of asters; choanosome containing few asters; oxea variable in size, slightly curved, average size of fully-grown spicule 0.72×0.012 mm.; asters, with strongylote rays, 0.006-0.009 mm. in diameter.

Holotype.—P. 783/1 Zool. Surv. Ind. (*Ind. Mus.*).

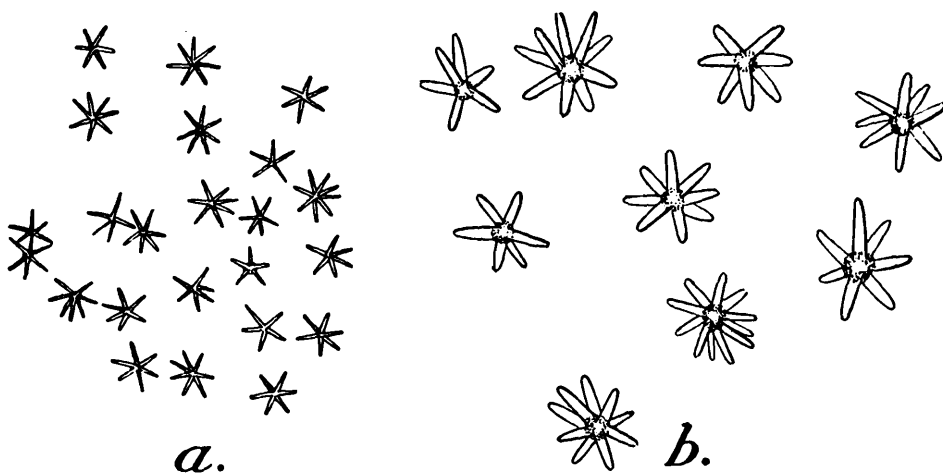
Remarks.—The species resembles *A. huxleyi* Sollas but differs from it not only in the size of the spicules but in the shape of the asters. In

the latter, the microscleres are amphiasters with an elongated centrum; In the present species the centrum is much reduced and the spicul



TEXT-FIG. 3.—*Amphius sollasi*. *a.* oxea ($\times 30.6$); *b.* one of the oxea enlarged to show the two extremities only ($\times 146$).

has the appearance of a euaster. With the 1/12th oil immersion, however, it becomes evident that the asters of the two species are but modifications of the same spicule-form.



TEXT-FIG. 4.—*Amphius sollasi*. *a.* a group of dermal asters ($\times 146$); *b.* the same highly magnified (1/12 oil immersion).

Locality.—'Ain Musa, Gulf of Suez. (Col. R. B. Seymour Sewell, 8th January 1917).

Family ERYLIDAE.

Erylus ledenfeldi Sollas.

1880. *Stelletta euastrum*, Carter nec Schmidt, *Ann. Mag. Nat. Hist.*, VI, p. 136 pl. vii, fig. 42.

1888. *Erylus ledenfeldi*, Sollas, *op cit.*, p. 239.

1916. *Erylus ledenfeldi*, Dendy, *Trans. Linn. Soc. London*, XVII (2), p. 257, pl. xlvii, fig. 4.

The single specimen resembles very closely indeed the one described by Dendy as *Erylus proximus* (*l. c.*, p. 258) that no remarks concerning the external form of the sponge are necessary. The spiculation, on the other hand, is sufficiently like that of the specimen described by the same author as *E. ledenfeldi* to leave no possible doubt as to its correct identification.

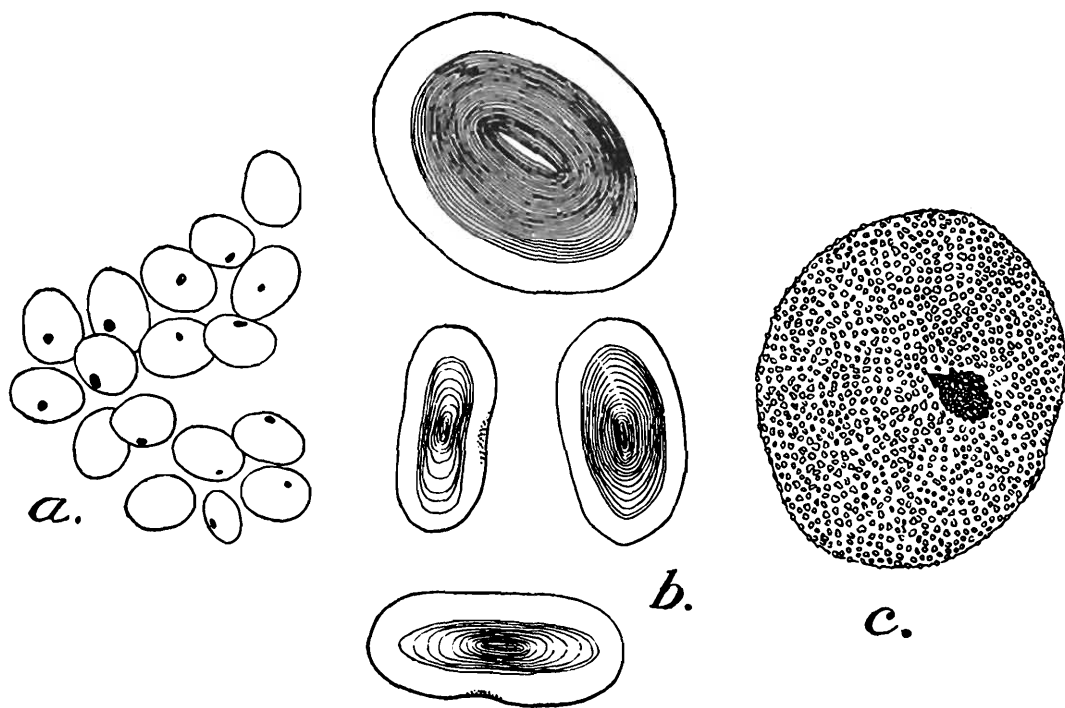
Locality.—Andamans.

Erylus geodioides, sp. nov.

Diagnosis.—Sponge irregularly massive, inextricably associated with the shell of *Siliquaria*; surface smooth, even; pores evenly distributed over surface; vents inconspicuous; colour, in spirit, yellow faintly tinged, in places, with light brown; skeleton composed of oxea, orthotriaenes, more or less globular aspidasters, large oxyasters, with minutely spined rays, and small oxyspherasters.

Holotype.—P 784/1 Zool. Surv. Ind. (*Ind. Mus.*).

Remarks.—The species differs from all known species of *Erylus* in the character of the aspidasters which, although somewhat flattened in the early stages, are more or less globular when mature. In this



TEXT-FIG. 5.—*Erylus geodioides*. a. a group of aspidasters ($\times 30.6$); b. the early stages of developing aspidasters ($\times 146$); c. one of the mature aspidasters ($\times 146$).

respect, it makes a close approach to the genus *Geodia*. For the rest, both external characters, and the arrangement of the skeleton, the species is a typical *Erylus*.

The form and dimensions of the spicules are as follows:—Oxea, smooth, slightly curved, not sharply pointed, 1.228×0.033 mm.; orthotriaenes, with shaft straight, 0.825×0.05 mm. and cladi gently curved, occasionally bifurcate, 0.495×0.05 mm., aspidasters, resembling the sterrasters of *Geodia*, $0.06 \times 0.045 \times 0.045$ mm.; large oxyasters, usually with 4-6 rays, but varying in number from 2-12, each ray about 0.028 mm. long $\times$ 0.003 mm. thick, forming the most conspicuous spicular element of the choanosome; polyactinose oxyspherasters, comparatively few in number, 0.024 mm. in diameter; centrotylote microstrongyla, gently curved, 0.053×0.004 mm.

Apart from the shape of the aspidasters, this species appears to resemble *E. rotundus* Lendenfeld, from the Galapagos Islands, more closely than any other known species of the genus.

Locality.—Mergui Archipelago (17th April 1913)—65 fms.

Family GEODIIDAE.

Genus *Geodia* Lamarck.

Among the numerous species of Geodiidae recorded from the Indian Ocean and the Indo-Pacific is a group of species so closely allied that their separation depends exclusively on the differences in the size of their spicules and on slight differences in the shape of their microscleres. The spiculation of this group consists of somal oxea, orthotriaenes, anatriaenes, protriaenes, including promesotriaenes, cortical styli, sterrasters, and two sorts of smaller asters. In separating the members of this group into species, considerable importance seems to have been attached to the shape of the microscleres, yet a cursory examination suffices to show that these spicules are essentially the same in all cases, the superficial differences depending on whether or not a centrum is present, and whether the rays are smooth and sharply pointed or truncate and roughened. This group includes *G. picteti* (Topsent), *G. lindgreni* Lendenfeld, *G. alba* (Kieschnick), *G. alba* var. *minor* (Hentschel), *G. micraster* (Lendenfeld), and their resemblance to one another is so strong that we propose to regard them as synonymous species without further comment.

In addition to these, there are several other closely allied species which must be considered here. *G. jousseaumi* (Topsent), and *G. micropunctata* (Row), both from the Red Sea, appear to differ only in the presence of anatriaenes and protriaenes in the former and their absence in the latter. Considerable evidence is available from the study of material in the British Museum collection that one or both of these two spicule forms may be absent in individuals of the species of *Geodia* normally possessing them, and it seems to be a matter of no taxonomic value whether they are present or absent. There is no reason, therefore, why *G. micropunctata* and *G. jousseaumi* should not be regarded as synonymous, especially as re-examination of Row's preparations suggests that the centrotylote oxea of the choanosome are foreign spicules, that cortical oxea such as are found in *G. jousseaumi* are present, and that the oxyasters vary from 0.015 - 0.021 mm. in diameter (not 0.008 mm. as stated by Row).

G. inconspicua Bowerbank from the South Seas (*sic*) differs again from the *G. picteti* group mainly in the absence of pro-and anatriaenes, but Bowerbank's preparations contain numerous long, slender, rod-like spicules which traverse the choanosome and pierce the cortex, and which may possibly be the headless shafts of one or both of these forms of spicules. Similarly, *G. contorta* Bow., from the Fiji Is., with rare orthotriaenes and no pro-or anatriaenes, is probably only a very much reduced form of *G. inconspicua*. These two species, together with *G. jousseaumi* and *G. micropunctata* differ from the *G. picteti* group in having cortical oxea instead of cortical styli.

Before proceeding further, it may be of advantage to examine the taxonomic significance of the cortical styli and cortical oxea. In our opinion there is none. Both styli and oxea are but expressions of a single spicule-form and, in many cases, it is extremely difficult to decide whether the cortical spicules of a given individual are styli or oxea. The best comment on this matter is found in Lendenfeld (1906, pl. xxxv, fig. 17) who speaks of styli and figures oxea. There appears to be no adequate reason, then, why *G. inconspicua* and its allies should not also be regarded as synonymous with the *G. picteti* group.

Two more species, closely allied to each other and two of the species already discussed, are *G. areolata* Carter and *G. ramodigitata* Carter. Again the measurements of their spicules, when compared with those of allied species, are seen to have little or no significance. So far as *G. areolata* is concerned, the distinctive feature of the species hitherto accepted has been the areolation of the surface by the cortical oxea. In no specimen so far recorded is this areolation found to be complete, but appears in patches, the intervening spaces between, being perfectly plain as in any other species of *Geodia*. Moreover, in some specimens, at first identified by us as *G. ramodigitata*, the surface also bears areolated patches, similar to those of *G. areolata* but less well marked. Assuming that the areolation of the surface is a variable feature which may or may not be present, there is no purpose in maintaining these two species distinct from those already regarded above as synonymous. We propose, therefore, to regard these ten species as synonyms of a single species, by priority, *G. inconspicua* Bowerbank.

It is of interest to note that what has been said of the Indian Ocean and Indo-Pacific groups of species, might almost have been said of a group of species centred round the West Indies and Central America. This group which includes *G. media*, *G. tuberculosa*, *G. tumulosa*, etc., is more or less very similar indeed to *G. inconspicua*, and it is extremely probable that they may all be ultimately recognised as belonging to a single species, the differences between them representing nothing more than geographical variations.

***Geodia inconspicua* (Bowerbank).**

1873. *Pachymatisma inconspicua*, Bowerbank, *Proc. Zool. Soc. London*, p. 326, pl. xxxi, figs. 1-6.

The present collection contains some 14 specimens of varying size, and external form which agree closely with one another in a general way, but exhibit slight differences in the size and shape of the spicules.

They conform closely to, and show the same range of general variations as, the various specimens hitherto recorded under different specific names, but now regarded as synonyms of *G. inconspicua*. We, therefore, refrain from recapitulating these details with reference to the specimens in the Indian Museum collection.

Localities.—Kilakarai, Ramnad Dist. (Coral reefs, Feb. 1923, S. W. K.); Ganjam Coast, Madras Pres. ("Golden Crown" coll.); (Mar. Surv. Sta. 649) marginal reef of Horsburgh Atoll, N. of Fehendu I. (Oct. 22, 1923); (Mar. Surv. Sta. 346), Persian Gulf, Oct. 1904; Krusadai I., Gulf of Manaar (B. N. C. & H. S. R. Feb. Mar. 1925); E. N. E., Preparis I., Bay of Bengal (41 fathoms, 30th November 1889); Galle, Ceylon; Point Pedro, entrance to Palk Straits (6-8 fathoms, 1893-94).

***Geodia perarmata* Bowerbank.**

1905. *Geodia perarmata*, Dendy, *op. cit.*, p. 83.

Geodia peruncinata, Dendy, *op. cit.*, p. 85, pl. iii, fig. 3.

1925. *Geodia perarmata*, Burton, *Rep. Fish. Mar. Biol. Surv. South Africa* No. 4 (for 1925), p. 15.

There are two specimens, 8 mm. and 16 mm. in diameter respectively in the collection. Their colour in spirit is chocolate brown, and yellow internally. In spiculation they are typical except that the sterrasters are 0.06, 0.07 mm. in length and breadth respectively.

G. peruncinata, which bears a strong likeness to the present species, was separated therefrom by Dendy (*l. c.*, p. 86) because of the absence of brown pigment-cells in the cortex, of the form of the spheraster, and of the presence of cortical anatriaenes. Re-examination of Dendy's specimens of *G. perarmata* has shown that cortical anatriaenes may often be present. Because of this, and because we consider the significance of the pigment-cells and the form of the spherasters to have been exaggerated, *G. peruncinata* is here regarded as synonymous with *G. perarmata*. On a careful study of the descriptions of *G. arripiens* and *G. sphaeroides* given by Thiele and Hentschel, we feel that there is no valid reason for regarding them as other than synonyms of the present species.

Locality.—E. N. E. Preparis I., Bay of Bengal (41 fms., 30th November 1889).

Family CHONDROSIIDAE.

Genus *Chondrosia* Nardo.

1847. *Chondrosia*, Nardo, *Atti delle Adri. dell'I. R. Inst. Veneto*, pp. 267-276.

Of the various species of this genus hitherto described most, if not all, have been established on slight differences in the structure of the cortex, or on the nature of the surface. To a lesser extent, the form and position of the vents and the habit, whether encrusting, free, or attached, have been used also as characters for specific differentiation. After careful study of *C. reniformis*, the genotype, *C. corticata* and *C. debilis* of Thiele, *C. plebeja* Schmidt, *C. ramsayi* Lendenfeld, and *C. spurca* Carter, we have come to the conclusion that there is no reason for regarding them as different species. All agree closely in internal structure, and the differences between them are due to such variations

as might be expected normally to exist. As Carter has said, in describing *C. spurca* (*Ann. Mag. Nat. Hist.*, p. 286, 1887) and comparing it with *C. reniformis* and *C. ramsayi*, "all these species appear to me to be so nearly allied that it is difficult to say how far their differences are of any real specific value." If any difference between them need be recognised at all, it should be in regarding them as "metamps" (Bidder)¹ or "tropi" (Vosmaer)² of a single species.

So far as can be seen, there appears to be but one species of *Chondrosia*, *C. reinformis* Nardo, and this can be divided into forms:—(a) free or attached, with definite shape, globular, oval or reniform; with well-developed cortex, giving a tough, leathery texture; with one or more raised vents; with smooth surface, or with pores so arranged, at least in preserved specimens, as to give a stellate or reticulate appearance: (b) encrusting, spreading over foreign objects; with one or more vents, level with the surface, smooth and even, with a reticulation of fibrillar structure. Both frequently accumulate sand or other foreign particles on the surface. The former may be known as the forma *typica*, to include *C. corticata*, *C. debilis*, *C. plebeja* and *C. ramsayi*, and the latter may be known as the forma *spurca*, to include Carter's species of that name.

Chondrosia reniformis Nardo.

1877. *C. reniformis*, Schulze, *Zeitschr. Wiss. Zool.*, XXIX, p. 13, pl. viii.

1887. *C. spurca*, Carter, *Ann. Mag. Nat. Hist.*, Ser. 5, XIX, p. 286.

Both forms of this species are represented in the collection. The form *typica* is represented by two small kidney-shaped individuals, purplish-grey in colour, attached to a calcareous substratum. The surface in both is conspicuously reticulated. The form *spurca* is represented by four specimens. The first, from Galle, Ceylon, is encrusting a calcareous nodule, with surface smooth in some places and reticulated in others, and is pale grey in colour. The second is found on the terminal branches of a young Madreporarian coral and is pale brown in colour. The third is a thin cream-white incrustation on the stem of a disintegrated Gorgonid.

The refringent bodies, or "glary bodies" of Carter, which have been described by Schulze (*l. c.*) are not at all distinct in the present specimens, though granules comparable to them, but much smaller and of no regular shape, are found scattered all over them. In addition to these, there are in the Ceylon specimen certain minute rod-like structures abundantly scattered over the surface of the sponge and forming a rough reticulation. These are about 0.003 to 0.004×0.0005 mm. and their exact nature is obscure.

Localities.—Pearl Oyster Banks, Tuticorin (H. S. R., Feb. 1926); Galle, Ceylon.

Genus **Chondrilla** Schmidt.

1862. *Chondrilla*, Schmidt, *Die Spongien Adriatischen Meeres*, Leipzig, p. 383 pl. iii.

¹ *Journ. Mar. Biol. Assn. Plymouth*, VI, p. 381 (1902).

² *Siboga Expedite, Porifera*, p. 26 (1911).

Chondrilla sacciformis Carter.

1879. *Chondrilla sacciformis*, Carter, *Ann. Mag. Nat. Hist.*, Ser. 5, III, p. 299, pl. xxv, figs. 9, 11, 12.

1916. *Chondrilla sacciformis*, Dendy, *Trans. Linn. Soc. London*, XVII, p. 268, pl. xlviii, fig. 8.

1924. *Chondrilla sacciformis*, Burton, *Ann. Mag. Nat. Hist.*, Ser. 9, XIV, p. 207.

There are two typical specimens in which the asters vary from 0.035 to 0.04 mm. in diameter.

Locality.—(Mar. Surv. Sta. 641) "Sam I.," Mulikadu, Maldives (6th March 1923).

Chondrilla australiensis Carter.

1873. *Chondrilla australiensis*, Carter, *Ann. Mag. Nat. Hist.*, Ser. 4, XII, p. 23, pl. i, figs. 10-14, 16.

1924. *Chondrilla australiensis*, Burton, *Ann. Mag. Nat. Hist.*, Ser. 9, XIV, p. 207.

It should be pointed out here that the diagnosis given under this name by Burton (*l. c.*) should read "spiny-rayed oxyasters," the smooth-rayed oxyasters being characteristic of *C. australiensis* var. *mixta*.

The several specimens present exhibit the usual variations for the species.

Localities.—Ganjam Coast ("Golden Crown" Coll.) Madras Presidency ; Madras (sta. 6).

Chondrilla australiensis var. **mixta** Schulze.

1887. *Chondrilla mixta*, Schulze, *Zeit. Wiss. Zool.*, XXIX, p. 32.

1924. *Chondrilla australiensis* var. *mixta*, Burton, *Ann. Mag. Nat. Hist.*, Ser. 9, XIV, p. 207.

Locality.—(M. S. Sta. 648) N. and W end of Fehendu I., Horsburgh Atoll (Oct., 21, 1923).

Sub-order SIGMATOSCLEROPHORA.

Family TETILLIDAE.

Genus **Paratetilla** Dendy.

1905. *Paratetilla*, Dendy, *Rep. Ceylon Pearl Oyster Fish.*, p. 97.

Paratetilla bacca (Selenka).

1921. *Paratetilla bacca*, Dendy, *Trans. Linn. Soc. London*, XVIII, p. 21.

Several typical specimens of this well-known species are present, the colour varying from a light brown to a chocolate brown.

Localities.—Kilakarai, Ramnad Dt., Marble rocks, Mergui Archip., Port Blair, Andamans ; Galle, Ceylon.

Genus **Tetilla** Schmidt.

1862. *Tetilla*, Schmidt, *Spongien der Adriat. Meeres Leipzig*, p. 40.

Tetilla cranium (Müller).

1789. *Alcyonium cranium*, Müller, *Zool. Dan.* pl. lxxxv, fig. 1.

1888. *Craniella cranium*, Sollas, *op. cit.*, p. 51.

There are several examples of this species which do not appear to differ at all from those found so commonly in the North Atlantic.

Localities.—Invisible Bank, Andamans; off C. Negrais, Burma (16th November 1909); 2-3 miles W of C. Comorin (Armstrong) 38 fms.

Tetilla dactyloidea (Carter).

1869. *Tethya dactyloidea*, Carter, *Ann. Mag. Nat. Hist.* Ser. 4, III, p. 15.

1916. *Tetilla dactyloidea*, Dendy, *Rep. Govt. Baroda Mar. Zool. Okhamandal*, p. 102, pl. ii, fig. 10.

This species, so exhaustively described by Dendy (*l. c.*) and other authors, is represented by several specimens.

Localities.—Osaka Market, Japan; Port Blair, Andamans.

Genus **Cinachyra** Sollas.

1888. *Cinachyra*, Sollas, *op. cit.*, p. 23.

Cinachyra arabica (Carter).

1869. *Tethea arabica*, Carter, *Ann. Mag. Nat. Hist.* Ser. 4, IV, p. 3, pl. i, figs. 1-8, pl. ii, figs. 19, 20.

1888. *Tetilla arabica*, Sollas, *Challenger Rep. Tetractinellida*, p. 42.

This species is represented by some sixteen specimens, all agreeing closely with the type, except that spherules are not always to be found.

Localities.—Camorta I., Nicobars (13th December 1921); Krusadai I. (B. N. C. & H. S. R., Feb., 1925); Andaman Is., M. S. Sta. 648.

Cinachyra australiensis (Carter).

1886. *Tethya cranium* var. *australiensis*, Carter, *Ann. Mag. Nat. Hist.*, Ser. 5, XVII, p. 127.

1888. *Tetilla* (?) *australiensis*, Sollas, *op. cit.*, p. 43.

The species differs from the foregoing in the presence of long, thin microxea scattered throughout the choanosome. In all other respects they are closely similar.

Localities.—Andamans (surf-line); Marble Rocks and Burleigh Rocks, Mergui Archipelago.

Cinachyra simplex (Sollas).

1888. *Chrotella simplex*, Sollas, *op. cit.*, p. 17, pl. ii, figs. 1-4.

There is a single small specimen agreeing very closely indeed with the holotype of this species. Both this specimen and the holotype are such obvious members of the genus *Cinachyra* that it is difficult to understand why Sollas failed to recognise it.

Locality.—(M. S. station 384) off C. Negrais, Burma (22nd February 1909).

Family DESMACIDONIDAE.

Sub-family MYCALEAE.

Genus **Biemna** Gray.1916. *Biemna*, Hallmann, *Proc. Linn. Soc. N. S. W.*, XLI, pp. 495-503.1921. *Biemna*, Dendy, *Trans. Linn. Soc. London*, XVIII, p. 56.1925. *Biemna*, Wilson, *Bull. U. S. Nat. Mus.*, 100, p. 422-424.**Biemna fortis** (Topsent).1897. *Desmacella fortis*, Topsent, *Rev. Suisse Zool.*, IV, p. 463, pl. xxi, fig. 30.1912. *Biemna fortis*, Hentschel, *op. cit.*, p. 350.

The single specimen in the collection agrees closely in external form with those described by Topsent and Hentschel, but the spiculation is slightly different. The megascleres, the large and small sigmata and the long raphides, are present, and are almost identical in shape and size with those described by Henschel (*l. c.*). In addition to these, however, a few intermediates between the large and small sigmata, about 0.04 mm. long, occur, as well as microxea, 0.03-0.04 mm. long.

Locality.—East of Puri coast, Bay of Bengal.

Biemna tubulata (Dendy).

(Pl. XVIII, Fig. 4.)

1905. *Desmacella tubulata*, Dendy, *Rep. Ceylon Pearl Oyster Fish.*, p. 155, pl. ix, fig. 4.

The individuals of the various species of *Biemna* are not easily differentiated, largely on account of the profusion and variety of microscleres present, and on account of the manner in which these spicules vary in size. It is probable that the several species of *Biemna* from the Indian Ocean area may eventually prove to be synonymous.

The present specimens, though not agreeing exactly with the holotype of *Biemna tubulata* in all respects, appear to be sufficiently closely related to warrant their inclusion in that species.

Localities.—(M. S. Sta. 667) N. W. side of Neill I., Andamans (Feb. 8, 1924); Rock reef, Naval Point, Nicobars (Oct. 21-22, 1922); Andamans (J. Woodmason); Elphinstone I., Port Maria, Mergui Archip. (6th-12th April 1913); Pearl Oyster Bank, Tuticorin (H. S. R. Feb., 1926).

Genus **Mycale** Gray.1867. *Mycale*, Gray, *Proc. Zool. Soc. London*, p. 533.1924. *Mycale*, Topsent, *Ann. Inst. Oceanogr.*, I, 3, pp. 77-118.**Mycale indica** (Carter).1887. *Esperia indica*, Carter, *J. Linn. Soc. London*, XXI, p. 72, pl. vi, figs. 3-6.

The species is represented by two encrusting specimens of a light yellowish-brown colour. The dimensions of the spicules are:—styli 0.53 × 0.018-0.022 mm.; chelae 0.013-0.015 mm.; sigmata, 0.04-0.06 mm.; trichodragmata 0.074 mm.

The present species is closely allied to *M. grandis* (Gray) Thiele (*Abh. Senckenb. Naturf. Ges.*, XXXIV, p. 337) from the Malay Archipelago. Thiele favours the retention of Gray's name for a sponge which Schmidt called an "Indian *Esperia*" and of which he only figured the chelae. Gray adds no more to our knowledge but gives the name *grandis* to this insufficiently known sponge. To diagnose a species of *Mycale* from the form of one of the chelae seems to us to be introducing unnecessarily an element of ambiguity, and for this reason we propose to abandon Gray's name and to use that proposed by Carter for a sponge in which all the characters are well-known.

Esperia pellucida Ridley may possibly be synonymous with *Mycale indica*.

Localities.—Mergui (A. Carpenter, 1st April 1886); Ross I., Andamans (12° 9' N, 98° 73' E, "Investigator" coll.); Snod I., (12° N, 98½° E, Mar. Surv.).

***Mycale parishii* (Bowerbank).**

- 1875. *Rhaphiodesma parishii*, Bowerbank, *Proc. Zool. Soc. London*, p. 283.
- 1880. *Amphilectus parishii*, Vosmaer, *Notes Leiden Museum*, II, p. 119.
- 1882. *Esperia plumosa*, Carter, *Ann. Mag. Nat. Hist.*, Ser. 5, IX, p. 299.
- 1884. *Esperia parishii*, Ridley, *Rep. Zool. Coll. H. M. S. 'Alert'* p. 436.
- 1887. *Esperella parishii*, Ridley and Dendy, *op. cit.*, p. 65.
- 1887. *Esperia plumosa*, Carter, *J. Linn. Soc. London*, XXI, p. 72.
- 1888. *Esperella ridleyi* vars. *robusta*, *intermedia*, Lendenfeld, *Sponges Australian Museum*, pp. 211-212, pl. vi.
- 1905. *Esperella parishii*, *plumosa*, Dendy, *op. cit.*, p. 159.
- 1911. *Mycale isochela*, *pectinicola*, Hentschel, *Fauna Südwest Australiens*, III, 10, pp. 297-299, figs. 7-8.
- 1914. *Esperella ridleyi*, Hallmann, *Proc. Linn. Soc. N. S. W.*, XXXIX, 2, p. 402.
- 1916. *Esperella plumosa*, Dendy, *Rep. Govt. Baroda Mar. Zool. Okhamandal*, II, p. 121, pl. i, fig. 4, pl. iii, fig. 19.
- 1924. *Esperella plumosa*, Dendy and Frederick, *J. Linn. Soc. London*, XXXV, p. 503.

That the various species included in the above list of synonyms are closely related is obvious from a mere superficial examination. The only differences between them, in fact, concern the presence or absence of one or more of the categories of microscleres. The differences between *M. plumosa* and *M. isochela*, for example, may be summarised thus: in *M. plumosa* large anisochelae in rosette formation are abundantly present, and the toxae, although sometimes forming toxodragmata, are never modified to form trichodragmata; in *M. isochela*, the large anisochelae and the larger sigmata are absent, and trichodragmata are present in addition to the toxodragmata.

The specimens present in this collection tend to show that such differences as these are unimportant and the two species are synonymous. In the specimen from Pamban for example, a fragmentary sponge with external form very like that of *M. plumosa*, the dermis is crowded with the smaller anisochelae, 0.024 mm. long, scattered toxa and toxodragmata, 0.06 mm. long, toxodragmata and trichodragmata, 0.03 mm. long, and the usual isochelae, 0.012 mm. long. Small sigmata are absent and the rosettes of larger anisochelae occur but rarely. The specimen resembles *M. isochela*, therefore, in the presence of trichodragmata, in the abundance of the smaller anisochelae, and

M. plumosa in the external form and in the presence of the large anisochelae. From both species it differs in the absence of the smaller sigmata.

In the specimen from the south portion of Malacca Straits rosettes of large anisochelae, the smaller anisochelae, large sigmata and large toxae occur sparingly. Small sigmata are very rare, and trichodragmata are apparently absent. The external form is similar to that of *M. plumosa*.

From the evidence afforded by these two specimens it is clear that forms intermediate between *M. plumosa* and *M. isochela* may be of common occurrence, and this is exactly what we find in re-examining the specimens described by earlier authors. Of the three specimens described by Dendy (1905) under the name of *M. plumosa*, R. N. 361 differs from *M. isochela* in the presence of large sigmata and occasional large anisochelae. The latter, however, never form rosettes. Trichodragmata are present in considerable quantities. R. N. 298 contains rosettes of large anisochelae, fairly rare small anisochelae and isochelae, abundant large and small sigmata, occasional trichodragmata and no toxae. R. N. 328 has a full complement of microscleres including large and small toxae, and trichodragmata. It is difficult to understand why Dendy should have failed to observe the trichodragmata in these three specimens.

Further, Dendy's specimens from Okhamandal show the same kinds of variation and, without labouring the point, we may assume that any collection of these sponges would show the same individual variations. *M. plumosa* and *M. isochela* represent, therefore, a single species in which the normal spiculation includes large anisochelae, usually in rosettes, small anisochelae, large and small sigmata, large toxae, scattered or in dragmata, small toxodragmata, and trichodragmata, and that from individual specimens one or more of these categories of spicules may be missing.

The little-known *M. parishii* (Bowerbank) possesses the full complement of these spicules and represents the normal, complete state of affairs in the species to which *M. plumosa* and *M. isochela* belong. *M. pectinicola* is an encrusting form of the same species from which the toxae only are missing, and *M. ridleyi* (Lendenfeld), re-described by Hallman (*l. c.*) is also identical with it.

Localities.—Pamban, Ramnad Dt. ; South portion of Malacca Straits, (Sherard Osborn, 23rd May 1886).

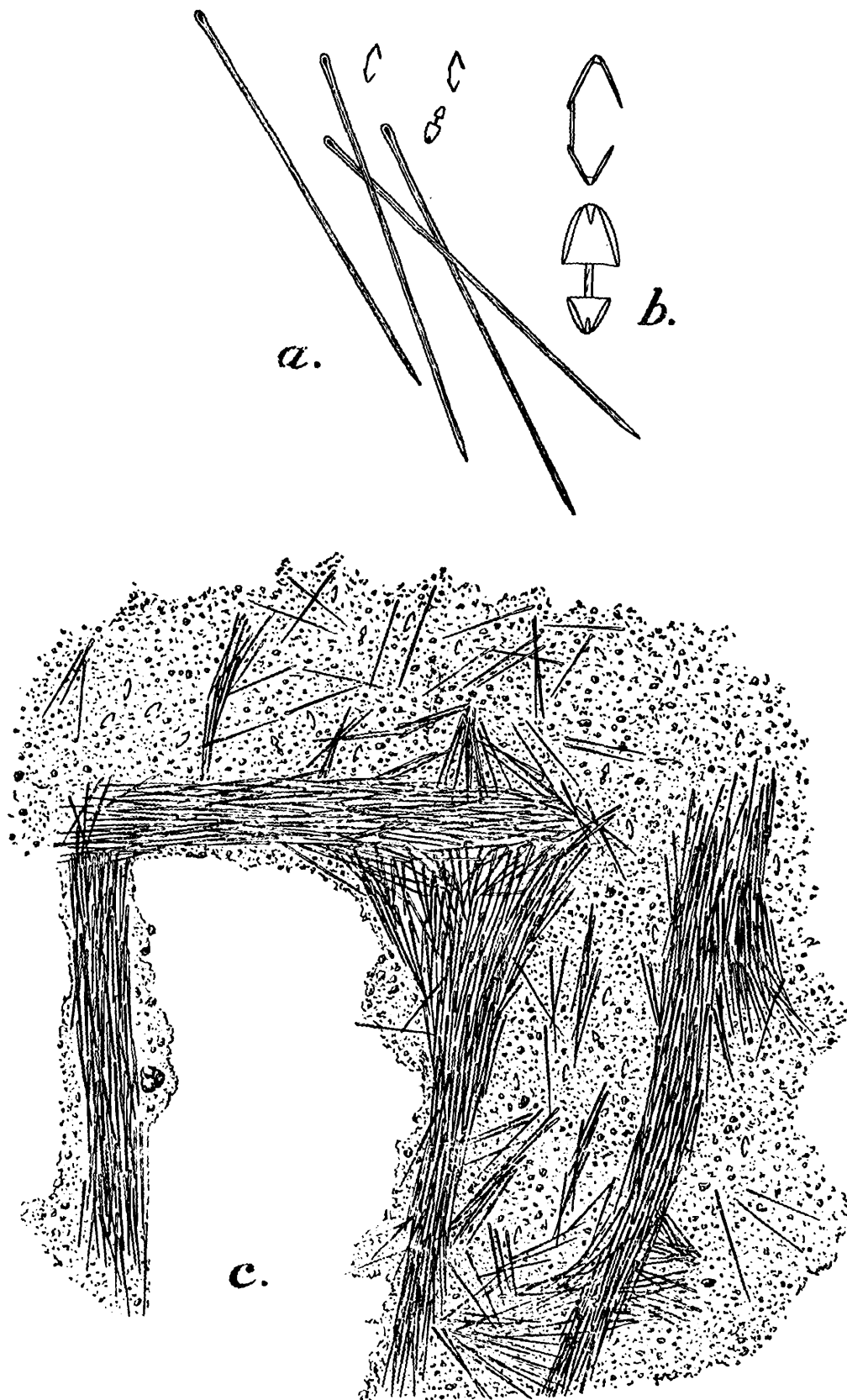
***Mycale monanchorata*, sp. nov.**

Diagnosis.—Sponge encrusting or massive ; texture soft, compressible ; interior of sponge cavernous ; surface smooth, uneven, bearing spinose processes, representing the projecting ends of the main fibres, about 2 mm. high ; main skeleton a coarse, irregular reticulation of multispicular fibres containing numerous megascleres ; dermal skeleton absent ; megascleres slender subtylostyli, 0.28×0.004 mm., microscleres a single sort of anisochela, occasionally occurring in rosettes 0.024-0.036 mm. long.

Holotype.—P. 785/1 Zool. Surv. Ind. (*Ind. Mus.*).

Locality.—Kilakarai, Ramnad Dist. (from coral reefs), Madras Presidency.

The holotype is in a most unsatisfactory state consisting as it does of a thin much-damaged crust on a slab of coral. The surface of the sponge is not intact except at one point, a patch of about 20 mm. square. Consequently the characters of the oscules and pores, and of the surface



TEXT-FIG. 6.—*Mycale monanchorata*. a. subtylostyli showing the conspicuous axia canal ($\times 200$); b. anisochela ($\times 600$); c. Skeletal fibres ($\times 50$).

tissues can only be judged with uncertainty. At the same time the species is well-characterised by the possession of a single form of microscelere. The megascleres, too, are of interest. They are very slender, with conspicuous axial canal, and give the impression of being very feebly developed or even vestigial. In the characters of the skeleton fibres and the megascleres the species approaches *Mycale* (*Arenocalina*) *mirabile* (Lendenfeld), a species which is entirely without microsccleres, and is distinguished from all other species by the possession of one form of microscelere only.

Sub-family MYXILLEAE.

Genus *Lissodendoryx* Topsent.

1905. *Lissodendoryx*, Lundbeck, *Danish Ingolf Exped. Porifera*, pt. ii, p. 153.

There is little to add to the remarks of Lundbeck (*l. c.*) concerning this genus, except to draw attention to the fact that *Tedania leptoderma*, the species for which it was originally established, is synonymous with *Halichondria isodictyalis* Carter. The latter becomes, therefore, the genotype of *Lissodendoryx*.

The question of the value of the shape of the chelae in delimiting genera of the Myxilleae is one on which we do not propose to make any comment, but we accept the genus *Lissodendoryx* in the sense used by Lundbeck.

Lissodendoryx similis Thiele.

1897, *Lissodendoryx isodictyalis*, Topsent, *Rev. suisse zool.*, IV, p. 456, nec *L. isodictyalis*, Carter, nec *L. isodictyalis*, Dendy, nec *L. leptoderma*, Topsent.

1899. *Lissodendoryx similis*, Thiele, *Zoologica*, XXIV, p. 18, pl. v, fig. 10.

Thiele (*l. c.*) has shown that *L. isodictyalis* as recorded by Topsent and Dendy has no connection with the genotype of that name recorded by Carter from the West Indies. The specimen described by Topsent under this name from Amboina has been referred by Thiele to *L. similis*. This species differs from *L. isodictyalis* Carter chiefly in the dimensions of the spicules, particularly in those of the microsccleres.

The four specimens in the present collection belonging to this species are all encrusting, with a thin dermal membrane and scattered vents measuring 1-2 mm. in diameter. The dimensions of the spicules are:—Styli, 0.148-0.164 mm. long, tylota, 0.148-0.177 mm. long; chelae and sigmata, 0.0185-0.022 mm.

Locality.—Marble Rocks (11° 33½' N, 98° 20¾' E, 25th December 1886); Jack and Una Is., (Shore collection, Mar. Surv. Stn. 571), Mergui Archipelago.

Lissodendoryx ternatensis (Thiele).

1882. *Lissodendoryx isodictyalis*, Carter, *Ann. Mag. Nat. Hist.*, Ser. 5, XVII, p. 52.

1896. *Myxilla isodictyalis*, Dendy, *Proc. Roy. Soc. Victoria*, p. 30.

1899. *Hamigera ternatensis*, Thiele, *Zoologica*, XXIV, p. 18, pl. v, fig. 10.

1929. *Lissodendoryx sinensis*, Brøndsted, *Zool. Anz.*, LXXXI, p. 228, fig. 5.

The specimens described by Carter, and by Dendy from Australia under the names of *Lissodendoryx isodictyalis* and *Myxilla isodictyalis*

respectively are practically identical and agree, moreover, with the sponge described by Thiele from Ternate as *Hamigera ternatensis*. They differ from the holotype of *Lissodendoryx isodictyalis* from the West Indies, in having chelae and sigmata differentiated into two sizes. *Lissodendoryx sinensis* appears to be identical also with these forms.

There is a single representative of this species which differs little from that described by Brøndsted as *L. sinensis*.

Locality.—Vizagapatam (12th March 1918), Madras Coast.

Kirkpatrickia spiculophila, sp. nov.

(Pl. XVIII, Figs. 5, 5a.)

Diagnosis.—Sponge irregularly massive; surface uneven, sub-meandri form, minutely hispid; large sub-dermal spaces visible beneath a covering of aspiculous ectosome; vents small, scattered; colour, in spirit, greyish yellow; main skeleton an irregular reticulation of long, smooth, slightly curved styli, up to 0.8×0.021 mm.; ectosome pierced by stout dermal brushes of oxeote tornota 0.4×0.008 mm.

Holotype.—P 786/1 Zool. Surv. Ind. (*Ind. Mus.*).

Locality.—Port Blair, Andamans (G. H. Booley, April 1890). W. Andamans, (9945/6)-co-type.

A noteworthy feature of the two specimens, and one which may conceivably prove a specific character, is that they have incorporated the long diactines of Hexactinellida so that one looks, at first, like a *Monorrhaphis*, and the second like a *Rosella* with an incipient root-tuft. The type forms an incrustation, $55 \times 10 \times 5$ mm. on a spicule 100 mm. long. The co-type is a subspherical mass, 25×10 mm., with a number of small diactines at one end.

The present species is closely allied to the only two other species of the genus, *K. coulmani* and *K. variolosa* from the Antarctic, but differs in details of external form and spiculation.

Ectyobatzella enigmatica, sp. nov.

(Pl. XVIII, Fig. 6.)

Diagnosis.—Sponge massive with lobose outgrowths, with surface thrown into a number of irregular conulations, or irregularly clathrous, with small digitate processes, and minutely conulose; surface, between conulations, smooth, composed of a thin aspiculous dermis overlying cavernous subdermal spaces; oscules and pores not apparent; colour, in spirit, light brown; skeleton an irregular multispicular reticulation of bundles of tornota, bound together with much spongin and echinated by short smooth styli, with wisp-like columns of tornota running more or less vertically from the outer meshes of the main skeleton to the surface; tornota strongylote or slightly amphitylote, straight, smooth, 0.175×0.0035 mm.; styli smooth, thickest at about the lower third of the spicule length, 0.122×0.006 mm.

Holotype.—P 787/1 Zool. Surv. Ind. (*Ind. Mus.*).

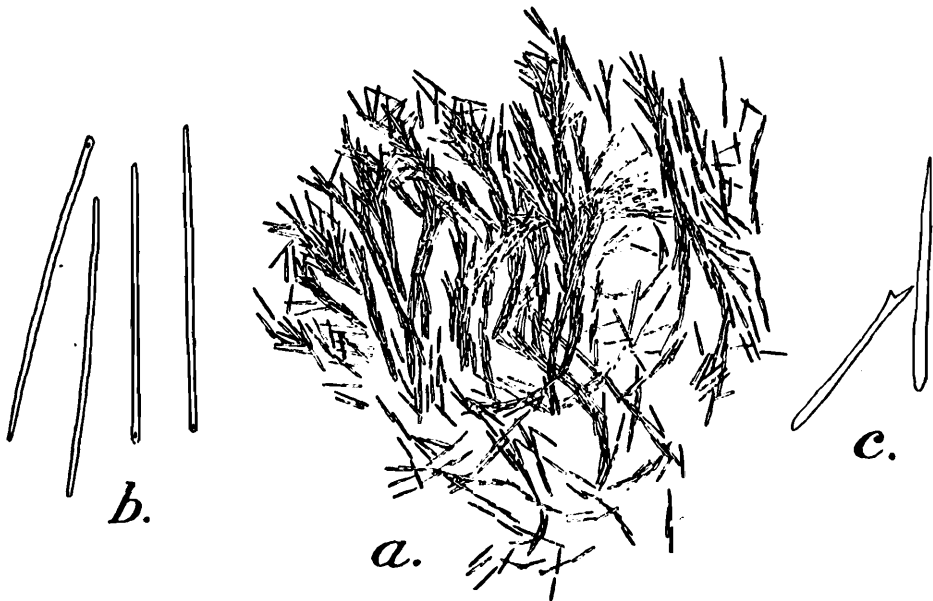
Locality.—Nicobar I. (Wood-Mason).

There are two specimens in the collection which are slightly dissimilar in external form, the holotype being massive and the co-type



TEXT-FIG. 7.—*Ectyobatzella enigmatica*. main skeletal fibres consisting of tornota and styles ($\times 30.6$).

clathrous. Both, however, agree in spiculation. The dominant spicule is the strongylote, whose ends may occasionally become tylote, the styli being comparatively scarce. The fact that the ends of the strongyla may become tylote suggests that the spicules may be included



TEXT-FIG. 8.—*Ectyobatzella enigmatica*. a. wisp-like surface columns of tornota from the outer meshes of the main skeleton ($\times 30$); b. tornota; c. echinating styles (both $\times 146$).

in that category known as tornota, and that the genus belongs, therefore, more properly to the Myxillae. The nature and disposition of the echinating styli suggests nothing more than that the genus belongs to the Ectyoninae. Provisionally, therefore, we regard it as a primitive member of the Myxillae.

It is probable that the genus *Batzella*, to which the present genus appears to be related, should also be included in the Myxillae.

***Psammochela elegans* Dendy.**

(Pl. XVIII, Fig. 7.)

1916. *Psammochela elegans*, Dendy, *Rep. Govt. Baroda Mar. Zool. Okhamandal*, p. 126, pl. i, fig. 6, pl. iii, fig. 22.

The present specimen resembles the holotype closely except in the external form. It forms a thin incrustation on the shell of an oyster and a Gorgonian, and associated with a Polyzoon. The spicules are fairly typical, the only difference being in the size of the microscleres which are tridentate chelae, 0.018-0.027 mm., C-shaped chelae 0.005-0.011 mm., and sigmata 0.005-0.033 mm.

Locality.—Off the N. coast of Table I., Cocos group (Dec., 1888), Mergui Archipelago (16 fms.).

In Dendy's description of this species there are several fundamental errors. In the first place, the small isochelae have been treated as vestigial when it would be more in conformity with the generally accepted views on the phylogeny of Sponges to regard them as primitive or rudimentary. Secondly, the mere presence of sand has been allowed to outweigh all other characters in considering the affinities of the genus. The ease with which sponges of most families are able to incorporate sand grains or foreign spicules in their skeletons is well-known, and is obviously of little taxonomic significance. Thirdly, it seems fallacious to include *Desmacidon psammodes* Hentschel in the same genus. This species belongs evidently to the Isodictyeae and forms one of the links between that group and the Gelliinae, making a close approximation to *Gellius bidens* Topsent.

Psammochela elegans Dendy cannot be placed anywhere but with the Myxillae, and the genus itself differs from *Myxilla* chiefly in the absence of dermal tornota. It is important to notice that *Desmacidon reptans* Ridley and Dendy shows many of the characters of *Psammochela elegans*, differing chiefly in the possession of oxea instead of styli. With our present conceptions of the classification of the Desmacidonidae this is of fundamental importance, and any attempt to include *Desmacidon reptans* and *D. psammodes* in the genus *Psammochela* would result in upsetting the present foundations of the group.

Sub-family CLATHRIEAE.

***Clathria lendenfeldi* Ridley & Dendy.**

1886. *Clathria lendenfeldi*, Ridley & Dendy, *Ann. Mag. Nat. Hist.*, Ser. 5, XVIII, p. 474.

1886. *Clathria inanchorata*, *id.*, *op. cit.*, p. 475.

1887. *Clathria lendenfeldi*, *id.*, *Rep. Challenger, Monaxonida*, XX, p. 148, pl. xxviii, fig. 5, pl. xxix, fig. 6, pl. xlvii, fig. 5,

1887. *Clathria inanchorata*, *id.*, *op. cit.*, p. 150, pl. xxviii, fig. 4, pl. xxix, fig. 13.
 1901. *Echinonema anchoratum* var. *lamellosa*, Whitelegge, *Rec. Austral. Mus.*, IV, p. 82.
 1907. *Microciona clathrata*, *id.*, *op. cit.*, p. 493, pl. xlvi, fig. 38.
 Clathria lendenfeldi, *id.*, *op. cit.*, p. 494.
 Clathria inanchorata, *id.*, *op. cit.*, p. 495.
 1912. *Clathria spicata*, Hallmann, *op. cit.*, p. 210.
 Clathria coelata, *id.*, *op. cit.*, p. 212, pl. xxxi, figs. 4-43.
 C. costifera, *id.*, *op. cit.*, p. 215, pl. xxxi, figs. 2-44.
 1921. *C. spicata*, Dendy, *op. cit.*, p. 65, pl. v, fig. 2, pl. xiii, fig. 4.
 1921. *C. whiteleggei* *id.*, *op. cit.*, p. 67, pl. vii, fig. 1, pl. xii, fig. 5.

There are five specimens in the present collection bearing so strong a resemblance in external form and in the arrangement of the skeleton that there can be practically no doubt as to their being conspecific. They are all of low growth, either encrusting or, more commonly, consisting of a basal crust from which arise irregular laminae or clavate branches. The surface in all cases is produced into irregularly-arranged blunt processes. The skeleton consists of an irregular reticulation of horny fibres in which the principal megascleres are arranged in a plumose manner, with their ends frequently protruding at the surface of the fibre, or are actually echinating the surface of the fibre. It is, in fact, the type of skeleton described by Dendy for *C. spicata* and by Hallmann for *C. coelata*, and described by the latter (1912, p. 215) as the *spicata*-group. Despite the similarity between the present specimens in most respects, there are, nevertheless, striking differences in certain details of the spiculation: All the specimens described below are from the Pearl Oyster Banks, Tuticorin:—

1. Styli smooth, occasionally basally spined 0.3 mm. long; subtylostyli 0.24 mm. long; acanthostyli 0.08 mm. long; chelae 0.016-0.02 mm. long; toxa 0.03-0.12 × 0.004 mm.
2. Styli smooth, 0.21 mm. long; subtylostyli 0.24 mm. long; acanthostyli 0.06 mm. long; chelae very rare, 0.016 mm. long; toxa not seen.
3. Has smooth styli, rare chelae and toxa as in No. 1.
4. Has rare hair-like toxa instead of stout toxa.

The example from the Ganjam Coast ("Golden Crown" Coll.) has basally tuberculate styli 0.4 mm. long; subtylostyli 0.4 mm. long; acanthostyli 0.12 mm. long; chelae 0.016 mm. long; toxa hair-like, 0.16 mm. long.

It is clear, therefore, that these five specimens represent a species which may have the principal styli smooth, basally-spined, or basally-tuberculate; that the chelae or the toxae may be rare or absent; and that the toxae may be one of two kinds, stout and bow-shaped, or hair-like and with the arms nearly parallel.

The question next arises as to how such a species compares with the closely related species already described. Here it becomes clear that several apparently well-marked species must be treated as synonymous.

Microciona clathrata Whitelegge differs from the present specimens in that the sponge is stipitate and the tubercles of the surface are produced into blunt spinose processes. The spiculation differs little from such a form as our No. 1 from Tuticorin Pearl Oyster Bank, and the

external form, except for the stalk, is practically identical with that of the example from Ganjam.

Clathria coelata Hallmann is again stipitate, with the spiculation similar to that of No. 1 from Tuticorin, but the external form is merely a modification of that of *Microciona clathrata* or of any of the present specimens. If, for example, we again imagine one of the lamellae of the present specimens mounted on a short stalk, with the surface processes more numerous and more closely set, we have a form almost exactly identical with that of *C. coelata*.

Clathria whiteleggei Dendy has spiculation like that of our example from Ganjam, and an external form whose counterpart is occasionally seen as in No. 2 from Tuticorin, the largest of the present specimens, when the laminae become broken up, anastomosing and clathrous.

In the holotype of *C. spicata* the sponge is flabelliform and the surface tuberculations are replaced by irregular ridges, the whole being obviously a modification of such a form as that of *C. coelata*. The spiculation is similar to that of the specimen from Ganjam.

Clathria costifera Hallmann does not appear to differ materially from *C. spicata*.

Clathria lendenfeldi has chelae 0.016 mm. long, not 0.005 mm. as stated by Ridley and Dendy, has rare toxae, and is clearly conspecific with our present specimens, while *C. inanchorata* appears to stand in a similar relation, but has a much reduced spiculation as regards the microscleres.

To those unacquainted with the actual specimens representing the species discussed above, it may appear extravagant to regard them all as conspecific, but actually to handle the specimens and compare them leaves little doubt that such is the case. Short of lengthy and tiresome descriptions of details, and numerous illustrations, it is not possible to set forth convincing arguments in favour of such a view, and this is impracticable at the moment. Nevertheless, experience has shown us, that, unless we are to continue to recognise small spicular and morphological differences as of specific significance, which course can only result in greater chaos than at present prevailing, we must, in the genus *Clathria*, at all events, accept a much more liberal conception of the term "species." Particularly is this so, as regards the microscleres. These spicules can so easily disappear, or be modified, that their value in the limitation and diagnosis of species is, in cases, almost negligible. Specific differentiation must, we are convinced, rest more and more on the arrangement of the megascleres and the details of external form.

***Clathria indica* Dendy.**

(Pl. XVIII, Figs. 8, 9.)

1889. *Clathria indica*, Dendy, *op. cit.*, p. 73, pl. iv, fig. 10.

1905. *Clathria indica*, Dendy, *op. cit.*, p. 171.

The species is represented by several complete specimens and a number of fragments. All are of essentially the same form, namely erect and flabellate, composed of a number of branching and anastomosing, more or less cylindrical, processes.

Localities.—Pearl Oyster banks, 12 miles off Tuticorin, Gulf of Manaar (H. S. R., 1926). 2-3 miles S. W. of Cape Comorin, 38 fms.

The characteristic feature of the species is the absence of coring spicules, the irregular fibres composing the main skeleton being without spicules other than the acanthostyli echinating them. The auxiliary spicules are short, slender styli, peculiarly shaped at the base. Microscleres appear to be invariably absent.

Tenacia frondifera (Bowerbank).

1875. *Halichondria frondifera*, Bowerbank, *Proc. Zool. Soc. London*, p. 288.

1889. *Clathria corallitincta*, Dendy, *Ann. Mag. Nat. Hist.*, Ser. 6, III, p. 85, pl. iv, fig. 8.

1898. *Rhaphidophlus ridleyi*, Lindgren, *Zool. Jahrb.*, XI, p. 310, pl. xvii, fig. 8; pl. xviii, fig. 14; pl. xix, figs. 17a-d.

1899. *Rhaphidophlus seriatus*, *R. erectus*, *R. topsenti*, Thiele, *Zoologica*, XXIV, pp. 14 & 15, pl. i, fig. 6; pl. v, fig. 7; pl. ii, figs. 2, 3.

Diagnosis.—Sponge massive and clathrous, sub-ramose, irregularly ramose, or erect and tree-like; surface may be smooth, meandrine or irregularly tuberculate; vents not apparent; skeleton composed of irregularly isodictyal network of spongin fibres cored by several lines of smooth styli and echinated by acanthostyli, auxiliary spicules subtylostyli of two sizes, larger occurring interstitially, smaller as dermal skeleton; microscleres chelae and toxae, one or both of which may be more or less completely divided into two categories.

Coring styli 185-300 μ long, 10-15 μ thick.

Interstitial subtylostyli 200-300 μ long, 6-10 μ thick.

Dermal subtylostyli 68-200 μ long, 3-8 μ thick.

Acanthostyli 70-75 μ long, 7-8 μ thick.

Chelae 13-16 μ long.

Toxae 200 μ long.

In his report on the "Sealark" sponges, Dendy has suggested that he is "not at all sure that the distinction between this species (*Clathria corallitincta*) and *Clathria procera* can be maintained, and both may be merely varieties of *C. frondifera*." This is not the case. While *T. frondifera* and *C. corallitincta* are obviously synonymous, *C. procera* differs in an important respect from both. While the rest of the spiculation is the same in both cases, the coring spicules of *Tenacia frondifera*, as it should be called, are short, stout, slightly curved styli, those of *T. procera* are comparatively long, slender subtylostyli, often bearing a crown of spines at the base, resembling very closely the auxiliary spicules, both interstitial and dermal. This difference is so striking and constant as to give an unmistakable means of distinguishing the two species even from hand-sections of individuals belonging to them.

T. frondifera, as exemplified by the present specimens, is very variable in external form. The spiculation varies little except in so far as the dimensions of the spicules are concerned, and even this variation is shown to a striking degree only in the microscleres. The chelae, for example, may be, in one individual, of a tolerably constant length,

(as in the example from Tuticorin where they are 0.01 mm.) or they may vary between differing limits of size (from 0.012-0.016 mm., to 0.009-0.016 mm. as in the example from Pt. Pedro, Palk Straits). In the specimen from M. S. Sta. 593 the chelae measure up to 0.02 mm. long. In some individuals they are so rare as to be virtually absent. The toxae show even more striking variations. In the specimen from Pt. Pedro there are short toxae, 0.037 mm. long, and long hair-like toxae 0.014 mm. in length often associated in bundles with occasional intermediate forms. In the example from Tuticorin the only toxae present, and these are very rare, measure 0.04 mm. in length. In general, it may be said of the toxae that they normally vary between 0.04 and 0.14 mm. in length; that they occasionally appear to be divisible into two distinct categories, that in one individual the short toxae only may be present, and in another, mainly long toxae are present.

The external form varies between irregularly clathrous and bushily ramose, with long cylindrical branches. But a more detailed consideration of the external form will be given in correlation with the following comparison between *T. frondifera* and other closely related species described from the Indo-Pacifico-Australian area.

The spiculation consists, typically, of smooth, slight curved styli, coring the fibres, measuring 0.24 mm. long; auxiliary interstitial subtylostyli 0.23 mm. long; auxiliary dermal subtylostyli 0.16 mm. long; acanthostyli, spined more particularly at the base, and in the upper half (Cf. Dendy 1889, pl. iv, fig. 8d) 0.07 mm. long; chelae varying between 0.008 and 0.02 mm. long; toxa varying between 0.04 and 0.14 mm. long.

Rhaphidophlus ridleyi Lindgren differs from the type species in the apparent absence of toxa and in the shape of the acanthostyli (Cf. Lindgren 1898, pl. xix, fig. 17c). These latter have blunt apices instead of the typical sharply pointed apices. At the same time, the example from Cinque I., Andamans with external form and the rest of the spiculation almost identical with the holotype of *T. frondifera*, has acanthostyli identical with those of *Rhaphidophlus ridleyi*. Moreover, although the toxae may be very rare, it is doubtful whether they are entirely absent. In this respect, Lindgren's species is like the specimen from M. S. Stn. 655 in which neither chelae nor toxae could be found, although in all other respects the sponge is typical of *T. frondifera*. In external form, *R. ridleyi* makes a near approach to our specimens from Tuticorin.

Rhaphidophlus seriatus, *R. erectus* and *R. topsenti*, all three erected by Thiele must be regarded as representing a single species. All agree closely in spiculation with one another and with *T. frondifera*. *R. erectus* and *R. topsenti*, like *R. ridleyi* Lindgren represent the ramose form, and *R. seriatus* resembles strongly the clathrous form of *T. frondifera*.

R. filifer var. *spinifera*, in which Lindgren failed to record the dermal subtylostyli, agrees closely with the typical form of *T. frondifera* in spiculation, and with our specimens from Cinque I. and Pt. Pedro in external form.

R. reinwardti var. *subcylindrica* Ridley agrees with *R. erectus* Thiele in representing, almost certainly, a "metamp (Bidder)¹ or "tropus" (Vosmaer)² of *T. frondifera*.

Clathria nuda Hentschel agrees in spiculation with the typical form of *T. frondifera* and with our Tuticorin specimen in external form.

Clathria frondifera var. *dichela* Hentschel agrees so closely with the holotype, except in the matter of the chela, that one must assume that it represents merely a slightly unusual form in which the chelae have become differentiated into two categories, with possible intermediates. Similar cases have been found among the present specimens, so that this division of the chelae into categories implies probably no more than that it is the result of a slightly unusual variation, at the most.

C. frondifera and *C. frondifera* var. *major* Hentschel differ only in the dimensions of their spicules, a totally negligible feature in the light of the present studies. In external form they resemble closely our specimens from M. S. Stas. 655 and 528.

Although Whitelegge's species are but inadequately known it is possible that *Clathria tenuifibra*, *C. calopora* and *C. multipora* are also synonyms of *T. frondifera*. In external form the first and third of these resemble to a remarkable degree the dry specimen included in our collection (282.i.). According to Hallmann *C. multipora* is a *Tenacia*, although Whitelegge only described one form of auxiliary subtylostyle. Assuming that he erred in the same way with the other two species of Whitelegge, there is no reason to believe that all the three species should not be regarded as synonyms of *C. frondifera*.

It is also probable that *Rhaphidophylus* (*Spongia*) *cratitius*³ and *Clathria ulmus*⁴ Vosmaer, species very imperfectly known, may represent examples of the clathrous and ramose forms of *T. frondifera* respectively.

Localities.—Pearl Oyster Banks, Tuticorin (H. S. R., Feb., 1926); Kilakarai, Ramnad Dt., Madras Presidency; Pt. Pedro, Palk Straits; (M. S. Sta. 655) N. side of Fuladu I., Goifurfehendu atoll (on reef, 10th December 1923); Paway I., 11° 25' N., 98° 31' E. (Feb.-March 1914); Elphinstone I., Port Maria, Mergui Archipelago (6-12th April 1913), Surf line off Rutland I., Andamans (Dr. Giles Coll., 1887); Mergui Archipelago (16 fms.); Andamans (J. Woodmason).

***Tenacia robusta* (Dendy).**

1921. *Microciona strepsitoxa*, Hope var. *robusta*, Dendy, *op. cit.*, p. 60.

The single specimen is practically indetical with Dendy's specimen in all respects, and it is tolerably certain that neither of them has any relation to Hope's species from the British Isles.

In its basal portions, the main skeleton of this species has the appearance of a typical *Hymedesmia*, but in the upper portions it shows clear indications of the arrangement found in *Tenacia*. The dermal skeleton, the interstitial auxiliary spicules, and the microscleres, too, are those

¹ *Journ. Mar. Biol. Assn., Plymouth*, VI, p. 381 (1902).

² *Siboga Expeditie, Ponferra*, p. 26 (1911).

³ Esper, *Forts. d. Pflanzenthier.*, I, p. 195, pl. liii (1797).

Ehlers, *Die Espers. Spong. Zool. Samml. K. Univers. Erlangen*, p. 18 (1870).

⁴ Vosmaer, *Notes from the Leyden Museum*, 11, p. 151 (1880).

of *Tenacia*. Moreover, the spiculation, as a whole, is practically identical with that of *Clathria whiteleggei* Dendy (= *C. lendenfeldi*) which suggests that the species is the juvenile form of *C. lendenfeldi* and that the dermal skeleton, and other features characteristic of *Tenacia*, are primitive characters which all species of *Clathria* may possess at some time or other in their life, but which in those species we refer to *Tenacia* remain throughout life. Should this prove to be the case, and this can only be proved by a closer study of the young forms, it would be necessary to merge *Tenacia* in *Clathria*.

That the species should ever have been referred to *Microciona* shows the inadvisability of laying stress on the encrusting habit as a generic character.

Locality.—Tana Murah Besar, Singapore I., (Annandale, 22nd December 1915).

***Tenacia procera* (Ridley).**

1921. *Clathria procera*, Dendy, *op. cit.*, p. 64, pl. ii, figs. 6.

The difference between the present species and *T. frondifera* has already been pointed out in dealing with the latter. The present specimens show both the clathrous and the ramose forms, with a few forms intermediate between the two.

In addition to those synonymous with this species, given by Dendy (1921, p. 64), there are others which may be justifiably included. *Rhaphidophlus arborescens* differs in no important respect from the holotype of *T. procera*, although Ridley's description of the former suggests otherwise, nor does *Clathria reinwardti* var. *palmata* Ridley.

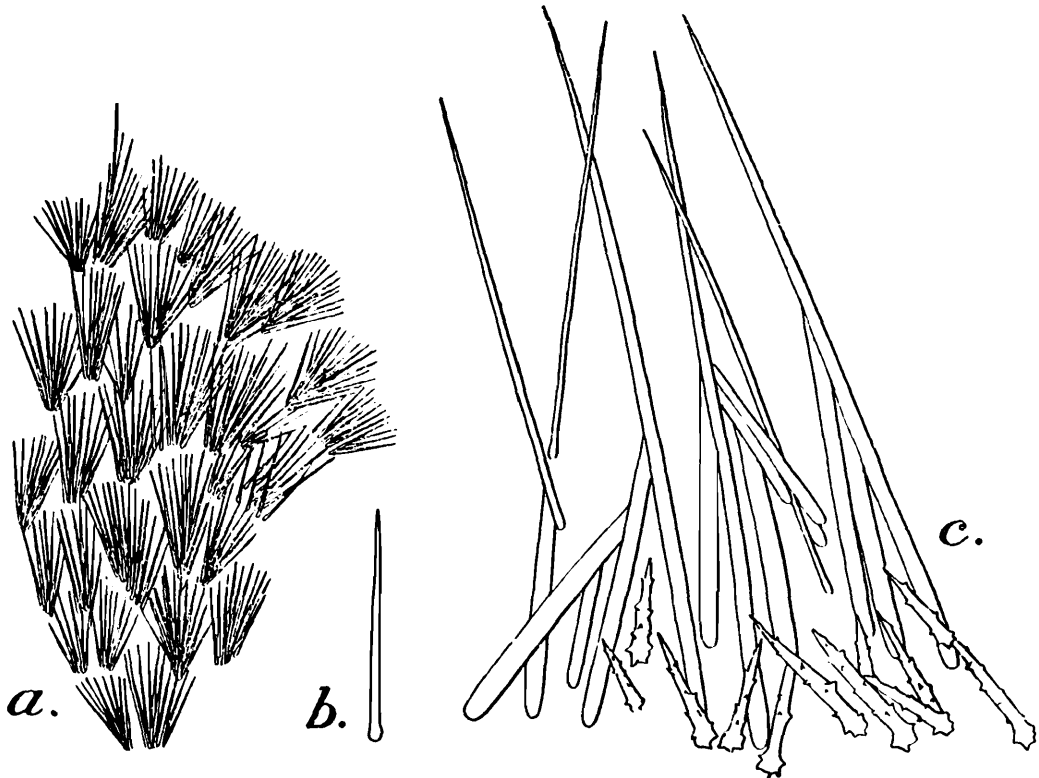
Spongia cactiformis Lamarck is probably indetical with the clathrous form of the species, but of this we cannot yet be certain. Should this prove to be identical, it would be necessary to change the specific name but, at present, it is extremely doubtful that *T. procera* and Lamarck's species are conspecific, and consequently no change in the name is admissible.

Localities.—Pearl Oyster Banks, Tuticorin (H. S. Rao, Feb.-March 1926); Tholayiram Par, Tuticorin (J. Hornell); 2-3 miles S. W. of Cape Comorin (38 fms., Armstrong Coll., 13th January 1884); Pt. Pedro, Entrance to Palk Straits (Mar. Surv. 1893-94); Arabian Sea (13° 44' N., 72° 6' E., 15th January 1895—28 fms.).

***Tenacia micropunctata*, sp. nov.**

Diagnosis.—Sponge thinly encrusting, about 2 mm. thick; surface smooth, minutely punctate; vents probably represented by occasional rounded apertures; colour, in spirit, white; choanosome cavernous, traversed by numerous, compressed, transverse canals; skeleton composed of a basal layer of acanthostyli from which columns of spicules extend upwards to surface to end in a dense layer of brushes of small subtylostyli set at right angles to surface; columns formed in basal half of smooth, comparatively stout styli and in upper half of slender subtylostyli; microscleres absent.

Remarks.—The dimensions of the spicules are:—acanthostyli, 0.074×0.005 mm.; styli, 0.015 to 0.024×0.008 mm.; long subtylostyli of main columns, 0.026×0.008 mm.; short subtylostyli of dermal brushes, 0.074×0.004 mm.



TEXT-FIG. 9.—*Tenacia micropunctata*. *a.* surface brushes of tylostyles ($\times 30.6$); *b.* a single tylostyle from the surface brush ($\times 146$); *c.* basal layer of acanthostyles from which columns of stout styli and slender subtylostyli arise ($\times 146$).

The types of spicules present show this sponge to be a fairly typical *Tenacia*, although the arrangement of the skeleton is that of a *Hymedesmia*. This is but one instance of the many which tend to show that both the genus *Hymedesmia* and the group Hymedesmieae are founded on a false assumption. We shall probably find, eventually, that all species of Ectyoninae have the habit and form of a typical *Hymedesmia* during the stage immediately following the metamorphosis.

Holotype.—P 788/1 Zool. Surv. Ind. (*Ind. Mus.*).

Locality.—Pearl Oyster Banks, 12 miles off Tuticorin (9-10 fms., H. S. R. Feb.-Mar. 1926).

***Isociona tuberosa* (Hentschel).**

1909. *Lissodendoryx tuberosa*, Hentschel, *Fauna Südwest-Australiens*, Jena, III, p. 326.

1911. ? *Clathria hartmeyeri*, *id.*, *op. cit.*, p. 379.

1919. *Isociona tuberosa*, Hallmann, *Proc. Linn. Soc. N. S. Wales*, XLIV, p. 768.

The single specimen is clathrous, composed of a number of irregular, anastomosing lamellae. The arrangement of the skeleton is practically the same as that of *Isociona tuberosa* but there are, in addition, occasional smooth subtylostyli such as are found in *Clathria hartmeyeri*.

It is extremely probable that *Lissodendoryx tuberosa* is an encrusting form of *Clathria hartmeyeri*. The main differences between them, apart from differences in external form, are that there is more spongin in the latter, and that the former does not appear to possess the smooth

subtylostyli (fig. 50*b*, Henstchel, *l. c.*, p. 379). The first point is negligible and as regards the second, it may be said that these spicules are not numerous and appear to be modified forms of acanthostyli.

Locality.—Ganjam Coast, Madras Pres. ("Golden Crown" coll., March, 1909.)

Genus **Raspailia** Schmidt.

1862. *Raspailia*, Schmidt, *Spongien. Adriat. Meer.*, p. 59, pl. v, figs. 11-13.

1905. *Raspailia*, Pick, *Arch. Naturg.*, i, pp. 1-46, 4 pls.

1911. *Raspailia*, Hentschel, *Faun. Südwest-Austral.*, III, p. 381.

1921. *Raspailia*, Wilson, *Elisha Mitchell Sci. Soc. Chapel Hill*, XXXVII, pp. 54-60.

The position of the genus among the Ectyoninae and its history, with a bibliography and a list of species, are given by Pick (*l. c.*). An emended definition of the genus, making it more comprehensive than before, is suggested by Wilson (*l. c.*).

Raspailia viminalis Schmidt.

1862. *Raspailia viminalis*, *freyeri*, *stelligera*, Schmidt, *op. cit.*, p. 59.

1905. *Raspailia viminalis*, *freyeri*, Pick, *op. cit.*, pp. 7, 30, pls. i-iv.

The two specimens are both from the Bay of Bengal, the one from Cinque I., and the other from the coast off Puri. The former consists of a branched anastomosing colony, at present somewhat broken into fragments, with a strongly hispid surface. The latter is entire and consists of an elaborately branching and anastomosing stock, 230 mm. high and about as broad, surmounting a stalk about 20 mm. in diameter. The surface is less hispid and there are several minute circular openings on the surface.

R. stelligera Schmidt is based on an incrustation of a foreign sponge on *R. viminalis*. We consider *R. freyeri* to be identical with the present species, although Pick regarded it as a separate species.

Raspailia tenuis Ridley and Dendy.

1887. *Raspailia tenuis*, Ridley and Dendy, *op. cit.*, p. 189, pl. xxxix, fig. 2, pl. xl, fig. 8.

The single specimen forms a thin incrustation on the shell of a *Nassa*, spreading over the greater part of the convex side of the shell, from the centre of which arise the erect columns. These columns divide into three branches, and these again repeatedly branch and anastomose. The extremities of the branches are pointed. The height of the whole specimen is 50 mm., and the colour, in spirit, pale yellow. The structure of the skeleton agrees closely with that of the holotype, and the spiculation differs only in the comparative rarity of the slender strongyla.

Locality.—Indian Seas—Details of the locality are wanting.

Protoraspailia, gen. nov.

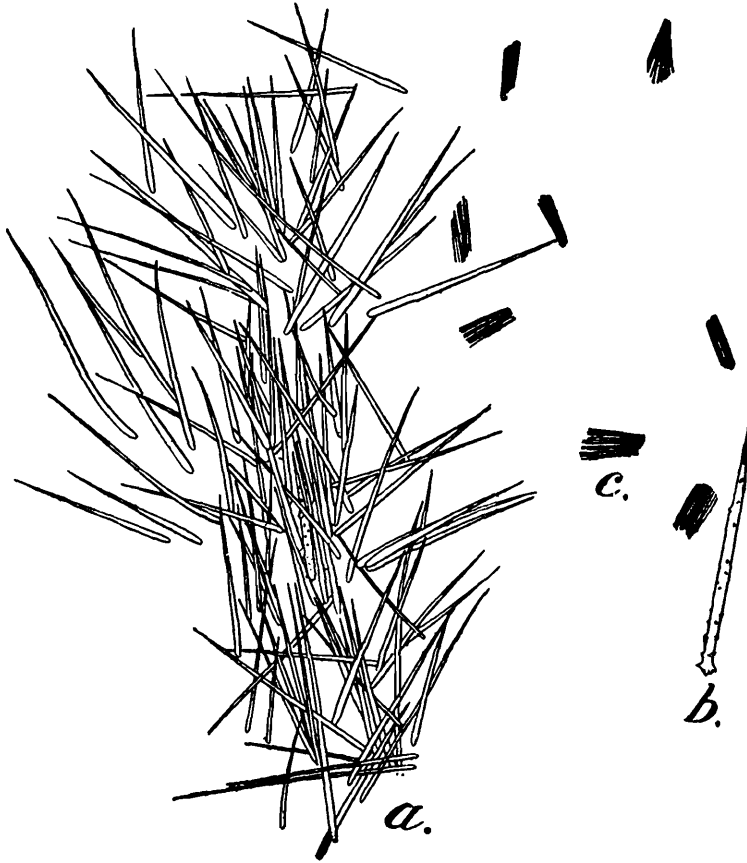
Genotype.—*Protoraspailia cactoides* sp. nov.

Ectyoninae in which the main skeleton consists of plumose columns of long smooth styli passing vertically towards the surface, echinated by sparingly spined acanthostyli; no special dermal skeleton; microcleres trichodragmata.

***Protoraspailia cactoides*, sp. nov.**

(Pl. XVIII, Fig. 10.)

Diagnosis.—Sponge erect, cactiform, consisting of a stout stem from which springs a number of slender cylindrical branches which frequently coalesce; surface coarsely hispid; oscules and pores not apparent; colour, in spirit, brown; skeleton composed of plumose



TEXT-FIG. 10.—*Protoraspailia cactoides*. a. one of the plumose columns of the main skeleton ($\times 23$); b. echinating acanthostyle; c. trichodragmata ($\times 110$).

columns of long smooth styli, passing on occasionally into tylostyles, variable in size upto 0.85×0.016 mm., passing vertically to the surface, and sparsely echinated by sparingly spined acanthostyli 0.140 mm. long; microscleres abundant trichodragmata measuring 0.048 mm. long, and 0.008 – 0.020 mm. thick.

Holotype.—P 789/1 Zool. Surv. Ind. (*Ind. Mus.*).

Locality.—Round I., ("Investigator" coll. Col. R. B. S. Sewell).

While this genus is regarded as belonging to the Ectyoninae, it has much in common with the members of the Axinellinae and it must be regarded as constituting a link between these two groups.

***Acanthostylotella*, gen. nov.**

Genotype—*Stylotella cornuta* Topsent.

Ectyoninae in which the skeleton is composed of a mixture of smooth styli, or sparingly spined acanthostyli, arranged in an irregular or subisodictyal reticulation.

Acanthostylotella cornuta (Topsent).

1897. *Stylotella cornuta*, Topsent, *Rev. Suisse Zool.*, IV, p. 464, pl. xxi, fig. 32.

The single specimen is a large massive sponge, with irregularly conulose surface, without visible oscules. The colour of the interior, in spirit, is light brown, the surface almost black. The details of the skeleton are almost obscured by abundant, large deeply-pigmented cells. In boiled out preparations, it is seen that the only spicules present are smooth styli, or styli bearing one or a few spines near the base, and some with a few spines near the apex also. According to Topsent these styli "peuvent difficilement passer pour des acanthostyles", but if we regard them as styli and retain the species in *Stylotella*, the chief character will tend to be obscured. The better course seems to be to regard them as incipient acanthostyles, and to regard the genus as a member of the Ectyoninae, with affinities to the Axinellinae.

The spicules in the present specimen measure only 0.280×0.008 mm. as against 0.320×0.018 mm. in the holotype. Despite this, however, there can be little doubt as to the accuracy of our determination, since the two specimens agree so well in all details but the dimensions of the spicules.

Locality.—(Mar. Surv. Sta. 640.) Bay between Huludu and Heratera Is., Maldives (shore of reef-flat, 6th March 1923).

A second very fragmentary specimen from Galle, off Ceylon appears to be very like the holotype in external form, while the spicules, measuring 0.350×0.014 mm., are mostly smooth styli, with which are associated styli, bearing one or, at the most, two spines at the base.

Microciona prolifera Verrill.

1919. *Microciona prolifera*, George and Wilson, *Bull. Bureau Fish.*, XXXVI (1917-18), p. 157, pl. LXII, figs. 31, 33; pl. LXIII, figs. 35, 36; pl. LXVI, fig. 57a-e.

There are two specimens in the collection. The first agrees almost exactly with the description of George and Wilson in external form and spiculation. The second specimen is associated with a calcareous alga, on whose branches it appears to be encrusting. In this specimen, correlated no doubt with its habit, the skeleton differs from that of the first specimen in that the main fibres are more regular, running vertically to the surface and the secondary fibres are completely aspiculous.

Locality.—21 miles S. W. W. of Mangalore, Arabian Sea (31 fms.). Off Karwar, Arabian Sea (Carpenter, Oct. 1885, 29 fms.).

Microciona atosanguinea Bowerbank.

1864. *Microciona atosanguinea*, Bowerbank, *op. cit.*, p. 188, pls. xxxiii, fig. 368, xxxiv, fig. 369.

1921. *Microciona atosanguinea*, Dendy, *op. cit.*, p. 60, pl. 13, fig. 1 a-e.

In the series of specimens before us from various localities on the Indian and Burmese coasts we have a complete range of variation in external form and spiculation occurring in the genus. It is doubtful whether the numerous species ascribed to this genus are distinct from one another. The spicular categories seem to vary so much in the

degree and extent to which spines are developed on the styli and in the size and form of the toxa and chela that it is extremely difficult to distinguish the different species.

Localities.—Kilakarai, Ramnad Dist. (Coral reefs, S. W. K., Feb., 1913) (Colour in life “bright vermilion”); Puri coast, Bay of Bengal (“Golden Crown”); Off Cape Negrais, Burma (Mar. Surv. Sta. 384, 40 fms., Feb., 1909); Varkalay sea-shore, Travancore (Arabian sea, Nov. 1908), from living shell of *Melongena bucephala*; Off Karwar, Arabian sea (Carpenter, Oct. 1885, 29 fms.); 26 miles W. S. W. of Honnavar, Arabian sea (May 1888, 29 fms.).

***Aulenella*, gen. nov.**

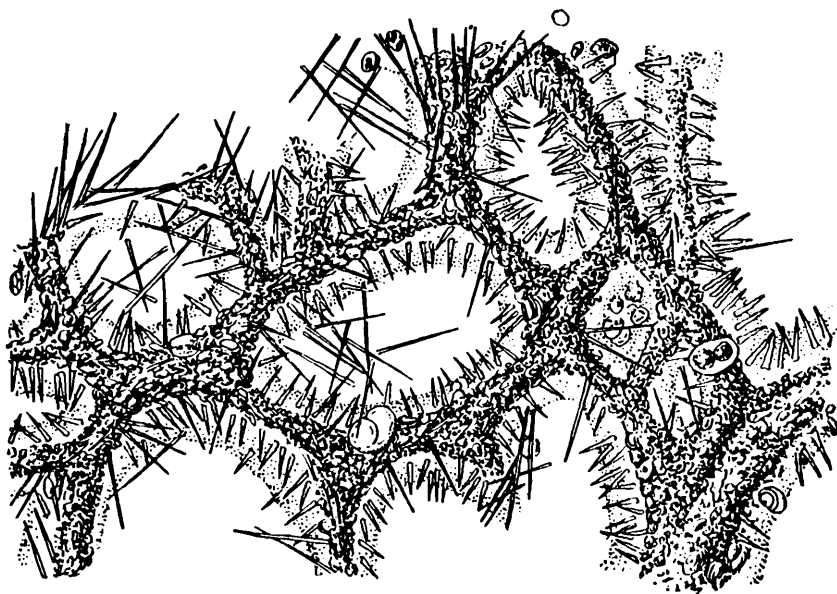
Genotype-*Aulenella foraminifera* sp. nov.

Clathriae in which the body of the sponge is composed of a mass of anastomosing trabeculae; main skeleton an irregular reticulation of spongin fibre, cored by animal or mineral debris and echinated by acanthostyli and basally tuberculate styli; auxiliary spicules slender subtylostyli; special dermal skeleton absent; microscleres palmate isochelae.

***Aulenella foraminifera*, sp. nov.**

(Pl. XVIII, Fig. 11.)

Diagnosis.—Sponge flabello-digitate, formed of a mass of small honey-comb trabeculae; surface minutely hispid; vents few, scattered, 1-1.5 mm. in diameter; colour, in spirit, greyish-yellow; skeleton an irregular reticulation of spongin-fibres cored by a more or less continuous axis of foreign particles, chiefly the tests of Foraminifera, and



TEXT-FIG. 11.—*Aulenella foraminifera*. A portion of the main skeleton ($\times 30.6$).

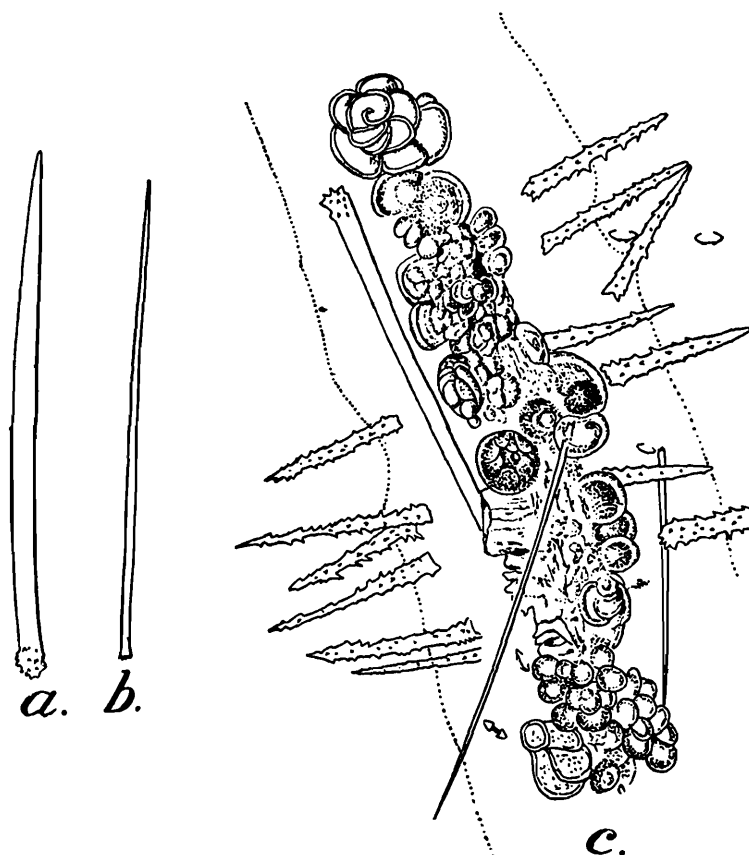
echinated by numerous acanthostyli and by occasional, basally tuberculate tylostyli; auxiliary spicules straight, smooth subtylostyli; special

dermal skeleton absent, though the surface, in places, appears to be echinated by acanthostyli where the fibres are close to the surface.

Holotype.—P 790/1 Zool. Surv. Ind. (*Ind. Mus.*).

Locality.—Gaspar Straits (T. S. Gardiner).

The form and size of the spicules are : (1) basally tuberculate tylostyli, 0.3×0.014 mm. with well-marked globular base covered with rounded tubercles ; only of rare occurrence compared with the acanthostyli, but responsible for the surface hispidation, (2) acanthostyli variable in size up to 0.12×0.012 mm., abundantly echinating the fibres, spined throughout, with a slight concentration of the spines at the base of the spicules, (3) auxiliary subtylostyli, 0.24×0.004 mm. straight, slender, with slightly marked oval head and with the apical end sometimes rounded instead of sharply pointed, (4) chelae of usual *Clathria*-type, 0.016 mm.



TEXT-FIG. 12.—*Aulenella foraminifera*. *a.* echinating style ; *b.* auxiliary subtylostyle ; *c.* one of the skeleton-fibres enlarged to show the axial core, the echinating acanthostyli and basally tuberculate styli, and chelae (all $\times 146$).

The species bears a resemblance in external form to the species of such genera as *Aulena*, *Echinoclathria*, and *Echinochalina*, and suggesting, as a consequence, that this type of external form may have little or no significance from a taxonomic point of view. The shape of the spicules in general recalls the species *Clathria lendenfeldi*, and the presence of foreign debris in the sponge is reminiscent of *Clathria spongodes* Dendy, although in the latter the debris does not constitute a regular core in the axis of the fibre. The species seems to be therefore clearly related to *Clathria*, but since its spicules show a decidedly different arrangement from that obtaining in that genus, it seems best to make it the type of a new genus.

Genus **Hemectyon** Topsent.1920. *Hemectyon*, Topsent, *Bull. Inst. Oceanogr. Monaco*, No. 381, p. 25.**Hemectyon thurstoni** (Dendy).1887. *Raspailia thurstoni*, Dendy, *Ann. Mag. Nat. Hist.*, Ser. 5, XX, p. 161, pl. xii, fig. i.

Raspailia thurstoni and *R. fruticosa* Dendy, from the same locality, bear a strong resemblance to each other and may prove to be merely varieties of a single species. Moreover, there is a striking resemblance between them both and *Hemectyon hamatum* (Schmidt) from the West Indies, the chief difference being the greater length of the dermal styli in Dendy's species.

The acanthostyli in the holotype of *H. thurstoni* measure 0.15 mm. long, not 0.025 mm. as recorded by Dendy.

Localities.—2-3 miles W of Cape Comorin (38 fathoms, Armstrong) ; Pearl Oyster Banks, Tuticorin (H. S. Rao, Feb., 1926).

Genus **Aulospongos** Norman.1878. *Aulospongos*, Norman, *Ann. Mag. Nat. Hist.*, Ser. 5, I, p. 266.**Aulospongos tubulatus** (Bowerbank).1889. *Axinella tubulata*, Dendy, *Ann. Mag. Nat. Hist.*, Ser. 6, III, p. 89, pl. v, fig. ii.1921. *Aulospongos tubulatus*, Dendy, *op. cit.*, p. 61.

There are five specimens in this collection, of which the largest is stipitate and measures 60-65 mm. in diameter. In life, their colour was an orange red, but this is entirely lost in spirit. In the dried condition, however, the original colour is retained, though to some extent faded. The vents are conspicuous among the surface conuli as irregularly stellate openings, 2-3 mm. in diameter, leading into moderately deep cloacae. There are also smaller openings all over the surface, apart from those caused by the worm-tubes characteristically present. One of the smaller specimens has no worm-tubes associated with it, but has instead a number of barnacles embedded in cavities in the sponge tissue.

The dermal membrane is charged with brownish masses composed of an aggregation of the vesicles mentioned by Dendy (1921, p. 62), to which the colour of the sponge is obviously due. The nature of these bodies is still obscure, but they may be some sort of symbiotic organism.

Locality.—Pearl Oyster Banks, Tuticorin (H. S. R., Feb., 1926). Tuticorin Harbour, Shore-collecting (H. S. R., March, 1926).

Genus **Echinodictyum** Ridley.1881. *Echinodictyum*, Ridley, *J. Linn. Soc. London*, XV, p. 493.1887. *Echinodictyum*, Ridley and Dendy, *op. cit.*, p. 164.1921. *Echinodictyum*, Dendy, *op. cit.*, p. 73.**Echinodictyum nervosum** (Lamarck) Ridley.1881. *Echinodictyum nervosum*, Ridley, *op. cit.*, p. 496, pl. xxviii, figs. 7-10.

The single specimen agrees with that described by Ridley (*l. c.*). It is a branching, stipitate sponge, with the branches arranged in several

planes. There is little anastomosis. The surface is rather hirsute, and the colour, in the dried state, pale brown. The oxea measure $0.5-0.7 \times 0.034$ mm., the styli 0.7×0.02 mm., and the acanthostyli 0.11×0.007 mm.

Locality.—Ganjam Coast, Madras Presidency ('Golden Crown' Coll., 24-30 fms., 8-16 March, 1909).

***Echinodictyum asperum* Ridley and Dendy.**

1887. *Echinodictyum asperum*, Ridley and Dendy, *op. cit.*, p. 165, pl. xxxii, fig. 2.

The single specimen resembles the holotype in external form and spiculation, but is only 40 mm. high and 50 mm. broad. The colour is dark brown. The spiculation includes a few long thin styli, also present in the holotype but not mentioned in the original description.

Locality.—Ross I., Andamans..

***Echinodictyum gorgonoides* Dendy.**

1916. *Echinodictyum gorgonoides*, Dendy, *op. cit.*, p. 129, pl. I, fig. 7, pl. IV, fig. 23.

The single specimen, growing on an oyster shell, differs little in external form or spiculation from the holotype. It consists of a thin lamella, 50 mm. long and 40 mm. broad, and bears a number of flattened erect processes varying in height from 5 to 40 mm. two of which are branched. The colour is pale brown.

Spongin is well-developed in this example, and, apparently correlated with this, the spicules are reduced in number and in size. Many of the acanthostyli are faintly spiny. In other respects it agrees with the holotype.

Locality.—Pearl Oyster Banks, Tuticorin (H. S. R. Feb., 1926).

***Dendrocia antyaja**, sp. nov.**

(Pl. XVIII, Fig. 12.)

Diagnosis.—Sponge clathrous, massive, flabello-digitate, composed of a main central, rounded, fan-shaped lobe surrounded by a number of smaller fan-shaped or digitate processes; surface minutely hispid; vents not seen; colour, in spirit, pale brown; skeleton an irregular reticulation of stout spongin fibres, in which primary and secondary fibres may be distinguished; main fibres cored by slender smooth styli and echinated by acanthostyli; secondary fibres often completely aspiculous; occasionally they may bear sparingly-scattered acanthostyli or, in rare cases, tufts of smooth styli, similar to the coring spicules but slightly larger, echinating the nodes of the mesh; smooth styli identical with those coring main fibres rarely occur interstitially; microscleres palmate chelae.

Holotype.—P 791/1 Zool. Surv. Ind. (*Ind. Mus.*).

Locality.—Pearl Oyster Banks, 12 miles off Tuticorin, Gulf of Manaar (H. S. R. Feb., 1926).

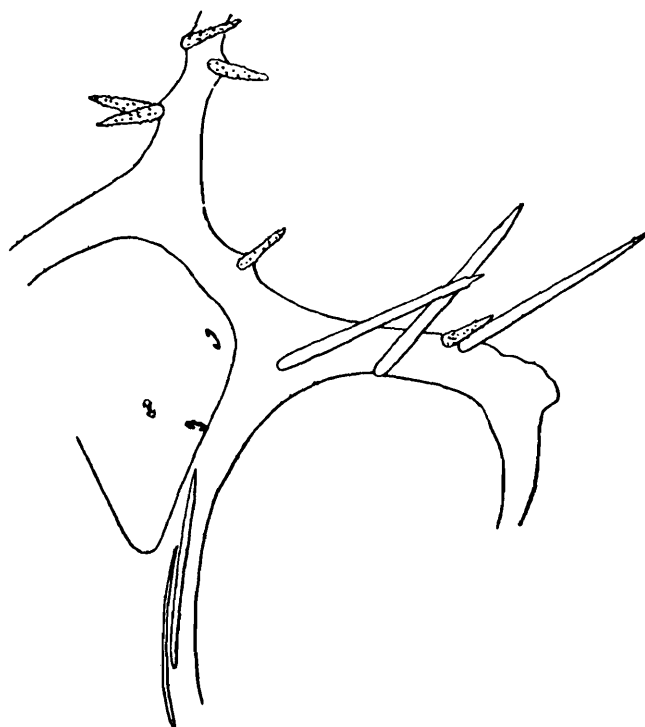
* The specific name is derived from a Sanskrit word which means "last-born" and is associated with a class of people depressed in society due to social upheavals.

The smooth styli coring the main fibres are straight or slightly curved and measure 0.15×0.004 mm. The acanthostyli measure $0.042 \times$



TEXT-FIG. 13.—*Dendrocia antyaja*. skeleton showing the main and the secondary fibres ($\times 23$).

0.006 mm. and are spined throughout their length, the spines being more or less concentrated at both base and apex, sparingly but evenly distributed over the rest of the spicule. The chelae are 0.014 mm. long.



TEXT-FIG. 14.—*Dendrocia antyaja*. one of the main fibres showing the coring spicules, the echinating acanthostyles and smooth styles, and chelae ($\times 110$).

There are two specimens in the collection both of which appear to be devoid of much of the protoplasmic tissues suggesting that they may have been dead long before they were collected. On this account it is always possible that some parts of the spiculation, not enclosed in the horny fibres, may have been lost, and it is to be hoped that better

preserved material may soon be forthcoming. Moreover, the general paucity of the spiculation suggests that these two individuals may be representatives of a species in which, normally, the spiculation is more abundant.

Sub-family HYMEDESMIEAE.

Genus *Hymedesmia* Bowerbank.

1910. *Hymedesmia*, Lundbeck, *Porifera, Danish Ingolf Exped.*, VI, 3, p. 39.

1921. *Hymedesmia*, Dendy, *op. cit.*, p. 81.

1928. *Hymedesmia*, Topsent, *Res. Camp. Sci. Albert Monaco*, LXXIV, p. 258.

Hymedesmia dendyi Burton.

1921. *Hymedesmia radiata*, Dendy, *op. cit.*, p. 84.

1930. *Hymedesmia dendyi*, Burton, *J. Mar. Biol. Ass. Plymouth*, XVI, p. 496.

The species is represented by a small massive incrustation on a shell of *Arca*. Its surface is sparsely hispid and bears a number of small openings varying up to 1.0 mm. in diameter. The texture is soft and compressible, and the dermal membrane is filled with oval granular bodies, brown in colour. These bodies invade the interior of the sponge and give rise to a pseudo-cortical layer between the dermal membrane and the choanosome.

The skeleton of the holotype of this species consists of three elements :—(a) Large smooth tylostyli, 2.0 mm. long, 0.03 mm. thick ; (b) Acanthostyli, entirely and evenly spined, with spines slightly recurved, varying in size from 0.12 to 0.24 mm. ; (c) oxeote tornota, smooth, straight, sharply and gradually pointed, 0.7×0.016 mm. The acanthostyli form an even layer echinating the substratum, the large tylostyli extend upwards from the substratum to project at the surface, and the oxeote tornota are arranged in bundles around the shafts of the large tylostyli at the point where they pierce the ectosome. The types of spicules present, and more particularly their arrangement, suggest that this species may prove to be no more than the immediate post-fixation stage of one of the Indian species of *Raspailia*.

Locality.—2-3 miles W. of C. Comorin, Indian Ocean (38 fms., Armstrong).

Hymedesmia crelloides, sp. nov.

Diagnosis.—Sponge thinly encrusting (on *Cryptotethya agglutinans*), surface smooth, marked by faint branching and anastomosing lines where subdermal canals run immediately beneath the dermis, colour in spirit yellow ; skeleton composed of tornota running in vertical fibres from base to surface of the sponge, and of small acanthostyli, scattered throughout the tissues without apparent order ; tornota strongylote, 0.21×0.0035 mm., acanthostyli slender, 0.09×0.0035 mm. ; microscleres chelae arcuatae 0.017 mm., and sigmata 0.024 mm.

Holotype.—P 792/1 Zool. Surv. Ind. (*Ind. Mus.*).

Locality.—N. side of Fehendu I., Goifurfehendu Atoll, Maldivé group, Arabian Sea.

The general habit of this species is that of a *Hymedesmia*, but the spiculation suggests, to some extent, a *Crella* and were it not for the

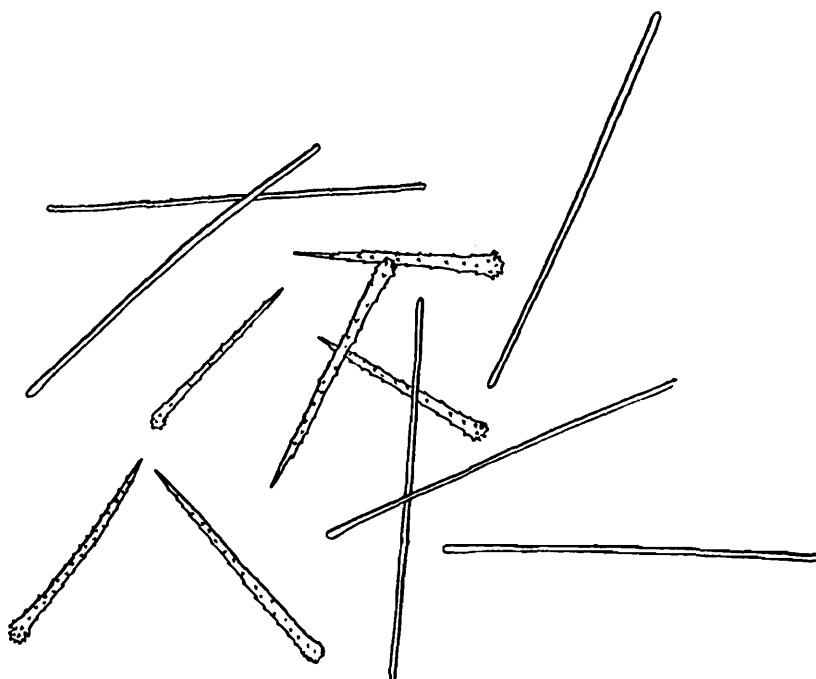


TEXT-FIG. 15.—*Hymedesmia crelloides*. Skeletal elements consisting of tornota, thin acanthostyli, chelae and sigmata (all $\times 146$).

fact that the acanthostyli are scattered throughout the tissues generally and do not form a dermal layer, the species would have been placed in the latter genus without hesitation. The dermis is crowded with isochelae.

***Hymedesmia parvispicula*, sp. nov.**

Diagnosis.—Sponge forming a thin but extensive crust on a fragment of coral ; surface smooth ; pores and oscules not visible ; colour, in spirit, yellow ; skeleton composed of small acanthostyli and slender tornota ; acanthostyli forming a basal layer echinating the substratum, 0.105-



TEXT-FIG. 16.—*Hymedesmia parvispiculata*. Skeletal elements consisting of tornota (strongylote to amphitylote) and acanthostyli (all $\times 146$).

0.130 $\times$ 0.004 mm.; tornota strongylote to amphitylote, usually with ends not equal, 0.21 $\times$ 0.003 mm., scattered sparsely and without order in the upper tissues of the sponge.

Holotype.—P $\frac{793}{1}$ Zool. Surv. Ind. (*Ind. Mus.*).

Locality.—Mergui Archipelago ("Investigator" coll.).

The sponge is about 0.5 mm. thick.

Sub-family ACARNEAE.

Genus *Acarus* Gray.

1867. *Acarus*, Gray, *Proc. Zool. Soc. London*, p. 544.

1884. *Acarus*, Ridley, *Rep. Zool. H. M. S. 'Alert'*, p. 453.

This genus was originally founded on a drawing by Bowerbank, and this is all we have to guide us as to what may constitute the characteristics of the species *A. innominatus*, the genotype. Nevertheless, the spicules figured in this drawing, the cladotyli, are so distinctive that we may accept Gray's genus as valid, at least until such time as we know of two perfectly distinct genera with cladotyli common to both. The species *A. innominatus* is, however, unrecognisable and the holotype, so far as we are aware, non-existent. Carter's *A. innominatus*, from the West Indies has already been made the type of a new species (*vide* Ridley *Rep. Zool. Coll. Voy. H. M. S. 'Alert'* 1884, p. 454, footnote), *A. carteri*. In the Australasian area, for example, there are two quite distinct species of *Acarus*, *A. tenuis* Dendy and *A. ternatus* Ridley, both possessing smooth cladotyli and styli for megascleres, and the spicules figured by Bowerbank and used by Gray to represent *A. innominatus* might equally well have belonged to a representative of either of these two species.

Acarus ternatus Ridley.

1884. *Acarus ternatus*, Ridley, *op. cit.*, p. 453, pl. xlii, fig. b.

1889. *Acarus wolfgangi*, Keller, *Zeitschr. wiss. Zool.*, XLVIII, p. 399, pl. xxiv, fig. 53.

1905. *Acarus ternatus*, Dendy, *op. cit.*, p. 177, pl. viii, fig. 4.

The four specimens present in the collection agree closely in spiculation with the holotypes of *A. ternatus* and *A. wolfgangi* in all respects but the size of the chelae. Three of them are encrusting, and the fourth is massive and almost identical in external form with the holotype of *A. ternatus*. With regard to the chelae, there is no reason why their small size, 0.011 mm., should render the erection of a new species necessary since those of Ridley's specimen measure 0.024 mm., those of Dendy's specimen, 0.02 mm., and those of *A. wolfgangi*, 0.016 mm. It is evident, therefore, in view of the similarity between these various specimens in all other respects, that we are dealing with a species characterized by chelae of variable size.

Locality.—Galle, Ceylon.

Genus *Iotrochota* Ridley.

1884. *Iotrochota*, Ridley, *Rep. Zool. Coll. H. M. S. 'Alert'*, p. 433.

***Iotrochota baculifera* Ridley.**

1884. *Iotrochota baculifera*, Ridley, *op. cit.*, p. 435, pl. xxxix, fig. M, pl. xlii, fig. f.
 1905. *Iotrochota baculifera*, Dendy, *Rep. Ceylon Pearl Oyster Fish.*, p. 165.

A single small, flabellate specimen growing on a shell of *Pinna nigra* is present. Its colour, in life, was black, but in spirit it is a deep crimson red, and in this respect it resembles the holotype. The dimensions of the spicules are as follows:—strongyla, 0.19-0.23 × 0.003 mm.; styli, 0.14-0.16 × 0.003-0.005 mm.; birotulae, 0.011-0.015 mm. long. Short stout strongyla, measuring 0.08 × 0.007 mm., occasionally occur.

Locality.—(Mar. Surv. Sta. 629.) N. W side of Spiteful Bay near Leader Pt., Nicobars (Nov. 7, 1922).

Sub-family TEDANIEAE.

***Tedania nigrescens* (Schmidt).**

1862. *Renicra nigrescens*, Schmidt, *Spong. des. Adriat. Meeres*, p. 74.
 1862. *Reniera digitata*, *id.*, *ibid.*, p. 75, pl. vii, fig. 11.
 1864. *Reniera ambigua*, Schmidt, *Suppl. Spongien d. Adriat. Meeres*, p. 39, pl. iv, fig. 8.
 1867. *Tedania digitata*, Gray, *Proc. Zool. Soc. London*, p. 520.
 1867. *Tedania ambigua*, *id.*, *ibid.*, p. 520.
 1868. *Reniera muggiana*, Schmidt, *Spong. der Küste Alger*, p. 28.
 1884. *Tedania digitata*, Ridley, *Rep. Zool. Coll. H. M. S. "Alert"*, p. 417.
 1886. *Tedania digitata*, Carter, *Ann. Mag. Nat. Hist.*, Ser. 5, XVII, p. 52.
 1887. *Tedania digitata*, Ridley and Dendy, *op. cit.*, p. 51, pl. ix, fig. 3.
 1887. *Tedania digitata* var. *fibrosa*, *id.*, *ibid.*, p. 51.
 Tedania digitata var. *bermudensis*, *id.*, *ibid.*, p. 51.
 1887. *Tedania nigrescens*, Vosmaer, *Spongien in Bronn's Klassen und Ordnung*, p. 338.
 1887. *Tedania digitata*, Dendy, *Ann. Mag. Nat. Hist.*, Ser. 5, XX, p. 157.
 1888. *Tedania rubicunda*, Lendenfeld, *Catalog. Austr. Mus. Sydney*, p. 190.
 Tedania rubra, *id.*, *ibid.*, p. 191.
 1891. *Tedania chevreuxi*, Topsent, *Mem. Soc. Zool. France*, IV, p. 3, pl. ii, figs. 1, 2.
 1891. *Tedania assabensis*, Keller, *Zeit. Wiss. Zool.*, LII, p. 313, pl. xvi, figs. 11, 12.
 1894. *Tedania fragilis*, Lambe, *Trans. Roy. Soc. Canada*, p. 116, pl. ii, fig. 3.
 1894. *Tedania brucei*, Wilson, *Journ. Morph.*, IX, p. 320, pls. xix, xx.
 1895. *Tedania digitata*, Dendy, *Proc. Roy. Soc. Victoria*, VII, p. 258.
 1897. *Tedania digitata*, Lindgren, *Zool. Anz.*, XX, p. 481.
 1897. *Tedania digitata* var. *vulcani*, Lendenfeld, *Abh. Senck. Natur. Ges.*, XXI, p. 112, pl. x, figs. 117-119.
 1898. *Tedania digitata*, Lindgren, *Zool. Jahrb.*, XX, p. 17, pl. xix, fig. 10.
 1902. *Tedania digitata*, Wilson, *Bull. U. S. Fish. Comm.*, II, p. 395.
 1906. *Tedania digitata* var. *sansibarensis*, Baer, *Arch. Naturges.*, I, p. 17, pl. i, fig. 2.
 1907. *Tedania ignis*, Verrill, *Newhaven Conn. Trans. Acad. Arts Sci.*, XII, p. 339.
 1911. *Tedania assabensis*, Row, *Journ. Linn. Soc. London*, XXXI, p. 353.
 1911. *Tedania digitata*, Hentschel, *op. cit.*, p. 332.
 Tedania digitata var. *inermis*, *id.*, *op. cit.*, p. 333.
 Tedania digitata var. *polytyla*, *id.*, *op. cit.*, p. 333.
 Tedania rubicunda, *id.*, *op. cit.*, p. 334.
 1912. *Tedania digitata*, Hentschel, *Abh. Senckenb. Naturf. Ges.*, XXXIV, p. 348.

Examination of a large number of specimens in the British and the Indian Museum collections has shown that *Tedania nigrescens* is a very variable species. It is essentially polymorphic in form. Its spicules

are variable in size and in the manner in which they are disposed in the skeleton: the main skeleton may be isodictyal, sub-isodictyal or irregularly confused, and the tornota may be disposed in brushes at the surface, irregularly scattered in the dermis, or forming a tolerably uniform tangential layer. The ends of the tornota may be strongylote or tylote and smooth, or strongylote or tylote and spined, and the spines may be few in number forming a crown, or may be numerous and besetting a fairly wide area of the end of the spicule. In this connection it appears that in one specimen all these forms may be present, as in the type of the species, or one or more forms may predominate. The usual form is that bearing oval heads with a crown of a few spines. Polytyloty is comparatively rare and, when it occurs, may affect all the three types of spicules.

The onychaeta may or may not bear a slight swelling near one end, and we regard this feature as of no systematic importance at all. So far as we can see, it is impossible to correlate any of the variations of the spicules with external form, or with ecological or geographical distribution.

In view of the variability of the species, it seems unnecessary to make use of the many varietal names which have been proposed, especially as the majority of them are based on very minor details of spicule-size or external form.

The specimens in the present collection exhibit most of the variations noted above, and range in form from flattened crusts with numerous large oscula, to massive forms with tubular or digitate outgrowths, and large irregularly massive specimens (the *T. chevreuxi*-type). *T. assabensis*, according to the specimens of Keller, Row, and Burton, shows much the same variations in form, and all the variations in spicule form and size noted above.

Localities.—Marble Rock, Mergui Archip.; Jack and Una Is., Mergui Archip.; Cinque I., Andamans; Aden (R. B. S. Sewell, 1st February 1916); 'Ain Musa, Gulf of Suez (R. B. S. Sewell); (Mar. Surv. Sta. 657) N. side of East end of Macpherson straits, near Chiriyatapu, Andamans (Jan. 20, 1924). Pamban bridge, Gulf of Manaar (B. N. C. & H. S. R., Feb., 1925); Cone I., surf rocks (13° 47' N. 98° 33' E., 4th February 1886).

Genus **Histoderma** Carter.

1910. *Histoderma*, Lundbeck, *op. cit.*, p. 7.

Histoderma fucoides Topsent.

1897. *Histoderma verrucosum*, Carter var. *fucoides*, Topsent, *Rev. Suisse Zool.*, IV, p. 452.

The single specimen consists of an irregular mass, 80 mm. long, 50 mm. broad, and 30 mm. high, bearing a number of fistulae. It agrees very closely with Topsent's specimen from Amboina except that the chelae vary between 0.003 and 0.007 mm. instead of between .016 and .04 mm. as in the holotype.

Locality.—Off C. Negrais, Burma (M. S. Sta. 387), 40-49 fathoms.

Sub-family PLOCAMIEAE.

Genus **Plocamia** Schmidt.

1870. *Plocamia*, Schmidt, *Spong. Atlantisch. Gebietes*, p. 62, pl. iv, figs. 17-18.
 1881. *Dirrhopalium*, Ridley, *J. Linn. Soc.*, XV, p. 476, pls. xxviii, xxix.

Topsent (1928. *Res. Camp. Sci. Albert Monaco*, LXXIV, pp. 303-309) has made many useful suggestions concerning the Plocamiae as a whole.

Plocamia manaarensis (Carter).

1880. *Dictyocylindrus manaarensis*, Carter, *Ann. Mag. Nat. Hist.* VI, p. 37, pl. iv, fig. 1.
 1881. *Dirrhopalium novizealanicum*, *D. manaarensis*, Ridley, *op. cit.*, pp. 482-483.
 1904. *Heteroclathria hallezi*, Topsent, *Arch. Zool. Exp. Gen.*, II, *Notes et Revue*, 6, pp. xciii-xcviii.

The various specimens are profusely branched. Their colour, in spirit, is a pale gray. In spiculation they agree closely with the specimens described by Carter from the Gulf of Manaar and by Ridley from New Zealand. Moreover, there is no obvious reason why *Heteroclathria hallezi*, from an unknown locality, should not be regarded as identical with Carter's species.

Locality.—Laccadive sea, 13° 19' N., 74° 26' E, 22 fms., 16th Nov., 1900; off Mangalore, W. coast of India; 21 miles S. W by W. of Mangalore, 31 fms. (4th May 1888); off Karwar, 14° 37' N, 73° 49' E, 29 fms. (Carpenter Oct. 1885).

Sub-family CYAMONEAE.

Genus **Cyamon** Gray.

1867. *Cyamon*, Gray, *Proc. Zool. Soc. London*, p. 546.
 1921. *Cyamon*, Dendy, *op. cit.*, p. 107.

Cyamon vickersii (Bowerbank).

1879. *Dictyocylindrus vickersii*, Carter, *Ann. Mag. Nat. Hist.*, Ser. 5, III, p. 292, pl. xxvii, figs. 5-8.
 1921. *Cyamon vickersii*, Dendy, *op. cit.*, p. 108. pl. xvi, fig. 5.

The single representative is a portion of a dull brown, spherical mass. It agrees with the specimen described by Dendy (*l. c.*) except that the longest ray of the pseudactines bears a few recurved rays on the shaft and a crown of spines at the apex; the basal rays of these spicules have spines at the apex only; and the styli are very scarce.

Locality.—21 miles S. W W of Mangalore, S. India (4th May 1888).

INCERTAE SEDIS.

Genus **Agelas** Duchassaing and Michelotti.

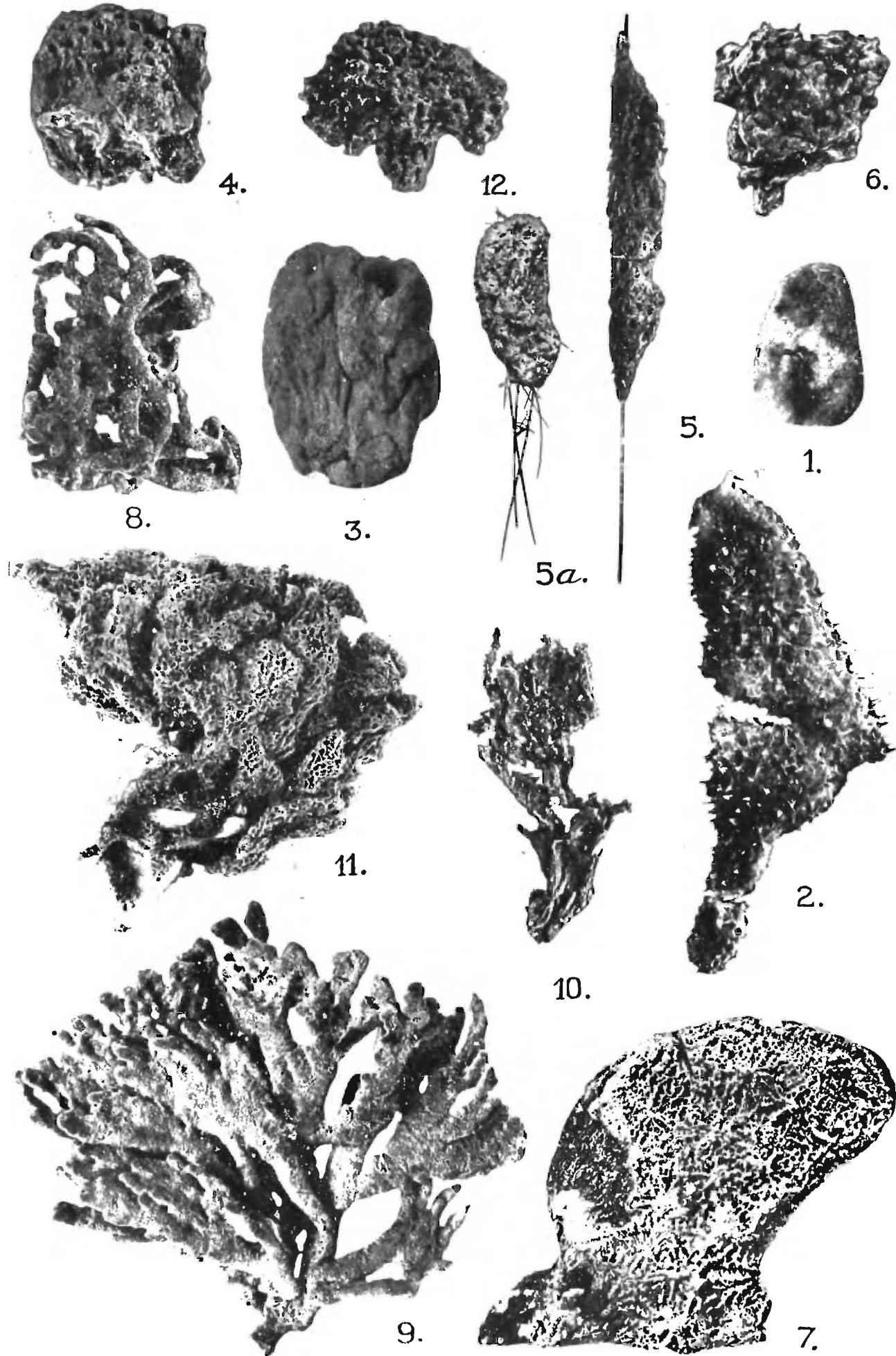
1864. *Agelas*, Duchassaing and Michelotti, *Naturk. Verh. Hollands. Wetensch. Haarlem*, XXI, p. 76.
 1867. *Ectyon*, Gray, *Proc. Zool. Soc. London*, p. 515.

Although the original specimens of the various species assigned by Duchassaing and Michelotti to this genus are known to be irretrievably

lost, there is no need to abandon the use of the name *Agelas*. In the British Museum collection there is a specimen so like that figured by these authors for *A. dispar* that there seems to be little doubt that the two represent the same species. It is accordingly proposed to regard this specimen in the British Museum as the *neotype* of the species *A. dispar* and to regard that species as the genotype of the genus *Agelas*.

EXPLANATION OF PLATE XVIII.

- FIG. 1.—*Pericharax canaliculata*, sp. nov. Holotype, $\times 4$.
- FIG. 2.—*Sycon grantioides* Dendy. Pedro shoal ("Investigator"), $\times 7$.
- FIG. 3.—*Aurora rowi* Dendy. Ganjam coast ("Golden Crown"), $\times 1/6$.
- FIG. 4.—*Biemna tubulata* (Dendy). Mar. Surv. sta. 667, $\times 3/5$.
- FIG. 5.—*Kirkpatrickia spiculophila*, sp. nov. Holotype, Natural size.
- FIG. 5a.—*Kirkpatrickia spiculophila*, sp. nov. Cotype, Natural size.
- FIG. 6.—*Ectyobatzella enigmatica*, sp. nov. Holotype, Natural size.
- FIG. 7.—*Psammochela elegans* Dendy. Table I., Mergui Archipl, $\times 3/5$.
- FIG. 8.—*Clathria indica* Dendy. 2-3 miles S. W. of Cape Comorin, $\times 3/5$.
- FIG. 9.—*Clathria indica* Dendy. Pearl oyster banks, Tuticorin, $\times 3/5$.
- FIG. 10.—*Protoraspailia cactoides*, Gen. et sp. nov. Holotype. Natural size.
- FIG. 11.—*Aulenella foraminifera*, Gen. et sp. nov. Holotype, Natural size.
- FIG. 12.—*Dendrocia antyaja*, sp. nov. Holotype, Natural size.



S. Mondul, Photo.