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Annelida Polychaeta of Tambalagam Lake, Ceylon

by

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(With twelve text figures)

Although the biology of the Windowpane Oyster (*Placuna placenta*) of Tambalagam Lake has received much attention in the past, very little is known of the other fauna of the lake. The present report deals with the polychaete worms collected during a survey of the oyster beds of the lake in November 1959. The collection contains twenty species, of which thirteen, including a nereid genus, are new to science and four are new to the fauna of Ceylon.

Tambalagam Lake is a brackish-water lake which is subject to tidal movements from the sea and the influx of fresh water from rivers. It is approximately seven square miles in area and situated south-west of Trincomalee Harbour and West of Koddiiyar Bay. Both Tambalagam Lake and Trincomalee Harbour open into Koddiiyar Bay. The opening of Koddiiyar Bay into the sea is about three miles wide. The opening of Tambalagam Lake into the bay is about a quarter of a mile wide. Several rivers flow into the lake and the bay, including the major river, Mahaveli Ganga into the latter. The average, highest and lowest salinities of the lake during the period of the survey were 13.0, 19.0 and 11.0 p.p.t., respectively. The average depth of the lake is one fathom and the greatest depth, which is near the opening into the bay, is four fathoms. The bottom is sandy in the peripheral areas but consists of fine black mud in the greater part of the central area. Near the opening into the bay it consists of coarse sand and shell fragments.

List of species :

- | | |
|------------|---|
| Nereidac | <i>Tambalagamia fauveli</i> , gen. et sp. nov.
<i>Perinereis nuntia</i> (Sav.) var. <i>vallata</i> Grube |
| Glyceridac | <i>Glycera rouxii</i> Audouin and M. Edwards |
| Eunicidac | <i>Eunice savignyi</i> Grube
<i>Marphysa sanguinea</i> (Montagu)
<i>Marphysa borradalei</i> T. G. Pillai
<i>Diopatra neapolitana</i> Delle Chiaje
<i>Lumbrineris pseudopolydesma</i> , sp. nov.
<i>Lumbrineris emandibulata</i> , sp. nov. |
| Orbiniidac | <i>Scoloplos (Scoloplos) marsupialis</i> Southern
<i>Scoloplos (Leodamus) gracilis</i> , sp. nov. |

Spionidae	<i>Laonice brevicristata</i> , sp. nov.
Opheliidae	<i>Animotrypane grandis</i> , sp. nov.
Capitellidae	<i>Heteromastides platyproctus</i> , sp. nov. <i>Notomastus ceylonicus</i> , sp. nov. <i>Heteromastus deductus</i> , sp. nov.
Maldanidae	<i>Axiiothella tambalagamensis</i> , sp. nov.
Terebellidae	<i>Loimia decora</i> , sp. nov.
Sabellidae	<i>Potamilla brevithoracica</i> , sp. nov.
Serpulidae	<i>Hydroides tambalagamensis</i> , sp. nov.

Perinereis nuntia var. *vallata*, *Glycera rouxii*, *Marphysa sanguinea* and *Scoloplos marsupialis* are new records from Ceylon.

The type specimens of the species new to science have been deposited in the British Museum (Natural History).

Family **NEREIDAE** Johnston 1865

Genus **TAMBALAGAMIA** gen. nov.

Dorsal cirri of the anterior region and ventral cirri throughout the body double. Prostomium indented in front, palps and tentacles tapering, two pairs of eyes. Branchiae present, each as a simple vascular modification of the region below the dorsal cirrus and with or without a ventral fin. Dorsal body wall of each branchiferous segment produced into a vascular flap. Setae all homogomph spinigers.

Dendronereis Peters (1854) and *Dendronereides* Southern (1921) are similar to the present genus in the following respects: Branchiae are present, each as a modification of the region below the dorsal cirrus. The proboscis lacks hard paragnaths. It bears the usual pair of hard jaws and either lacks any other armature or is armed with only soft papillae. Setae are all homogomph. Some of them are spinigers with long serrations along one side of their terminal portions. These genera are also typically brackish water forms. These similarities at once suggest a close natural relationship among them and the suitability of grouping them together under a separate sub-family. The name *Dendronereinae*, taking *Dendronereis* Peters as the type, is proposed for this new sub-family.

The three branchiferous nereid genera differ amongst themselves in important respects. Both *Dendronereis* and *Dendronereides* possess normal dorsal and ventral cirri. The double nature of the dorsal and ventral cirri in *Tambalagamia*, gen. nov., is an aberrant character. In *Dendronereis* each gill consists essentially of a pinnately branched modification of the region below the dorsal cirrus, the latter remaining unchanged at the tip of the gill. In *Dendronereides* too, as pointed out by Southern (1921), each gill is a modification of the

region below the dorsal cirrus, but consists essentially of a bunch of filaments between the dorsal cirrus and the dorsal ligule. The ventral ligule of the foot is present in *Tambalagamia* and *Dendronereis* but absent in *Dendronereides*. Homogomph falcates are present together with homogomph spinigers in *Dendronereides*, while only homogomph spinigers are present in the other two genera. Furthermore, in *Dendronereides* there is a peculiar gland opening to the exterior at the base of each dorsal cirrus, except a few anterior ones. Such glands are absent in the other two genera.

Southern (1921) could not see blood vessels in the gills of *Dendronereides* and considered this an important character to differentiate it from *Dendronereis*. Fauvel (1932), however, observed blood vessels in some of the gill filaments of *Dendronereides* and stated that Southern had not seen them probably because the empty blood vessels were not noticeable in the contracted gills. Fauvel's (1932, p. 86) generic definition of *Dendronereides* includes "Setae of two kinds, falcate homogomphs and spinose heterogomphs". His description of *D. heteropoda* (1932, p. 87), however, includes "Homogomph spinigerous setae and homogomph falcate setae with smooth terminal piece," which is the condition obtaining in the genus.

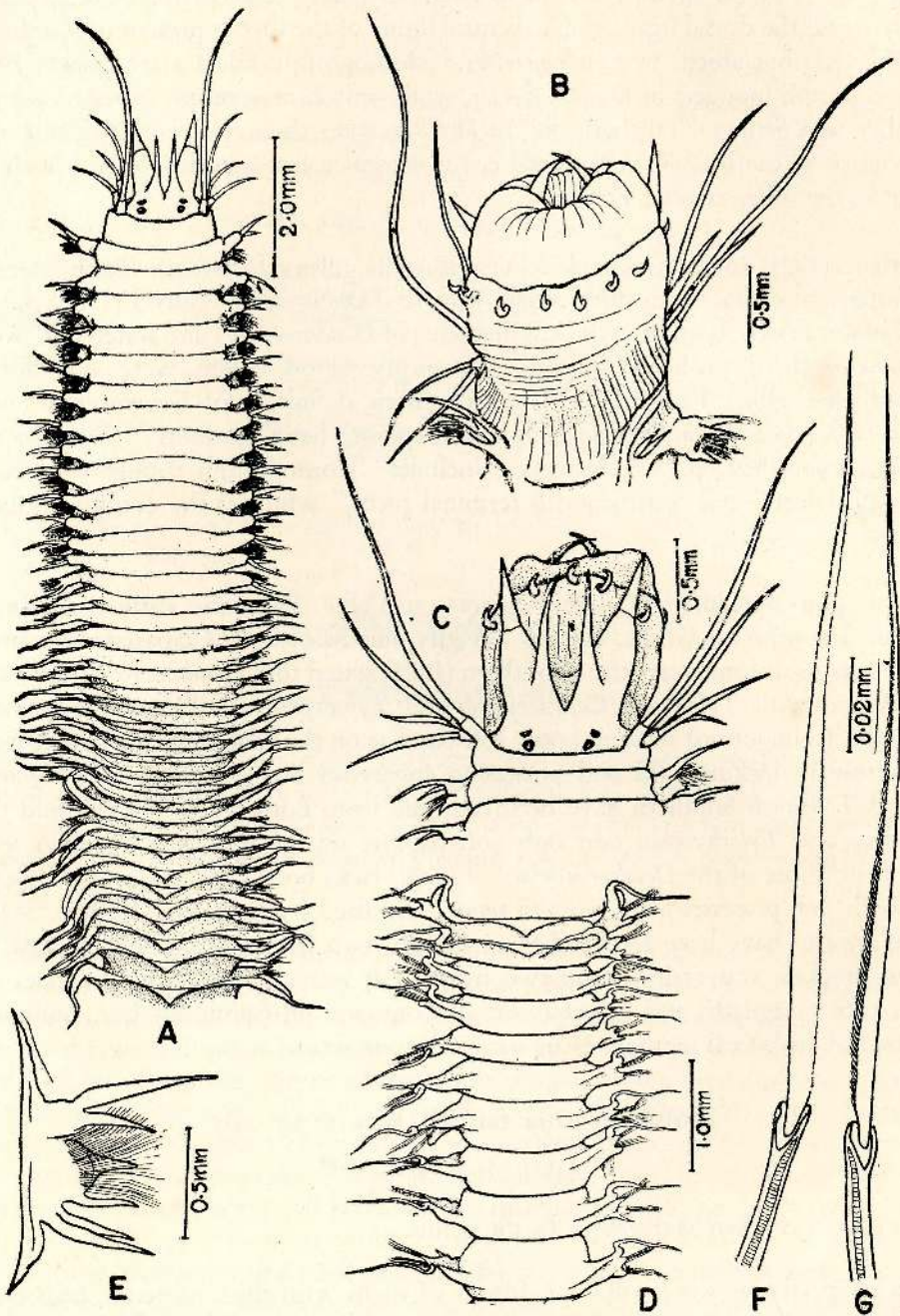
A few non-branchiferous nereid genera, namely, *Tylonereis* Fauvel, *Ceratocephala* Malmgren, *Tylorhynchus* Grube, *Lycastis* Savigny and *Micronereis* Claparède are similar to the present genus in some respects. Southern (1921) stated that *Dendronereides* shows rather distant affinities with *Tylonereis*, *Ceratocephala* and *Tylorhynchus*. *Tylonereis* possesses only homogomph (spinigerous) setae and only soft papillae on the proboscis, but differs from the *Dendronereinae* in lacking gills and possessing foliaceous dorsal ligules. *T. bogawlenskyi* Fauvel and *T. fauveli* Southern have been recorded from both brackish water and the sea. *Ceratocephala* and *Tylorhynchus* bear only soft papillae on the proboscis but their setae are different from those of the *Dendronereinae*. *Lycastis* lacks both hard and soft paragnaths on the proboscis, but possesses heterogomph setae. As listed by Southern (1921, p. 581), two species of *Lycastis* have been recorded from the sea, two from the sea and brackish water, two from brackish water alone, and two from fresh water. *Micronereis* possesses neither hard nor soft paragnaths and its setae are all homogomph (spinigers) but, unlike in the *Dendronereinae*, its buccal segment bears parapodia and setae.

***Tambalagamia fauveli*, gen. et sp. nov.**

(Fig. 1, A—G; Fig. 2, A—F)

This species is taken as the type for the genus.

Sixteen specimens were collected, fifteen of them with their posterior ends damaged or missing and one with its anterior end missing. The largest of the former is 54.0mm long and possesses 105 setigerous segments while the latter is 55.0mm long and possesses 110 setigerous segments. The maximum width of all the specimens is about 2.0mm in the pre-branchial and branchial regions. The body narrows to about 1.0mm posteriorly.



TEXT-FIGURE 1.—*Tambalagamia fauveli*, gen. et sp. nov., A—G. A, Dorsal view of anterior portion of worm; B, Ventral view of proboscis; C, Dorsal view of prostomium and proboscis; D, Dorsal view of 66th—75th scitigerous segments; E, Anterior view of first left foot; F, Homogomph spiniger from first foot; G, Homogomph spiniger with long serrations along one edge, from the first foot.

The prostomium (Fig. 1, A. & C) is deeply indented anteriorly and bears two pairs of eyes. The palps are two jointed, the distal joint tapering. The pair of tapering tentacles is situated dorsal to the palps. The longest tentacular cirrus, when bent backwards, reaches the sixth setigerous segment.

The proboscis (Fig. 1, B & C) possesses a pair of maxillae and only soft hooks. The maxillae are light brown in colour and transparent. The maxillary ring is devoid of any other armature. The oral ring has a dorsal row of 5 soft hooks, the 3 more medially situated hooks being somewhat closer together than the hooks on either side of them. The ring is completed ventrally by a row of 7 similar hooks which are approximately equidistant from one another.

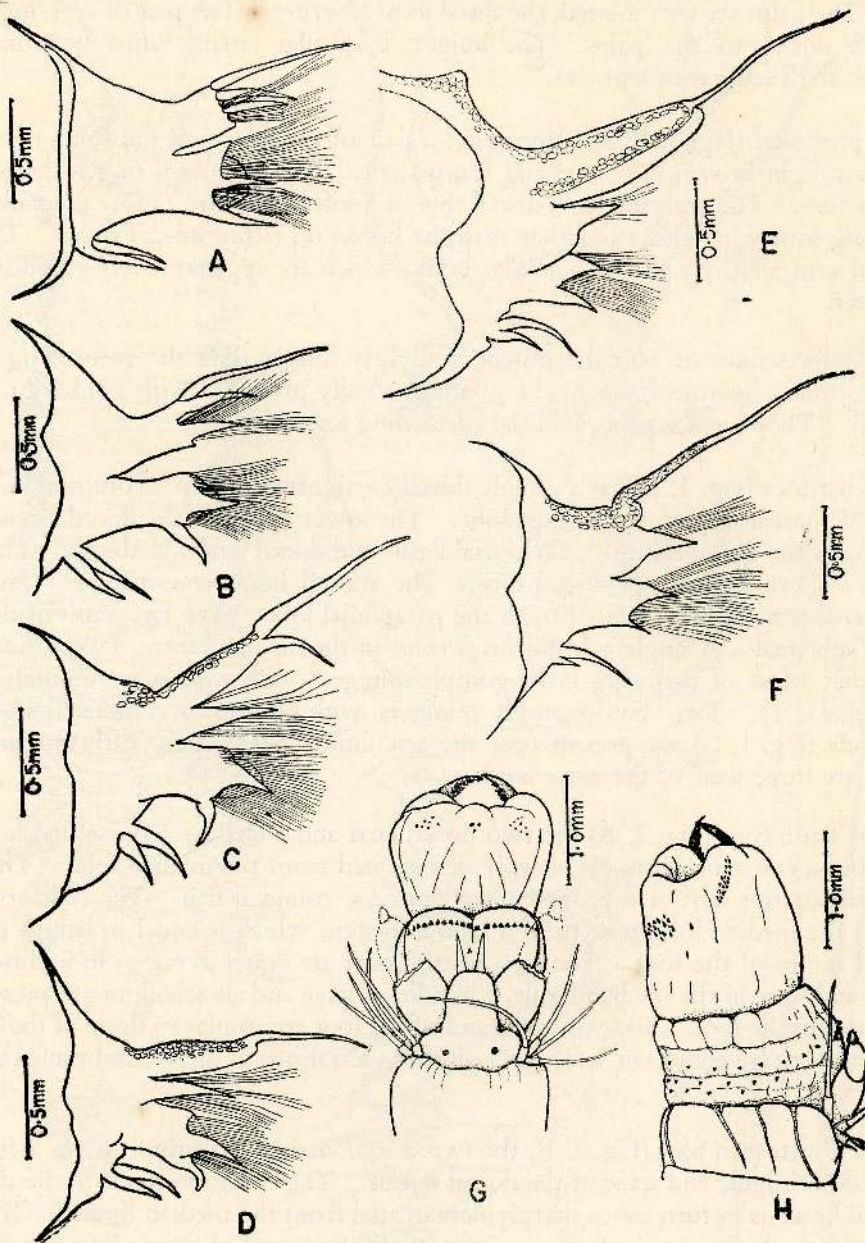
The peristomium or buccal segment is slightly longer than the succeeding segment. The first dozen setigerous segments or so are profusely provided with golden brown setae (Fig. 1, A). They are less profuse in the succeeding segments.

The first foot (Fig. 1, E) has a double dorsal cirrus arising from a common stem which is sharply demarcated from the median lobe. The lower ramus of the dorsal cirrus is about half as long as the dorsal ramus. The dorsal ligule and dorsal setae are absent. The median ligule has a short, tapering post-setal lobe. The ventral ligule is cirriform. The double ventral cirrus is somewhat isolated from the parapodial lobe. The two rami of the ventral cirrus are subequal. A single aciculum is present in the median lobe. Two kinds of setae are present. Most of them are homogomph spinigers with tapering, minutely serrated blades (Fig. 1, F). Two homogomph spinigers with plumose serrations along one side of the blade (Fig. 1, G) are present near the aciculum. Setae of the fifth foot are similar, but there are three setae of the latter kind.

In the tenth foot (Fig. 2, A) the two dorsal cirri and a cirriform dorsal ligule, all three arising from a common stem, are sharply demarcated from the median lobe. The median lobe has an anterior cirriform process and a posterior rounded flap. The cirriform ventral ligule and the median lobe arise from a common stem which is equal in length to that of the dorsal ramus of the foot. The two ventral cirri are equal in size. In addition to the aciculum and setae in the median ligule, a bundle of setae and an aciculum are present in the dorsal ramus of the foot. Setae of both rami of the foot are similar to those of the first foot, except that there are about ten setae with plumose serrations in the ventral ramus and none in the dorsal.

In the fourteenth foot (Fig. 2, B) the two dorsal cirri, on a common stem, are separated from the dorsal ligule and setae of the dorsal ramus. The common stem of the dorsal cirri and dorsal ligule is in turn more sharply demarcated from the median ligule. Of the two ventral cirri the lower one is shorter. Setae of this foot, and of succeeding feet are similar to those of the anterior feet, except that there is only one seta with a plumosely serrated blade.

The common stem of the two dorsal cirri of the fifteenth foot (Fig. 2, C) is elongated, swollen, vascular and functions as a gill. There is a single channel for the circulation of



TEXT-FIGURE 2.—*Tambalagamia fauveli*, gen. et sp. nov., A—F. A, Anterior view of 10th left foot; B, Anterior view of 14th left foot; C, Anterior view of 15th left foot; D, Anterior view of 16th left foot; E, Anterior view of 40th left foot; F, Anterior view of 70th left foot. *Periwereis muntia* (Sav.) var. *vallata* Grube, G—H. G, Dorsal view of prostomium and proboscis; H, Left lateral view of proboscis.

blood. The clotted blood is visible through the gill wall. The two dorsal cirri are situated at the tip of the gill. This is the beginning of the branchial region. The common stem of the gill and the dorsal ligule is shorter than in the fourteenth foot. The ventral cirri are shorter and subequal.

From the 16th foot (Fig. 2, D) backwards the ventral ramus of the dorsal cirrus is absent and the demarcation between the dorsal and ventral rami of the foot is less pronounced. The gills of the 16th foot, and of the few succeeding feet are similar to that of the 15th foot in being somewhat cylindrical and possessing a single channel for the circulation of blood. From about the 28th-33rd feet till the 60th-80th feet the gills are flattened. They are provided with a thin, membranous ventral fin and a double channel for the circulation of blood (Fig. 2, E). The dorsal body wall of each segment in the gill region is thrown into a triangular, vascular flap which overlaps the succeeding segment (Fig. 1, A). The branchial region ceases by about the 60th-80th feet but a few succeeding dorsal cirri are provided with a vascular supply within their bases. A single dorsal cirrus is present in each branchial and post branchial foot. The dorsal cirri of the post branchial segments have a characteristic upward and outward curvature and faint rounded swellings in the positions originally occupied by the ventral rami (Fig. 2, F). In all the specimens in the collection gills commence on the 15th foot and the ventral ramus of the dorsal cirrus is absent from the 15th or 16th foot.

The anal aperture is situated posteriorly at the centre of the anal segment. No anal cirri are present, but it cannot be said with certainty whether this is the natural condition or whether they had dropped off.

The worms live in the fine black mud which collects between the halves of dead window-pane oyster shells or between adjoining shells. When one half of a mud filled shell is removed, ramifying burrows are seen in a plane parallel to the shell and, usually, a single worm is present within the system of burrows. The burrows do not possess any special lining but are yellowish brown in colour and open to the outside on the outer margin of the mass of mud between the shells. Examination of the live worms with a powerful hand lens showed three bright red longitudinal bands corresponding to the row of median vascular flaps and the gills on either side of it. The gills were in constant motion from before backwards. The fin-like expansions of the gills undoubtedly serve the purpose of effectively wafting water through the burrows and over the body of the worm for respiration.

Holotype B.M.(N.H.), Reg. No. 1960. 3. 13. 1.

Paratypes B.M.(N.H.), Reg. Nos. 1960. 3. 13. 2 to 5.

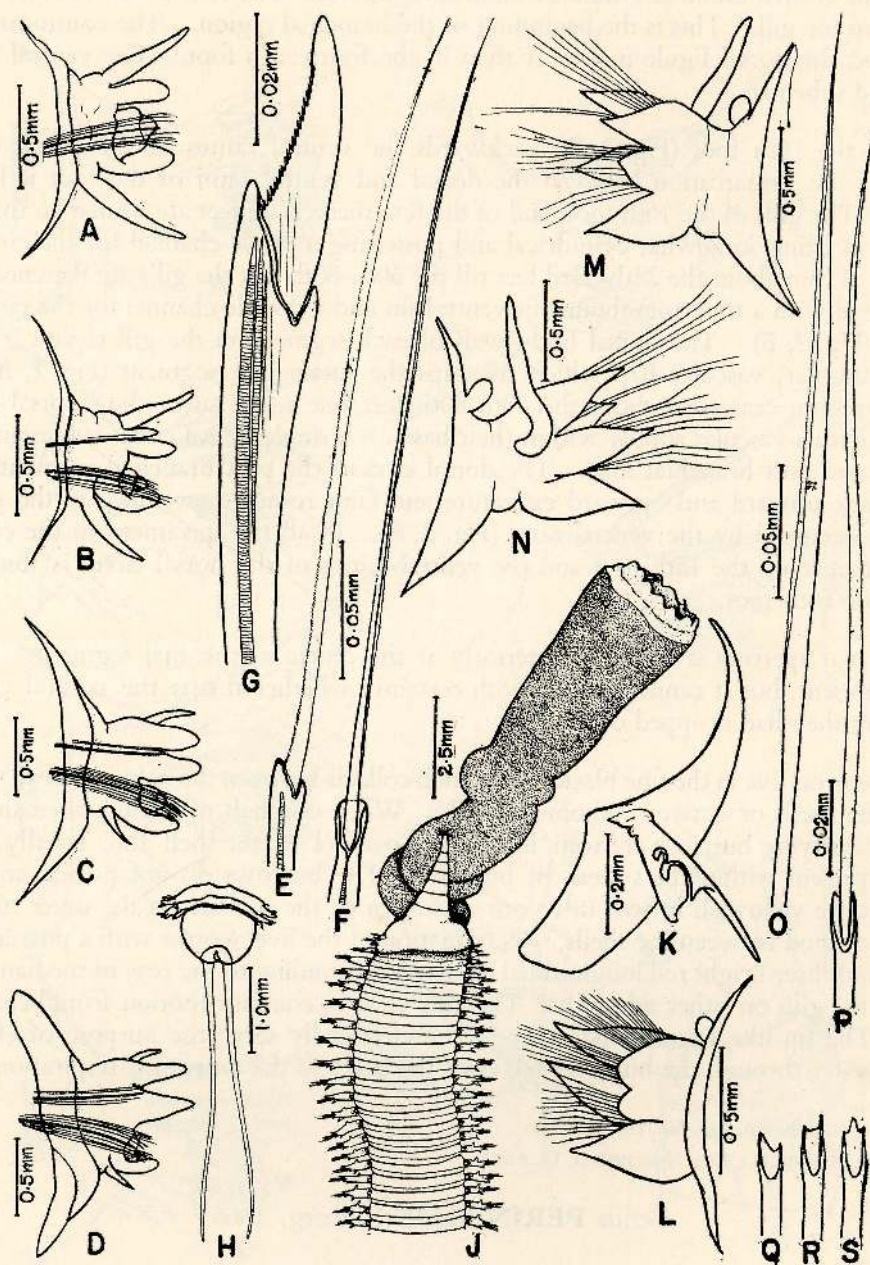
Genus **PERINEREIS** Kinberg, 1866

Perinereis nuntia (Savigny) var. **vallata** Grube

(Fig. 2, G—H ; Fig. 3, A—H)

Perinereis nuntia (Savigny) var. *vallata* Grube, Fauvel 1932, p. 110.

Perinereis nuntia (Savigny) var. *vallata* Grube, Aziz 1938, p. 28.



TEXT-FIGURE 3.—*Perinereis nuntia* (Sav.) var. *vallata* Grube, A—H. A, Anterior view of first left foot; B, Anterior view of third left foot; C, Anterior view of 10th left foot; D, Anterior view of 25th left foot; E & F, Homogomph spinigers; G, Heterogomph falciger; H, Anal segment. *Glycera rouxii* Audouin and Milne Edwards, J—S. J, Dorsal view of anterior end, with everted proboscis; K, A jaw from the proboscis; L, Posterior view of 10th left foot; M, Posterior view of an extreme posterior left foot; N, Anterior view of an extreme posterior left foot; O, Dorsal seta; P, Ventral seta; Q—S, Variations of the articular joints of the ventral setae.

Five specimens were dug up from the sand at the low-tide mark at Kappalturai and Kodimaraththadi. The largest specimen is 80.0mm long, 3.25mm wide and possesses 122 setigerous segments, the last three or so being smaller and newly formed.

The prostomium is shaped like a broad inverted T and the two tentacles arise from its anterior end (Fig. 2, G). The proboscis (Fig. 2, G & H) has a pair of black maxillae and paragnaths arranged as follows : group I, 1-3 small conical paragnaths; group II clusters; group III, a large irregular cluster, sometimes with an isolated paragnath on either side of it; group IV, a somewhat crescentic cluster with roughly three rows of paragnaths; group V, a single paragnath situated behind the level of group VI; group VI, a transverse row of conical or usually flattened paragnaths, some of the more median ones being double; group VII-VIII, three alternate rows of somewhat flattened paragnaths.

The first and second feet are similar in regard to their shape and setae (Fig. 3, A). The dorsal parapodial ramus possesses a single, blunt, dorsal lobe but lacks acicula and setae. The ventral ramus bears an aciculum and homogomph spinigers (Fig. 3, F). A few setae are somewhat heterogomph (Fig. 3, E). In the 3rd foot (Fig. 3, B) the dorsal ramus possesses two rounded lobes and an aciculum, and fine capillary setae run to a point between their bases. The ventral cirri increase in size up to the 5th or 6th foot after which they decrease in size. In the 10th foot (Fig. 3, C) the two lobes of the dorsal ramus are subequal. The 10th and succeeding feet show no differences, except for the somewhat more pointed condition of the two lobes of the dorsal ramus (Fig. 3, D). In all the feet, there are heterogomph falcigers (Fig. 3, G) in the ventral ramus, in addition to the homogomph spinigers. The anal segment is rounded and bears two long filamentous cirri (Fig. 3, H).

Distribution. Red Sea, Cape of Good Hope, Madagascar, India (Krusadi Island, Chappatti, Bombay), Karachi, Ceylon, Philippines, Australia, New Zealand.

Family **GLYCERIDAE** Grube, 1850

Genus **GLYCERA** Savigny, 1818

Glycera rouxii Audouin and M. Edwards

(Fig. 3, J-S)

Glycera rouxii, Quatrefages 1865, p. 176.

Glycera rouxii, Fauvel 1923, p. 389.

Glycera rouxii, Fauvel 1932, p. 128.

Glycera rouxii, Treadwell 1936, p. 275.

Six specimens were collected with a bottom grab from the muddy central part of the lake. The largest specimen is 83.5mm long, 2.25mm broad and possesses 138 setigerous segments.

The prostomium is acutely conical, consisting of about 7 rings and bears four minute tentacles at its tip (Fig. 3, J). The papillae of the proboscis are conical, globular or lanceolate and are devoid of terminal nail-like tips. Each jaw has a somewhat curved support, one side of which is produced into a long process (Fig. 3, K). In the anterior feet (Fig. 3, L) there are two long, equal, leaf-like anterior lobes with pointed tips, and two small subequal posterior lobes of which the dorsal one is slightly larger. The ventral cirrus is leaf-like. In the posterior feet (Fig. 3, M & N) the ventral cirri and the anterior lobes show no change but the dorsal posterior lobe is larger and more pointed than the other. The dorsal cirri on all the feet are small, knob-like and somewhat isolated from their respective feet. Gills commence on about the 10th-15th feet as a small knob on the antero-dorsal part of each foot. They are longer, unbranched and cirriform posteriorly and can be retracted into the anterior part of the feet. Dorsal setae are simple with flattened, minutely serrated blades (Fig. 3, O). Ventral setae are compound and with finely serrated blades (Fig. 3, P). The articular joints are mostly homogomph, but variations are found in the same worm, often in the same foot (Fig. 3, Q, R & S). The ventral cirri are foliaceous in two specimens but narrower and more pointed in the others. The feet are shorter and broader in the former but longer and narrower in the latter.

Fauvel (1932) states that *G. goesi* Malmgren is *G. rouxii* with all the gills retracted into the feet.

Distribution. Atlantic Ocean, Mediterranean Sea, Persian Gulf, India, Ceylon, Andaman Islands, Japan, California.

Family **EUNICIDAE** Savigny, 1818

Genus **EUNICE** Cuvier, 1817

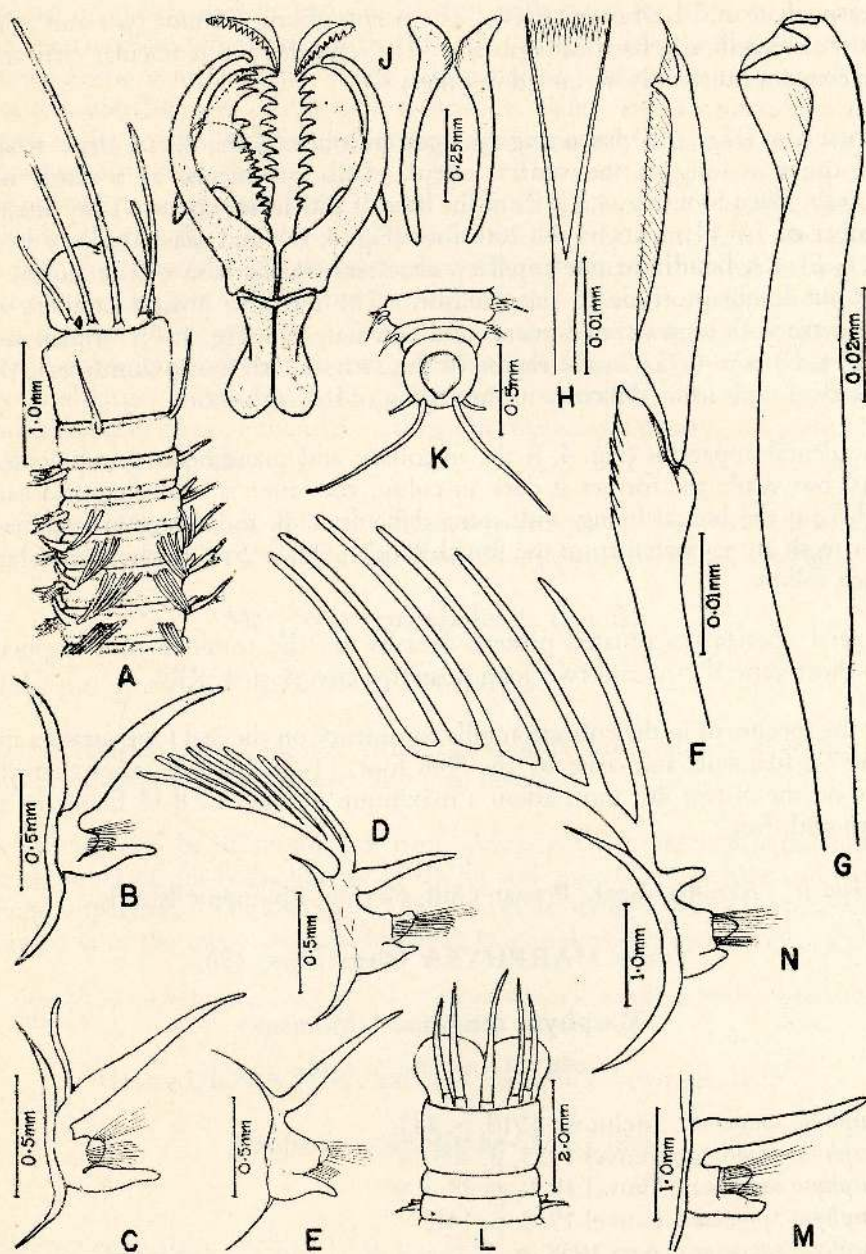
Eunice savignyi Grube

(Fig. 4, A—K)

Eunice savignyi, Fauvel 1932, p. 136.

30 specimens were collected with the bottom grab from all parts of the lake. The largest specimen is 60.5mm long, 2.0mm broad and possesses 110 setigerous segments. The pigmentation in alcohol is as follows: Dorsally, there is a reddish brown patch on the anterior border of the peristomium. The succeeding achaetous segment and the 20-25 setigerous segments possess two narrow brownish pigment bands, one along the anterior end and the other along the posterior end of each segment. The body is unpigmented ventrally. On the posterior dorso-lateral aspect of the last 25 segments or so there is, on either side, a small reddish-brown pigment spot.

The prostomium is bilobed, the two halves being separated only by a shallow anterior groove which does not extend over the dorsal part of the prostomium (Fig. 4, A). The tentacles are articulate. The median tentacle reaches the 5th or 6th setigerous segment



TEXT-FIGURE 4.—*Eunice savignyi* Grube, A—K. A, Dorsal view of anterior end; B, Anterior view of first left foot; C, Anterior view of 3rd left foot; D, Anterior view of 20th left foot; E, Anterior view of 30th left foot; F, Compound ventral seta from the first foot; G, Bidentate acicular hook from the 65th foot; H, Comb seta from the 30th foot; J, Dental apparatus (dorsal view); K, Dorsal view of anal segment. *Marphysa sanguinea* (Mont.), L—N. L, Dorsal view of anterior end; M, Anterior view of first left foot; N, Anterior view of 153rd left foot.

when bent backwards. A large conspicuous eye is present on either side between the bases of the intermediate and lateral tentacles. The peristomium is about two and a half times as long as the succeeding achaetous segment. The tentacles and tentacular cirri are smooth in some specimens but faintly wrinkled in others.

The first foot (Fig. 4, B) has a single setigerous lobe and the dorsal cirrus is about two and a half times as long as the ventral cirrus. Gills commence as a single or double filament on the third foot (Fig. 4, C) from the base of the dorsal cirrus. They attain a maximum number of 7-8 filaments by the 20th foot (Fig. 4, D), and cease abruptly by the 30th foot (Fig. 4, E). A bundle of fine capillary setae runs to the base of the dorsal cirrus in all the feet but do not protrude to the exterior. The feet also possess capillary setae and compound setae with long serrated guards and bidentate tips (Fig. 4, F). Bidentate hooded hooks (Fig. 4, G) commence in the region of the 24th or 25th foot. Comb setae (Fig. 4, H) can be observed with some difficulty in the region of the 30th foot.

In the dental apparatus (Fig. 4, J) the maxillary and mandibular groups consist of the usual parts, but while the former is dark in colour the latter is colourless and can be distinguished from the buccal lining with some difficulty. In the left great maxilla three of its anterior teeth are separated from the fourth tooth. These four teeth are also larger than those which follow.

The anal aperture is situated postero-dorsally on the rounded anal segment which bears two short ventral cirri and two long posterior cirri (Fig. 4, K).

In all the specimens in the collection gills commence on the 3rd foot, attain a maximum number of 7-8 filaments and cease by the 30th foot. Fauvel (1932) states that they may commence on the 3rd or 4th foot, attain a maximum number of 8-15 filaments and cease by the 30th-40th feet.

Distribution. Algulhas Bank, Persian Gulf, Ceylon, Philippine Islands.

Genus **MARPHYSA** Quatrefages, 1865

***Marphysa sanguinea* (Montagu)**

(Fig. 4, L-N ; Fig. 5, A-E)

Marphysa sanguinea, McIntosh 1910, p. 443.

Marphysa sanguinea, Fauvel 1923, p. 408.

Marphysa sanguinea, Fauvel 1930, p. 28.

Marphysa sanguinea, Fauvel 1932, p. 141.

Marphysa sanguinea, Aziz 1938, p. 37.

Marphysa sanguinea, Abbot 1946, p. 6.

One specimen was collected from Nachchikuda, where the bottom is mostly sandy. Length of worm 212.0mm, width 5.0mm in the region of the 15th foot. Total number of setigerous segments 392, the last 15 or so being small and newly formed.

The prostomium is bilobed and the tentacles are short but longer than the head (Fig. 4, L). A pair of eyes is present and can be seen with difficulty between the bases of the lateral and intermediate tentacles. In the first foot (Fig. 4, M) the dorsal cirrus is about twice as long as the ventral cirrus. Gills commence as a single filament on the 30th left foot and as a double filament on the 34th right foot. They attain a maximum number of 6-7 filaments in the 135th-295th feet and decrease progressively in the succeeding segments. Gills are present almost to the end of the worm. The ventral setae are compound, with somewhat curved tapering blades (Fig. 5, A). The dorsal setae are simple, with flattened tapering blades (Fig. 5, B). There are 2 aciculae in the first foot, 4 in the 26th, 3 till about the 90th and generally 2 in the succeeding feet. Bidentate, hooded hooks (Fig. 5, C) commence on the 47th left foot and the 45th right foot. There is usually one hook in each foot, but occasionally there are two. Comb setae of the anterior segments possess numerous slender teeth and a long curved process on either side (Fig. 5, D). Posterior comb setae have fewer and larger teeth (Fig. 5, E). The tooth counts of the dental apparatus are as follows: maxillae II, 4 on the left and 5 on the right; maxilla III or azygous plate 6; maxillae IV, 4 on the left and 8 on the right.

Distribution. West Indies, Atlantic Ocean, Mediterranean Sea, Red Sea, Indian Ocean, India, Ceylon, Australia, New Caledonia, China Sea, Japan, Melanesia, Hawaii.

***Marphysa borradailei* T. G. Pillai**

Marphysa borradailei, Pillai 1958, pp. 94-106.

Three specimens were collected from the muddy low-tide mark at Nachchikuda. Numerous cocoons of this worm were also seen here.

This species can be distinguished from *Marphysa graveleyi* Southern chiefly by its maximum number of gill filaments (up to 18-20) and general appearance and tooth counts of the dental apparatus. The cocoons of the worm are usually present wherever it occurs and examination of the metatrochophore larvae from a few cocoons serves as a check.

The lectotype of this species has been deposited in the Annelida Section of the British Museum (Natural History); Reg. No. 1960. 3. 13. 6.

Genus **DIOPATRA** Audouin and Milne-Edwards, 1833

***Diopatra neapolitana* Delle Chiaje**

(Fig. 5, F—M)

Diopatra amboimensis, Willey 1905, p. 274.

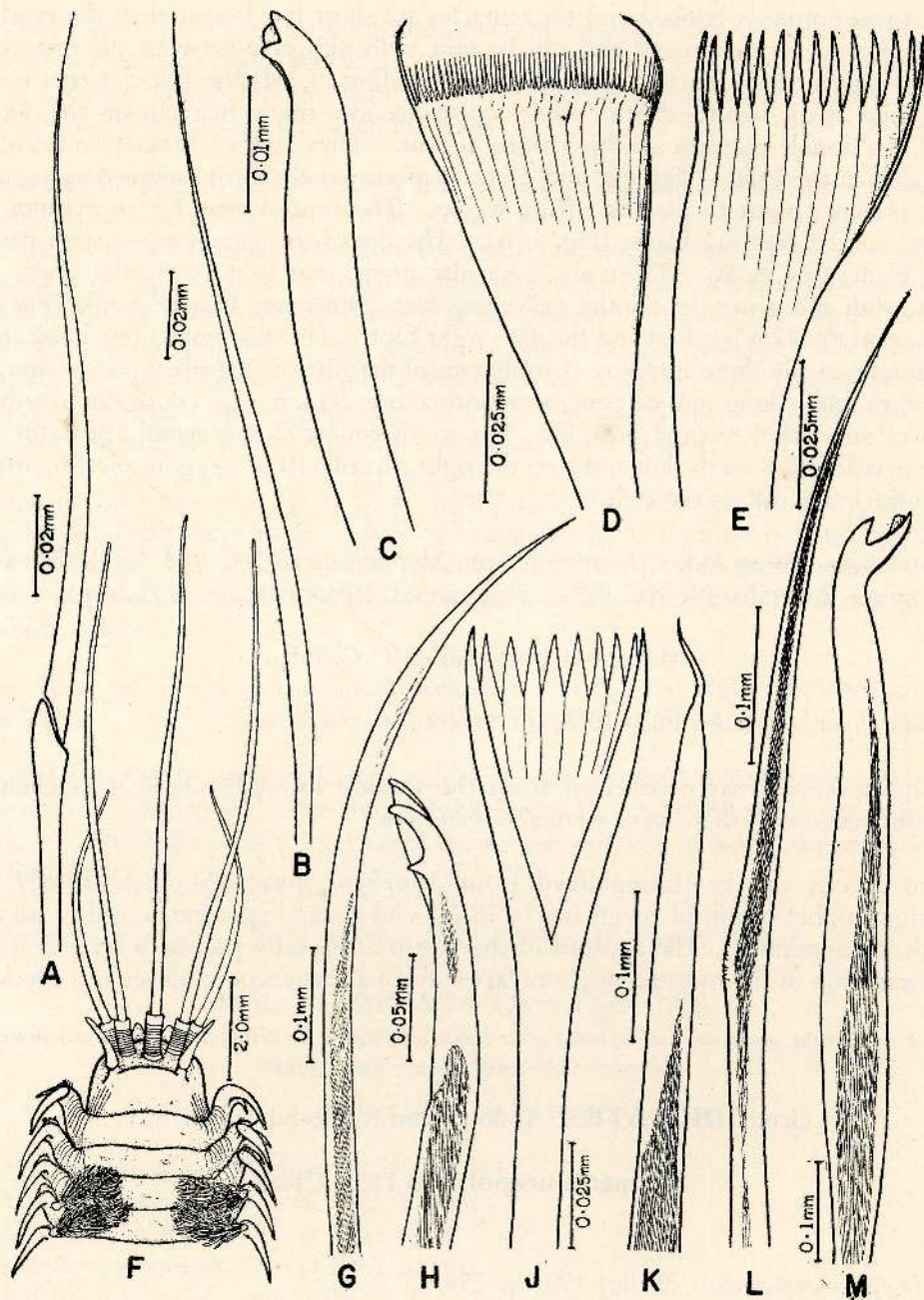
Diopatra variabilis, Southern 1921, p. 611.

Diopatra neapolitana, Fauvel 1923, p. 419.

Diopatra neapolitana, Fauvel 1932, p. 143.

Diopatra neapolitana, Aziz 1938, p. 39.

Diopatra neapolitana, Tebble 1955, p. 116.



TEXT-FIGURE 5.—*Marphysa sanguinea* (Mout.), A—E. A, Ventral compound seta from the 47th foot; B, Simple, flattened dorsal seta; C, Ventral hook from the 360th foot; D, Comb seta from the 300th foot; E, Comb seta from the 360th foot. *Diopatra neapolitana* Delle Chiaje, F—M. F, Dorsal view of anterior end; G, Dorsal seta from the first foot; H, Ventral, pseudocompound seta from the first foot; J, Comb seta from the 5th foot; K, Tip of an aciculum; L, Ventral seta from the 50th foot; M, Ventral hook from the 50th foot.

Fifteen small specimens, some with their tubes, 7 anterior fragments of very large specimens and several large tubes were collected from all parts of the lake. Of the smaller group, the smallest specimen is 43.0mm long, 2.0mm wide and possesses 142 segments and the largest is 60.0mm long, 2.25mm wide and possesses 156 segments. Of the larger group, the longest anterior fragment is 265.0mm long and 8.5mm wide in the region of the 15th-20th setigerous segments. The largest tube in the collection is 550mm long, about 160mm of which was exposed above the bottom. The tip of the exposed portion is 18mm in diameter and the posterior end is 8.0mm wide.

The two groups of specimens are differently pigmented. A common feature, however, is that the pigmentation of the first ten segments or so, together with the gills from the fourth setiger, is very much lighter than that of the succeeding segments.

The pigmentation of the smaller specimens is as follows: The dorsal aspect of each of the first ten segments or so possesses two, narrow, transverse, brown bands, one along the anterior border and the other along the posterior border of the segment. On the next fifteen segments the light brown pigment is diffused after which it gradually becomes lighter and disappears. The annulations of the ceratophores are brown. In some specimens there is a pigment spot on each side, between the bases of the median and intermediate ceratophores.

The larger specimens are iridescent purplish-green when freshly preserved but iridescent brown after long preservation. In some, as in the smaller specimens, there is a dark spot on either side of the median ceratophore on the prostomium. The tentacles are sparsely mottled with minute brown specks. Unlike in the smaller specimens, the first ten setigers or so have lightly diffused dark brown pigment dorsally. The colour becomes darker from the eleventh to about the fortieth setiger after which it gradually becomes lighter. In three specimens the region from the eleventh to about the fortieth segments is apparently uniformly pigmented but in reality the pigment is restricted to minute rhomboidal areas which correspond to the tessellations of the cuticle. In one specimen, the dorsal junctions between the first few feet and their corresponding segments, and the ventral parts of the same segments, possess conspicuous brownish-black patches.

The five prostomial tentacles are borne on ringed ceratophores. The median and intermediate tentacles are subequal, the latter being the shorter, and the lateral tentacles are about half as long as the intermediate ones (Fig. 5, F). The number of annulations in the median ceratophore of the smaller specimens is from 8-12 and in the larger ones 11-12. In the dental apparatus, the tooth counts agree with those of *D. variabilis* (Southern, 1921), but the azygous plate is on the right side in some small specimens and in one large specimen. The maxillary carriers are cordate. Each mandible has a flattened, calcareous, anterior expansion and a somewhat straight, sub-cylindrical shaft which ends in a blunt point.

An important difference between the smaller and larger specimens lies in the anterior feet. In the smaller specimens the first four feet possess normal dorsal and ventral cirri, a median ligule and a shorter ventral ligule (both ligules appearing like two post-setal lobes). The ventral ligule is not easily seen in dorsal view as it is situated antero-ventral to the median

ligule, but it is easily noticeable in lateral view. In the 5th foot the ventral ligule is reduced to a small knob. It is absent from the 6th posteriorly. The ventral cirrus is normal in the fifth foot too but is modified into a small knob in the 6th foot and, a flattened pad in each succeeding foot. In contrast, the larger specimens lack a ventral ligule in all the feet, there being apparently a single post-setal lobe, but the modifications of the ventral cirri are identical. The differences in the structure of the anterior feet between the smaller and larger specimens are possibly due to age and size.

Gills begin on the fourth foot in all the specimens in the collection (4th or 5th, Fauvel, 1932). They cease on the 30th-50th foot in the smaller specimens and on the 90th-100th foot in the larger ones. Each gill is a branch from the base of the dorsal cirrus with the filaments arranged spirally on it. The most posterior gills are merely a few filaments from the bases of the dorsal cirri. The number of gills, their lengths and the number of filaments apparently depend on the age and size of the worm. The method of fixation has some effect on the lengths of the gills, including the filaments, and the amount of crowding of the filaments on the central axis.

In the first few feet the main setigerous lobe has a dorsal bundle of ventrally curved, flattened setae (Fig. 5, G) and a ventral bundle of pseudocompound setae with bidentate, hooded tips (Fig. 5, H). The acicula possess slender, geniculate tips (Fig. 5, K). After about the fifth foot the ventral pseudocompound setae are replaced by flattened winged setae with very minute serrations at their bases (Fig. 5, L). Simple, bidentate, hooded hooks (Fig. 5, M) are present from about the 14th-17th foot in the smaller specimens and the 28th-42nd foot in the larger ones. There are some differences between the comb setae of the smaller and larger specimens and between those of the anterior and posterior feet of the same specimen. Generally, in the smaller specimens and in the anterior feet of the larger specimens, the comb-like tips are flat or only slightly curved, whereas in the posterior feet of the larger specimens the tips are more curved, almost into a three-quarter circle. Often, comb setae varying between both these extremes of curvature of their tips are found in the same foot. In both groups of specimens, there are less teeth in the comb setae of a few anterior feet than in those of the succeeding feet. The number of teeth in the comb setae of the posterior feet varies from about 13-25. In a comb seta from the fifth foot of a large specimen there are ten teeth (Fig. 5, J).

The anus is dorsal and the anal segment bears four short cirri, the ventral pair being the shorter.

The tube is thin and membranous in the smaller specimens and thick and parchment-like in the larger ones. Most of it is buried in the bottom and the exposed portion is more or less covered with mud, sand, shell fragments, algal fragments and debris.

Diopatra neapolitana Delle Chiaje is apparently a very variable species. The several records and descriptions of the species suggest that there may be several races, many of them geographically located, which probably accounts for some of the variations that have been reported. Some of the variations are apparently due to age and size.

In general, the pigmentation of the specimens in the present collection agrees with that of *D. variabilis* (Southern 1921), *D. amboinensis* Aud. and M-Edwards of Willey (1905) and *D. cuprea* (Bosc.). Both *D. variabilis* and *D. amboinensis* were regarded as synonyms of *D. neapolitana* by Fauvel (1932).

It is with some hesitation, in the present state of our knowledge, that the two groups of specimens in the present collection are assigned to *D. neapolitana*, in spite of the differences in the structure of the anterior feet, commencement of ventral hooks and the pigmentation. The anterior feet of *D. amboinensis* of Willey (1905) agree with those of the smaller specimens in the present collection. Willey's description includes a figure of the first foot (Pl. IV, fig. 96). With regard to the feet he stated the following: "The anterior appendages possess other characteristic features besides the setae which they carry. The lips of the orifice of the pharetra setarum are triangulate, an anterior short truncate border followed by a long stout cirriform posterior median lobe and a smaller ventral ligule; I do not know of any other species of *Diopatra* in which this third ligule has been described. Sometimes it is appressed against the median lobe and so concealed from view on the slide, but it can be found with a simple lens on the body of the worm." Judging by the description and size of Willey's single specimen it is identical with Southern's small specimens of *D. variabilis* and the small specimens in the present collection. Southern (1921, p. 616) states the following: "The smaller specimens, however, closely resemble certain species already described such as *D. chiliensis*, Quart (Ehlers 1901, p. 123) and *D. leuckarti* Kinberg (1910, p. 38). The structure of the dorsal capillary setae which apparently differentiates the present species, may have been overlooked by previous workers." With regard to the two groups of specimens in his collection he stated: "If the specimens had come from different localities they would probably have been regarded as distinct species. It seems very probable, however, that the distinctions observed are due to differences in size and age. . . . The question of whether one or two species are involved can only be decided by a more ample supply of material, collected at different seasons of the year. . . . These variations show that many of the criteria which have hitherto been used to discriminate the various species of the genus are of little or no value. Crossland (1903, p. 132) has already commented on this point."

In Southern's specimens a comb seta from the fourth foot had about 13 coarse teeth and two external slender teeth, the latter differing very little from the other teeth. This number falls within the range of teeth in comb setae of worms in the present collection. Fauvel (1932, p. 145) stated: "In Indian specimens there are comb setae often longer and with teeth finer and more numerous, but I have also found such setae on specimens from the Atlantic and sometimes both types of comb-setae may be observed together in the same foot. If such a slight difference were taken into account, this would at best characterize a variety and not a species. The very variable *D. variabilis* does not appear to be a distinct species."

Distribution. This species has a very wide distribution. It has been reported from the Atlantic Ocean, Mediterranean Sea, Indian and Pacific Oceans, Coast of France, East Africa, Ceylon, Chilka Lake, Krusadi Island, Persian Gulf, Burma, Mergui Archipelago, Tuticorin Harbour, Gulf of Siam, Karachi, Japan, Gold Coast.

Genus **LUMBRINERIS** Blainville, 1828

Lumbrineris pseudopolydesma, sp. nov.

(Fig. 6, A—H)

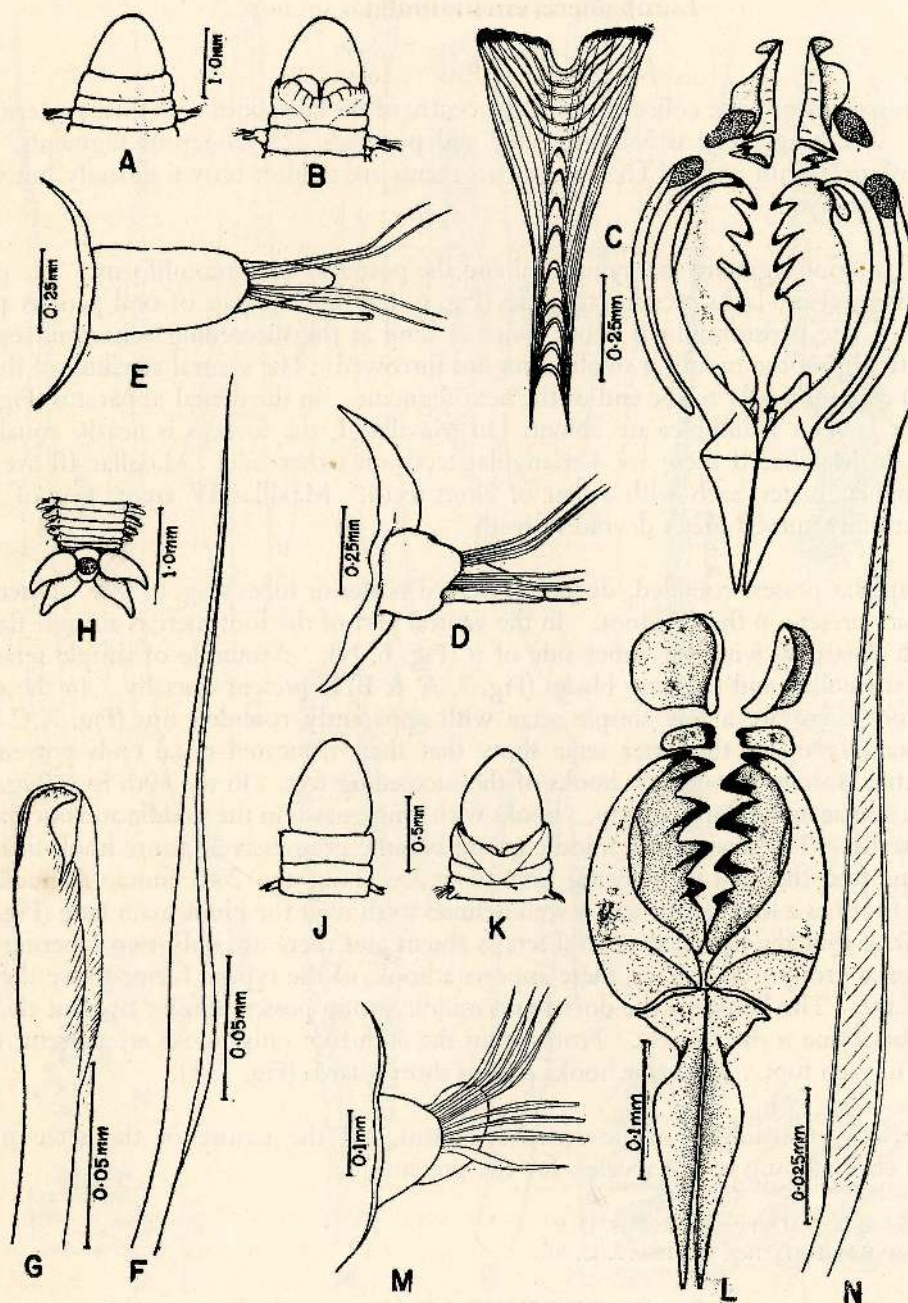
Two specimens were collected from the centre of the lake, one complete and the other with a few posterior segments missing. The former is 132.0mm long, 3.0mm broad at the level of the 18th foot and possesses 256 setigerous segments. The second specimen is 133.0mm long, 3.0mm wide and possesses 256 segments. The cuticle is iridescent and the anterior part of the body is reddish brown dorsally.

The prostomium is bluntly conical and lacks eyes and tentacles (Fig. 6, A & B). A pair of oral pads is present ventrally. The peristomium is about twice as long as the succeeding achaetous segment. The ventral lip of the mouth is furrowed. The intersegmental groove between the peristomium and succeeding achaetous segment is not complete ventro-medially owing to the extension of the ventral swelling of the former to the end of the latter segment. In the dental apparatus (Fig. 6, C) the pair of forceps or maxillae I are about twice as long as their tapering carriers. Lateral to the forceps are a pair of long, narrow, chitinous strips with finely spotted anterior expansions. Maxillae II have four teeth on both sides and their antero-lateral ends are curved upwards. Maxillae III consist of a pair of dorso-ventrally curved plates with a pair of outwardly directed teeth at their dorsal ends. Maxillae IV consist of a pair of dorso-ventrally curved plates each with a single outwardly directed postero-dorsal tooth. Lateral to Maxillae IV are a pair of finely spotted plates. The lower jaw has transverse markings anteriorly. The first foot is short but has a long posterior lobe (Fig. 6, D). The posterior feet are longer, the triangular posterior lobe being about half as long as the foot itself (Fig. 6, E). Two acicula with dark brown tips are present in each foot. Anterior feet have curved, tapering, bladed setae (Fig. 6, F). From about the 50th foot there are also simple, hooded, ventral hooks with several minute tubercles above the main fang (Fig. 6, G). The presence of hooks is irregular and there are several feet without them. Setae are missing in most of the feet behind the 20th foot in the second specimen. The anal aperture is dorsal and the anal segment has four short, equal cirri (Fig. 6, H).

Lumbrineris polydesma Southern, which shows the closest resemblance to the present species, differs in the following respects. The intersegmental groove between the peristomium and succeeding achaetous segment is incomplete ventrally owing to the anterior extension of the swelling of the latter. The crochets or ventral hooks possess 6-10 long slender spines above the main fang. In maxilla I the forceps is as long as its carrier. The tooth counts of Maxillae II are also different. *L. heteropoda* Marenzeller differs from the present form in possessing a rudimentary dorsal lobe in the middle and posterior feet. *L. impatiens* Claparède possesses crochets in the anterior feet.

Holotype B.M.(N.H.), Reg. No. 1960. 3. 13. 7.

Paratype B.M.(N.H.), Reg. No. 1960. 3. 13. 8.



TEXT-FIGURE 6.—*Lumbrineris pseudopolydesma*, sp. nov. A—H. A, Dorsal view of anterior end; B, Ventral view of anterior end; C, Dental apparatus (dorsal view); D, Anterior view of first left foot; E, Anterior view of a foot from the middle of the body; F, Seta from the 54th foot; G, Ventral hook from the 54th foot; H, Dorsal view of anal segment. *Lumbrineris emandibulata*, sp. nov. J—M. J, Dorsal view of anterior end; K, Ventral view of anterior end; L, Dental apparatus (dorsal view); M, Anterior view of 10th left foot; N, Ventral seta with flattened blade from first foot.

Lumbrineris emandibulata, sp. nov.

(Fig. 6, J—M; Fig. 7, A—F)

Two specimens were collected from the centre of the lake, both with their posterior ends missing. The longer one is 55.0mm long and possesses 225 setigerous segments. Both specimens are 0.8mm wide. The anterior segments are reddish brown dorsally but unpigmented ventrally.

The anterior segments are cylindrical and the posterior ones moniliform. The prostomium is conical and lacks eyes and tentacles (Fig. 6, J & K). A pair of oral pads is present ventrally. The peristomium is about twice as long as the succeeding achaetous segment. The ventral lip of the mouth is swollen but not furrowed. The ventral swelling of the peristomium extends nearly to the end of the next segment. In the dental apparatus (Fig. 6, L) the lower jaws or mandibles are absent. In Maxillae I, the forceps is nearly equal to its carrier. In Maxillae II there are 4 triangular teeth on either side. Maxillae III are a pair of rectangular plates, each with a pair of blunt teeth. Maxillae IV are a pair of broad dorso-ventrally curved plates devoid of teeth.

Parapodia possess rounded, dorsally directed posterior lobes (Fig. 6, M). Three kinds of setae are present in the first foot. In the ventral part of the foot there is a single flattened seta with a narrow wing on either side of it (Fig. 6, N). A bundle of simple setae with somewhat swollen and tapering blades (Fig. 7, A & B) is present dorsally. In the middle of the foot there are a few simple setae with apparently rounded tips (Fig. 7, C & D). Close examination of the latter setae show that their truncated distal ends possess short pointed tips, foreshadowing the hooks of the succeeding feet. In the 10th foot (Fig. 6, M) there are 4 setae in the dorsal group, 3 hooks with long guards in the middle and one flattened seta ventrally. The setae of the middle group became progressively more hook-like in the succeeding feet, the final form being arrived at by about the 20th foot. A hook from the 20th foot has a long guard and 5 well defined teeth over the blunt main fang (Fig. 7, E.) By the 26th foot the flattened ventral seta is absent and there are only two tapering blades in the dorsal group. However, there appears a hook, of the typical form, above the dorsal bladed setae. The hooks of the dorsal and middle group possess similar tips but the guard of the dorsal one is the longest. From about the 40th foot only hooks are present, usually about 3 to each foot. Posterior hooks possess short guards (Fig. 7, F).

The lack of mandibles in the dental apparatus and the nature of the setae may be taken as characteristic of the species, for the present.

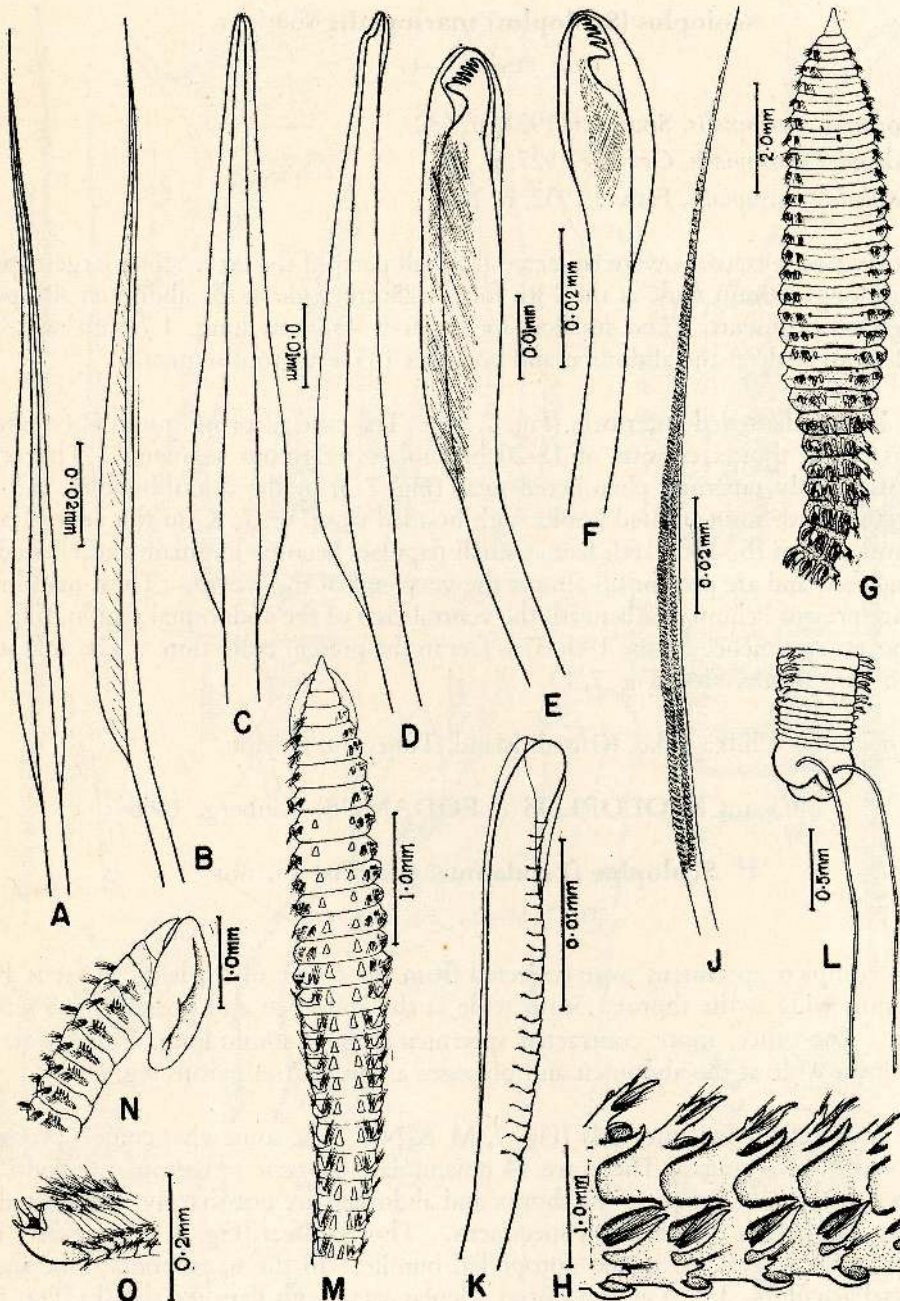
Holotype B.M.(N.H.), Reg. No. 1960. 3. 13. 9.

Paratype B.M.(N.H.), Reg. No. 1960. 3. 13. 10.

Family **ORBINIIDAE** Hartman, 1942

Sub-family **ORBINIINAE** Hartman, 1957

Genus **SCOLOPLOS** Blainville, 1828 (*sensu stricto*)



TEXT-FIGURE 7.—*Lumbrineris emandibulata*, sp. nov. A—F. A, Dorsal seta from the first foot; B, Same seta in side view; C, Seta from the middle group of the first foot; D, Same seta in side view; E, Hook, with long guard, from the 20th foot; F, Hook, with short guard, from the 26th foot. *Scoloplos (Scoloplos) marsupialis* Southern, G—L. G, Dorsal view of anterior end; H, Lateral view of a few abdominal segments showing the pockets; J, Dorsal thoracic seta; K, Ventral hook from the 6th foot; L, Dorsal view of anal segment. *Scoloplos (Leodamus) gracilis*, sp. nov., M—O. M, Dorsal view of anterior end, with extruded proboscis; N, Lateral view of anterior end, with extruded proboscis; O, Lateral view of anal segment.

Scoloplos (Scoloplos) marsupialis Southern

(Fig. 7, G—L)

Scoloplos marsupialis, Southern 1921, p. 632.*Scoloplos marsupialis*, Gravely 1927, p. 22.*Scoloplos marsupialis*, Fauvel 1932, p. 165.

Twenty two specimens were collected from all parts of the lake. The largest specimen is 79.0mm long, 2.0mm wide at the 13th foot, 1.25mm wide in the abdomen and possesses 204 setigerous segments. The smallest specimen is 45.0mm long, 1.75mm wide at the thorax, 1.0mm wide at the abdomen and possesses 135 setigerous segments.

The body is flattened anteriorly (Fig. 7, G). The conical prostomium is composed of two rings. The thorax consists of 18-20 biannulate setigerous segments. Thoracic segments possess only tapering, chambered setae (Fig. 7, J) in the dorsal bundles, and similar setae together with stout striated hooks with hooded tips (Fig. 7, K) in the ventral bundles. Gills commence on the 13th-16th feet as small papillae, become lingulate and ciliated in the succeeding feet, and are present till almost the very end of the worm. Thin, membranous pockets are present behind and beneath the ventral cirri of the abdominal region, (Fig. 7, H). These pockets commence on the 18th-37th feet in the present collection. The anal segment bears two long slender cirri (Fig. 7, L).

Distribution. Chilka Lake, Krusadi Island, Tuticorin, Ceylon.

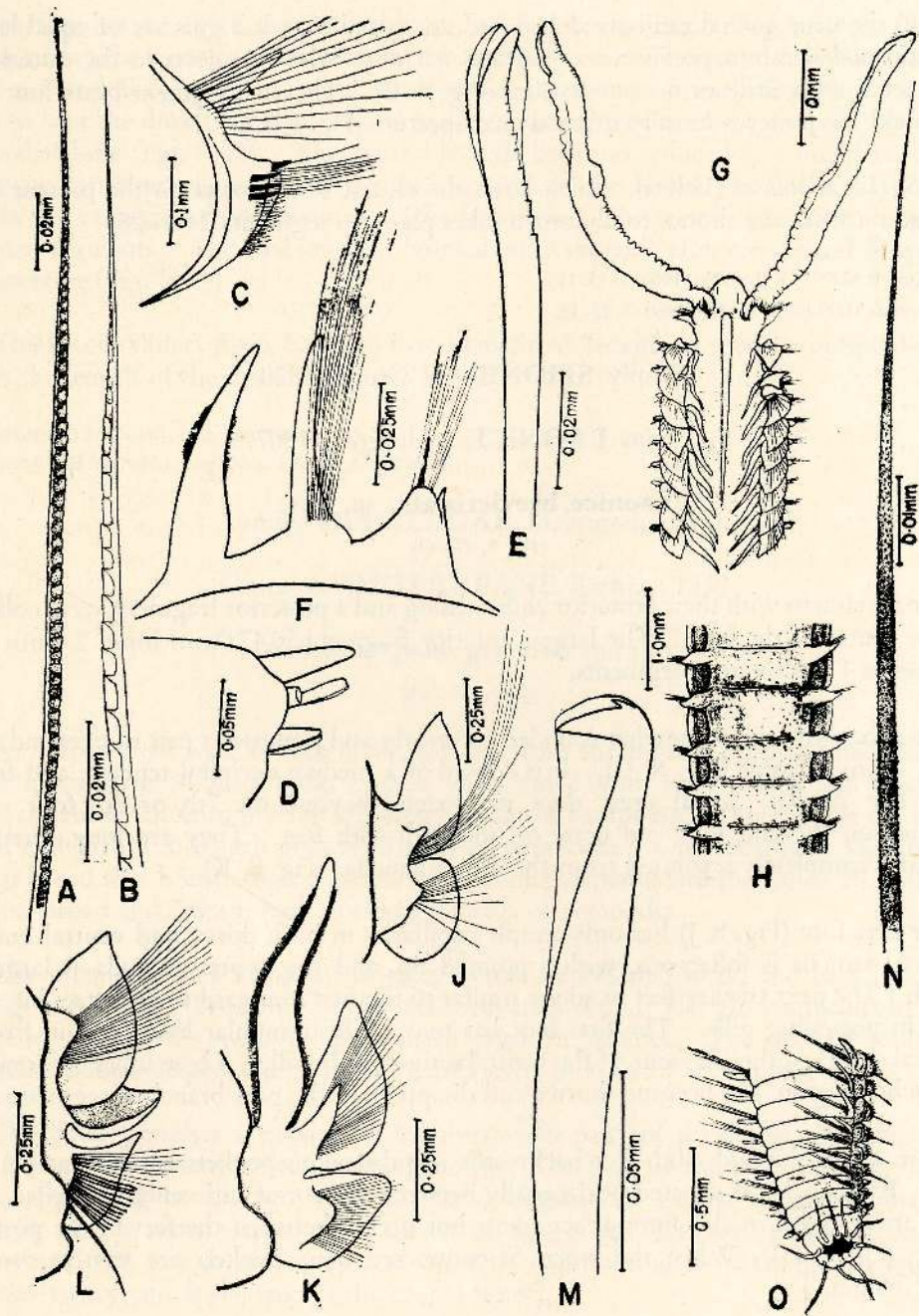
Genus **SCOLOPLOS (LEODAMUS)** Kinberg, 1866

Scoloplos (Leodamus) gracilis, sp. nov.

(Fig. 7, M—O ; Fig. 8, A—F)

Two complete specimens were collected from the centre of the lake. One is 49.0mm long, .75mm wide at the thorax, .5mm wide at the abdomen and possesses 168 setigerous segments. The other, more contracted specimen is about 46mm long, .9mm wide at the thorax, .6mm wide at the abdomen and possesses about 227 setigerous segments.

The body is flattened anteriorly (Fig. 7, M & N). The somewhat conical prostomium is composed of two rings. There are 14 uniannulate thoracic setigerous segments in one specimen and 15 in the other. The thorax and abdomen are not sharply demarcated. Gills commence on the 6th foot in both specimens. Thoracic feet (Fig. 8, C) possess a row of chambered setae (Fig. 8, A) in the notopodial bundle. In the neuropodial lobe there is a stout dorsal aciculum, 3 or 4 antero-dorsal acicular setae with flap-like sheaths (Fig. 8, C & D), a bundle of dorsal chambered setae and, ventrally, striated hooks (uncini) with somewhat conical hooded tips (Fig. 8, E). The tips of the acicular setae appear split longitudinally owing to the presence of the sheaths. The dorsal cirri of the anterior thoracic segments are short, but they are longer posteriorly. By about the 15th foot the neuropodial ramus projects as a distinct lobe and the ventral cirrus is quite distinct. In the abdominal segments



TEXT-FIGURE 8.—*Scoloplos (Leodamus) gracilis*, sp. nov., A—F. A, Thoracic notopodial seta; B, Thoracic neuropodial seta; C, Anterior view of 5th left foot; D, Dorsal part of thoracic neuropodial ramus, showing aciculum and acicular setae; E, Neuropodial thoracic hook; F, Anterior view of a posterior abdominal foot. *Laonice brevicristata*, sp. nov., G—O. G, Dorsal view of anterior end; H, Dorsal view of 60th—64th feet; J, Anterior view of first left foot; K, Anterior view of 25th left foot; L, Anterior view of 45th left foot; M, Ventral hook from the 45th foot; N, Stout, ventral seta from a posterior foot; O, Dorso-lateral view of posterior end.

(Fig. 8, F) the neuropodial rami are dorsal and the dorsal cirri and gills are of equal length. Each neuropodial ramus possesses a colourless aciculum which projects to the outside and striated setae with little or no camerations (Fig. 8, B). The anal segment bears four short cirri around the postero-dorsally situated anal aperture (Fig. 7, O).

In *S. (L.) tribulosus* (Ehlers), which bears the closest resemblance to the present form, the transition from the thorax to abdomen takes place on segments 24 to 28.

Holotype B.M.(N.H.), Reg. No. 1960. 3. 13. 11.

Paratype B.M.(N.H.), Reg. No. 1960. 3. 13. 12.

Family **SPIONIDAE** Grube, 1850

Genus **LAONICE** Malmgren, 1867

***Laonice brevicristata*, sp. nov.**

(Fig. 8, G—O)

Five specimens with their posterior ends missing and a posterior fragment were collected from the centre of the lake. The largest anterior fragment is 47.0mm long, 2.0mm wide and possesses 118 setigerous segments.

The prostomium is somewhat rounded anteriorly and possesses a pair of eyes and a pair of long, grooved palps (Fig. 8, G). It is devoid of a median occipital tentacle and frontal peaks. The median dorsal crest does not extend beyond the 7th or 8th foot. Gills commence on the 2nd foot and cease on the 40th-45th feet. They are long, cirriform, ciliated and completely separated from the dorsal lamellae (Fig. 8, K).

The first foot (Fig. 8, J) has only simple capillaries in both dorsal and ventral bundles. The dorsal lamella is foliaceous, with a pointed tip, and the ventral lamella is large and rounded. The next twenty feet or so are similar to the first in regard to the setae, but differ from it in possessing gills. The first foot has two small, triangular lobes, one in front of the dorsal and the other in front of the ventral setigerous bundle. These lobes are longer in the branchial region, but become shorter and disappear in the post branchial segments.

From about the 20th-30th feet backwards membraneous pockets are present between the feet. Each pocket is situated horizontally between the dorsal and ventral lamellae. The pockets are rounded in the anterior segments but stretch between the feet in the posterior segments (Fig. 8, H). When the worm is contracted these pockets are seen as rounded outward bulges.

From the 13th or 14th foot backwards, till the end of the worm, there is in each foot a somewhat stout, tapering, pointed seta which is covered with very fine tubercles (Fig. 8, N), below the ventral bundle of setae. In the middle and posterior feet this seta is directed ventro-medially. From the 40th-45th feet posteriorly (Fig. 8, L), the ventral setigerous lobe

of each foot has a row of simple, bidentate, hooded hooks (Fig. 8, M), between the dorsal bundle of capillary setae and the ventral tuberculated seta. The dorsal lamellae cease to be foliaceous and become shorter and semicircular in the post-branchial region. By about the 60th foot the dorsal lamella is an insignificant forwardly directed curvature of the dorsal parapodial lobe (Fig. 8, H). The ventral lamella becomes reduced to a small, transparent, semilunar flap from the region of commencement of the hooks, the hooks traversing the lamella and emerging from its outer border in a row. The ventral lamella is absent in the posterior segments. The anal segment bears about 9 short, slender cirri round the posterior anal aperture (Fig. 8, O).

This species differs from *L. cirrata* (Sars) chiefly in lacking a median occipital tentacle and in the length of the dorsal crest.

Holotype B.M.(N.H.), Reg. No. 1960. 3. 13. 13.

Paratypes B.M.(N.H.), Reg. Nos. 1960. 3. 13. 14 to 16.

Family **OPHELIIDAE** Malmgren, 1867

Genus **AMMOTRYPANE** Rathke, 1843

***Ammotrypane grandis*, sp. nov.**

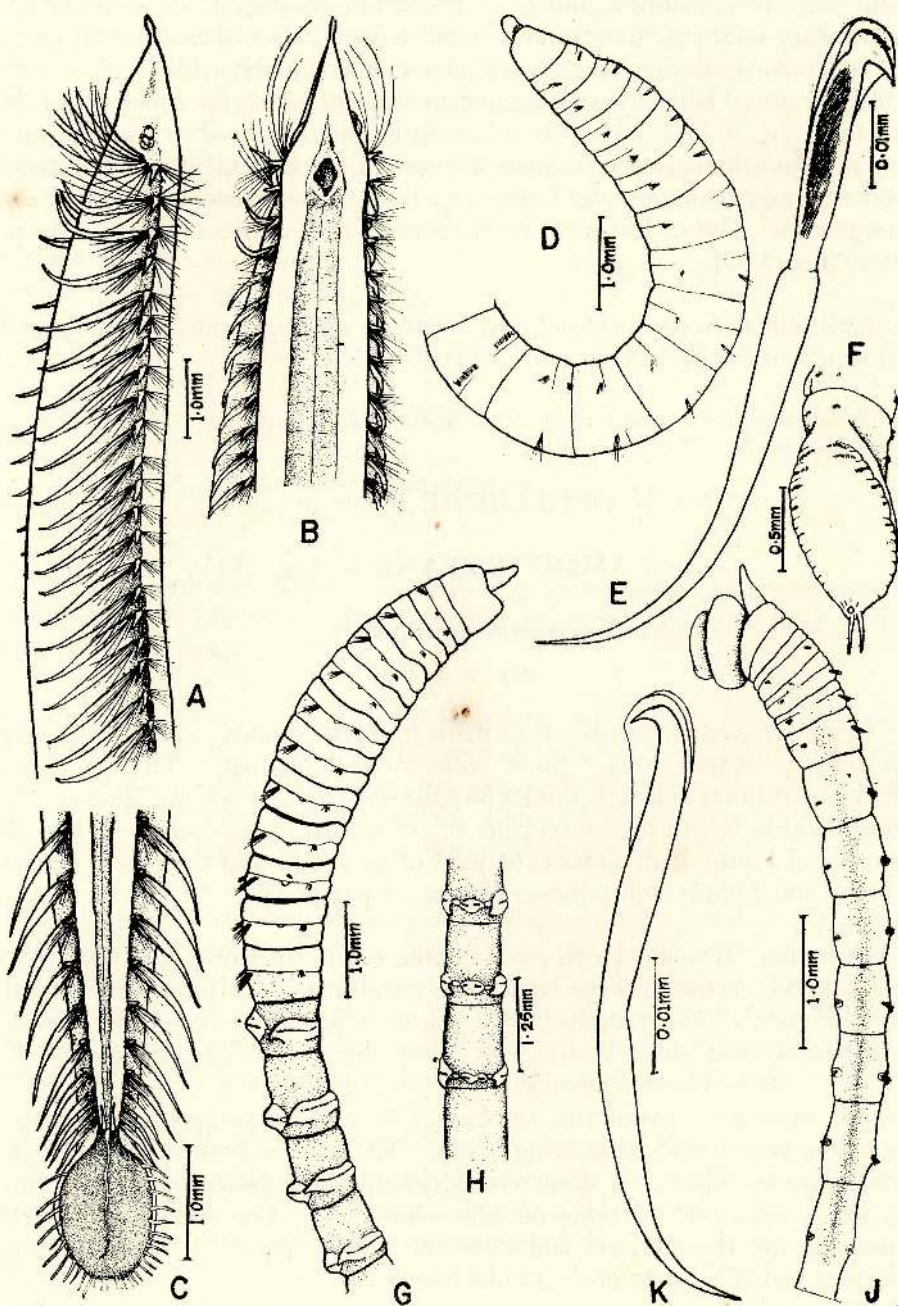
(Fig. 9, A—C)

Nine specimens were collected, all of them from the muddy centre of the lake. The largest specimen is 34.5mm long, 1.5mm wide and 2.0mm high. This and three other specimens above 31.0mm in length possess 66 pairs of parapodia. Three specimens between 24mm and 31mm in length possess 65 pairs of parapodia. One specimen, 18.0mm long, 1.2mm broad and 1.5mm high possesses 64 pairs of parapodia and the other, 21.5mm long, 1.25mm broad and 2.0mm high possesses 62 pairs of parapodia.

The prostomium is triangular in cross-section, tapers anteriorly, and ends in a clavate tip (Fig. 9, A & B). Prostomial and lateral eyes are absent. The protrusible nuchal organs are lobed and usually with reddish-brown pigment patches. The everted proboscis is somewhat funnel-shaped and, at its base, anteriorly, there are 7 short oral cirri.

The body possesses a maximum number of 66 pairs of parapodia, the range in the specimens of the present collection being 62-66. The body is rounded dorsally, its height slightly exceeding its width. A deep, ventral longitudinal groove is present throughout the body, and a ventro-lateral ridge on either side of it. The two ventro-lateral ridges curve round the mouth anteriorly and form the ventral angles of the prostomium, and posteriorly they end at the base of the caudal funnel.

Each parapodium is a short, conical, outwardly directed lobe, with bundle of simple capillary setae above and below it. The dorsal setae of the first two feet and a few of the third foot are curved forwards and are very much longer than those of the succeeding feet. Simple, long, cirriform gills commence on the second foot and are present till the last seg-



TEXT-FIGURE 9.—*Ammotrypane grandis*, sp. nov., A—C. A, Lateral view of anterior end; B, Ventral view of anterior end; C, Ventral view of posterior end. *Heteromastides platyproctus*, sp. nov., D—F. D, Lateral view of anterior end; E, Abdominal hook; F, Dorsal view of posterior end. *Notomastus ceylonicus*, sp. nov., G—H. G, Lateral view of anterior end; H, Dorsal view of 8th—10th abdominal segments. *Heteromastus deductus*, sp. nov., J—K. J, Lateral view of anterior end, with everted proboscis; K, Abdominal hook.

ment at the base of the caudal funnel. In most of the specimens a small reddish-brown pigment spot is present on each gill, usually at its base. These are mere pigment spots and not eyes. From the inter-parapodial positions 16-17 backwards there are blackish or creamish slit-like apertures on the dorsal aspect of the lateral ridges (Fig. 9, A).

The anal funnel is spoon-shaped and its rim bears several short, slender papillae, the posterior ones being shorter (Fig. 9, C). The ventro-lateral ridges end at the base of the caudal funnel and parapodia with gills are present till this region. Two, very slender, short, ventrally directed cirri and a anal cirrus are present at the caudal end of the ventral ridges. The anal cirrus is missing in some specimens, very short in a few and long in the others. The ventral flexure of the caudal funnel commences in the region of the 3rd or 4th foot the posterior end.

A. multipapilla Annenkova, *A. cylindricaudatus* Hansen and *A. breviata* Ehlers possess a cylindrical caudal tube which is absent in *A. aulogaster* Rathke, *A. gracilis* McIntosh and the present species. In both *A. aulogaster* and *A. gracilis* gills are absent in the last few segments and the pygidium is spoon-shaped, but the presence of two filaments on a pedicle at the base of the proboscis in the former distinguishes it from the latter which has 3 filaments. In the present species gills are present up to the base of the caudal funnel and the two posterior cirri are very slender and ventrally directed. In *A. aulogaster* the two posterior cirri are stout and directed outwards.

Holotype B.M.(N.H.), Reg. No. 1960. 3. 13. 17.

Paratypes B.M.(N.H.), Reg. Nos. 1960. 3. 13. 18 to 21.

Family **CAPITELLIDAE** Grube, 1862

Genus **HETEROMASTIDES** Augener, 1914

Thorax with 11-13 segments possessing only capillary setae in both notopodial and neuropodial bundles. Eye spots often present at the base of the prostomium. Abdomen with hooks on raised tori. A broad anal plate present, with or without hooks, and with two anal cirri.

Heteromastides platyproctus, sp. nov.

(Fig. 9, D—F)

One complete specimen, much coiled anteriorly, was collected from the centre of the lake. It is about 35mm long, 1.0mm wide at the thorax, .75mm wide at the abdomen and possesses 70 setigerous segments anterior to the anal plate.

The prostomium is bluntly fingerlike and possesses a cluster of numerous small eye spots on each side, at its base (Fig. 9, D). The achaetous peristomium is somewhat tapering anteriorly and is slightly longer than the succeeding setigerous segment. The thorax is composed of 11 rounded, faintly biannulate setigerous segments with capillary setae in both rami. The abdomen commences from the 12th setigerous segment and possesses only hooks

in both dorsal and ventral rami. Each abdominal hook possesses a waist and a hooded tip with four small teeth above the main fang (Fig. 9, E). The abdominal segments are cylindrical and the tori are shorter towards the posterior end of the body. The oval, slanting anal plate (Fig. 9, F) is composed of about 10 posterior setigerous segments. The dorsal uncinigerous tori are present in the anterior segments of the anal plate, the more anterior ones possessing more hooks. The anus is postero-dorsal and immediately behind it is a pair of short, straight cirri which arise independently.

Only one species of *Heteromastides* with this peculiar anal plate was known in the past, namely, *H. bifidus* Augener. It differs from the present species in regard to the anal plate which lacks uncinigerous tori and possesses two long diverging anal cirri arising from a common pedicle.

Holotype B.M.(N.H.). Reg. No. 1960. 3. 13. 22.

Genus **NOTOMASTUS** Sars, 1851

Thorax composed of ten or eleven setigerous segments with only capillary setae in both dorsal and ventral bundles. Abdominal segments with hooded hooks borne on raised tori. Gills simple small processes of the abdominal tori, simple filaments or bushy. Thorax wholly or partly tessellated or untessellated.

Notomastus ceylonicus, sp. nov.

(Fig. 9, G—H; Fig. 10, A)

Two specimens were collected from the centre of the lake, both incomplete behind. One is about 25.0mm long, 1.25mm wide at the thorax and possesses 35 setigerous segments. The other is about 21.0mm long, 1.25mm wide at the thorax and possesses 25 setigerous segments. Both specimens have 11 untessellated thoracic setigerous segments.

The prostomium is conical and the thorax is composed of 12 segments (Fig. 9, G). The first thoracic segment or peristomium is uniannulate and achactous. It is followed by 11 biannulate setigerous segments with simple capillary setae in both dorsal and ventral bundles. All the thoracic segments are untessellated. The abdomen commences from the 12th setigerous segment and the segments possess only hooks in both dorsal and ventral rami, arranged on raised tori. Each ventral torus lies transversely across the lateral aspect of the segment and its dorsal extremity is produced into a short triangular process or gill. The dorsal tori are small, the pair of each segment being approximated and coalesced in the anterior segments but more distinct posteriorly (Fig. 9, H). The abdominal hooks possess bidentate hooded tips (Fig. 10, A).

Holotype B.M.(N.H.). Reg. No. 1960. 3. 13. 23.

The differences between the present species and other species of *Notomastus* are shown in the following key.

- | | |
|---|---|
| 1. Gills bushy or single long filaments..... | 2 |
| 1. Gills short extensions of the feet, or absent..... | 3 |

2. Bushy, retractile gills in mid abdomen.....*N. giganteus* Moore
2. Gills simple long filaments.....*N. profundus* Eisig
3. Neurosetae absent on 1st thoracic setiger.....4
3. Neurosetae on 1st thoracic setiger.....5
4. Peristomium and a few anterior thoracic setigers lightly areolated, remaining thoracic setigers smooth.....*N. variegatus* Berkeley & Berkeley
4. All thoracic segments tessellated.....*N. aberrans* Day
5. Thoracic segments triannulate.....*N. sarsi* Claparède.
5. Thoracic segments biannulate.....6
6. Thorax composed of 10 setigers with hexagonal markings.....*N. lineatus* Claparède
6. Thorax with 11 setigers.....7
7. All thoracic segments tessellated, peristomium biannulate.....*N. latericeus* Sars
7. All thoracic segments untessellated.....8
8. All thoracic segments obscurely biannulate. No gills, genital pores or lateral sense organs visible.....*N. tenuis* Moore
8. Peristomium uniannulate, remaining thoracic setigers biannulate. Gills short dorsal extensions of the ventral tori. Genital pores and lateral sense organs visible.....*N. ceylonicus*

Notomastus zeylanicus Willey is possibly a species of *Heteromastides*. Unfortunately, Willey's (1905) single specimen was only an anterior fragment and its identity cannot be determined with certainty.

Genus **HETEROMASTUS** Eisig, 1887

Thorax with 10 or 11 setigerous segments, the first 4 or 5 with only capillary setae and the rest with long, stalked hooks. Abdominal segments with short hooks on raised tori. Posterior segments bell-shaped or strobiliform. Gills, when present, are mere extensions of the ventral tori. A median, pointed or club-shaped anal cirrus present.

Heteromastus deductus, sp. nov.

(Fig. 9, J—K; Fig. 10, B—C)

One specimen, with the posterior end damaged, was collected from the centre of the lake. Length about 34.0mm; width at the 2nd setigerous segment, which is the widest region, 0.8mm; number of setigerous segments 80.

The prostomium is acutely conical and the everted proboscis consists of two rounded lobes (Fig. 9, J). The peristomium is long and biannulate, the two annuli appearing like two separate segments. The thorax is composed of 10 untessellated setigerous segments, of which the first 4 are faintly biannulate and bear only capillary setae in both rami. The

next 6 are uniannulate and bear long stalked hooks in the dorsal rami and short hooks in the ventral rami. The setae of the first four thoracic setigerous segments are borne on the second annulus of each segment. The stalked thoracic hooks possess a few very fine serrations above the main fang (Fig. 10, B). Abdominal hooks are hooded and with 4 or 5 fine serrations above the main fang (Fig. 9, K). From the 3rd thoracic setigerous segment posteriorly there is a shallow, dorso-lateral groove on each side which makes the thorax somewhat triangular in cross-section. The abdomen commences after the 10th foot. It is somewhat narrowed anteriorly but widens from the region of the 15th-21st abdominal segments. By the 27th abdominal segment the body is flattened and there is a longitudinal mid-ventral groove and two lateral ridges (Fig. 10, C). The two dorsal tori of each segment are approximated, coalesced and separated only by a faint groove.

H. similis Southern differs from the present form in the following respects. In addition to the peristomium, the thorax possesses five setigerous segments with only capillary setae in both rami and six segments with long crochets in both rami. The abdominal hooks possess a nodular swelling in the middle of the shaft and two indistinct spines above the main fang. The dorsal abdominal tori, as figured by Southern (1921) are distinct. *H. filiformis* (Claparède) also possesses 5 anterior thoracic segments with capillary setae in both rami followed by six thoracic segments with long crochets in both rami. Fauvel (1932) considers it to be very little different from *H. similis* and that it may be synonymous with it. *Parheteromastus tenuis* Monro is similar to the present species in possessing 4 anterior thoracic setigerous segments with only capillary setae in both rami and appears to be closely related to it. The abdomen commences after the 11th setigerous segment, unlike in the present species.

Holotype B.M.(N.H.). Reg. No. 1960. 3. 13. 24.

Family **MALDANIDAE** Malmgren, 1867

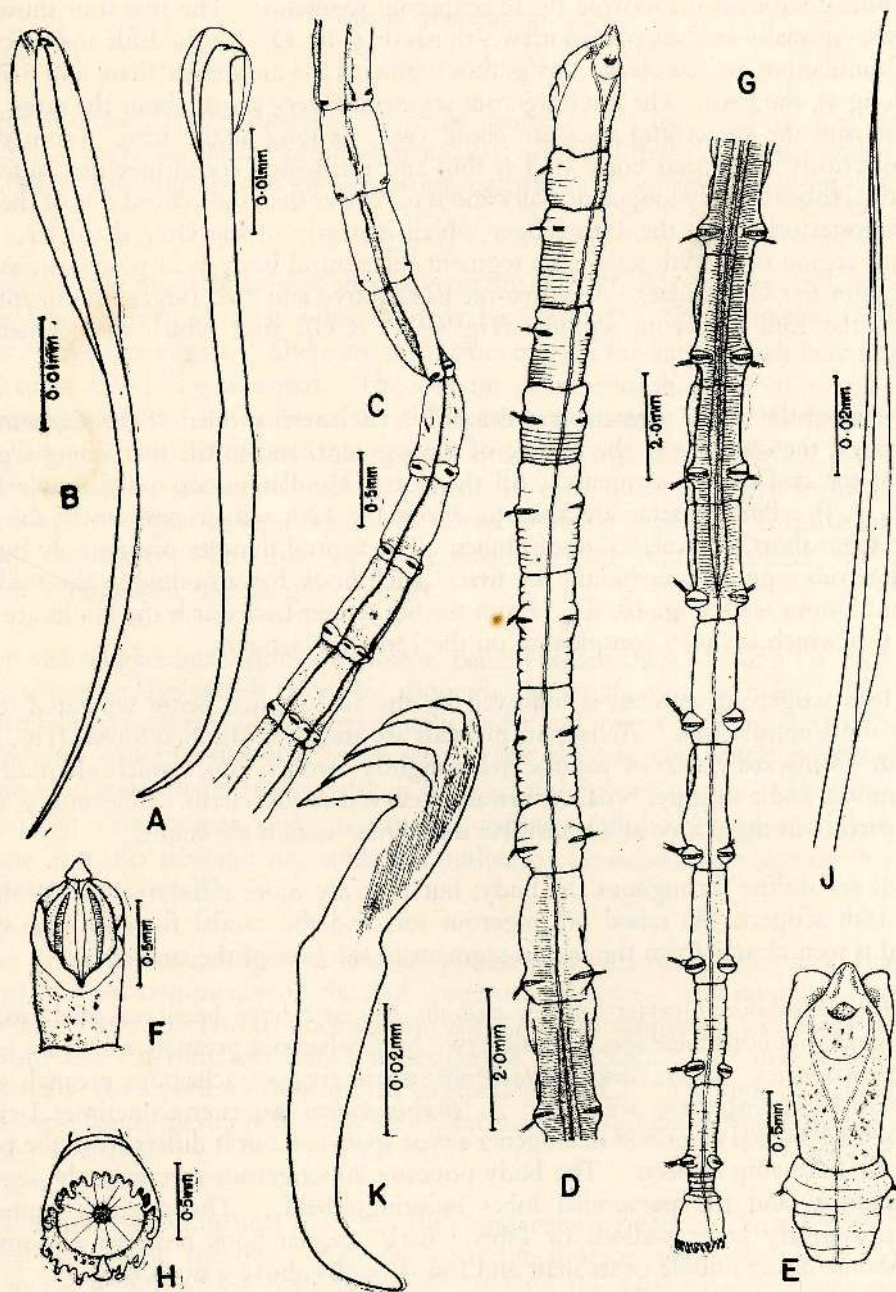
Genus **AXIOTHELLA** Verrill, 1900

***AxiotHELLa tambalagamensis*, sp. nov.**

(Fig. 10, D—K)

One complete specimen was collected from a somewhat sandy area at Nachchikuda. Length 33.0mm; width 1.5mm at the 9th setigerous segment, which is the widest region. Total number of setigerous segments 18.

The ventral side of the prostomium and the anterior ventral part of the cephalic rim, on either side, bear numerous reddish eye spots (Fig. 10, D & E). The buccal segment is about twice as long as the succeeding setigerous segment. The ventral lip of the mouth is swollen, crescentic and pad-like. The cephalic plate has a longitudinal keel ending at the base of the prostomium and a long nuchal organ on each side of it (Fig. 10, F). The cephalic rim is a single smooth membrane continuous round the posterior end of the cephalic plate.



TEXT-FIGURE 10.—*Notomastus ceylonicus*, sp. nov., A, Abdominal hook. *Heteromastus deductus*, sp. nov., B—C. B, Long, stalked thoracic hook; C, 27th—34th abdominal segments. *Axiothella tambalagamensis*, sp. nov., D—K. D, Ventral view of prostomium, buccal segment and 1st—10th setigerous segments; E, Ventral view of prostomium, buccal segment and first setigerous segment; F, Dorsal view of cephalic plate; G, Ventral view of 10th—18th setigerous segments and the anal funnel; H, Postero-dorsal view of the anal funnel; J, Notopodial seta from the first foot; K, Hook from the 8th foot.

The buccal segment is followed by 18 setigerous segments. The first four show small annulations, especially in their posterior two-thirds (Fig. 10, D). In the fifth and succeeding segments annulations are less clear. Setigerous segments 2-4 are longer than, and 5-7 about twice as long as, the first. The 8th setigerous segment is very short, about the same length as the first, and the succeeding ones are about twice as long as the first. From the 9th setiger posteriorly the dorsal body wall is thin and this region constitutes the "intestine". The intestinal tube is faintly looped dorsally and is narrower than the ventral side of the body. It merges posteriorly with the 14th setiger which is nearly of the same diameter. From the anterior region of the 9th setigerous segment the ventral body wall possesses transverse markings as in the Opheliidae. A ventro-median groove and two ridges are present up to the end of the 13th setigerous segment (Fig. 10, D & G), after which the segments are cylindrical.

The setae of the first 7 segments are situated in the anterior third of the segments. In the 8th setiger, the setae are in the middle of the segment, and in the succeeding segments they are at the end of the segments. All the dorsal bundles possess only simple bladed setae (Fig. 10, J). Pinnate setae are absent. From the 12th setiger posteriorly the dorsal setae arise from short, conical, setigerous lobes. The ventral bundles possess only hooks in all the setigerous segments, including the first. Each hook has a nodule in the middle of its shaft and 5 stout teeth (Fig. 10, K). From the 8th setiger backwards the hooks are borne on raised tori which are very conspicuous on the 13th-18th setigers.

The 18th setigerous segment is followed by the anal funnel, being separated from it by a very short constriction. Achaetous preanals are absent. The anal funnel (Fig. 10, H) bears about 13 inwardly curved papillae with slightly swollen tips, which alternate with shorter papillae, and a stumpy, broader, inwardly curved caudal cirrus. The anus is a small circular aperture in the centre of a transverse membrane within the funnel.

Glands are diffuse throughout the body, but they are more numerous on the 4th-8th and 14th-18th setigers, the raised uncinigerous tori and the caudal funnel. The ventral nerve cord is seen clearly from the buccal segment to the base of the anal cirrus.

Axiiothella obockensis Gravier and *A. australis* Augener have been reported from the Gulf of Mannar, but both these species possess two long achaetous preanals which are lacking in the present species. In *A. campanulata* Moore there are two achaetous preanals and in *A. catenata* (Malmgren) there are four. *A. quadrimaculata* Augener sometimes lacks the single achaetous preanal described in Augener's type specimen but it differs from the present species in the following respects. The body possesses 20 setigerous segments, the segments being cylindrical and the parapodial lobes indistinguishable. The pygidial funnel has 10-12 comparatively large scallops or lobes. Each acicular hook possesses a prominent, rounded nodule in the middle of its shaft and five denticles above a main fang.

Holotype B.M.(N.H.). Reg. No. 1960. 3. 13. 25.

Family **TEREBELLIDAE** Malmgren, 1867

Genus **LOIMIA** Malmgren, 1866

***Loimia decora*, sp. nov.**

(Fig. 11, A—D)

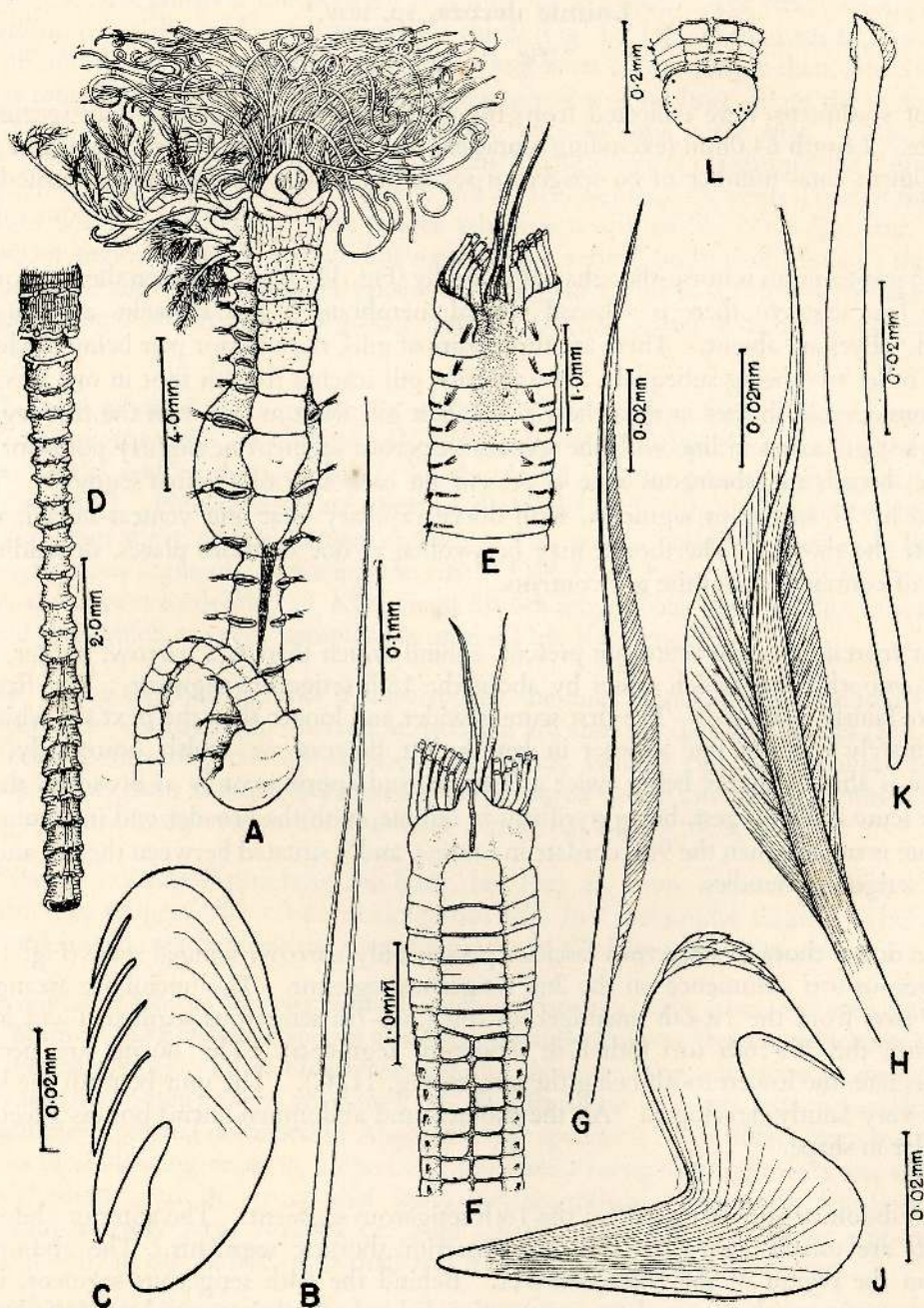
Four specimens were collected from the centre of the lake. Only one specimen is complete. Length 64.0mm (excluding tentacles); width of thorax 2.5mm; width of abdomen 2.0mm; total number of 86 setigerous segments. Tube membranous, coated with sand.

The prostomium is horse-shoe shaped ventrally (Fig. 11, A). Between the prostomium and the first segment there is a broad ventral membrane. The tentacles are long and grooved. Eyes are absent. There are three pairs of gills, the anterior pair being the longest and the other two being subequal. The anterior gill reaches the 9th foot in one specimen, but is considerably shorter in the others. The first gill arises in line with the first segment, and the last gill arises in line with the second setigerous segment or slightly posterior to it. A single, broad, membranous lobe is present on each side of the first segment. This is followed by 17 setigerous segments, with dorsal capillary setae and ventral uncini, which constitute the thorax. The thorax may be swollen in one or more places, depending on its state of contraction and the gut contents.

Ten ventral glandular scutes are present, behind which there is a narrow, darker, tessellated or smooth ridge which ceases by about the 13th setigerous segment. The first few scutes are faintly tessellated. The first scute is wider and longer than the next six which are approximately equal to one another in length but decrease in width posteriorly. The 8th scute is almost square, being twice as long as, and approximately as broad as, the 7th. The 9th scute is the longest, being pyriform in outline, with the broader end in front. The 10th scute is smaller than the 9th, cordate in outline, and is situated between the 9th and 10th pairs of setigerous bundles.

The dorsal thoracic setigerous fascicles possess only narrow, winged setae (Fig. 11, B). Uncinigerous tori commence on the 2nd setigerous segment. The uncini are arranged in a single row from the 1st-6th uncinigerous tori (2nd-7th setigerous segments) and in two rows from the 7th-16th tori (8th-17th setigerous segments). The uncini are pectinate and 5-dentate, the lowest tooth being the largest (Fig. 11, C). The spur beneath the lowest tooth is very faintly developed. All the thoracic and abdominal uncini possess 5 teeth and are similar in shape.

The abdomen commences from the 18th setigerous segment. The anterior abdominal segments are usually narrower than the posterior thoracic segments. The abdomen is widest in the region of the 50th-56th feet. Behind the 64th setigerous segment, in the complete specimen, there is a sharp constriction behind which is a rectal tube of about 22 setigerous segments (Fig. 11, D). The last 9 or 10 segments possess a wide lumen and a thin body wall. Each abdominal segment possesses only a ventral pair of uncinigerous tori. The abdominal uncini are similar to the thoracic uncini in regard to the number of teeth and shape. The posterior abdominal uncini are about half the size of the anterior ones.



TEXT-FIGURE 11.—*Loimia decora*, sp. nov., A—D. A, Ventral view of the thorax and a few abdominal segments; B, Notopodial seta from the first foot; C, Uncinus from the 3rd thoracic neuropodial torus; D, Ventral view of 63rd and 64th feet and the rectal tube. *Potamilla brevithoracica*, sp. nov., E—L. E, Dorsal view of anterior end (gill pinnules not shown); F, Ventral view of anterior end (gill pinnules not shown); G, Notopodial seta from the first thoracic setigerous segment; H, Paddle-shaped seta from the 2nd thoracic notopodial bundle; J, Thoracic hook (uncinus); K, Pennoned (pickaxe shaped) seta from a thoracic neuropodial torus; L, Dorsal view of anal segment.

All four specimens are similar in regard to the anterior lateral lobes, gills, number of thoracic segments, number and arrangement of scutes, the setae and uncini.

In *Loimia medusa* (Savigny) the three pairs of gills all lie anterior to the first setigerous segment and the uncini are 6-dentate only or mixed with 5-dentate uncini. Six-dentate uncini are also present in *L. montagui* (Grube). In *L. arborea* Moore the thoracic uncini possess 5 teeth and a rudimentary 6th. The 6th tooth is well defined in the abdomen. In the present species the origin of the gills, the relative size and shape of the ventral scutes, and the form of the uncini and number of teeth are different.

Holotype B.M.(N.H.). Reg. No. 1960. 3. 13. 26.

Paratypes B.M.(N.H.). Reg. Nos. 1960. 3. 13. 27 to 28.

Family **SABELLIDAE** Malmgren, 1867

Genus **POTAMILLA** Malmgren, 1866

Potamilla brevithoracica, sp. nov.

(Fig. 11, E—L)

One complete specimen and two specimens with their posterior ends missing were collected from a somewhat sandy area at Nachchikuda. The complete specimen is 12.5mm long (excluding the tentacles), 1.25mm wide at the thorax and possesses 61 setigerous segments.

The gills are arranged in a semicircle on each side (Fig. 11, E & F). The complete specimen has 10 gills on the left and 11 on the right. Gills possess about 9 transverse, maroon bands and a longitudinal band at the base of each gill. Each gill ends in a long, bare, terminal filament. Branchial eyes are absent. The two palps are tapering and grooved. Each half of the collar ends ventrally in a triangular lobe. The thorax is composed of 5 setigerous segments. The first thoracic setiger possesses only dorsal setae. From the 2nd-5th setigers there are ventral uncinigerous tori in addition to the dorsal setigerous fascicles. From the 6th setigerous segment posteriorly the uncinigerous tori are dorsal to the setigerous fascicles.

There are six large, rectangular, ventral scutes anteriorly, behind which each segment possesses a pair of somewhat square scutes, with the faecal groove running between them (Fig. 11, F). The first scute is the largest, being twice as long as the next five which are approximately equal to one another in length and width. The posterior half of the first scute and the 2nd-5th scutes correspond to the five thoracic setigerous segments. The 6th scute corresponds to the first abdominal segment. From the second abdominal segment backwards there is a pair of scutes to each segment with the faecal groove running between them. Since the first abdominal scute is situated across the mid-ventral region, the faecal groove takes an oblique turn to the right behind it, the scutes adjoining this diversion being modified accordingly.

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The setae of the first thoracic segment are arranged in a tuft. Each seta has a striated, tapering blade which is usually constricted at a short distance from its tip (Fig. 11, G). The remaining dorsal thoracic fascicles possess setae of two kinds. The dorsal setae of each bundle are similar to those of the first setiger, but the ventral setae are paddle-shaped and possess tapering tips (Fig. 11, H). The thoracic uncinigerous tori possess uncini and pennoned setae. Each uncinus possesses a wide, striated, flattened body, a tapering basal process and several small teeth over a main fang (Fig. 11, J). The pennoned setae are different from the usual type met with in other known species of the genus *Potamilla*. Each pennoned seta has a short, somewhat hooked tip with two striated fins on opposite sides of the latter, but without a long, attenuated tip (Fig. 11, K). Abdominal setae are paddle-shaped as in the 2nd-5th thoracic setigers, but their tips are shorter. The abdominal uncinigerous tori bear only uncini, which are similar to those of the thorax.

The anal segment bears several red eye spots, especially on its ventro-lateral aspects (Fig. 11, L). The tube is horny and coated with sand particles and small fragments of shells and algae.

Potamilla reniformis Leukart and *P. ehlersi* Gravier possess branchial eyes which are lacking in the present form. *P. neglecta* Sars, *P. leptochaeta* Southern, *P. casamancensis* Fauvel, *P. ceylonica* Augener, *P. minuta* (Treadwell) and *P. elongata* (Treadwell) are devoid of branchial eyes as in the present form, but their pennoned (pickaxe-shaped) setae are different from those of the present form. In *P. minuta* there are four thoracic setigerous segments and the gills possess a frilled, foliaceous membrane at their bases. *P. elongata* possesses very long-handled uncini and very long gill tips free of pinnules. In *P. casamancensis* there is only a very slight ventral break in the anterior border of the collar. *P. ceylonica* possesses 15-23 thoracic setigers (45-46 according to Augener) and lacks anal eyes. In *P. leptochaeta* anal eyes are absent and the thoracic and abdominal capillary setae possess very long filiform tips. *P. neglecta* possesses usually 8 (5-8) thoracic setigers and anal eye spots but, as stated earlier, its pennoned setae are different from those of the present form.

Holotype B.M.(N.H.). Reg. No. 1960. 3. 13. 29.

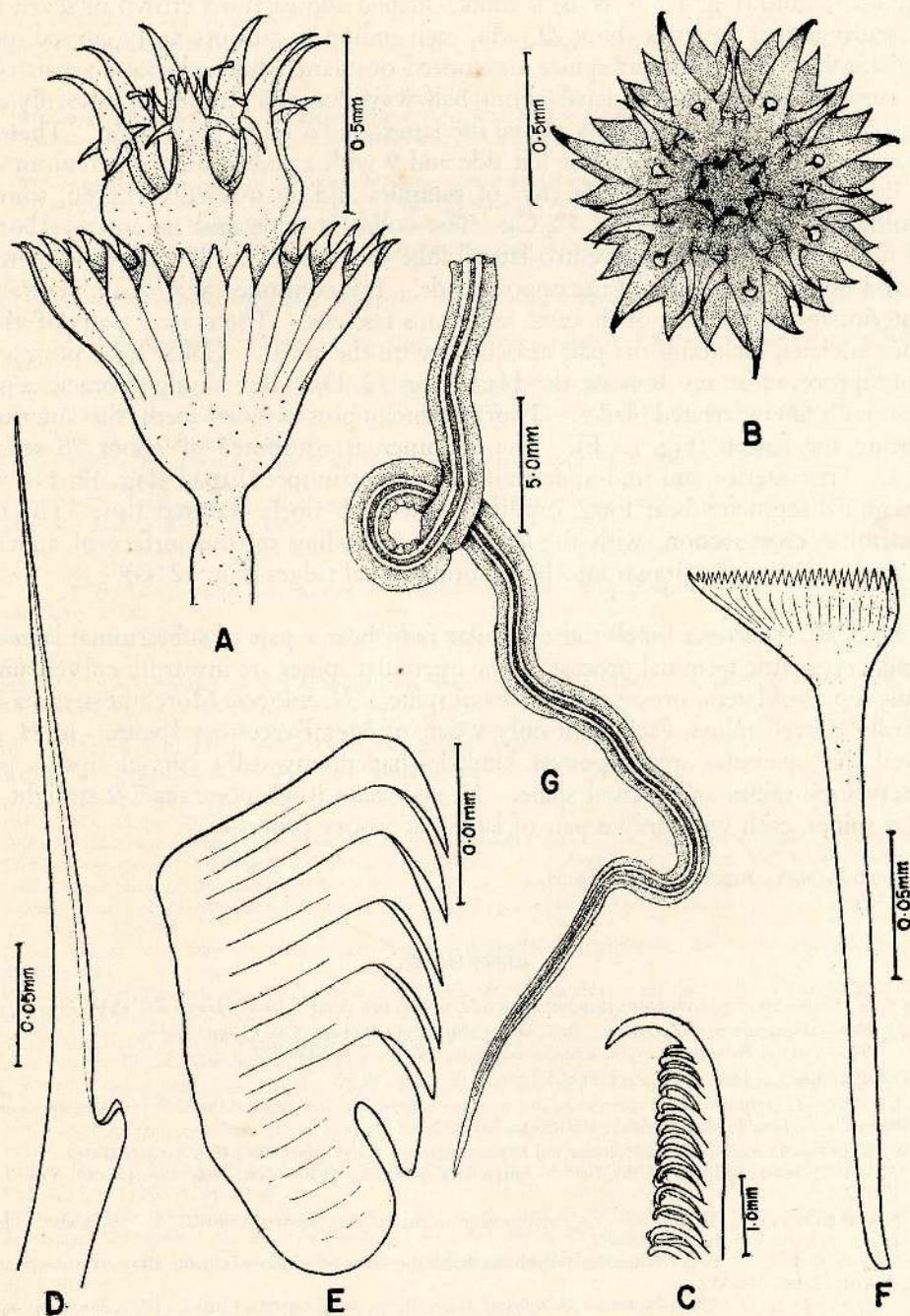
Family **SERPULIDAE** Savigny, 1818

Genus **HYDROIDES** Gunnerus, 1768

Hydroides tambalagamensis, sp. nov.

(Fig. 12, A—G)

One specimen, growing on the inside of a dead windowpane oyster shell, was collected from Nachchikuda. Length of operculum with spines 1.25mm; gills 2.0mm; thorax 2.0mm long, 1.25mm wide; abdomen 18.5mm long and 1.0mm wide. In alcohol, the specimen has a reddish-brown pigment patch at the base of each thoracic setigerous fascicle and a lighter band between it and its fellow of the opposite side.



TEXT-FIGURE 12.—*Hydroides tambalagamensis*, sp. nov. A—G. A, Lateral view of operculum; B, Top view of operculum; C, Tip of a gill; D, Bayonet-shaped collar seta; E, Thoracic uncinus; F, Anterior abdominal seta; G, Tube.

The operculum (Fig. 12, A & B) is funnel-shaped and carries a crown of seven spines. The opercular funnel possesses about 23 radii, each ending in an outwardly curved, pointed marginal tooth. The opercular spines are curved outwards and each bears a pair of outwardly curved lateral spines situated about half-way along its length, an inwardly curved median spine at the level or slightly above the latter, and a blunt basal spine. There are 8 branchiae with the operculum on the left side and 9 with a rudimentary operculum on the right. Each branchia has a double row of pinnules and an inwardly curved, somewhat hard, colourless, pointed tip (Fig. 12, C). The collar is wide and its anterior border is divided into a dorso-lateral and ventro-lateral lobe on each side. The thoracic membrane is wide and overlaps its fellow of the opposite side. It is continued as a broad, ventral back-flap posterior to the last pair of thoracic setigerous fascicles. There are 7 pairs of thoracic setigerous fascicles, including the pair associated with the collar. Collar setae possess a pair of conical processes at the base of the blade (Fig. 12, D). Remaining thoracic segments bear setae with finely serrated blades. Thoracic uncini possess 6 or 7 teeth, the anteriormost tooth being the largest (Fig. 12, E). The abdomen is composed of about 78 setigerous segments. The anterior and mid-abdominal setae are trumpet-shaped (Fig. 12, F). Posterior abdominal segments bear long, capillary setae with finely serrated tips. The tube is quadrilateral in cross-section, with the lower side spreading on the surface of attachment and the two upper angles drawn into blunt longitudinal ridges (Fig. 12, G).

In *Hydroides homoceros* Pixell the opercular radii bear a pair of subterminal lateral processes and a crescentic terminal process. The opercular spines are inwardly curved and each bears only a pair of lateral processes and a basal spine. *H. crucigera* Morch possesses a crown of inwardly curved spines, each with only a pair of lateral accessory spines. In *H. parvus* Treadwell the opercular spines possess kunckle-shaped, inwardly curved tips, a pair of lateral accessory spines and a basal spine. *H. mucronata* Rioja possesses 7-9 straight, blunt opercular spines, each with only a pair of lateral accessory processes.

Holotype B.M.(N.H.). Reg. No. 1960. 3. 13. 30.

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New Species of Insects from Ceylon (7)

by

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(With three Plates)

The present paper deals with the description of three new species of insects collected in Ceylon. Facilities for obtaining these specimens were provided by the University of Ceylon, for which I acknowledge my gratitude. The type specimens are deposited in the collection of the Department of Zoology of the University of Ceylon. The new species are listed below :—

1. *Tridactylus dreyfus*
2. *Gonolabis calas*
3. *Dorylaca archershee*

ORDER ORTHOPTERA

1. *Tridactylus dreyfus*, sp.n. (Plate 1, Fig. 1 and Plate 2, Figs. 2-4).

Small insects, rather longer than broad; colouration creamish white anteriorly, blackish posteriorly.

Head: Creamish white, except along posterior margin and anteriorly behind labrum. Eyes black. Ocelli, small, black.

Antennae: 10-jointed; basal joint black; second somewhat lighter; the colour gradually changes to light brown at the terminal joint; basal joint broader than long; 3rd joint longer than 2nd; rest of joints gradually increasing to the end.

Palpi: Creamish white, brownish at apex; 2nd joint shorter than 3rd; 3rd joint almost equalling 4th; 5th joint longest, equalling 3rd and 4th together. 2nd joint of labial palpi a little longer than 3rd; terminates in three elongate, brownish spines.

Pronotum: Creamish white; trapezoidal; feebly convex anterior margin, which is rounded laterally; posterior margin round.

Elytra: Light brown; adjacent at base, gradually narrowing towards apex, which is rounded.

Wings: Transparent; elongate, reaching beyond apex of abdomen almost to the tips of cerci. Venation visible.

Scutellum: Visible beneath clytra, with blackish pointed apex.

Legs: Anterior legs creamish white; femora thick with small spines; internal inferior margin with a row of about fifteen strong bristles, of which five are longer than the others; anterior tibiae short and wide, armed at apex with four spurs which are straight and rounded at apex, external face covered with small spines. Median femora elongated, rounded at apex, somewhat dark patch in middle; tibiae wider than femora but tapering at apex, conspicuous opaque white with transparent margin, but somewhat dark at base and apex; tarsi 3-jointed, the first two very short; apex of tarsal joints brownish. Posterior femora wide, compressed, dark brown; tibiae bearing three internal and four external lamellae; metatarsus tuberculiform; lamellae and spurs white; metatarsus black.

Abdomen: Blackish, with whitish apex, subgenital plate with somewhat crenulated margin. Cerci with 1st joint brown; 2nd joint yellowish. Anal valves creamish, light brown at apex.

Length of body: 4.5 mm.

Locality: Bank of Moderagam Aru, in Wilpattu National Park; 5 specimens; collected by Wilfred Fernando Jnr.

This new species of *Tridactylus* differs distinctly from those described from Ceylon in its coloration. I name it *Tridactylus dreyfus* after Captain Alfred Dreyfus, a victim of evil perjury resulting in a miscarriage of justice at the hands of a face-saving administration.

The specimens of *Tridactylus dreyfus* were collected by my son Wilfred on a trip to Wilpattu National Park during January 13th to 15th, 1961 along the bank of Moderagam Aru. The specimens were obtained with difficulty on account of the fact that the colouring of the insects blended with the sands of the river bank. I wish to thank the University of Ceylon and Mr. J. A. de Silva, Warden of the Department of Wild Life, for all the facilities given me during this trip. I wish to acknowledge my gratitude to Mr. H. P. de Alwis, Game Ranger of the Wilpattu National Park, who personally took us round the Park and very patiently assisted my two sons in collecting specimens during the trip.

ORDER DERMAPTERA

2. *Gonolabis calas*, sp.n. (Plate 3, Figs. 6-8).

Male: Small, slender, shining, dark brown in colour.

Head: Triangular; widest behind eyes; caudal angles rounded; caudal margin convex; sutures obsolete; scantily covered with hairs. Eyes black, smaller than 1st antennal joint. Maxillary palps short.

Antennae: 12-jointed; dark brown; last two joints yellowish; 1st joint cylindrical, longest; 4th and 5th joints somewhat globular, the rest gradually lengthening to become ovate.

Pronotum: Narrower than head, somewhat longer than broad and slightly broader at posterior margin; angles rounded; caudal margin rounded; caudal angles each with a stiff bristle; cephalic angles each with one long stiff and two short, stiff bristles; median suture well marked.

Elytra: Entirely absent.

Legs: Yellowish; femora brownish.

Abdomen: Dark brown, gradually widening from the base to apex. Last dorsal segment rectangular and twice as broad as long; posterior margin truncate; external depression and ridge present; penultimate ventral segment very broadly rounded.

Pygidium: Not protruding.

Forceps: Branches very stout and trigonal; remote at base; branches strongly bent inwards distally; inner margin somewhat crenulate.

Locality: University of Ceylon, Colombo. Two males collected by Mr. G. R. L. Wijeratne, of the laboratory staff of the Department of Zoology.

Length of body: 8.5 mm.

Length of forceps: 1 mm.

Maximum breadth of Abdomen : 2 mm.

Minimum breadth of abdomen: 1.5 mm.

This new species of *Gonolabis* differs from its closest relative *G. electa* in size, the antenna and the nature of the forceps. I name it *Gonolabis calas* after Jean Calas who was the victim of a gross miscarriage of justice and was legally murdered on March 9th, 1762. Voltaire worked indefatigably for three years to procure justice for Calas, who, long after his death, was finally declared innocent.

ORDER DICTYOPTERA

3. *Dorylaca archershee*, sp.n. (Plate 2, Fig. 5).

Female: Black. Ocelli testaceous. Eyes black. Base of antennal sockets whitish with a brown ring. Antennal joints dark brown to black. Clypeus yellowish-brown. Labrum dark brown. Maxillary palps dark brown. Labium whitish; labial palp brown.

Pronotum: Uniformly black; arched; postero-lateral angles rounded; posterior margin convex.

Tegmina: Black; extending up to 5th tergite only; well sclerotized; venation distinct.

Hind Wings: Membranous; well developed; shorter than tegmina.

Legs: Black, strongly spined; posterior metatarsus equal to the other joints combined and armed with two rows of fine spines; arolia large; tarsal claws symmetrical.

Abdomen: Black above and below; 7th abdominal tergite furrowed in middle. Supra-anal plate broadly furrowed in middle, with yellowish streak in middle; lateral lobes with scanty hairs.

Cerci: Black, robust, hairy, extending beyond supra-anal plate about half its length.

Total length: 27 mm.

Length of pronotum: 7 mm.

Breadth of pronotum: 12 mm.

Length of tegmen: 17 mm.

Locality: Talawakelle. 2 specimens collected by Mr. E. F. W. Fernando of the Tea Research Institute.

The present species resembles *Dorylaea zeylanica* Princis but differs from it in size and in the shape of the supra-anal plate. I name this new species *Dorylaea archershee* after Naval Cadet George Archer-Shee, the "Winslow Boy", who was the victim of a most palpable injustice committed during the early part of this century.

EXPLANATION OF PLATES

PLATE 1.

FIG. 1. *Tridactylus dreyfus*, sp.n.

FIGURE

1. *Tridactylus dreyfus* (dorsal view).

PLATE 2.

FIGS. 2—4 *Tridactylus dreyfus*.

FIGURE

2. Antenna.
3. Anterior leg.
4. Middle leg.

FIG. 5. *Dorylaea archershee*, sp.n.

FIGURE

5. Apex of abdomen (dorsal view).

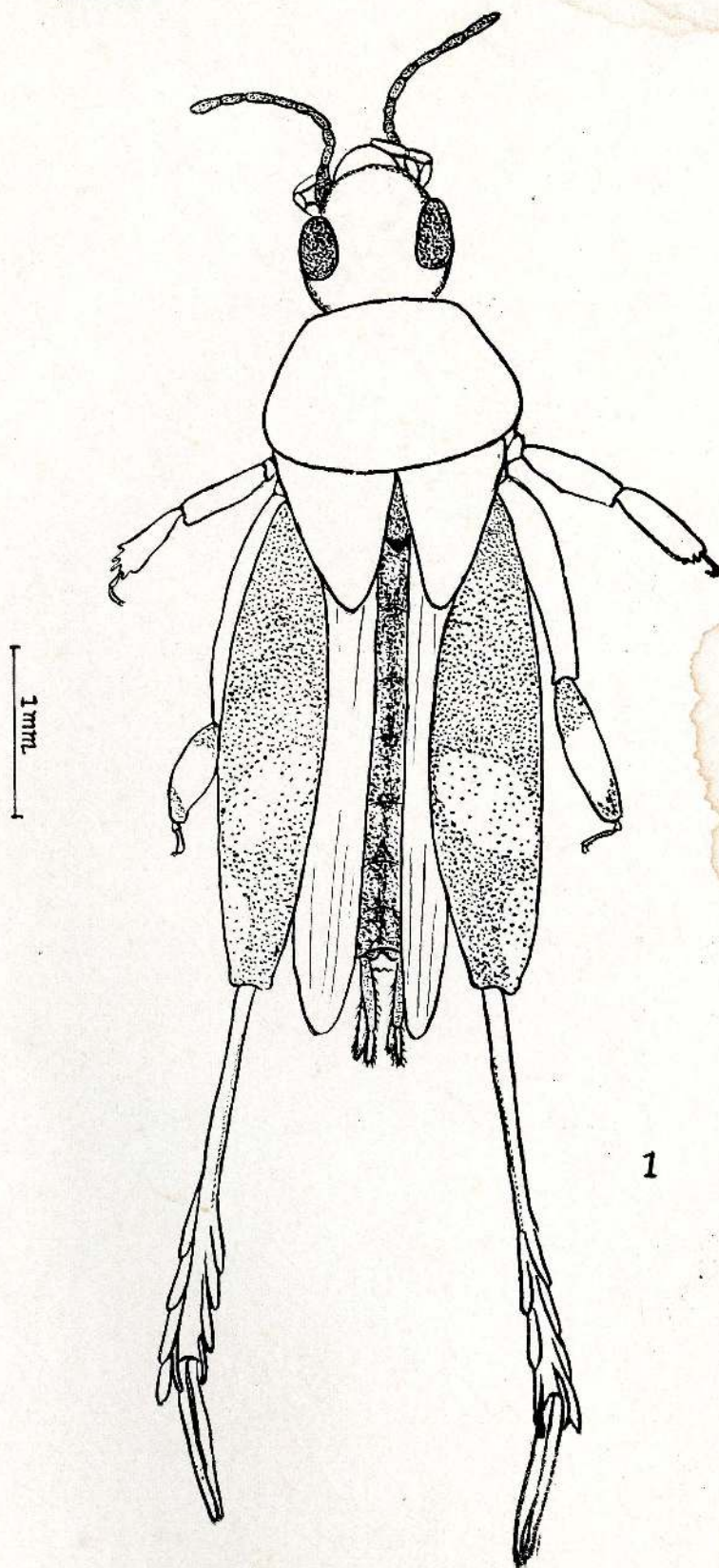
PLATE 3.

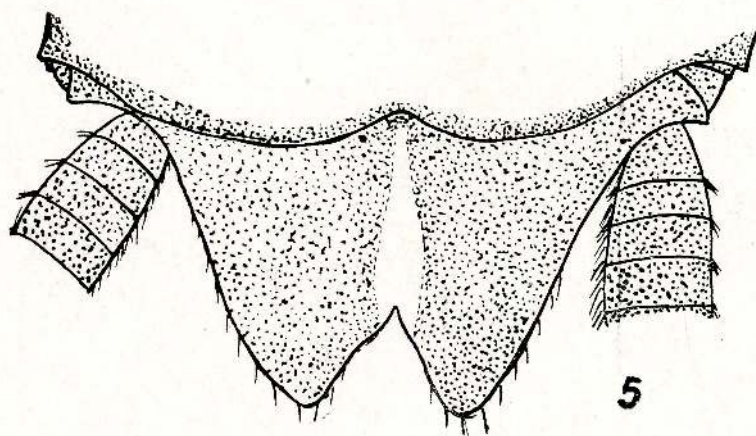
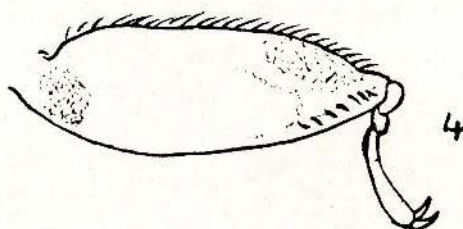
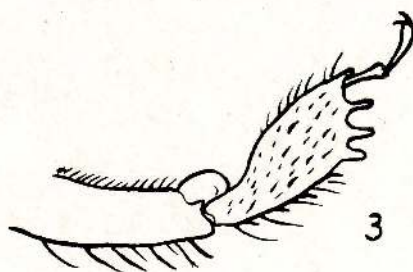
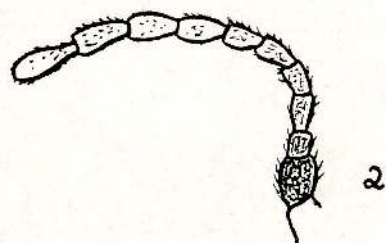
FIGS. 6—8 *Gonolabis calas*, sp.n.

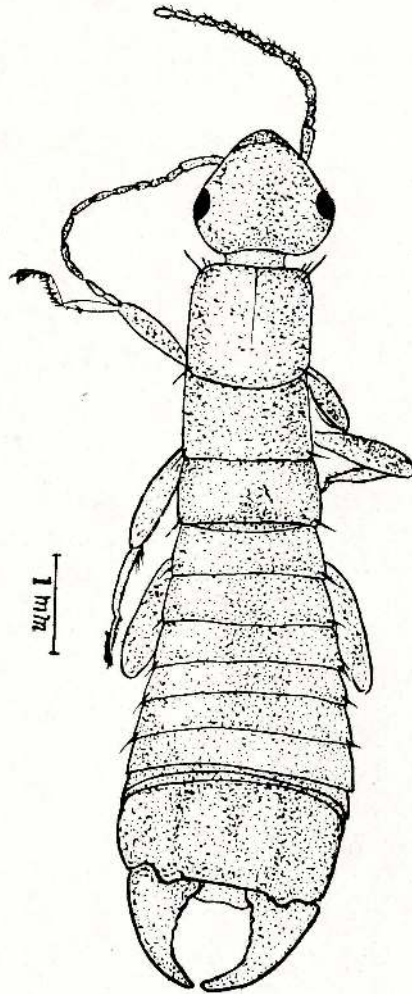
FIGURE

6. *Gonolabis calas* (dorsal view).
7. Apex of abdomen (ventral view).
8. Antenna.

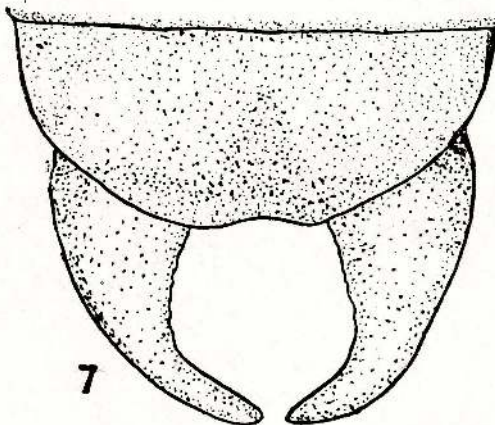
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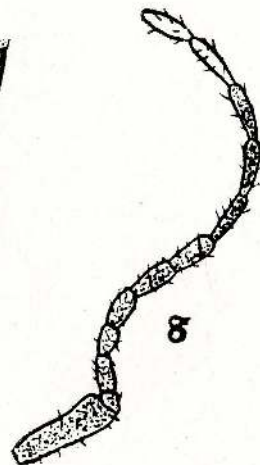




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8

Aquatic insects taken at light in Ceylon, with a discussion and bibliography of references to aquatic insects at light

by

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INTRODUCTION

During the period September 1956—January 1959, I collected aquatic insects coming to lights at night. Although many of the records were from Nugegoda where I reside, I was able to get a number of records from other parts of Ceylon too. The number of species taken was remarkably large and belonged to practically every family of aquatic insects whose members are known to fly. There are no previous records of aquatic insects at light from Ceylon. Although there are many records of aquatic insects at light scattered in journals from many parts of the world no systematic study of the phenomenon has so far been made.

The present paper gives records of aquatic insects taken at light during 1956-1959 in Ceylon. The phenomenon of flight at night is discussed in terms of the available information and, in order to bring together some of the available information, a bibliography of records of aquatic insects at light is given.

AQUATIC INSECTS TAKEN AT LIGHT

Insects belonging to the following families were captured at light :—Noteridae, Hydrophilidae and Dytiscidae (Coleoptera) and Hydrometridae, Veliidae, Gerridae, Corixidae and Belostomatidae (Hemiptera—Heteroptera).

NOTERIDAE

One species *Canthydrus luctuosus* Aube was taken on three occasions. (Table 1). This species is very common in paddy fields in the vicinity of their capture at light. I am not aware of any previous records of members of this family at light.

HYDROPHILIDAE

Twelve species were recorded (Table 1), namely *Hydraena fontana* Orch., *Limnebius rutipennis* Reg., *Berosus indicus* Motsch., *B. pulchellus* MacL., *Enochrus esuriens* (Walk.), *Paracymus evanescens* (Sharp), *Helochaeres anchoralis* Sharp, *H. densus* Sharp, *H. pallens* MacL., *Regimbartia attenuata* (F), *Sternolophus brachyacanthus* Rég., and *Amphiops gibbus* (Ill.).

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Note.—The naming of Hemiptera—Heteroptera is that of Lundblad (1933), Hutchinson (1940) and Brooks (1951).

The commonest species were *Berosus indicus* and *Enochrus esuriens*. *Berosus indicus* is one of the commonest hydrophilid beetles in small freshwater habitats. It is often found in pools and paddy fields. Fernando (1959 b) found it to be a common colonizer of small habitats throughout the country. *Enochrus esuriens* is also found in large numbers in muddy pools and ponds.

The references to hydrophilid beetles at light have been summarised by Fernando (1958 a) and are included in the bibliography. Additional references are those of d'Orchymont (1923) and Guignot (1954).

The Hydrophilidae are the commonest aquatic insects taken at light. The small size of many of the species is perhaps the reason why they have not been recorded more often. Yamamoto (1951) found 21 species of a total of 51 species of aquatic beetles at light to be hydrophilids, in Japan. In addition to the large number of species recorded and their relative frequency at light, some species come to light in large swarms. Fernando (1958 a) took about 1,500 specimens of *Helophorus brevialpis* Bedel in a single night in an artificial habitat only 4 ft. by 4 ft.

Hydrophilidae are with few exceptions herbivorous and feed largely on living and dead plant tissue. The abundance of the type of food in habitats like paddy fields and ponds enables them sometimes to reach enormous numbers. They form an important and numerous component of the insect fauna of Ceylon freshwater habitats of small size.

DYTISCIDAE

Seven species were recorded (Table 1) namely *Cybister confusus* (Sharp), *Copelatus indicus* Sharp, *Laccophilus flexuosus* Aube, *L. chinensis inefficens* Walk., *Hydraticens fabricii* MacL. and *Eretes sticticus* L. and *Bidessus inconstans*.

The commonest species were *Laccophilus chinensis inefficens* and *Bidessus inconstans*. Both these species are small and probably herbivorous. They are commonly found in temporary habitats, small ponds and paddy fields.

One of the large Dytiscidae, *Dytiscus marginalis* (L) is commonly recorded in Europe at light. In Ceylon the largest dytiscid *Cybister confusus* which is similar in size to *Dytiscus marginalis* is commonly recorded at light. The large size of these two beetles makes them conspicuous and facilitates recording. These large species are generally not found in large numbers. They often occur singly.

The records of Dytiscidae at light have been summarised by Fernando (1958 a) and are included in the bibliography.

HALIPLIDAE

Only a single specimen of *Haliplus pulchellus* Clark was recorded. This beetle has not so far been recorded from Ceylon although it is widely distributed in Siam, Sumatra, Burma, India (Bengal) and Celebes. The only other records of Haliplidae at light are those of Hickman (1931) and Yamamoto (1951).

Haliplidae are generally few in numbers and species as compared with the Hydrophilidae and Dytiscidae and this alone could account for the few records. Haliplidae are also generally small in size and therefore likely to be missed in collections at light.

GYRINIDAE

Only one specimen of *Dineutes unidentatus* Aube was recorded (Table 1). Yamamoto (1951) found 3 species of Gyrinidae at light in Japan.

HYDROMETRIDAE

Four specimens of *Hydrometra greeni* Kirk. were taken (Table 2). I found in the collection at the Ceylon National Museum, Colombo, one specimen taken on 7-11-24 and four on 1-9-27 in Colombo. Although Sprague (1956) mentions that the North American species *Hydrometra martini* Kirk. can fly well yet captures at light have not been recorded as far as I know except by White (1879).

VELIIDAE

A single species *Microvelia longicornis* Bueno was recorded (Table 2). On account of its very small size this species can easily be missed in collections at light. *Microvelia longicornis* is a common colonizer of small freshwater habitats all over the low country. It is sometimes found in ephemeral puddles of water. The only record I am aware of is that of White (1879) who took this genus at light on a steamer on the Amazon.

GERRIDAE

Two specimens of *Limnogonus nitidus* (Mayr) were taken (Table 2). In the Ceylon National Museum collections, Colombo, four specimens have been taken at light on 16-12-23, 23-9-24, 16-10-26 and 22-11-26.

Limnogonus nitidus is a very common colonizer of small freshwater habitats all over the low-country. It is often seen in ornamental ponds and roadside pools of water. Fernando (1959 b) records it as a common colonizer of small habitats (*Limnogonus nitidus* = *Gerris nitida* of Fernando 1959 b).

BELOSTOMATIDAE

Although only two specimens of *Lethocerus indicus* (Lep. et Serv.) were recorded both from Jaffna peninsula (Table 2), yet this species is a common flier to artificial lights in Ceylon and because of its large size (about 21 ins. long) is a very conspicuous insect. Species of Belostomatidae are common at light and in North America they are called "electric light bugs". In textbooks and many papers mention is made of their attraction to artificial lights. Hungerford (1919) includes many references in his bibliography. Leidy (1847), Hoffman (1924), Step (1925), Cummings (1933), Ramakrishna Aiyer and Anantanarayan (1934), Hidalgo (1935), Stehr (1931) and Corbet (1959) mention Belostomatidae at light.

In Ceylon there are two species of belostomatids, *Lethocerus indicus* and *Spheredema rusticum* (F.). The latter though extremely common in paddy fields, ponds and small streams is not found flying to lights. It seems likely that this species which is a very good swimmer, reaches small habitats by swimming along temporary collections of water formed as a result of rain (Fernando, in press).

CORIXIDAE

I have recorded two species of *Micronecta* at light (Table 2), *Micronecta quadristrigata** Breddin and *M. albifrons* Motsch. The former species was found at light in very large numbers on two occasions. Corixidae are the commonest aquatic Hemiptera at light. These records have been summarised in a previous paper (Fernando 1959 a). To this must be added the records of Distant (1906) and Hutchinson (1940). Hutchinson (1940) states that all the specimens of *Micronecta siva* (Kirk.) he examined which had any notes were taken at light. It is interesting that *Micronecta siva* and *M. albifrons* are very closely related species, the former being a common species in India.

NOTONECTIDAE

Three species of *Anisops* and one species of *Enithares* have been recorded (Table 2). Of the three species of *Anisops*, *A. batillifrons* (Lundb.) and *A. crinita* Brooks are new records for Ceylon. *Anisops batillifrons* which is a very common species has probably been identified earlier as *Anisops nasuta* Fieb. The other species *A. nivea* (Fieb.) has been previously reported from Ceylon.

Hale (1924) observed a large number of either *Anisops hyperion* Kirk. or *A. doris* Kirk. flying from a lake in Australia early in the morning. The specimens of *Anisops batillifrons* and *A. nivea* I have recorded were taken early morning.

Anisops batillifrons is one of the common Notonectidae colonizing small habitats in the low-country, (Fernando 1959 b).

Enithares indica (F.) was recorded on one occasion. This species although not as common as species of *Anisops* is nevertheless found in ponds in many parts of Ceylon.

GENERAL REMARKS

In the aquatic Coleoptera all the families are represented in captures at light. The number of species recorded is 22 and this is a very high proportion of the total number of species of aquatic beetle. In the Hemiptera-Heteroptera six families are represented namely, Hydrometridae, Gerridae, Belostomatidae, Corixidae and Notonectidae. Six others, Nepidae, Ranatridae, Naucoridae, Helotrephidae, Mesovelidae and Hebridae are not represented.

The Nepidae, Ranatridae and Naucoridae often have reduced wings and wing muscles and it is likely that this condition is found in the Ceylonese species too. The Helotrephidae and Mesovelidae are represented in Ceylon by one species each and the Hebridae by two species.

The only mention of members of these six families flying are those of Swammerdam (1749) who mentioned *Nepa* as flying at night, Kirichenko (1911) of *Ranatra linearis* L. flying in Odessa, Russia, and White (1879) who recorded *Mesovelina* at light on a steamer on the Amazon.

*Wrongly called *Micronecta quadrisignata* (Fernando 1958, 1959b and 1960) due to an error of spelling.

It is possible that members of these species not taken at light fly during the day. This is however unlikely because these species are not found in small habitats and are therefore probably restricted to the larger habitats which they can reach by swimming.

The occurrence of aquatic insects at light is a phenomenon recorded from Europe, North and South America, Africa, South East Asia and the Far East. The records alone do not give us an adequate idea of the extensive and frequent occurrence. Aquatic insects are generally not collected by agricultural stations or similar institutes that keep a light trap and even when collected they are often left unidentified, because of their innocuous nature as pests. The amateur does not find them sufficiently attractive to collect. I have been reliably informed that in the Pacific Islands and Korea they are common at light but I am not aware of any records from this area. There are perhaps a few records scattered in agricultural and popular journals which I have missed in compiling the bibliography.

The Corixidae (Hemiptera—Heteroptera) and the Hydrophilidae (Coleoptera) are by far the commonest groups recorded at light. Both these families are represented mainly by small herbivorous species. They are also the commonest and the most abundant of the aquatic insects found in small freshwater habitats. Their food which is abundant and their ability to fly both by day and night makes them the most widely distributed and abundant of aquatic insects.

The Belostomatidae because of their large size are generally recorded at light out of proportion to their frequency as compared with the other aquatic insects.

SEASONALITY OF CAPTURES AT LIGHT

There is a marked seasonality in the flight of aquatic insects at night as shown by captures at artificial lights. In Ceylon there are generally four periods in the year when such flights are recorded. In April, May and June, two periods coinciding with the early monsoonal rains and the established monsoonal rains and again in October—January two similar periods with the early and established monsoonal rains. This periodicity corresponds to the normal colonization cycle in these species, (Fernando 1958 b).

In temperate countries like Britain there is only one period in the year when flight occurs as recorded by captures at light. This is during the height of summer (Fernando 1958 a, 1959 a). Yamamoto (1951) recorded large numbers of aquatic beetles in summer using a light trap in Japan. There is evidence that many species of aquatic insects fly during early spring (Fernando 1958 a, 1959 a). It is likely that in temperate countries the overwintering generation does not fly at night in spring because of the prevailing low night temperatures.

Flight at night is therefore not a casual occurrence but a regular and integral part of the normal colonisation cycle of these insects. Regular trapping at night is therefore a useful method in recording the movements of certain aquatic insects for purposes of studying their colonization cycle.

FACTORS CAUSING FLIGHT IN AQUATIC INSECTS

In a previous paper (Fernando, 1959a), I considered flight as a step in the process of colonization of habitats by aquatic insects and discussed the various factors causing colonization. Flight is caused by two types of factors, (a) Proximate e.g. the internal state of the insect and light intensity, and (b) Ultimate e.g. food and habitats.

The proximate factors causing flight at night have so far not been systematically studied although there is some evidence from laboratory studies that light intensity plays a part, Stehr (1931) and Popham (1942, 1953). Sajo (1897) states that insects fall into a "Nervous State" during a barometric depression and mentions *Corixa* as one of these insects. In Ceylon flight to artificial lights coincides with rain (Tables 1 and 2). Nath (1933) observed that the numbers of insects taken at light increase during rainy weather.

The ultimate factors that cause flight are food and habitats. In a tropical monsoonal country like Ceylon habitats are available, at such times of the year when rain occurs, in greatly increased numbers.

Since captures at light indicate that flight at night is a widespread phenomenon it is worthwhile to discuss the survival value of this type of behaviour as compared with flight during the day. In hot weather the likelihood of desiccation is very great for small insects flying in sunshine. Flight at night enables an insect to travel much farther. There are fewer predators in the air at night than during the day. This may be of importance because many birds feed on aquatic insects in flight, (Fernando 1958 a, 1959 a).

SUMMARY

Aquatic insects captured at light in Ceylon during 1956—1959 are recorded. They belong to the following families: Noteridae (1 Sp.), Hydrophilidae (12 Spp.), Dytiscidae (7 Spp.) and Gyrinidae (1 Sp.), (Colcoptera); and Hydrometridae (1 Sp.), Veliidae (1 Sp.), Gerridae (1 Sp.), Belostomatidae (1 Sp.), Corixidae (2 Spp.) and Notonectidae (4 Spp.), (Hemiptera—Heteroptera).

The commonest species recorded were *Micronecta quadristigata* (Corixidae); *Berosus indicus* and *Enochrus esuriens* (Hydrophilidae); and *Laccophilus chinensis inefficens* (Dytiscidae).

The flight of aquatic insects at night is a widespread phenomenon all over the world and it is an integral part of the colonization cycle in certain species.

The seasonality of captures and the proximate and ultimate factors causing flight at night are discussed.

A bibliography of records of aquatic insects at artificial light is given.

ACKNOWLEDGEMENTS

I wish to thank Mr. R. A. Crowson of Glasgow University, Professor G. E. Hutchinson of the Osborn Zoological Laboratory, Yale University and Mr. W. A. F. Balfour-Browne of the British Museum (Natural History) for helping in the identification of the aquatic insects. Professor H. B. Hungerford of Kansas University, U.S.A. sent me many reprints of papers on aquatic insects which were of great use in this work.

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LOCALITY	Nugegoda	Nugegoda	Nugegoda	Nugegoda	Nugegoda	Maha-illupalama	Horowapotana	Lunawa	Anuradhapura	Nugegoda	Nugegoda	Nugegoda	Nugegoda	Nugegoda	Kimiyama	Neddalagamawa	Colombo (Pettah).	Wattala	Jaffna (Mamipay)	Nugegoda
DATE	12.10.56	8. 1.57	16. 6.57	11.11.57	24.11.57	30.11.57	1.12.57	11.12.57	8.12.57	12.12.57	6.4.58	29. 4.58	1. 5.58	2. 5.58	3. 5.58	4. 5.58	30.7.58	15. 9.58	2.11.58	10.11.58
SPECIES	Rain = R	R	R	R	R	R	R	R	R	R		R	R	R	R	R	R	R	R	R
Noteridae																				
<i>Canthydrus luctuosus</i>		1														3				1
Hydrophilidae																				
<i>Hydraena fontana</i>				2																
<i>Limnebius rutipennis</i>					2		1					1	8	28	1	8				
<i>Berosus indicus</i>					1		1													
<i>Berosus pulchellus</i>					3										2	2				2
<i>Enochrus esuriens</i>	5			11	3	9				14		3	26	131						
<i>Paracymus evanescens</i>	3													11						
<i>Helochaeres anchoralis</i>																38				
<i>Helochaeres pallens.</i>	6			6	3	3						1	5							
<i>Helochaeres densus</i>						4									7					
<i>Regimbartia attenuata</i>															11					2
<i>Sternolophus brachyacanthus</i>					3	1						3		8		3				
<i>Amphiops gibbus</i>						2														
Dytiscidae																				
<i>Cybister confusus</i>											1						1	1	1	
<i>Copelatus indicus</i>						7	1						4	9					1	
<i>Laccophilus flexuosus</i>						3									1					
<i>Laccophilus chinensis inefficens</i>	1		1	11		1	12	2		11		1	12	125					1	3
<i>Hydraticus fabricei</i>												1		1						
<i>Bidessus inconstans</i>	5			5	1															
<i>Eretes sticticus</i>							4		2			2								
Haliplidae																				
<i>Haliplus pulchellus</i>						1														
Gyrinidae																				
<i>Dineufes unidentatus</i>																				1

TABLE I. AQUATIC COLEOPTERA. TAKEN AT LIGHT 1956-1958.

A new species of *Paratelphusa* Milne-Edwards (Crustacea; Brachyura), from Ceylon by

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(With one Plate and one Text Figure)

INTRODUCTION

Whilst collecting potamonid crabs for a study of their ecology and distribution, I found the regular occurrence of what appeared to be young specimens of *Paratelphusa ceylonensis* Fern., which differed in colour pattern of the carapace, were more rectangular in shape and lived in very shallow burrows. Regular collecting at Nugegoda, where this was noticed, over a period of two years showed the presence of egg-carrying females which were much smaller in size than was usual for *Paratelphusa ceylonensis* or in fact for any of the low-country species of *Paratelphusa*. A detailed study was made of these small specimens of *Paratelphusa* and it became evident that they belong to a species hitherto undescribed. I have named this species *Paratelphusa parvula* sp. nov. because of its small size as compared with the other members of the "ceylonensis" complex found in Ceylon namely *Paratelphusa ceylonensis*, *P. innominata* Fern., *P. bouvieri* (Rathbun) and *P. hippocastanum* (Müller). These species have been described in detail by Roux (1915) and Fernando (1957 a, 1961). All these species except *Paratelphusa bouvieri* are illustrated in Plate 1.

Paratelphusa parvula, sp. nov. (Fig. 1A—F; Plate 1A and 1B).

Carapace slightly convex fore and aft, marked dorsally with somewhat large reddish brown or greenish brown spots. Anteriorly are four groups of slightly larger spots located symmetrically, two on either side of the midline. One pair is placed anteriorly in the branchial portion and the other pair slightly anterior to this and nearer the midline.

In the male type, the carapace measures 16.20* at the broadest portion and 13.00 in length. The posterior end of the carapace measures 9.30 and where the epibranchial spine arises it is 15.40. The antero-lateral border of the carapace is limited by a narrow shelf beginning just behind the base of the epibranchial spine and extending about halfway down the carapace. (Fig. 1A). The postero-lateral border is marked by 5—7 oblique striations.

The epibranchial spine is of medium size, stout basally and somewhat pointed apically. The anterior border of the carapace between the eyes is slightly curved backwards towards the midline (Fig. 1A).

* All measurements in millimetres.

The cervical furrow is broad and shallow anteriorly, then disappears almost completely in the median portion and appears again as a shallow, narrow channel behind the mesogastric region. The mesogastric region is prominently marked off and has two indentations in level with the median portion of the cervical furrow. The branchial lobes are indistinct except at the inner margins. They are elongate and slightly inclined outwards. The urogastric lobules are prominent and somewhat elongate horizontally (Fig. 1A).

The epigastric crests are short and elevated, the elevated portion facing directly forwards. They are in advance of the postfrontals. The latter curve backwards and follow a wavy course to the bases of the epibranchial spines. In its course the postfrontal shows a distinct break (Fig. 1A).

The chelipeds (Fig. 1C) are subequal in the male and almost equal in the female. The merus is somewhat rectangular in shape with a number of rugosities running from the central portion to the outer sides. The carpus is more or less square in shape with very fine striations running across the upper aspect (away from body). It bears a small, pointed spine very like a rose thorn on its inner side (facing body). The propodus is swollen in its median portion and the chelae bear numerous teeth of varying size on their biting edges. The chelae are curved away from the body in the middle and the dactylus is almost equal in length to the propodus.

The apex of the male abdomen is shown in Fig. 1B. The sixth segment is distinctly longer than the seventh. It is also broader than long.

The male pleopods are shown in Fig. 1D—F. The first pleopod has a broad basal portion and a narrower apical portion. The apical portion is spirally twisted and the twist is most prominent where the basal and apical portions meet. The tip of the apical portion is ornamented (Fig. 1E). The apical portion bears a series of short spines running obliquely at the base of the ornamented region and a number of longer spines of varying size on the convex portion just behind the first series but laterally. The second pleopod is bent near its apex so as to fit into the first pleopod.

HOLOTYPE: Male, Gangodawila, Nugegoda, Ceylon. British Museum (Natural History), Reg. No. 1961 3-1-1.

ALLOTYPE AND PARATYPES: From same locality, British Museum (Natural History), Reg. No. 1961, 3-1-2 and Reg. Nos. 1961, 3-1-3—8.

PARATYPES: From same locality.

Ceylon National Museum, Colombo.

Raffles Museum, Singapore.

Zoology Department, University of Malaya, Singapore.

Range of size in material examined: 9.50×8.50 — 22.0×18.0 .

REMARKS

Superficially adult *Paratelphusa parvula* resembles *P. ceylonensis* of the same size and these two species occur together in paddy fields. However specimens of this size can be recognized as one or the other species by an examination of the female abdomen. In *Paratelphusa parvula* it has assumed the typical broad shape of the adult female whilst in *P. ceylonensis* it is hardly distinguishable from the abdomen of the male.

In general structure *Paratelphusa parvula* resembles closely the other members of the "ceylonensis" complex namely *P. ceylonensis*, *P. hippocastanum*, *P. innominata* and *P. bouvieri*. It is however separable from all these species by its small size, more rectangular carapace and the structure of the male pleopods. It also differs from other species in the general shape of the carapace, the shape and nature of the epigastric and postfrontal crests, the shape and position of the mesogastric region, branchial lobes and urogastric lobules and the shape and extent of the cervical furrow. In view of these differences it is necessary to create a new species to accommodate it.

Although *Paratelphusa parvula* is closely related to Indian species (see Alcock, 1910), it differs from all those previously described from the Indian region and Eastern Asia where species of *Paratelphusa* occur.

ECOLOGY OF PARATELPHUSA PARVULA

Paratelphusa parvula lives in paddy fields in shallow burrows. Most of these burrows are found in the bunds but it sometimes burrows into the sides of irrigation ditches too. Like other Potamonidae the female carries the eggs in a pouch formed by the abdomen and the ventral portion of the cephalothorax. The female and male occupy a single burrow during the mating season which is at the beginning of the drought (January–February). The eggs are incubated during the drought. The young are liberated during the monsoonal rains.

At present this species is known only from one locality in Ceylon but is perhaps widespread in the low-country, having been missed in collections because of its small size and close resemblance to the other members of the "ceylonensis" complex. The ecology and distribution of Ceylonese Potamonidae are given by Fernando (1957 b, 1961).

ACKNOWLEDGEMENT

I wish to thank the authorities of the British Museum (Natural History) for the photographs reproduced in Plate I.

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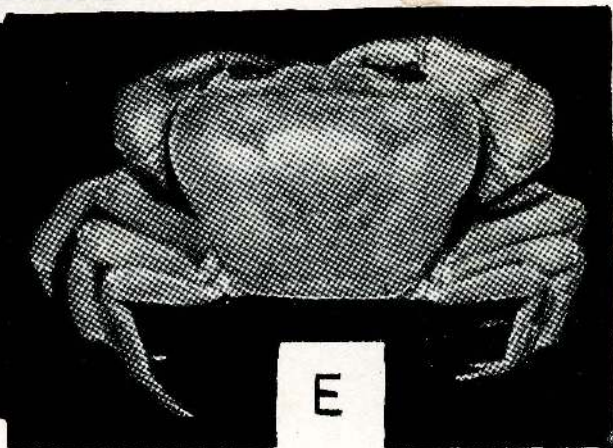
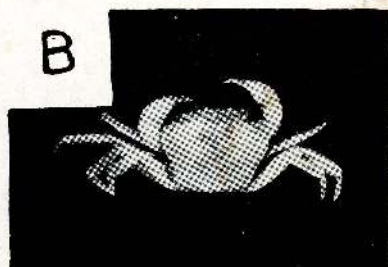
Roux, J. 1915—Sur les Potamonides qui habitent l'île de Ceylan. *Rev. suisse Zool.* 23, 262-284.

LEGEND TO FIGURE 1

Paratelphusa parvula, sp. nov.:— A. Dorsal aspect of carapace x 3.5; B. Distal segments of male abdomen; C. Cheliped of male x 4, inner aspect (facing body); D. First pleopod of male; E. Distal portion of first pleopod of male; and F. Second pleopod of male.

LEGEND TO PLATE I

A. *Paratelphusa parvula*, sp. nov. x 2.5; B. *P. parvula*, about natural size; C. *P. imominata* Fern., natural size; D. *P. hippocastanum* (Müller), natural size and E. *P. ceylonensis* Fern., natural size.



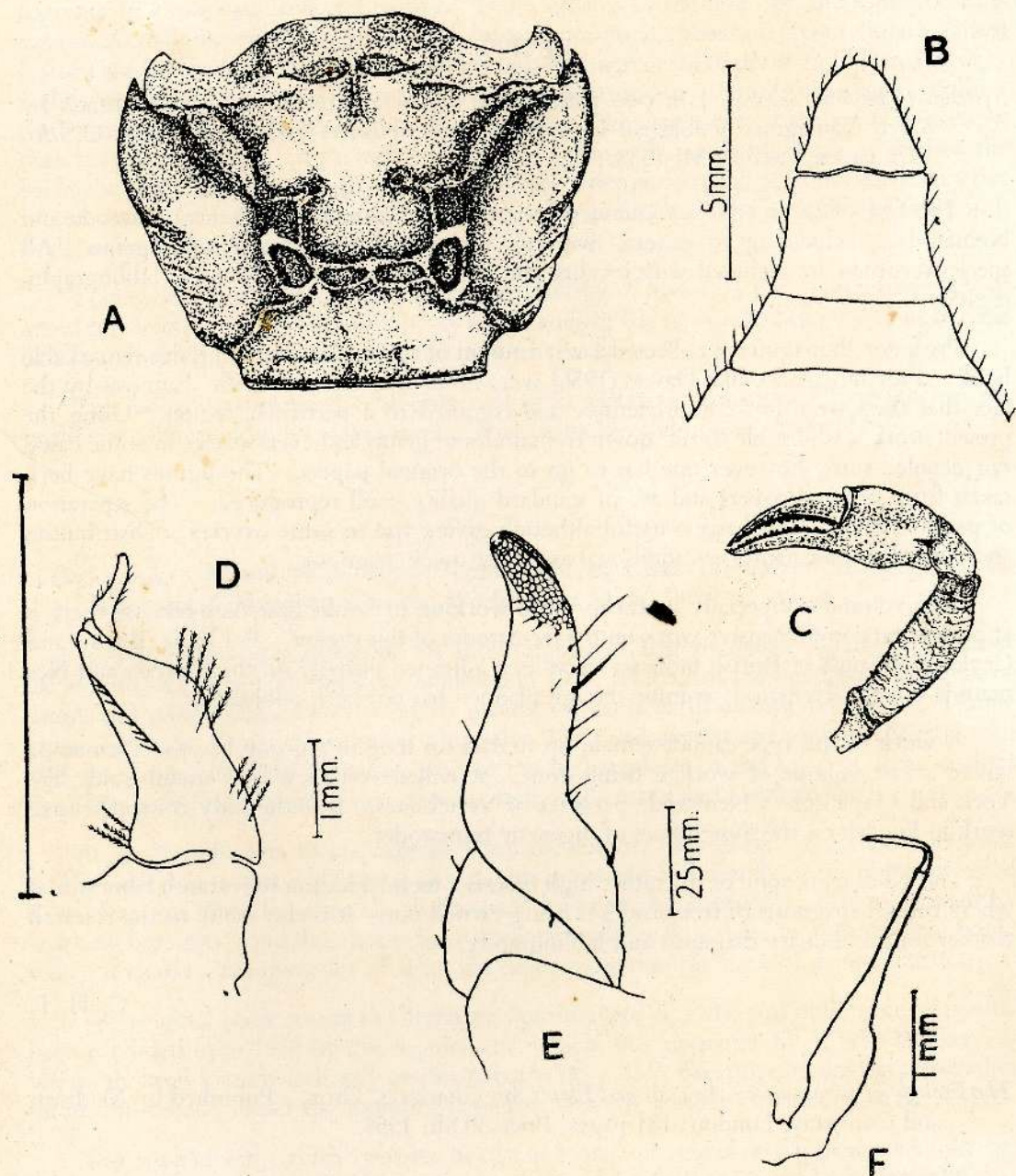


FIG. 1

REVIEWS

Systema Helminthum—Vol. 1 in two parts; The digenetic Trematodes of Vertebrates by Satyu Yamaguti. Published by Interscience Publishers Inc., New York, U.S.A., 1575 pages; Price £ 34; 1958.

The first of three volumes intended to cover the Trematoda (Digenea), Cestoda and Nematoda. Includes up to generic diagnosis with figures illustrating each genus. All species recorded are included with locality and host. A very comprehensive bibliography is given.

Professor Yamaguti has collected a vast amount of material in compiling this remarkable book. Previous works like Dawes (1956) were limited as aids to specific diagnosis by the fact that they were not comprehensive and confined to a particular region. Using the present work it is possible to run down trematodes to genus and even species in some cases. For detailed study however one has to go to the original papers. The figures have been taken from original papers and are of standard quality, well reproduced. The separation of parasites on the host basis is useful although giving rise to some overlap. Distribution and individual host names are additional assets for quick diagnosis.

This volume is especially useful to those working in South East Asia because there is at present no comprehensive work on the trematodes of this region. For India, Burma and Ceylon the Fauna of British India serves at least a limited purpose on the Cestoda and Nematoda but the Trematoda volume though planned has not been published.

A work of this type cannot remain up to date for long in a group like the Trematoda where a vast volume of work is being done. It will nevertheless be a useful guide like York and Mapleston's Nematode parasites of Vertebrates. It is the only comprehensive work in English on the Systematics of digenetic trematodes.

This volume, in spite of the rather high cost, is a useful addition to research laboratories where routine diagnosis of trematodes is being carried out. It is also useful to the research worker for preliminary diagnosis and bibliography.

C. H. F.

The Ecology of Invasions by Animals and Plants, by Charles S. Elton. Published by Methuen and Company, London; 181 pages; Price 30 Sh; 1958.

The spread of animal and plant species into new areas is sometimes accompanied by disastrous consequences, spreading disease in man and causing damage to crops and livestock. Most invasions are however not so conspicuous in their consequences, yet there is especially at the present time a very rapid spread of many organisms due to conscious or chance introductions.

Charles Elton, in the tradition of his classic "Animal Ecology" of 30 years earlier, brings together in a lucid and forceful manner "three streams of thought" on the ecology of invasions; faunal history, the structure and dynamics of populations and conservation. Faunal history is a fascinating and absorbing subject with so much detail to draw on. Here it is very rightly restricted to "simple realities" to illustrate historical invasions by organisms. Individual instances have been selected carefully to show how introduced species first occupy, then spread and finally erupt with explosive violence. These facts are placed against the background of population balance. Many of the examples are taken from North America where well documented instances are more readily available. The basis of conservation is dealt with admirably in the space available.

This book is not a reference work on the ecology of invasions past, present and how to avoid future ones. The vast complexity of the subject has not pushed the writer into a loss of balance which might have happened only too easily.

This book has provided ecologists with new vistas for constructive thought on the problems connected with conservation and is a valuable addition in this field.

C. H. F.

A Bibliography of Eastern Asiatic Botany: Supplement 1. by Egbert H. Walker. 552 pp. American Institute of Biological Sciences, Washington, D. C. 1960.

This book is a supplement to "A Bibliography of Eastern Asiatic Botany" by Elmer D. Merrill and Egbert H. Walker, published in 1938, which lists the literature on the taxonomy and related studies on the higher groups of plants of all of eastern Asia, i.e., China, Japan, Formosa, Korea, Manchuria, Mongolia, Tibet and eastern and southern Siberia, and also the major published papers relating to the higher plants of the adjacent areas, such as the Philippines, Indo-China, Siam, Burma, India and central and northern Asia.

In the Introduction to the original book the authors express the hope that "the work will be a real aid to that wide group of botanists interested in the study of the rich and varied flora of eastern Asia, for after all, all botanical bibliography is merely a tool to be used by working botanists", and their hopes have without doubt been realised by this excellent book, which is nearly a complete list of what has been written on the flora of these countries.

The original book covers the literature upto the end of 1936, and now its coverage has been extended upto 1958 by this supplement, which was prepared by E. H. Walker, to whom the well-known authority on east Asian botany, S. D. Merrill, entrusted its preparation on his retirement, under the sponsorship of the National Science Foundation of the U.S.A.

This supplement, which contains nearly as many references as the original book, has been prepared on essentially the same pattern, and brings up to date this Bibliography, which has become a standard reference work of great value to all those interested in the flora of eastern Asia.

M. D. D.

The Handling of Chromosomes by C. D. Darlington and L. F. La Cour. 248 pp. 43 photographs. George Allen and Unwin Ltd., London, 1960. 30 s.

"The Handling of Chromosomes", first published in 1942, has since then served as a most useful handbook to practical cytology of the nucleus and chromosomes. This third edition follows the plan of the original book, which has been revised and enlarged to include recent advances in cytological technique.

The main additions are a chapter on autoradiography and a description of the stripping film technique in an appendix. In Chapter 8 on "Special Treatments" the section on microchemistry has been enlarged to include techniques for the estimation of nucleic acid, and Chapter 9 on "Control of Mitosis" has been enlarged to include the main types of ionizing and non-ionizing radiations and chemical agencies. The "Schedules of Treatment" has been extended to include recent techniques such as the quick-freeze method for making squash preparations permanent. There are nine additions to the excellent photographic illustrations, and the list of references has been greatly enlarged to include recent publications.

These changes bring up to date this handbook which all those engaged in teaching and research involving the cytology of the nucleus and chromosomes will continue to find invaluable.

M. D. D.

Translations from the Russian for Scientists by C. R. Buxton and H. S. Jackson. Blackie and Son, Ltd., London 1960. pp. 299—xix, 30sh.

The declared aim of this book is to 'enable the scientist to acquire an adequate reading knowledge of the Russian language.' The emphasis in the early pages, on mastery of the Russian alphabet implies that the book is also intended for absolute newcomers to the language.

The authors have at the outset stated their aversion to over-simplification of the language. Accordingly, they have dealt extensively with the grammar, making this book rather more suitable as a textbook for a teacher's guidance than as an instrument of self-instruction. Although the main intention is to impart a 'reading knowledge' of the language, it seems a pity that problems of pronunciation and more particularly accentuation, have not received more attention. It might also have been desirable if a more liberal use were made of English meanings and equivalents—at least in the earlier pages.

The collection of Russian passages at the end of the book is extremely generous. However, one cannot fail to be struck by the almost complete omission of examples from the medical and biological sciences, although a few passages are of relevance.

U. P.

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Nematology: Fundamentals and Recent Advances with Emphasis on Plant Parasitic and Soil Forms. Edited by J. N. Sasser and W. R. Jenkins. pp. xvi+480 with 131 text figures and 79 tables. University of Carolina Press. Chapel Hill. 1960. \$12.50.

This book is a collation of a series of lectures delivered after the fashion of an extension course in Nematology, with the accent on plant and soil forms. Although the lectures were primarily meant for graduate students, teachers and research workers, the material remains very readable in book form, leading logically from one section to the next. The success of this intensive course could be traced not only to the participant leading phytonematologists of the southern region of the United States, but also to the recruitment of research workers in the same field from Canada, the United Kingdom and Holland.

Phytonematology was given its due prominence only in the last decade as the result of the enormous strides made in research in this direction, and its economic importance may be realised since, in Dr. Steiner's own words, "nematodes outnumber in individuals, all other groups of the metazoa" and, furthermore, when it is reasonably computed that one may find more than eighty billion nematodes per acre of soil in the tropics.

The 47 chapters comprising the book are grouped under nine sections. The first section, the Introduction, is ably led off by Dr. Steiner in a stimulating and thought-provoking "outlook" as he terms it. Section Two deals with Methodology or the technique of the handling of nematodes and nematode populations. Morphology and Anatomy fall into the third section, in which the chapter apportioned to reproduction is profusely illustrated with clear diagrams. Some selected genera of economic importance, falling within the ecological groups of plant and soil nematodes, are treated in 13 chapters of the next section. Within the limitations set by a course of lectures delivered to a select group of people, one could not hope for a better selection of types as illustrative of phytonematological importance. In section five Physiological and Biochemical aspects are dealt with where information is admittedly limited and based on knowledge among animal parasitic nemas. Four chapters are devoted to Genetics and Cytology, included in which material is a useful method for the handling of female rootknot nematodes for chromosome study. The usefulness of chromosome numbers in taxonomic work is assessed in a short chapter that completes this section. Section seven, on nematode Ecology, is a comprehensive review by Dr. R. D. Winslow of the available literature on this subject. The sole chapter in this section is supplemented by plentiful illustrations, graphs and summarised tables. There are four brief chapters on host-parasite relations of plant nematodes in section eight, and the final section on Nematode Control embraces all known methods, from physical, chemical and operations of agricultural practice to those of biological control and what little is known to date of the mechanism of resistance to plant parasitic nematodes.

Whatever abridgement, revision or change from the original lecture material has been made by the editors does not detract from the value of the book and the need it justly fulfills. The omitted section of lectures on the Theory of Soil Fumigation, though published elsewhere separately, could well have been issued as a supplement to this book.

R. A. J.

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