NOTES ON SOME NEMATODES IN THE MUSEUM OF THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE.—II

BY

E. L. TAYLOR

(*Received for publication* 28 *December*, 1924)

SPIRONOURA CONGOLENSE, n.sp.

Material :—Specimens collected in the Congo from a fish.

This worm presents all the characters typical of the genus with the exception of the arrangement of caudal papillae in the male, which appears to be somewhat variable in this species.

The body tapers towards the extremities in both sexes and is covered with exceedingly fine cross striations. The head (figs. 1 and 2) presents the usual globular outline and is followed by a well-marked neck. The male measures 13 to 17 mm. in length, by 0·45 to 0·72 mm. in greatest diameter; the head has a diameter of 0·183 to 0·21 mm., the small cervical papillae are placed 1·47 and

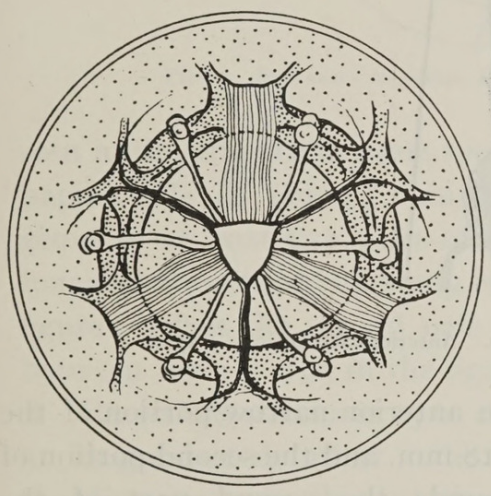

FIG. 1. *Spironoura congolense*, n.sp. Head, anterior view. × 250.

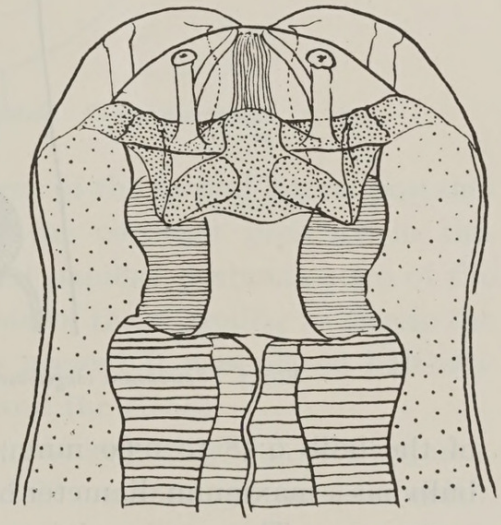

FIG. 2. *Spironoura congolense*, n.sp. Head, dorsal view. × 250.

1·72 mm. from the anterior extremity and the excretory pore 1·95 to 2·1 mm. from the same point. The pharynx joins the second part of the oesophagus at a point 0·1 to 0·116 mm. from the anterior extremity, from which point the oesophagus continues as a cylindrical muscular tube to the double bulb at its extremity ; the complete length of the oesophagus (fig. 3) is 2·85 to 3·00 mm. and the length

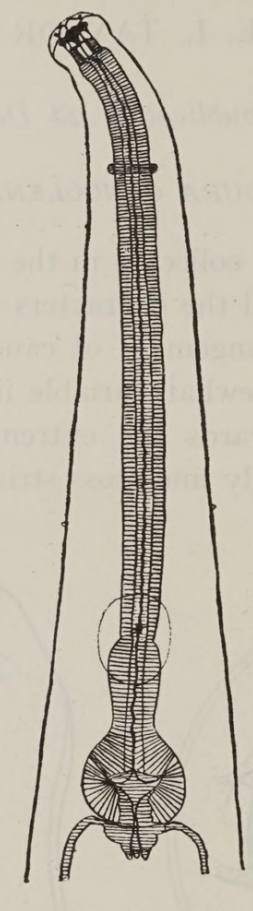

FIG. 3. *Spironoura congolense*, n.sp. Anterior extremity. × 37.

of the bulb 0·58 to 0·60 mm. ; the anterior narrow portion of the bulb has a maximum diameter of 0·18 mm. and the second portion of 0·36 mm. The nerve ring surrounds the second part of the oesophagus at a point 0·52 to 0·66 mm. from the anterior extremity. The caudal extremity (fig. 4) is ventrally curved and terminates in a sharp point ; the special caudal muscles are well developed and continued for a distance of about 3·3 mm. forward along the ventral aspect, but the fan-like formation of muscular fibres forming the pseudo-sucker, seen in some species, is entirely unrepresented. The

spicules are short, measuring only 0·51 to 0·6 mm. in length, and having a maximum diameter of 0·073 to 0·10 mm. The gubernaculum is a distinct and well chitinised organ. The preanal papillae number three pairs and are very small, the unpaired preanal papilla is present. The postanal papillae vary from seven to nine in number : of the four males present two showed eight postanal papillae on the right-hand side and seven on the left, one showed nine on the right and seven on the left, and the remaining specimen showed eight on either side. A further variation from the generic type is

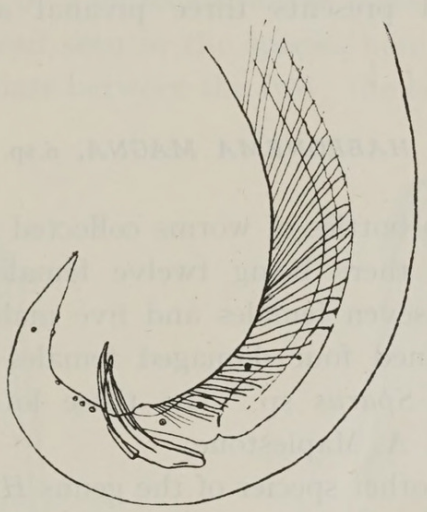

FIG. 4. *Spironoura congolense*, n.sp. Male. Caudal extremity. × 27.

seen in the absence in some specimens of the second lateral postanal papilla—Baylis (1922), points out the constant presence in this genus of at least two pairs of lateral papillae postanal—two of the four males examined had only one pair of these papillae as seen in the figure ; when the second pair was present it was placed half-way between the arc seen in the figure and the cloaca.

The female measures 13 to 22 mm. in length by 0·45 to 0·795 mm. at its greatest diameter ; the head is 0·2 to 0·232 mm. in width, the distance from the anterior extremity of the excretory pore is 1·95 to 2·55 mm. and to the cervical papillae 1·65 to 1·85 mm. The oesophagus has a complete length of 2·55 to 3·06 mm., the bulb measures 0·57 to 0·69 mm. in length and 0·3 to 0·36 in diameter at the second portion. The distance from the caudal extremity to the anus is 1·125 to 1·375 mm., the vulva is placed posterior to the middle of the body, being 5·25 to 10 mm. from the posterior extremity,

the vagina has a length of 0·6 to 1·2 mm. and is directed antero-dorsally ; it divides into the two divergent branches which describe the usual loops before reaching the ovaries. The eggs are large and filled with a granular mass when laid ; they measure 106 by 73 μ.

In general form and measurement this worm closely resembles *S. barbi* (Baylis, 1922), but differs in the arrangement of the papillae on the caudal extremity of the male, in the length of spicules and in the absence of the pseudo-sucker. *S. barbi* has spicules about twice the length of the spicules of this species, has a well-developed pseudo-sucker, and presents three preanal and seven postanal papillae.

HABRONEMA MAGNA, n.sp.

Material :—Two bottles of worms collected from the air-sacs of *Trachurus declivis*, there being twelve females and eight males in one bottle and seven females and five males in the other. A third bottle contained four damaged females collected from the sub-peritoneum of *Sparus* sp. The three lots were collected in Australia by Dr. P. A. Maplestone.

Compared with other species of the genus *Habronema* this worm is large, measuring up to 94 mm. in length and 1·2 mm. in width. The body is of a dirty yellowish-white colour and of a fairly even thickness throughout its length, tapering a little towards the two extremities. In either sex the cuticle in the anterior part of the body shows a rather coarse transverse striation, but posteriorly the markings are different in the two sexes as described below. Cuticular alae are bilateral in both sexes and in cross section are seen to be as thick as broad. The head may be described as having two large lateral lips and two smaller median lips continuous with the lateral lips by means of a cuticular fold (figs. 5, 6 and 7). Seen anteriorly the two lateral lips appear as triangular pieces base to base. The median lips are much smaller structures, and in viewing the head dorsally appear as thickenings in the level fold of cuticle joining the lateral lips : viewing the head laterally these median lips are seen to have considerable thickness, and an anterior view of the head shows them to project in a wedge-shaped manner into the space between the outer edges of the two lateral lips.

Gendre (1923) makes a general distinction between the type of head seen in species belonging to the genus *Habronema* from birds and from mammals. It is only a very general difference and cannot be strictly adhered to, but he points out that species parasitic in birds have large triangular lateral lips with a broad extremity and narrow base, and two median lips on a broad base, each composed of two lateral globular masses, with a median conical piece, and carrying the two papillae, on the contrary the type parasitic in mammals presents lateral lips of a more quadrangular shape, joined on either side merely by a cuticular fold in place of the two median lips. The type of head seen in the species here described may be regarded as intermediate between the two; the lateral lips show the

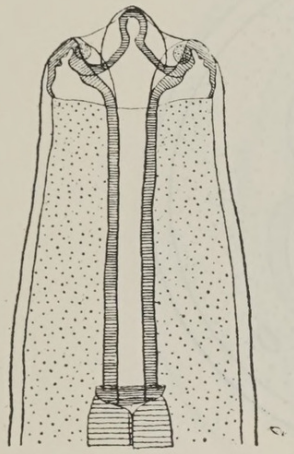

FIG. 5. *Habronema magna*, n.sp. Head, lateral view. × 125.

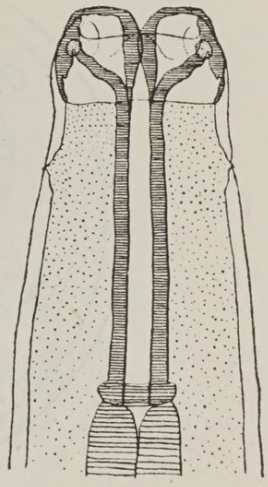

FIG. 6. *Habronema magna*, n.sp. Head, dorsal view. × 125.

triangular form of the avian type, while the median lips, although showing the wedge-shaped point are without the two lateral globular masses and are not separated by any dividing cleft from the lateral lips, in which two points the head resembles the mammalian type.

The whole head structure is strengthened with chitin which forms an outer subcuticular capsule as well as lining the mouth parts, where it is continuous with the thick chitinous wall of the pharynx. There are four, large, flat, submedian papillae, placed just below the margin of the cuticular folds between the lateral and median lips. The cervical papillae are small and situated far forward, one-third the distance down the pharyngeal portion of the

body. The pharynx is thick-walled, long and cylindrical in form. The oesophagus is long and divided into two portions ; the anterior, muscular portion is narrow and about one-third the length of the second part ; at a short distance from its anterior end it carries the nerve ring. After the junction of muscular and glandular portions the oesophagus rapidly widens to twice its former diameter and from this point it continues at an even width to its junction with the intestine.

The male measures 23·25 by 0·45 mm. to 25 by 0·6 mm. ; the head has a diameter of 0·15 to 0·17 mm., the pharynx has a diameter of 0·04 to 0·043 mm. and terminates a distance of 0·33 to 0·345 mm.

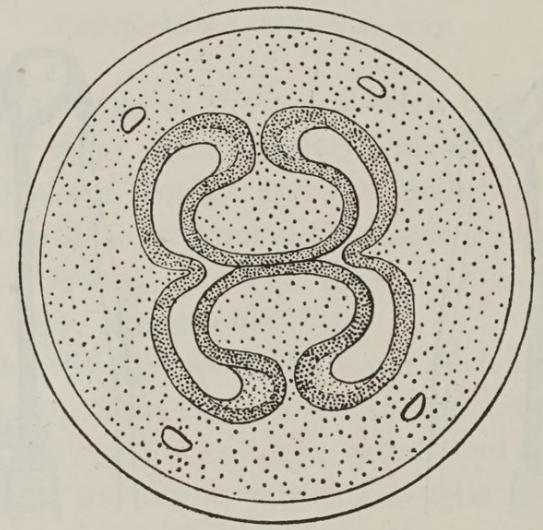

Fig. 7. *Habronema magna*, n.sp. Head, anterior view. × 250.

from the anterior extremity. Cervical papillae are situated at a distance of 0·133 mm. and the excretory pore 0·70 to 0·75 mm. from the same point. The length of the first part of the oesophagus is 1·5 mm. and of the second part 3·9 mm. ; the nerve ring surrounds the first portion at a distance of about 0·43 mm. from the anterior extremity. The distance between the cuticular striations increases from about 5·5μ at the anterior end to 25μ near the caudal extremity. These transverse striations are only continued to the caudal extremity on the dorsal side of the lateral alae ; the ventral aspect of the worm for the posterior 9 mm. of its length presents a series of parallel longitudinal folds in the cuticle, each about 30μ wide, these are

continued up to a point just anterior to the cloaca. The caudal extremity is spirally coiled and describes two or three complete turns. Towards the cloaca the lateral alae widen in each dimension, reaching a maximum width just in front of this orifice where they are broad and semi-cylindrical in shape ; posterior to this point they diminish in size to the extremity of the tail. The pedunculated papillae number eight pairs (figs. 8 and 9) ; there are four large pedunculated preanal pairs, the posterior three of which are in a line subventrally placed, while the anterior pair is more laterally placed, a little in advance of the second papilla. Posterior to the anus and a short

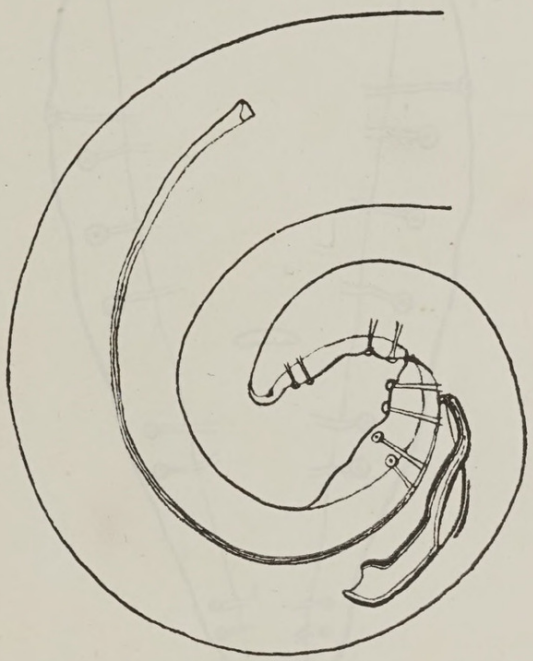

Fig. 8. *Habronema magna*, n.sp. Caudal extremity of male, lateral view. × 55.

distance behind, are two pairs of similar large pedunculated papillae sub-ventrally placed, while two much smaller pedunculated pairs occupy a subventral position nearer the extremity. Near to the extreme end and ventrally placed are two broad sessile papillae, each carrying three points. The spicules are very unequal in size, but differ from those of other species of *Habronema* in that the long, delicate spicule is placed on the right side of the worm, while the short one is the left spicule. The long spicule varies in length from 1·7 to 1·8 mm. and in average width of shaft from ·013 to ·023 mm., being broader at the proximal end and tapering to a very fine point at the

extremity ; the spicule appears to carry a lateral flange in its posterior three-quarters. The short left spicule is very short and of a peculiar shape ; the proximal end is in the form of a wide bulb and is bent ventrally ; this is followed by a stout cylindrical shaft which leads to a narrow portion, that describes a gradual dorsal curve followed by a decided ventral bend ; a short distance from the extremity it bends forwards to the side and terminates in two divergent points :

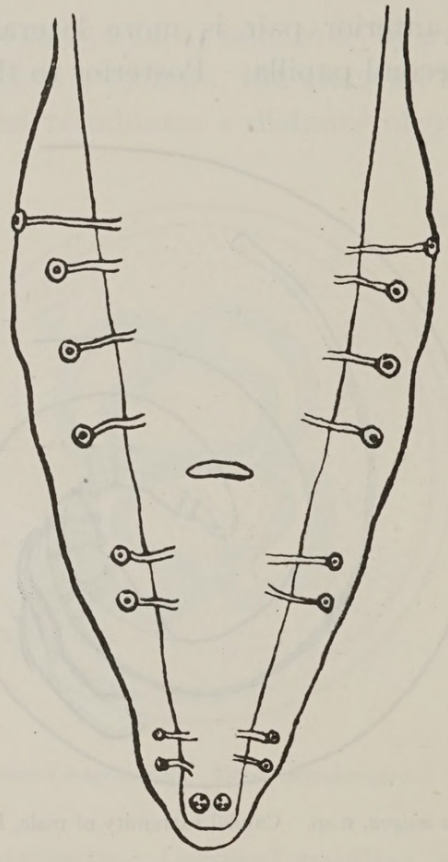

Fig. 9. *Habronema magna*, n.sp. Caudal extremity of male, ventral view. × 80.

there is also a keel-like piece which, commencing dorsally in the middle of the shaft, winds round the outer side to terminate ventrally near the extremity ; this spicule varies in length from 0·39 to 0·45 mm. and in greatest thickness from 0·053 to 0·063 mm. The gubernaculum is a small, well-defined piece about 0·093 mm. long and lies immediately behind the shaft of the short spicule. The tail measures 0·27 to 0·31 mm. from cloaca to extremity.

The female measures 19 by 0·30 to 94 by 1·2 mm. The diameter of the head is 0·13 to 0·285 mm., the cervical papillae are placed at

0·1 to 0·166 mm. from the anterior extremity and the excretory pore is 0·52 to 1·05 mm. from the same point. The cuticle in the anterior part of the body is striated at intervals of about 4μ near the head, increasing to intervals of 22μ just anterior to the vulva; here the narrow grooves which cross the raised portion between the striations are more in evidence than they are near the head and the raised portion is seen to be composed of numerous more or less oblong shaped elements; posterior to the vagina these elements rapidly increase in size and near the caudal extremity the striations are seen to be at a distance of 99μ apart, rather irregular in appearance and the raised intermediate portion composed of projecting pieces of varying shape and size, roughly twice as long as broad. The lateral alae are stout structures commencing about 0·75 mm. from the head in a mature female and projecting at their maximum width a distance of 0·076 mm.; they are almost as thick as they are broad and have a rounded, striated edge; they are prolonged to the caudal extremity, where they gradually diminish in width, and present a rather broken outline. The pharynx has a diameter of 0·025 and 0·066 mm. and terminates a distance of 0·226 to 0·45 mm. from the anterior extremity. The first part of the oesophagus measures 1·005 to 2·4 mm. in length and the second part 3·3 to 7·5 mm. The vulva (fig. 10) is placed ventrally about the junction of the anterior and middle third of the body length, being 8·5 to 23·5 mm. from the anterior extremity; it is surrounded by a prominent muscular ring which in a small female measured 0·18 mm. deep and 0·28 mm. in diameter. In the gravid female the anterior and posterior parts of this ring meet one another to form two prominent muscular lips. The vagina opens on the inner side of the anterior lip, from which place it may be seen to take an immediate turn backwards. After leaving this muscular ring, the vagina is continued backward as a long, straight muscular tube 0·04 to 0·07 mm. in diameter and up to 22 mm. long; at its extremity it divides into the two divergent branches of the uterus. In one immature female the vagina was found to run back a distance of 0·9 mm., then bend forwards to a point 1·5 mm. in front of the vulva, then double back again for a distance of 0·75 mm. where it divided. The caudal extremity of the female is a short, blunt cone and is usually bent dorsally; the anus is about 0·1 to 0·21 mm. from the extremity.

The eggs are about 37 by 23μ in size, thick shelled and have a small 'button' arrangement at either end, from each of which proceed two very delicate flagella each of about the same length as the egg. The contents of the egg are segmented when laid.

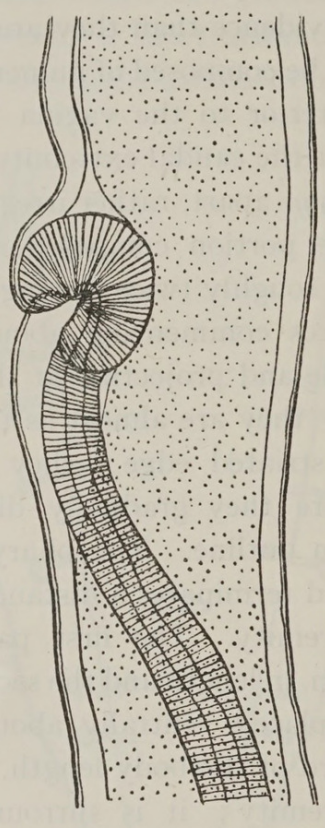

FIG. 10. *Habronema magna*, n.sp. Genital opening of female. × 190.

CONTRACAECUM CLAVATUM (Rud., 1809)

Material :—Seven bottles of worms from *Gadus morrhua*, two from *G. merlangus*, one from *Solea* sp., one from *Raja* sp. and one from *Belone belone*.

Most of the bottles contained a large number of worms in a good state of preservation.

Two clearly related species of *Contracaecum* have been described in these hosts. *Contracaecum clavatum* (Rud., 1809) and *Contracaecum pedum* (Deslgch, 1824), the only difference apart from a slight difference in total length being in the length of spicules; the male *C. pedum* is described as 32 mm. long, with spicules 2·4 mm.

long ; and *C. clavatum* as 33 and 46 mm. long with spicules measuring 1·25 mm. This difference in spicule length is quite a considerable one and when worms were found in the material at hand showing this variation, it was at first thought that two species were present ; on making further examinations, however, and taking a large number of measurements of worms picked at random from various bottles, it was found that only one species was represented. Without any reference to size or relative maturity of worm in some forty specimens measured, the ratio of spicule length to total length showed an even variation between the extremes of $\frac{1}{9{\cdot}5}$ to $\frac{1}{27}$. In view of the absence of any further difference between the two species, it seems that the two worms are synonymous and refer to a species which shows a rather remarkable variability of spicule length, so that *C. pedum* (Deslgch, 1824), falls as a synonym of *C. clavatum* (Rud., 1809).

PROCAMALLANUS LAEVICONCHUS (Wedl, 1862)

Material :—Four females collected from a silurid fish in the Congo.

These specimens conformed in every way to Baylis's (1923) description, but as there do not seem to be in existence any clear drawings of the rather peculiar mouth capsule, it has been thought advisable to produce some from the well-preserved specimens available (figs. 11 and 12).

The mouth parts may be described as follows :—The buccal capsule is deep and of a dark brown colour and has a particularly thick wall at the bottom where it joins the oesophagus. At the anterior opening of this capsule are six inwardly curving plates directed forward ; these plates have rounded extremities and are adjacent towards their free ends, but at their bases are separated by spaces in the chitinous wall of the capsule ; the spaces are both broader and deeper between the two subventral and between the two subdorsal plates, so that although the mouth is not actually in the form of a dorso-ventral slit—which is the type met with in the family *Camallanidae*—it still has a bilateral symmetry which approaches the type. Anteriorly the mouth is bounded by an

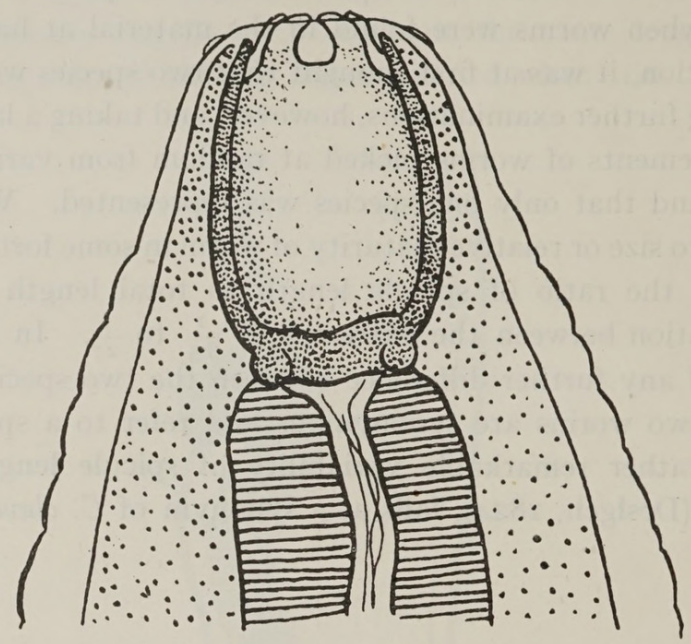

FIG. 11. *Procamallanus laeviconchus.* Head, dorsal view. × 500.

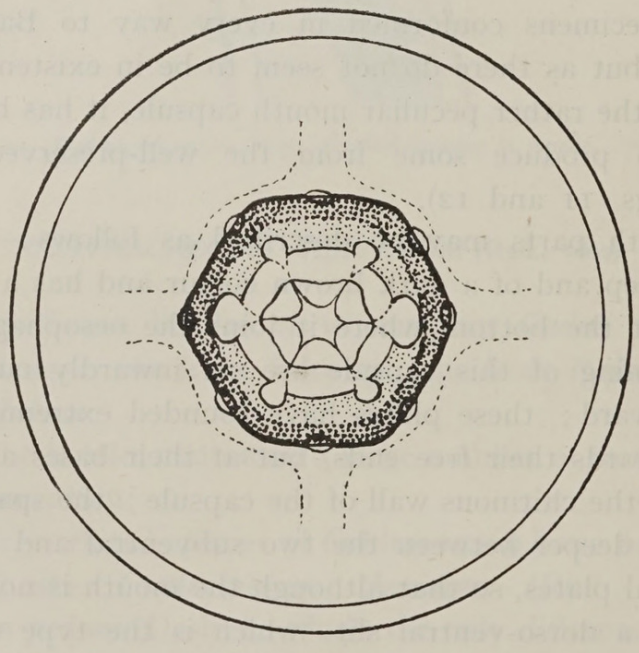

FIG. 12. *Procamallanus laeviconchus.* Anterior view. × 500.

external membrane which is merely a continuation of the integuments of the body ; the orifice formed is somewhat hexagonal, corresponding with the hexagonal shape of the buccal capsule. Eight head papillae are present, one dorsal, one ventral, two subdorsal, two subventral and two lateral.

ECHINOCEPHALUS SOUTHWELLI, Baylis, 1920

Material :—Male and female specimens collected from *Urogymnus* sp. in Ceylon.

ECHINOCEPHALUS SPINOSISSIMUS (v. Linstow, 1905)

Material :—Male and female specimens collected from *Trygon sephen*. Pearl Banks, Ceylon.

PROLEPTUS OBTUSUS, Duj., 1845

Material :—Numerous specimens collected from *Acanthias vulgaris, Scyllium canicula* in Ceylon, and *Coronilla scillicola* in South Africa.

REFERENCES

Baylis, H. A. (1923). Report on a Collection of Parasitic Nematodes. Mainly from Egypt. Part III. *Parasitology*, Vol. XV, pp. 26 and 27.

Baylis, H. A., and Daubney, R. (1922). *Memoirs of the Indian Museum*, Vol. VII, No. 4, pp. 305 and 309.

Baylis, H. A., and Lane, Clayton (1920). A Revision of the Nematode Family *Gnathostomidae*. *Proc. Zool. Soc., Lond.*, pp. 277-289.

Dujardin, M. F. (1845). Histoire Naturelle des Helminthes, pp. 105, 208, 209, 211 and 212.

Gendre, E. (1923). Sur quelques espèces d'*Habronema* parasites des Oiseaux. *Procés-Verbaux de la Société Linnéenne de Bordeaux*, pp. 4 and 5.