1858), and *G. spinulosa* (Diesing, 1839). They originally existed under many different generic names, and they were placed in the genus *Goezia* Zeder, 1800, by Railliet and Henry (1915), who did this on the published descriptions of the worms, and without examining any material. These worms do not appear to have been described since their original discovery so the descriptions are naturally incomplete according to modern standards. It is therefore not possible to say with absolute certainty that the present worm is a new species, but it is considered probable that it is so, in view of the different host and locality in which it has been found. At the same time it must be remembered, that although all the members of this genus hitherto described have been found in fish, the present worm is in a fish eating animal, and it is possibly a true parasite of a fish, which has only been liberated by digestion from its true host in the stomach of the Gharial in which it was found.

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

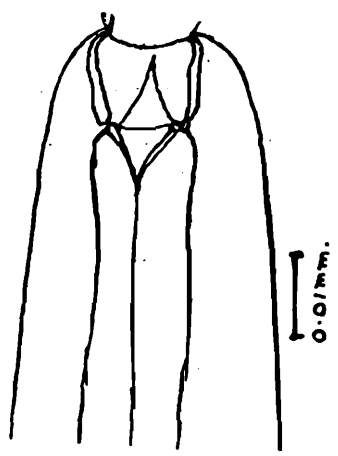
## PART 2. THE SUBFAMILY AMIDOSTOMINAE TRAVASSOS, 1919.

Baylis and Daubney (1926) raised this sub-family to family rank without making any change in it, but this seems an unnecessary elevation of a small group of Nematodes, which show sufficiently close affinities with the Trichostrogylinae to be classed in the family Trichostrongylidae.

### Amidostomum fuligulae, n. sp.

This worm was found on the first occasion in the gizzard of a Golden-Eyed Pochard (*Fuligula cristata*). It has since been recovered from *Aythya ferina*, and several ducks, which were not identified.

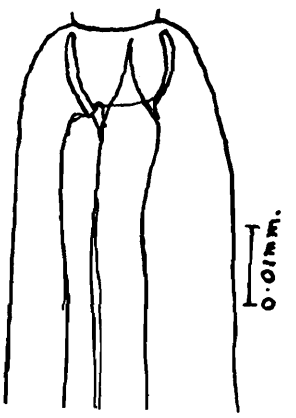
The worms are slender and slightly attenuate anteriorly, and they have fine transverse cuticular striations. The head is narrow and rounded, with four fine hair-like sub-median papillae projecting anteriorly. There is a relatively large thin-walled buccal capsule. There



Text-fig. 15.—*Amidostomum fuligulae.* Anterior end, dorsal view.

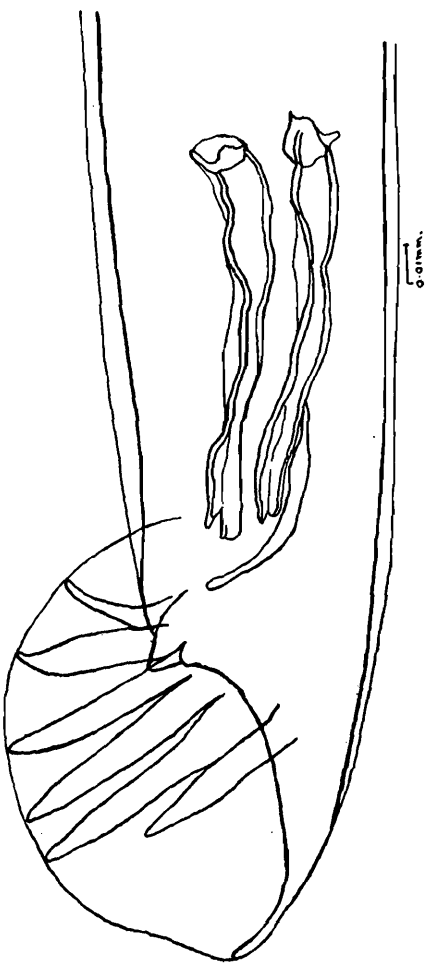
is a large triangular dorsal tooth, which extends forwards from the oesophagus almost to the mouth of the capsule, and in addition there are two small knob-like accessory sub-ventral teeth. These latter teeth really appear to be the thickened anterior ends of the two sub-dorsal

plates, which form with the dorsal plate the tri-radiate oesophagus (figs. 15 and 16). Male :—The male is 7·6—9 mm. in length, and 0·11—0·12 mm. in diameter. The oesophagus is 0·65—0·69 mm. in length and it ends in a slight bulbar enlargement. The nerve ring is near the




Text-fig. 16.—*Amidostomum fuligulae.* Anterior end, lateral view.

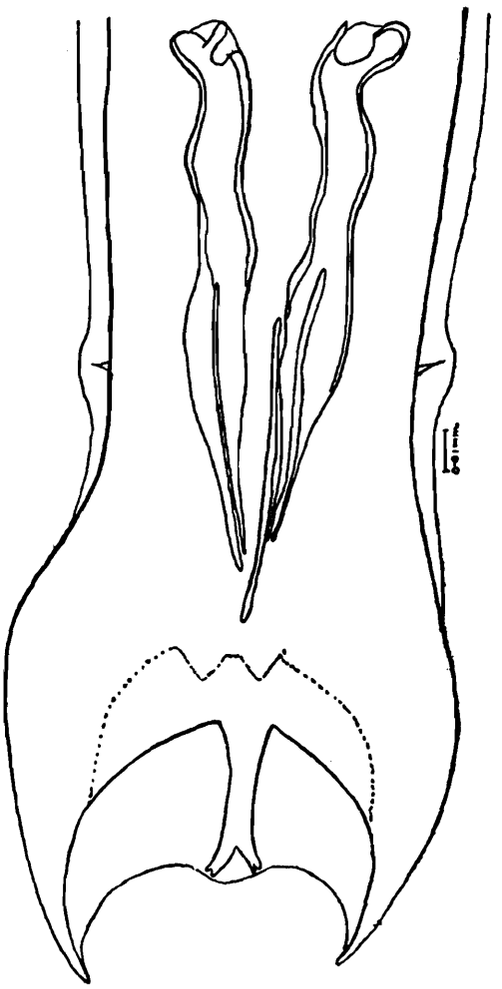
middle of the oesophagus, and the cervical papillae are 0·37—0·39 mm. from the anterior end. The bursa consists of two large lateral lobes and a small dorsal lobe. The ventro-ventral ray is much finer than




Text-fig. 17.—*Amidostomum fuligulae.* Posterior end of male, lateral view.

the latero-ventral ray, from which it is separated. The lateral rays are approximately equal and parallel. The externo-dorsal rays are

short and stout, and they arise separately from the dorsal ray. The dorsal ray is divided only at its tip end and each branch ends in two points (figs. 17 and 18). Prebursal papillae are present. The ventral lip of the cloaca is surmounted by two mammilate papillae (fig. 18). The spicules are stout and equal; they are 0·13—0·15 mm. in length, and they end in two points, being divided for about half their length (fig.18). A straight gubernaculum is present. Female :—The female is 10—13·5 mm. in length, and 0·12—0·14 mm. in diameter. The oesophagus is 0·73—0·78 mm. in length, and the cervical papillae are 0·37—0·42 mm. from the anterior end. The vulva is not prominent and it opens 2·65 mm. from the tip of the tail. A short vagina leads inwards from the vulva, and from it the ovejectors diverge at right angles. The anus is 0·26 mm. from the tip of the tail, and immediately behind this opening the worm becomes suddenly narrower. The tail tapers

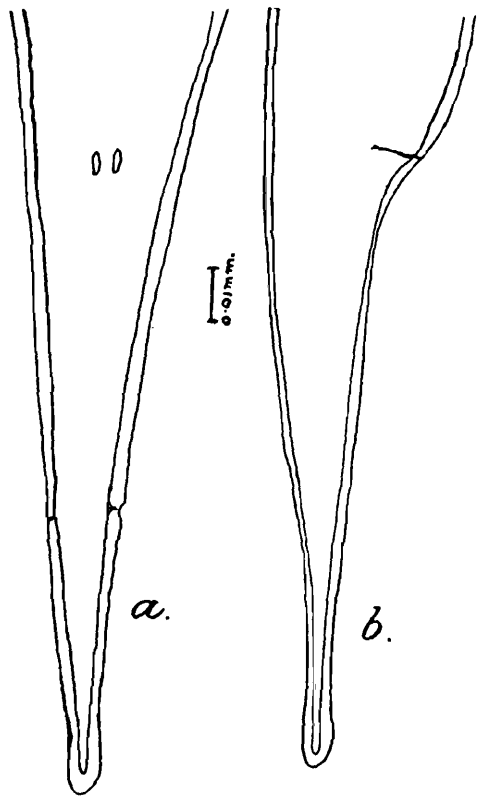


Text-fig. 18.—*Amidostomum fuligulae.* Posterior end of male, dorsal view.

gradually to end in a fine rounded tip and there are two sensory papillae on the sub-ventral surface a little more than half way between the tip of the tail and the anus (fig. 19, *a* and *b*). The eggs are 0·080—0·082 × 0·050—0·052 mm.

The dorsal tooth is similar to that of *A. chevreuxi* Seurat, 1918, but this species has not the small accessory teeth. The bursa is also different, as in *A. chevreuxi* the only rays which reach the edge of the bursa are the medio-lateral and postero-lateral, whereas in the present species the only ray which does not reach the edge of the bursa is the

externo-dorsal. The worm differs quite distinctly from the other species of the genus so it is proposed to name it *Amidostomum fuligulae*, n. sp.




Text-fig. 19.—*Amidostomum fuligulae.* Posterior end of female. *a.* ventral view. *b.* lateral view.

Type-host. *Fuligula cristata.*
Type-specimens are in the Indian Museum, Calcutta.

## **Epomidiostomum** Skrjabin, 1916.

There seems to be considerable confusion regarding the characters of the head in this genus, this is brought out by comparing the following descriptions.

Yorke and Maplestone (1926). " ..... on the dorsal and ventral surfaces of the head is a pair of posteriorly directed nodules (epaulettes) with blunt extremities, on each side is a pair of lateral papillae."

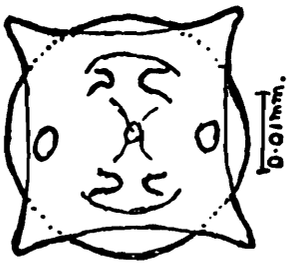
Baylis and Daubney (1926). " Head distinct, with a pair of backwardly directed " *nodules* " or epaulettes dorsally and ventrally, hooked or blunt at their tips."

Boulenger (1926) in his description of *E. querquetulae* says. " Head provided with a pair of laterally situated cuticular expansions reflected backwards and, although less devloped, obviously corresponding to the " epaulettes " described by Skrjabin in the type-species. Mouth surrounded by six head-papillae, four submedian and two lateral in position."

Cram (1927). " Head distinct, bearing on its dorsal and ventral surfaces a pair of nodules (also referred to as lips or papillae) which are directed posteriorly, and are either uncinate or obtuse at their extremity. According to Seurat the head bears a pair of lateral papillae on each side. Cephalic cuticle ornamented with a pair of epaulettes or festoons, which, according to Skrjabin, have zig-zag incisions in their posterior portion."

In these descriptions the terms nodules, epaulettes, lips, papillae, and cuticular expansions seem to have been applied to the same structures by the different workers. The reason for this confusion is probably

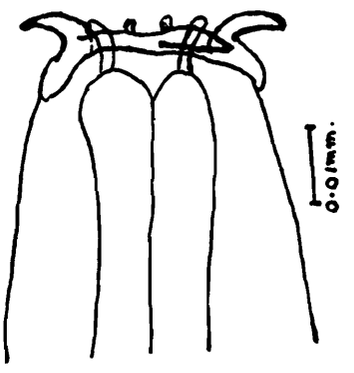
because the real nature of the structures surrounding the mouth have never been properly understood, and Skrjabin's original figure, which has been the only one available, is not at all clear.




**Text-fig. 20.—*Epomidiostomum uncinatum.* Anterior end, end-on view.**

I have recently obtained a number of worms of this genus from the following ducks, *Dafila acuta*, *Fuligula nyroca* (4), *Querqedula circia*, *Sarcidiornis melanonota*, *Tadorna casarca*, and several others which were not identified. All of my specimens appear to belong to the type-species *E. uncinatum*.

An end-on view of the head (fig. 20) explains the difficulty that has existed, for the structure has never been recognised for what it is. There are four cuticular or chitinous structures projecting horizontally beyond the edge of the head, in the sub-median fields, and there are four long sub-median papillae more centrally placed and projecting forward. These surround the small mouth opening. In addition there is a pair of oval pulpy papillae placed laterally, they do not project, and are only visible in an end-on view. A common position for the worm to

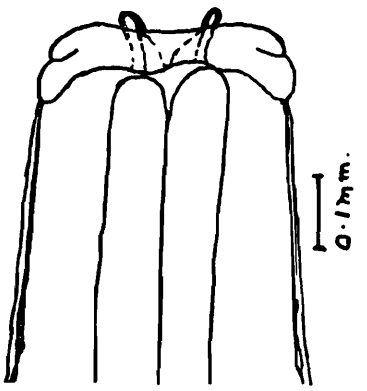



**Text-fig. 21.—*Epomidiostomum uncinatum.* Anterior end, semi-lateral view.**

take up on a slide is a semi-dorsal or semi-ventral one, and then the appearance shown in fig. 21 is seen. The two cuticular projections that are in profile appear as two outwardly curving projections of varying degrees of length and sharpness of their tips depending on the angle from which they are viewed, and the cuticular projection, which is lying uppermost, is pressed to one or other side by the coverslip. In fig. 21 it is lying to the right. When seen in this position the four oral papillae are all visible.

When the worm is accurately rolled dorsally or laterally, the cuticular projections, being only the same diameter as the head in these directions, do not project but tend to lie flat against the anterior surface of the head, where they seem to have been mistaken for lateral papillae by some observers (fig. 22). Only two oral papillae are visible at a

time in this position as they overlie the corresponding papillae on the further side of the mouth. The structures which have been described as epaulettes by some and as cephalic expansions by Boulenger appear to be really a chitinous cap surmounting the anterior extremity, with



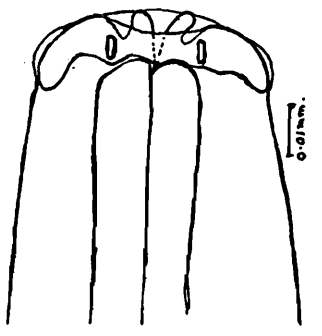

Text-fig. 22.—*Epomidiostomum uncinatum.* Anterior end, lateral view.

a more or less wavy posterior border. When seen in optical section through the mid-sagittal plane from any angle, the two sides, being in focus, appear to project backwards, and the parts nearer and further from the microscope, being out of focus, are not seen, so one gets the impression of two backwardly projecting structures. The wavy posterior border of the cephalic cap probably explains the notched border of the epaulettes described by Skrjabin.

Seurat said there is a short buccal capsule, which Skrjabin said was absent. I am inclined to agree with Seurat, but the small capsule is difficult to see, as it can only be viewed through the chitinous cap overlying the head.

## **Pseudamidostomum** Boulenger, 1926.

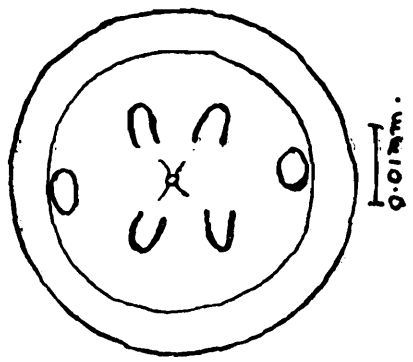
Boulenger (1926) made this genus on the description of three female worms. He says they could not be included in the genus *Amidostomum* on account of certain characters of the head, but they are in reality much closer to *Epomidiostomum*, especially as the posterior extremity is very similar to the females of this genus.




Text-fig. 23.—*Pseudamidostomum boulengeri,* Anterior end, dorsal view.

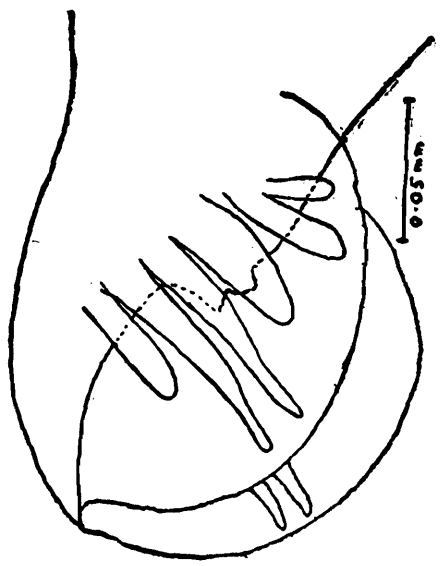
I have obtained several specimens, which I have referred to this genus. The hosts are several Cotton Teal (*Nettapus coromandelianus*), Cattle Agret (*Bulbulcus coromandus*), and one duck which was not identified.

These small worms are attenuate anteriorly and they have transverse striations on the cuticle. The anterior end of the worm is surmounted by a chitinous cap similar to that in *Epomidiostomum*, and which gives it an appearance of slight cuticular inflation (fig. 23). There is a large shallow funnel-shaped depression anteriorly, in which there are situated four long sub-median papillae, surrounding the small mouth opening. There are also two pulpy papillae, one on each side of the head, which do not project and which are only visible in an end-on view (fig. 24). The oesophagus is very slightly swollen at its posterior extremity, and there is a small very short buccal capsule, which is somewhat difficult to see.




Text-fig. 24.—*Pseudamidostomum boulengeri.* Anterior end, end-on view.

Male :—The males are 8·3—8·6 mm. in length with a maximum diameter of 0·18—0·21 mm. The diameter of the head is 0·040—0·044 mm., and the oesophagus is about 1 mm. in length. The bursa consists of two relatively broad semi-circular lateral lobes and a small barely-defined dorsal lobe. The ventral rays are separated, the ventro-ventral being the thinner of the two. The externo-lateral is short and stout, the medio-lateral and postero-lateral rays are somewhat more delicate and longer, being the only two rays which approach the edge of the bursa.

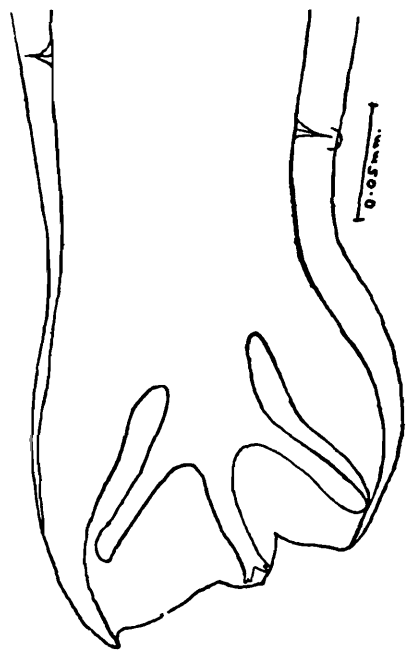



Text-fig. 25.—*Pseudamidostomum boulengeri.* Tail of male, lateral view.

The dorsal ray is stout at its base near to which the short stout externo-dorsal rays are given off. The tip of the dorsal ray is bifurcate and each

branch ends in two points (figs 25 and 26). There is a pair of asymmetrical prebursal papillae (fig. 26). There are two mammilate papillae on the ventral lip of the cloaca. The spicules are equal, being 0·120-0·124 mm. in length, they are stout and slightly curved, and have broad membranous alae. The tips are not divided though there appear to be double tips, which are fused (fig. 27).

Female :—The females are 11—11·5 mm. in length,and 0·22—0·24 mm. in maximum diameter. The oesophagus is 1·3—1·4 mm. in length. The nerve ring and excretory pore are 0·3 mm. from the anterior end, and the cervical papillae are 0·26 mm. posterior to them. The vulva is 2·7—2·8 mm. from the tip of the tail, and the uteri are divergent. The tail becomes narrower behind the anus which is 0·28 mm. from its tip, and there are two submedian sensory papillae a little more than halfway from the anus to the tip of the tail (fig. 28). The eggs are of the usual strongyle type and are 0·116—0·120 × 0·070—0·080 mm.



Text-fig. 26.—*Pesudamidostomum boulengeri.* Tail of male, dorsal view.

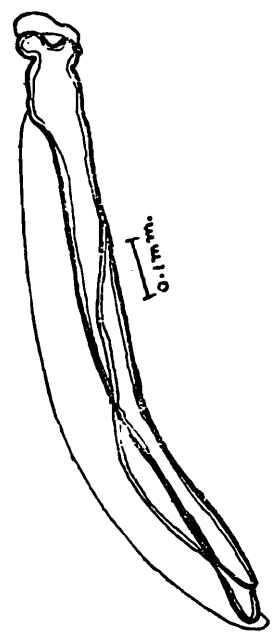
This worm is different from *P. loossi* Boulenger, 1926, as it is much bigger in all its dimensions and the eggs are much larger. It is therefore proposed to name it *Pesudamidostomum boulengeri*, n. sp.

Type-host. *Nettapus coromandelianus.*

Type-specimens are in the Indian Museum, Calcutta.

Boulenger in describing *P. loossi* gave no definition of the genus ; Cram (1927) has defined it as far as possible, but as she only had Boulenger's description of the females of his species to go on, her definition is naturally inadequate. The only real difference between *Epomidiostomum* and *Pseudamidostomum* seems to be that in the former there are four horizontal structures projecting from the anterior extremity, and that these are absent in the latter. The spicules of *Epomidiostomum* end in three branches and those of the only species of *Pseudamidostomum* which has been seen, end in two points which are fused together. The differences in structure of the head are sufficiently marked to

render the making of a new genus justifiable, though Boulenger apparently failed to recognise this striking character when making the

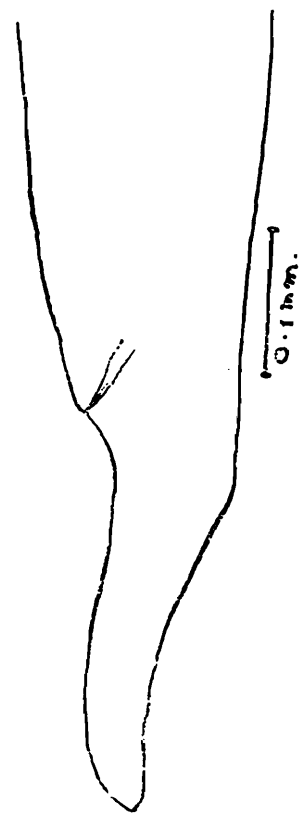



Text-fig. 27.—*Pseudamidostomum boulengeri.* Spicule.

genus *Pseudamidostomum.* It is proposed to define it as follows, using the males of *P. boulengeri* for the purpose.

*Pseudamidostomum* Boulenger, 1926.

Definition :—Amidostominae. Head with a chitinous cap giving the appearance of a cuticular inflation. Four large submedian papillae




Text-fig. 28.—*Pseudamidostomum boulengeri.* Female tail, lateral view.

surrounding the mouth, and a pair of lateral sessile papillae. The four horizontal projections seen in *Epomidiostomum* are absent. Short

wide buccal capsule present. Oesophagus tri-radiate. Male with bursal rays as follows. Ventral rays separated, externo-lateral short and stout, medio-lateral and postero-lateral rays parallel and nearly reaching the edge of the bursa. Dorsal ray thick at its origin, near to which it gives off the short externo-dorsal rays, tip of dorsal ray bifurcate and each branch bidigitate. Spicules equal, and end in a simple tip composed of two points fused together. Gubernaculum absent. Prebursal papillae present. Vulva in posterior half of body, uteri divergent, and diameter of tail dimished behind the anus.

## PART 3. NOTES ON THE GENERA *HABRONEMA* DIESING, 1861, AND *CYRNEA* SEURAT, 1914.

The separation of the genera *Habronema* and *Cyrnea* is a matter of great difficulty, and Baylis and Daubney (1926) have indicated that they do not consider it possible, as they place *Cyrnea* as a synonym of *Habronema*, but they add the following footnote.

> " Seurat (1914) proposes the genus *Cyrnea* for a Spirurid parasite of a partridge which he says, differs from *Habronema* in the absence of lateral alae and usually in the presence of an egg-reservoir in the ovejector."

Yorke and Maplestone (1926) accept the two genera as distinct and so does Cram (1927). The following table (p. 404) has been compiled from the definitions of the above authors, and it gives the essential points whereby these genera are considered to be distinguished by them.

*Lips.*—There is nothing characteristic as they may be simple or tri-lobed, and they may or may not have teeth on their inner surfaces in either species. Yorke and Maplestone are not correct in stating that *Habronema* is without teeth, while *Cyrnea* has teeth, for many species of the former genus are described and figured with these structures.

*Lateral flanges.*—These are said to be always absent in *Cyrnea*, but their presence or absence as a diagnostic character disappears, when it is found that two, one, or none at all may be present in *Habronema*.

*Cervical papillae.*—Cram says that these papillae are far posterior to the nerve ring in *Cyrnea*, and " precervical" in *Habronema*. This may possibly be true in most instances, but in the type-species, *C. eurycerca*, Seurat's figure which Cram has copied, shows these structures so far forward as to be opposite the vestibule. Therefore this point appears useless in diagnosis.

*Vestibule.*—Yorke and Maplestone state that the vestibule is thick-walled in *Habronema* and thin-walled in *Cyrnea*. This is in any case only a relative character, and one which does not survive when individual species of the genera are examined.

*Post-anal papillae in the male.*—Cram says these are asymmetrical in *Habronema* but does not mention what they are like in *Cyrnea*. She gives drawings from various sources of the tails of eleven males of members of this genus, but examination of these figures shows that in six of them the post-anal papillae appear to be absolutely symmetrical, in four they are very slightly asymmetrical, and in only one, *viz.*, *H. leptoptera*, is the asymmetrical arrangement sufficiently pronounced to be considered definite. Therefore this character will not stand.