

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 diminished 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.

	Baylis and Daubney.	Yorke and Maplestone.		Cram.	
	<i>Habronema.</i>	<i>Habronema.</i>	<i>Cyrnea.</i>	<i>Habronema.</i>	<i>Cyrnea.</i>
Lips	Large, entire or trilobed. Sometimes with internal teeth, and overlapped dorsally and ventrally by shields of cuticle.	Two lateral lips usually trilobed and without teeth, sometimes dorsal and ventral lips in addition.	Two well-developed lateral lips, with dentiform thickenings internally and dorsal and ventral lips with the free border deeply notched.	Four lips	Four
Lateral flanges or alae	May be present	May be present on one or both sides.	Absent	Usually one or two	No lateral alae.
Vestibule or buccal capsule	Well-developed	Well-developed, strongly chitinized and cylindrical or funnel-shaped.	Cylindrical and not strongly chitinized.
Cervical papillae	In front of nerve ring	Far forward, anterior to oesophagus.	Precervical	Far posterior to the nerve ring.
Male caudal papillae	Four pairs preanal, variable number of postanal usually asymmetrically placed.	Four pairs pedunculated preanal, one or two pairs of postanal, and two or three pairs small near tip of tail.	Nine pairs of long pedunculated, of which 3 are preanal, and an additional pair of small preanal.	Postanal papillae asymmetrically disposed.
Vulva and female generative organs.	Vulva in middle region of body, occasionally displaced posteriorly.	Vulva near middle Uteri divergent.	Vulva near middle or a little in front of anus. Uteri parallel.	In median region but may be anterior or posterior of middle. Ovejector with vestibule not differentiated as an organ for storage of eggs. Uteri divergent.	Usually considerably posterior to middle. Ovejector with vestibule differentiated into an organ for storage of eggs. Uteri parallel.

Position of vulva.—In all but one species of *Cyrnea* the vulva is only a little anterior to the anus, but the value of this character is upset by *C. excisa*, in which it is said to be immediately in front of the middle of the body. This is approximately the position of the vulva in most species of *Habronema*. Another point is the presence of an egg-reservoir near the vulva and parallel uteri in *Cyrnea*, and its absence with divergent uteri in *Habronema*. But Seurat, who originally suggested the distinction between these two genera, and used these points among others in his differential diagnosis, describes the egg-reservoir of *C. parroti* as similar to some of the species of *Habronema* from birds. In both the species of the “*Cyrnea*” type which are described below, the uteri are at first parallel, running towards the anterior, and although their point of divergence could not be actually seen because all the specimens are crowded with eggs, there is no doubt it is present, because one of the ovaries ends anterior to the hinder end of the oesophagus, and the other ends just a little anterior to the anus.

The above examination of the diagnostic points between these two genera indicates that none are valid and a further similarity is that all the members of *Cyrnea* and the majority of *Habronema* species are found in birds, and they are always in the proventriculus or gizzard, and the few species of *Habronema* which occur in mammals are found in a corresponding position, *viz.*, in the stomach. It is therefore considered that Baylis and Daubney are correct in making *Cyrnea* a synonym of *Habronema*, and that any attempt to distinguish between them, in the light of present knowledge, is more likely to lead to confusion than to simplification.

THE LIPS.

In the above table it will be seen that Yorke and Maplestone do not describe the dorsal and ventral lips in *Habronema*, but merely mention their possible presence or absence in this genus. In *Cyrnea*, however, they follow Seurat (1914) in describing the dorsal and ventral lips with their free borders deeply notched. Cram does not describe the lips in either of the genera, but in her species *Cyrnea colini* she obviously follows Yorke and Maplestone and Seurat in their conception of the dorsal and ventral lips in this genus. Both Yorke and Maplestone and Cram also reproduce Seurat's figure of *C. eurycerca*, which appears to be obviously diagrammatic.

The lips of *C. eurycerca* and of *C. colini* both appear to resemble those of *Habronema indica* Maplestone, 1929 and of *Habronema euplocami* n. sp. described below. I have recently re-examined and redrawn on a large scale the anterior end of *H. indica*, making special note of the relations of the lips. A lateral view is given in fig. 29, and this shows a large semi-circular lip with ridges on its inner surface, and on its outer surface there is a prominent more or less quadrangular median structure (papilla), the borders of which are continuous with large conical papillae placed dorsally and ventrally to it. In fig. 30, which is a dorsal view the two large sub-dorsal papillae are seen connected by a fold of cuticle,

and between them the large lateral lips are seen curving posteriorly. In an end-on view, which is given in fig. 31, the lateral lips are seen to run dorsally and ventrally between the sub-dorsal and sub-ventral papillae. This is practically the same arrangement described and figured by Cram in *C. colini*, and she says the lateral lips bear two wing-like expansions, which project into the median groove of the dorsal and ventral lips, so that in some views they appear as processes of the latter lips. If one turns to fig. 33 of *H. euplocami* it is seen that the sub-dorsal papillae have prominent outwardly projecting angles, which in lateral view (fig. 32) appear as smaller accessory papillae towards the bases of the larger ones.

Seurat's idea that the sub-dorsal and sub-ventral papillae represent deeply notched dorsal and ventral lips does not seem to be in accord with the above observations, so it appears preferable and more in accord with the general conception of the Spiruridae, to consider that the genus *Habronema* has two large lateral lips. In some species the lips bear three well-developed papillae, a lateral broad papilla, and large, conical sub-dorsal and sub-ventral papillae with occasionally smaller accessory, papillae near their bases, and these papillae may be connected by small cuticular flaps on the dorsal and ventral sides of the mouth.

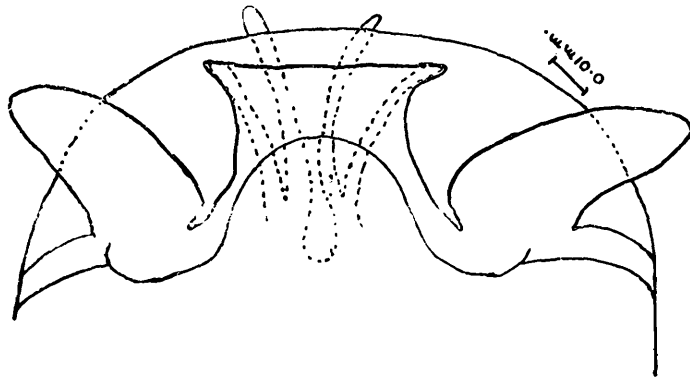
***Habronema euplocami*, n. sp.**

Two female specimens of this worm were found in the gizzard of a Kalij Pheasant (*Euplocamus leucomelanus*).

There are two large lateral lips and a small dorsal and ventral cuticular flap surrounding the mouth. Each of the lateral lips consists of a central quadrangular portion, and two large pointed papillae, one lying dorsal and one ventral to it (fig. 32). When examined in the dorsal position the papillae are seen to have an outwardly projecting angle (fig. 33), which appears as an accessory papilla towards the base of the main papilla, when looked at from the side (fig. 32). The central portion of the lateral lips has four tooth-like ridges on its inner surface, the two central ones projecting beyond the anterior border. There is a strongly chitinized pharynx and the oesophagus is divided into two parts. The cervical papillae are very far forward, being about opposite the middle of the pharynx (fig. 33).

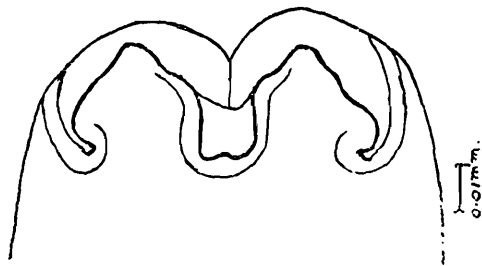
Female :—The female is 18.5—19.5 mm. in length, and 0.34—0.44 mm. in maximum diameter. The mouth is 0.050 mm. in depth and the pharynx or vestibule is 0.056 mm. in depth. The nerve ring is 0.35 mm. and the excretory pore 0.475 mm. from the anterior end. The anterior portion of the oesophagus is 0.46 mm. and the posterior portion 1.5 mm. in length. The vulva is situated 1.45 mm. from the posterior end, and it opens into a thick-walled ovejector (fig. 34). An unpaired trunk runs forward from the ovejector, but its length could not be determined as the worms are crowded with eggs. The uteri are, however, divergent,

as one ovary ends just behind the junction of the two parts of the oesophagus, and the other a short distance anterior to the rectum. The



Text-fig. 29.—*Habronema indica*. Anterior end, lateral view.

anus is 0.42 mm. from the tip of the tail, which ends in a blunt point, and there are two submedian sensory papillae about the junction of



Text-fig. 30.—*Habronema indica*. Anterior end, dorsal view.

the posterior and middle thirds of the distance from anus to tip of tail. There is a cuticle-lined rectum 0.7 mm. in length. The eggs are thick-shelled and contain embryos, they are 0.045×0.021 mm. with straight sides and rounded ends.

Male:—Unknown.

This worm differs from all other species of *Habronema* in which the vulva is placed near the anus, so it is proposed to name it *Habronema euplocami*, n. sp.

Host. *Euplocamus leucomelanus*.

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

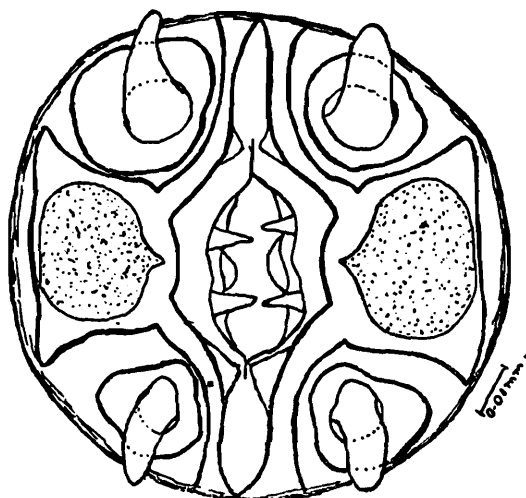
***Habronema indica* Maplestone, 1929.**

Since my original description I have obtained a second and bigger collection of these worms from the same host. They are in a slightly better state of fixation, and the ovejectors contain eggs, which my original specimens did not have, so the second collection has obviously reached full maturity. They are one or two millimetres longer in both sexes, and the eggs in the ovejectors measure 0.045×0.026 mm., otherwise they are identical.

Habronema imbricata, n. sp.

This species of worm was found in the gizzard of a Scops Owl (*Scops pennatus*).

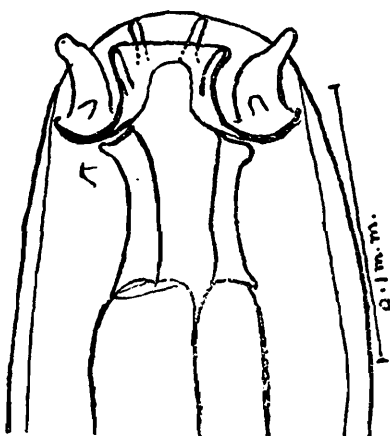
The cuticle is marked by coarse transverse striations which begin at a slight cuticular inflation about opposite the anterior end of the vestibule. In optical section the edges of the striations are sharp and backwardly projecting, giving the worm a segmented or imbricate appearance similar to that of *Habronema fischeuri* (fig. 35b).



Text-fig. 31.—*Habronema indica*. Anterior end, end-on view.

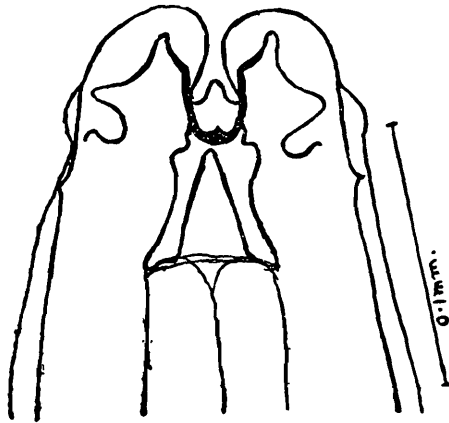
There are two large lateral lips which are divided into three large lobes superficially (fig. 35a) and do not appear to have any papillae. On the internal surface these lips are supported by outwardly curving anterior extensions of the vestibule, and there are three pointed teeth between them (fig. 35b). There are also small dorsal and ventral lips (fig. 36a).

There is a short lateral flange on one side of the body only, it begins about 0.4 mm. from the anterior end and extends posteriorly for a distance of about 1 mm. The vestibule is thick-walled and almost cylindrical, it is about 0.075 mm. in depth, and anteriorly it sends for-

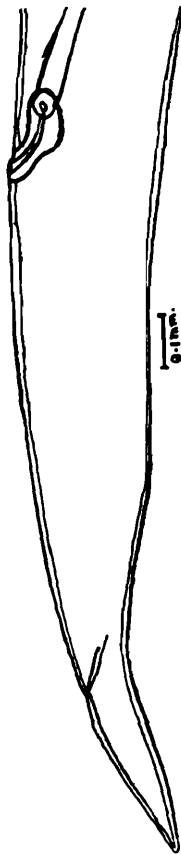


Text-fig. 32.—*Habronema euplocami*. Anterior end, lateral view.

wards into the lips, curving chitinous plates (figs. 35 and 36b). The oesophagus consists of two parts.



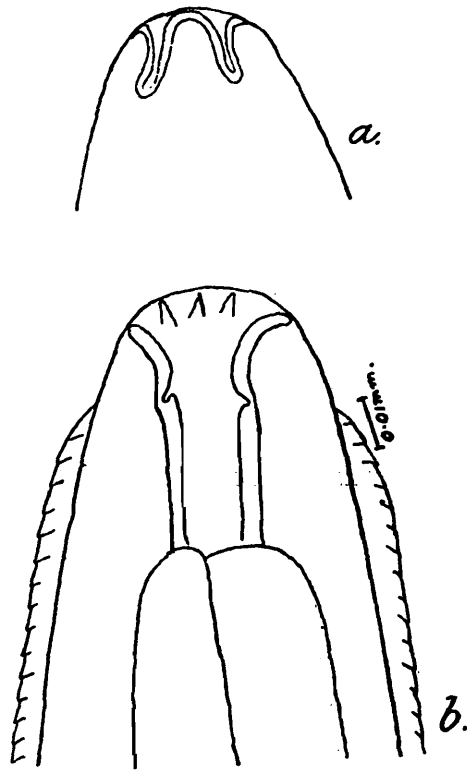
Text-fig. 33.—*Habronema euplocami*. Anterior end, dorsal view.



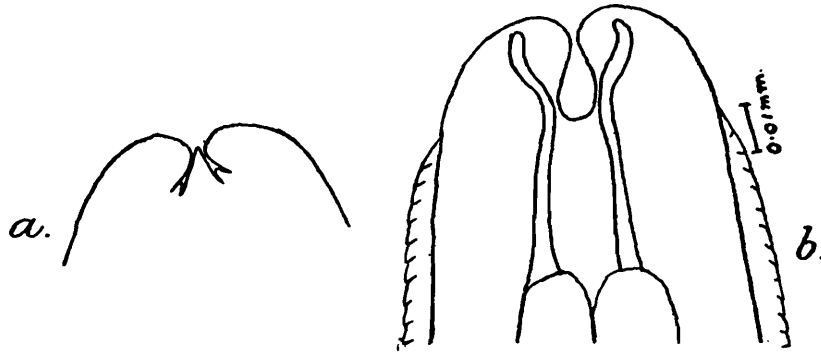
Text-fig. 34.—*Habronema euplocami*. Posterior end of female, lateral view.

Male:—The male is about 8.3 mm. in length, with a maximum diameter of 0.23 mm. The diameter of the head is only 0.44 mm. The nerve ring is 0.24 and the excretory pore 0.3 mm. from the anterior end. The anterior part of the oesophagus is 0.44 mm. and the posterior part 2.34 mm. in length respectively. There is a pair of broad caudal alae which meet in a point beyond the tip of the tail (fig. 37b). The alae are supported by five pairs of pedunculate papillae, four of which are precloacal and one behind the cloaca. The precloacal papillae are arranged in pairs on each side. There is a sixth pair of sessile papillae placed a little behind the cloaca (fig. 37, a and b). The distance from the cloaca to the tip of the tail is about 0.2 mm. The spicules are very

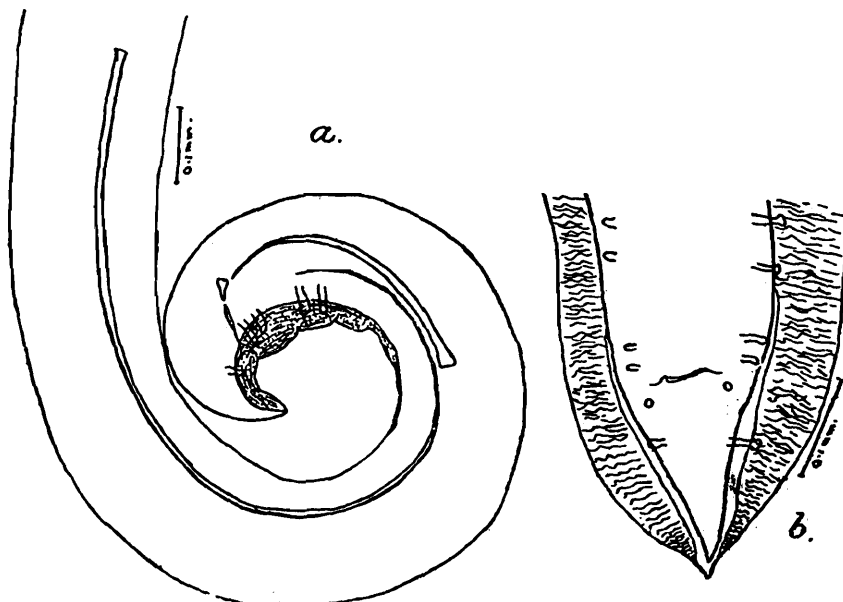
unequal, being 1.33 and 0.38 mm. in length respectively, and there is a short gubernaculum (fig. 37a).



Text-fig. 35.—*Habronema imbricata*. Anterior end, lateral view. a. superficial. b. deeper view.

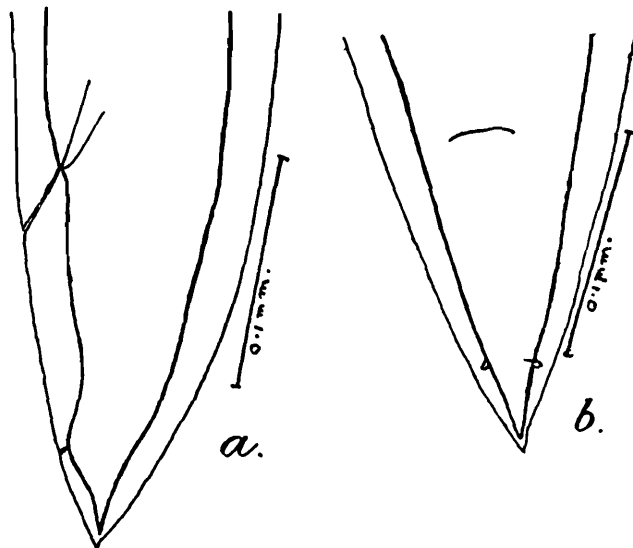


Text-fig. 36.—*Habronema imbricata*. Anterior end, dorsal view. a. superficial. b. deeper view.



Text-fig. 37.—*Habronema imbricata*. Male tail. a. lateral view. b. ventral view.

Female :—The female is 10·6 mm. in length and 0·26 mm. in maximum diameter. The oesophagus is 2·5 mm. in length. The vulva is 5·7 mm. from the anterior end, that is just behind the middle of the body, and the uteri are divergent. The tail is straight and it ends in a sharp point, and a little distance anterior to its tip there is a pair of small sensory papillae (fig. 38, *a* and *b*). The anus is 0·15 mm. from the tip of the tail. The eggs are thick-shelled and contain embryos; they measure $0\cdot036 \times 0\cdot15\text{--}0\cdot16$ mm. with straight sides and rounded ends.



Text-fig. 38.—*Habronema imbricata*. Female tail. *a.* lateral view. *b.* ventral view.

This species clearly differs from all the described species of *Habronema* from birds, so it is proposed to name it *Habronema imbricata*, n. sp.

Host. *Scops pinnatus*.

Type-specimens are in the Indian Museum, Calcutta.

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