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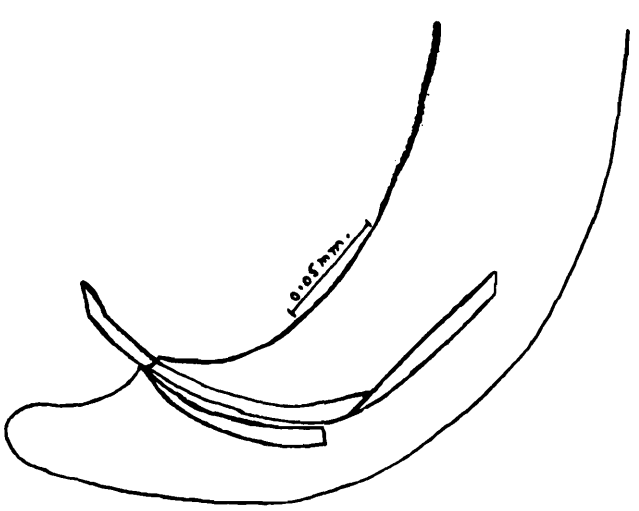
PART 5. FILARIIDAE.

Paraprocta, n. gen.

Chandler (1924) described "*Filaria brevicauda* n. sp." from a Hunting Cissa which died in the Calcutta Zoological Gardens. I have found worms which appear to be the same as Chandler's species in the following birds, also from the Calcutta Zoo. Six *Oriolus indicus*, two *Coracias indica*, and one each of *Arboricola atragularis*, *Dendrocitta rufa*, *Copsychus saularis*, and *Polyplectrum bicalcaratum*. The finding of the same worm in such a variety of hosts suggests that the infection is acquired in the Zoo, where the numerous species of birds, confined in close proximity to one another, would be easily attacked by an insect vector, and an infection of this nature thus readily propagated.

Chandler described the species from two males, and one female from the same bird. The latter he doubtfully named as the female of *Filaria brevicauda* as there were two species of microfilaria in the host's blood, but from the examination of my ample material it appears that Chandler was correct.

Male.—All of my male specimens agree with Chandler's description regarding dimensions, except in the case of the spicules, which I found to be normally 0·2 and 0·070 mm. in length, whereas Chandler gives their length as 0·106 and 0·065 mm. It will be noted in fig. 27 that the long

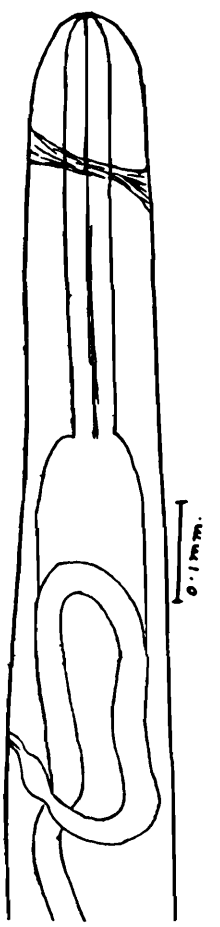


TEXT-FIG. 27.—*Paraprocta brevicauda*, n. gen. Posterior end, male, lateral view.

spicule is partially extruded, but in Chandler's figure both spicules appear to be wholly within the body of the worm. In one or two specimens, otherwise identical, I found spicules about the same length and appearance as those described and figured by Chandler, but most of the males

had the long spicule partially extruded as shown in fig. 27, it therefore seems probable that the long spicule is habitually partly extruded in this species, and when in this position the free portion may be broken off, thus giving the spicules an appearance similar to those of Chandler's material. Chandler also says there are two pairs of inconspicuous papillae, one pre-anal and the other post-anal. These were not observed in any of my specimens, but an appearance simulating papillae in these positions is caused by an optical section of the body pulp, which bulges round the cloacal aperture.

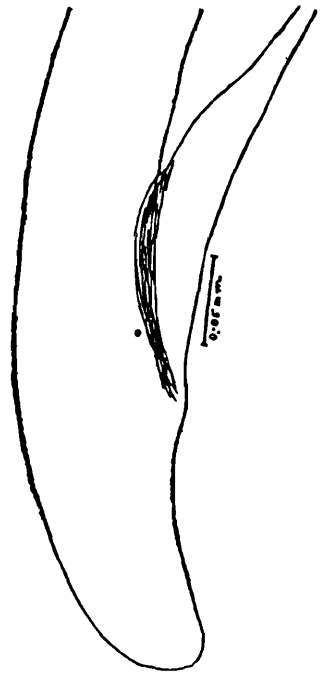
Female.—My female specimens also agree with Chandler's description. He describes, from his single specimen, a rapid widening of the intestine in the form of a cone just after its junction with the oesophagus. The shape of the oesophago-intestinal junction varies considerably in my specimens, and the most usual appearance is a sudden widening of the intestine at its junction with the oesophagus (fig. 28). Chandler



TEXT-FIG. 28.—*Paraprocta brevicauda*, n. gen. Anterior end, female, lateral view.

says the opening of the vulva is 0·38 mm. from the anterior end, and in all of my specimens this distance is about 1 mm. My fig. 28, which shows the curve taken by the terminal portion of the uterus, was drawn from a damaged specimen with the uterus nearly empty of larvae, but in intact specimens with the uterus crowded with larvae the course of this curve cannot be followed, and the vulva is also very inconspicuous and hard to see, so it is probable that Chandler took the vulva to be opposite the most anterior part of the uterus, which in my specimens varied from 0·25 mm. to 0·99 mm. from the anterior end. In any case a slight difference in the position of the opening of the vulva is not of specific value. The uteri are parallel and the ovaries both terminate in the posterior

end of the worm, but it was noted that the farthest posterior point reached by these organs varied from some little distance anterior to the imperforate anus, to the extreme posterior end of the body cavity, well behind the anus. The anus is completely covered by cuticle and a fibrous cord is seen leading anteriorly from it in young specimens, from one of which fig. 29 has been drawn; but in older worms even this



TEXT-FIG. 29.—*Paraprocta brevicauda*, n. gen. Posterior end, female, lateral view.

vestigial cord seems to have disappeared, and with the ovaries fully developed and occupying most of the hinder part of the body cavity the actual termination of the gut is difficult to find.

Although from the above discussion there may seem to be several important differences in these two worms the table below shows how similar they really are.

	CHANDLER'S MATERIAL.		MY MATERIAL.	
	Male.	Female.	Male.	Female.
Length	7·5—10·5	18	8—9·5	16·—17·5
Diameter	0·16—0·18	0·45	0·16—0·2	0·35—0·38
Oesophagus	0·4—0·48	0·6	0·45—0·5	0·4—0·5
Tail	0·06—0·065	0·16	0·064	0·16
Spicules	0·106 & 0·065	..	0·18—0·2 & 0·06—0·07	..
Vulva from ant. end	..	0·38	..	1—1·2

By the absence of head papillae and papillae on the tail of the male and by the presence of a short undivided oesophagus this worm agrees

with the genus *Aprocta*, but one spicule is over twice the length of the other. On the classification of Yorke and Maplestone (1926), which has been partly followed by Baylis and Daubney (1926), this character would exclude it even from the sub-family Aproctinae.

Chandler (1929) objects to the separation of Filariinae and Aproctinae on the length of the spicules alone. Although in some genera and even sub-families of Nematodes spicule characters are remarkably constant, Chandler's objection seems well-founded in the present instance, especially as the worm under discussion is a typical *Aprocta* in all but the difference in length of its spicules. Although one is reluctant to do so, there seems to be no alternative but to create a new genus to accommodate this worm, otherwise it would be necessary to alter the definition of *Aprocta* and in the present state of classification of the sub-families Filariinae and Aproctinae it seems to me better to create new genera if worms do not agree with existing definitions, rather than to alter the definitions. At present it is impossible to divide the genera of these sub-families satisfactorily, for in whatever way one tries to make groups, using one or two well-defined characters, exceptions and forms intermediate between what at first appear to be well-defined divisions occur. It is possible that when more is known of the worms in these sub-families distinct lines of cleavage may emerge, which will permit of a better system of classification. On account of these difficulties it is proposed to create the new genus *Paraprocta* to accommodate *Filaria brevicauda* Chandler, 1924.

Definition :—

Paraprocta, gen. nov. Filariform worms, lips and head papillae absent. Oesophagus short and undivided. Caudal alae and papillae absent in the male. Spicules unequal. Vulva opens near the junction of the oesophagus and intestine, uteri parallel, viviparous. Posterior portion of gut atrophied. Parasite of the body cavity of birds.

Type-species. *Paraprocta brevicauda* (Chandler, 1924).

Synonym. *Filaria brevicauda* Chandler, 1924.

Type-host. *Cissa chinensis*.

Specimens are in the Indian Museum.

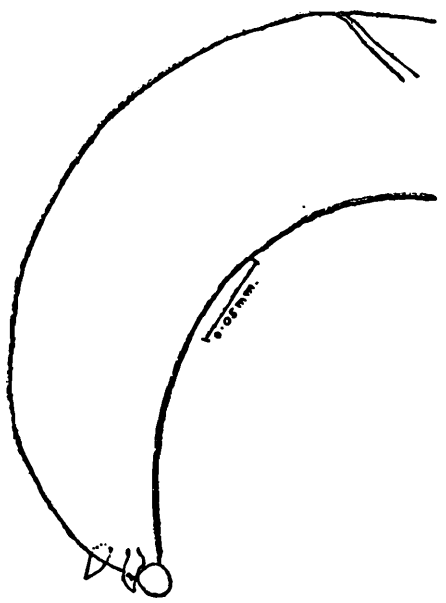
Setaria cervi, n. sp.

Two female specimens of this worm were obtained from the abdominal cavity of a Hog deer (*Cervus axis*).

The worms are similar to *Setaria digitata*, according to the description of this species by Boulenger (1920), in all their dimensions but they are a little smaller. In the following description the measurements of my species are given first and in each case they are followed by the corresponding measurement for *S. digitata* taken from Boulenger, the latter being in brackets.

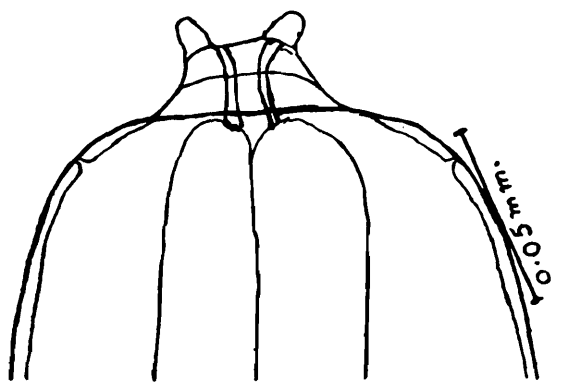
The worms are 60 mm. (62—78 mm.) in length and 0·5 mm. (0·5—0·68 mm.) in diameter. The anterior portion of the oesophagus is 0·44 mm. (0·53—0·8 mm.), and the posterior portion 4·1 mm. (6·5—8 mm.) in length. The tail is loosely coiled in one or two spiral turns and there

are a pair of large fleshy papillae about 0·5 mm. (0·1 mm.) from the rounded tip (fig. 30). The anus is 0·376 mm. (0·4—0·48 mm.) from the



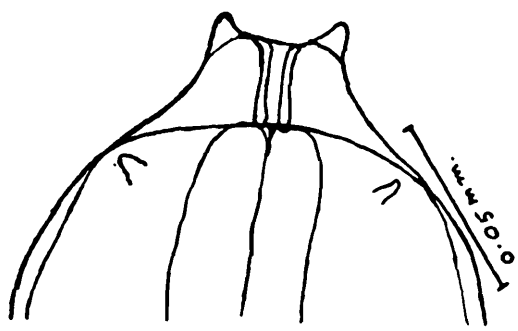
TEXT-FIG. 30.—*Setaria cervi*, n. sp. Posterior end, female, lateral view.

tip of the tail, and the vulva is 0·396 mm. (0·5—0·65 mm.) from the anterior end. Comparison of these measurements does not reveal any sufficiently marked difference whereon to erect a new species, but the



TEXT-FIG. 31.—*Setaria cervi*, n. sp. Anterior end, dorso-ventral view.

chitinous mouth collar is much more prominent in my material as it projects about 0·22 mm. beyond the anterior end of the worm, and within



TEXT-FIG. 32.—*Setaria cervi*, n. sp. Anterior end, lateral view.

it there is a definite cuticle-lined mouth of a corresponding depth (figs. 31 and 32), whereas the mouth collar of *S. digitata* appears to be only about

0·009 mm. in length, from Boulenger's figure. Another difference is that there is an anterior projection from the centre of the lateral surface of the mouth collar in *S. digitata*, and this is absent in my worms (fig. 32). Another slight difference is that the tip of the tail is more obtuse and the large lateral papillae are much nearer to it in my material than in *S. digitata*.

It is accordingly proposed to name this worm *Setaria cervi*, n. sp.

Male.—Unknown.

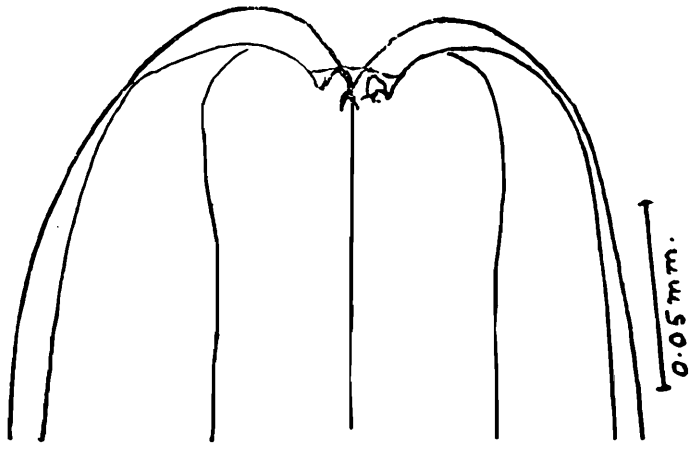
Host.—*Cervus axis.*

The type of the female is in the Indian Museum, Calcutta.

Papillosetaria veversi, n. sp.

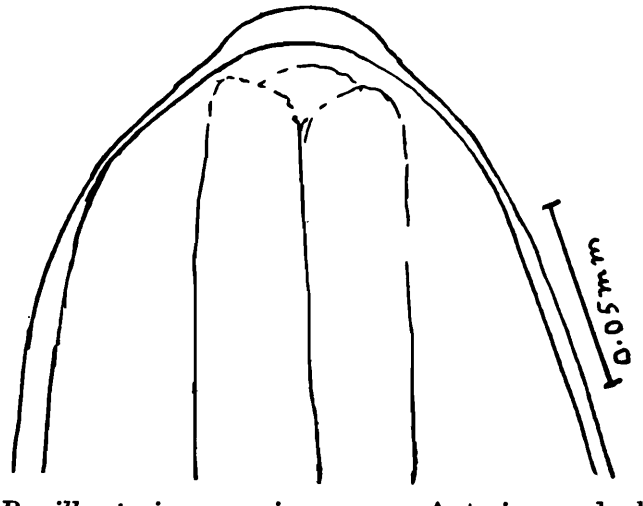
One male and one female of this species were found on the extra-peritoneal surface of the abdominal wall of a Java Mouse-deer (*Tragulus javanicus*).

They are long thin worms with irregularly placed papilliform structures on the cuticle. These papillae first appear opposite about the middle of the oesophagus, and in the female they are present as far back as the anus, but in the male they could not be seen further back than about 3 mm. from the posterior end. The mouth is bounded by two thick, simple lateral lips, which are surmounted by a thickening of the cuticle, which may be of a chitinous nature. No head papillae could be



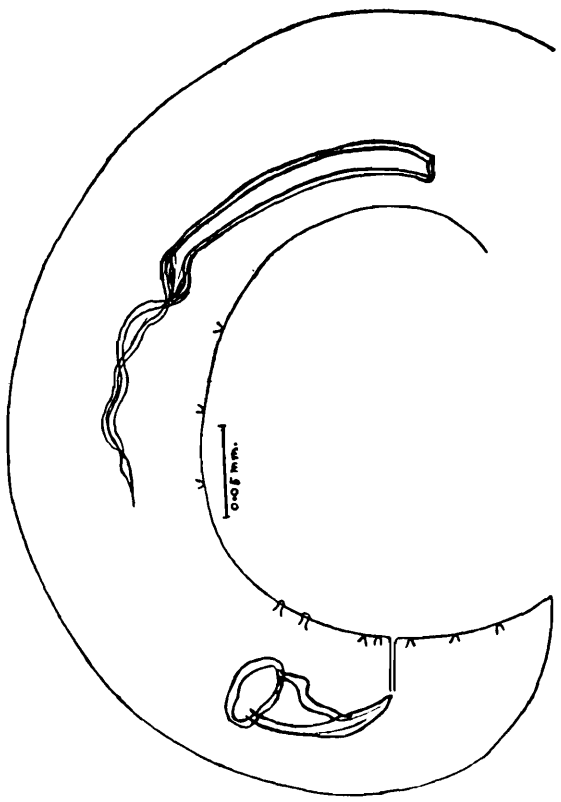
TEXT-FIG. 33.—*Papillosetaria veversi*, n. sp. Anterior end, dorso-ventral view.

made out (figs. 33 and 34). The oesophagus is long and is divided into two parts.



TEXT-FIG. 34.—*Papillosetaria veversi*, n. sp. Anterior end, lateral view.

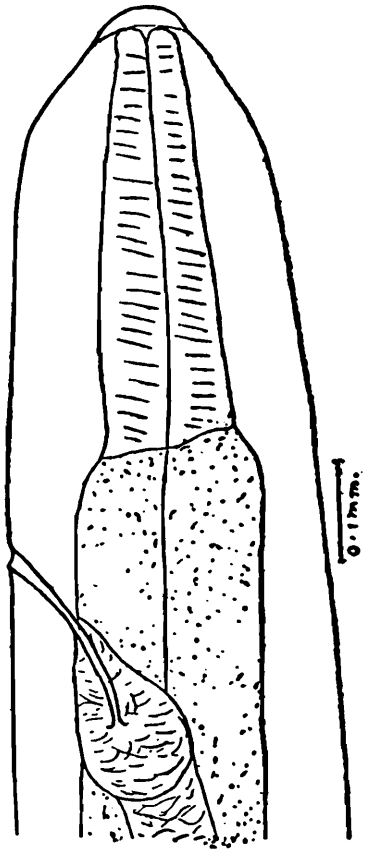
Male.—The male is about 70 mm. (57) in length, and 0·24 mm. (0·28) in maximum diameter. The anterior part of the oesophagus is 0·58 mm. (0·5), and the posterior part is about 11 mm. (9·1) in length. The nerve ring is situated 0·297 mm. (0·2) from the anterior end. The tail is wound in one or two open spiral turns and it ends in a point 0·09 mm. (0·12) behind the cloaca. There are seven pairs of precloacal and three pairs of postcloacal papillae (fig. 35). From the nature of the papillae it appears possible there may be narrow caudal alae, but this could not be determined as it was not possible to obtain a ventral view of the tail. The spicules are unequal and dissimilar. The long spicule is 0·275 mm. (0·37) in length, and its proximal part consists of a stout curved tube, and the distal half appears to consist of two or more lash-like portions coiled round one another. The short spicule is 0·09 mm. (0·085) in length, it is very stout and of a peculiar shape (fig. 35).



TEXT-FIG. 35.—*Papillosetaria veversi*, n. sp. Posterior end, male, lateral view.

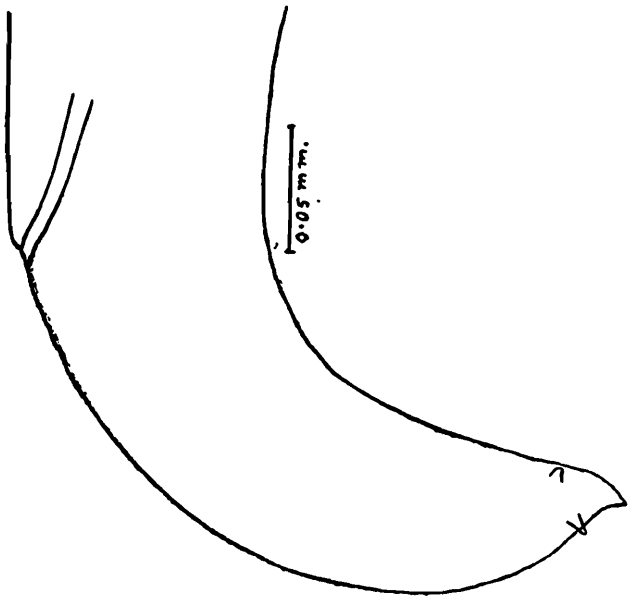
Female.—The female is about 142 mm. (145) in length, and 0·46 mm. (0·46) in maximum diameter. The two parts of the oesophagus are 0·44 mm. (0·4) and 8·8 mm. (9·6) in length respectively, as this is less than in the male it is probable that the length of the oesophagus is subject to considerable variation. The vulva opens 0·535 mm. (0·65) from the anterior end, and a cuticle-lined vagina leads inwards and backwards to end in a pyriform muscular ejaculatory organ (fig. 36). An unpaired trunk runs posteriorly from the ejector for a distance of about 17 mm. It then divides into two uteri, which run posteriorly and the ovaries terminate a little distance in front of the anus. The terminal two or three millimetres of the worm is much thinner than the rest of the body. The tail is curved with the anus on its convexity 0·26 mm. (0·5) from its tip. The tail ends in a simple point with a pair of

large prominent papillae on each side of it a short distance anterior to the tip (fig. 37). The uterus contains embryos.



TEXT-FIG. 36.—*Papillosetaria veversi*, n. sp. Anterior end, female, lateral view.

This worm is remarkably close to *P. traguli* Vevers in all its dimensions, which for convenient comparison have been placed in brackets



TEXT-FIG. 37.—*Papillosetaria veversi*, n. sp. Posterior end, female, lateral view.

after the corresponding measurements of my worms. The points in which these two worms differ is that in the male the tail ends in a simple point in my species, whereas it ends in a rounded knob in *P. traguli*, and in my worm there are seven pairs of precloacal papillae, whereas *P. traguli* has only four pairs. In the female of my species the tail ends in a simple point with two pairs of pointed papillae on each side of it,

whereas in *P. traguli* the tail is bifid with two lateral appendages; the anus is about twice as far from the tip of the tail in *P. traguli* as it is in my species. Vevers (1922) makes no mention of the peculiar ejaculatory organ in the female, but as the worms are so similar in all points described, it is probable that this organ is also present in *P. traguli*, but was not noted by him, therefore its omission in the description of this species is not of any importance unless specially looked for and found to be absent. The differences in the tail of these two species are so distinct in both sexes it is considered my worm is new, so it has been decided to name it *Papillosetaria veversi*, n. sp. The hosts from which these two worms come are closely allied, as Vevers obtained his material from *Tragulus stanleyanus*, and mine was found in *T. javanicus*.

Type-specimens are in the Indian Museum, Calcutta.

Hastospiculum spinigerum Chandler, 1929.

Chandler (1929) described this species from *Varanus flavescens* which died in the Calcutta Zoological Gardens. I have recently obtained many female specimens but no males of this worm from the same host and locality.

Baylis and Daubney (1922) obtained several fragments and a single complete female from several *Varanus* species, which also came from the Calcutta Zoo. These they have referred to *Filaria macrophallos* Parona, 1889. My material agrees with their description and also with Chandler's, the only difference being in some of the measurements, which are found to be covered by normal variation when several specimens are examined. Two very striking characters, *viz.*, the peculiar cuticular ornamentation, and the collar-like thickening at both ends of the eggs are present in all my specimens, and they appear to be identical with the drawings and descriptions of both Baylis and Daubney and Chandler. Therefore there seems to be no doubt even in the absence of males, that *Filaria macrophallos* Parona, 1889, of Baylis and Daubney, 1922 is identical with *Hastospiculum spinigerum* Chandler, 1929. Although Baylis and Daubney do not seem to have fully recognised the chitinous structure on the anterior end, there seems to be no doubt that the worms are the same for they describe two small prominent chitinoid teeth projecting forward. From examination of my material I am in agreement with Chandler that this chitinous structure is similar to that in *Hastospiculum varani*. Therefore the correct name of this species is as follows.

Hastospiculum macrophallos (Parona,1889).

Synonyms. *Filaria macrophallos* Parona, 1889.

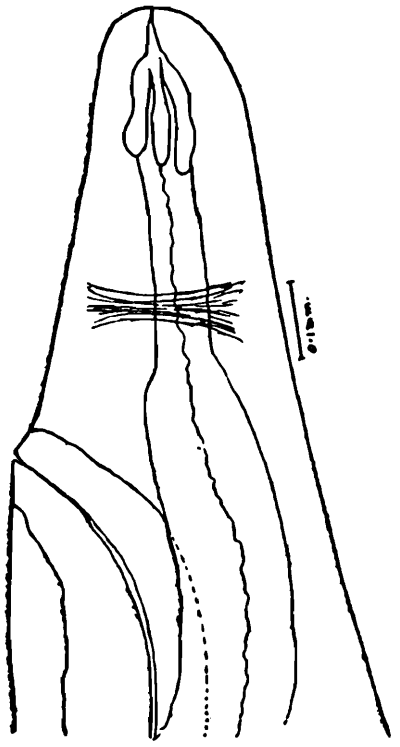
Hastospiculum spinigerum Chandler, 1929.

Diplotriaenia graculi, n. sp.

Seven females and three males of this species were found in the subperitoneal tissue of the body cavity of two Red-billed Choughs (*Graculus eremita*).

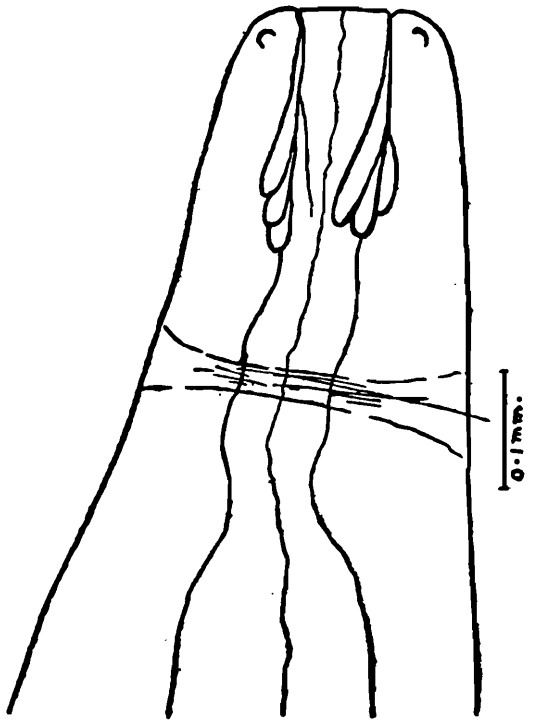
The worms are long and thin and the cuticle appears to be without striations. In lateral view the anterior extremity is rounded, and when

seen from the dorso-ventral aspect is flat (figs. 38 and 39). The chitinous tridents are somewhat irregular in shape and their branches



TEXT-FIG. 38.—*Diplotriaenia graculi*, n. sp. Anterior end, female, lateral view.

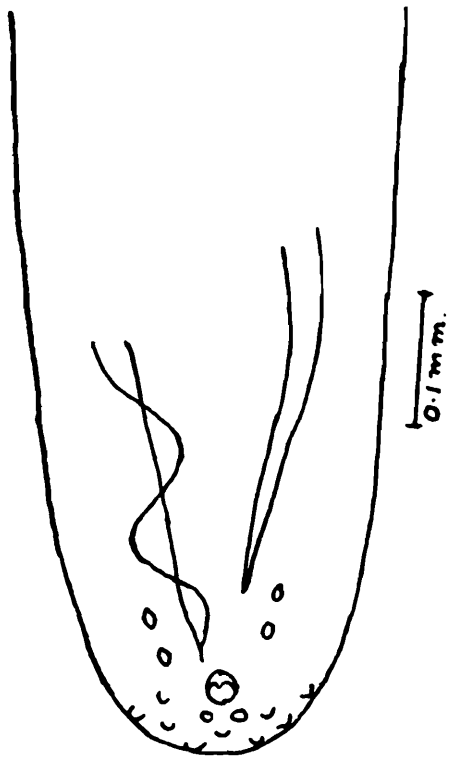
show considerable variation in length, even in a single specimen. The total length of the tridents from the tip of the root to the end of the branches varies between 0·180 mm. and 0·208 mm. The roots are finely pointed and they lie in the bottom of small pits on the anterior end of the worm (fig. 39). There are four large submedian papillae. The



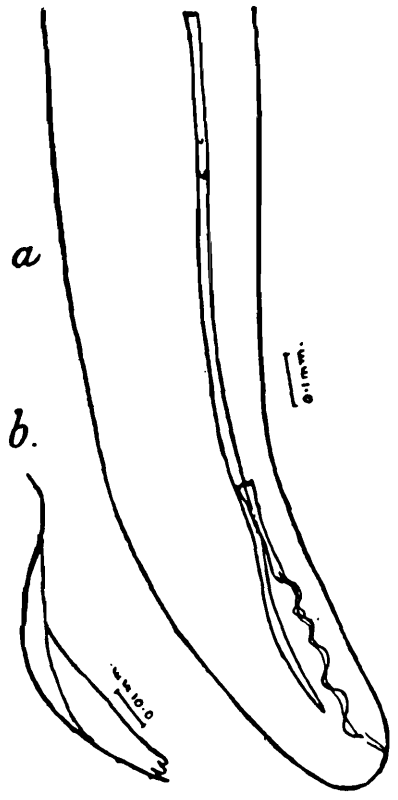
TEXT-FIG. 39.—*Diplotriaenia graculi*, n. sp. Anterior end, dorso-ventral view.

oesophagus is divided into a short anterior portion and a much longer posterior portion. The nerve ring encircles the anterior part of the oesophagus a short distance in front of its junction with the posterior part.

Male.—The males are from 27·5 to 32 mm. in length and 0·594 mm. in diameter opposite the posterior end of the oesophagus, and the head is 0·16 mm. in lateral diameter. The oesophagus is about 1·2 mm. in total length, of which the anterior portion composes 0·45 mm. The posterior end is bluntly rounded, both in dorso-ventral and lateral views (figs. 40 and 41*a*). The cuticle behind the cloaca on the ventral surface is closely set with small round bosses, and there appear to be a pair of



TEXT-FIG. 40.—*Diplotriaenia graculi*, n. sp. Posterior end, male, ventral view.



TEXT-FIG. 41.—*Diplotriaenia graculi*, n. sp. (*a*) Posterior end, male, lateral view. (*b*) Tip of short spicule.

papillae immediately behind this opening and two papillae on each side, in front of it. The right spicule is 1·565 mm. in length, and it is long and straight. The left spicule is 0·634 mm. in length, and its proximal third is straight and tubular, but the distal third is spirally twisted in five or six turns, and its broad membranous ala gives it an appearance similar to an auger (fig. 41).

Female.—The females vary from 70—108 mm. in length, and from 0·326—0·455 mm. in diameter opposite the vulva. The vulva is slightly prominent, and it is situated 0·49—0·59 mm. from the anterior end (fig. 38). There is an unpaired trunk or vagina running posteriorly from the vulva for a distance of 0·89—1·3 mm. The uteri are parallel and contain embryos, and the ovaries are in the posterior end of the body.

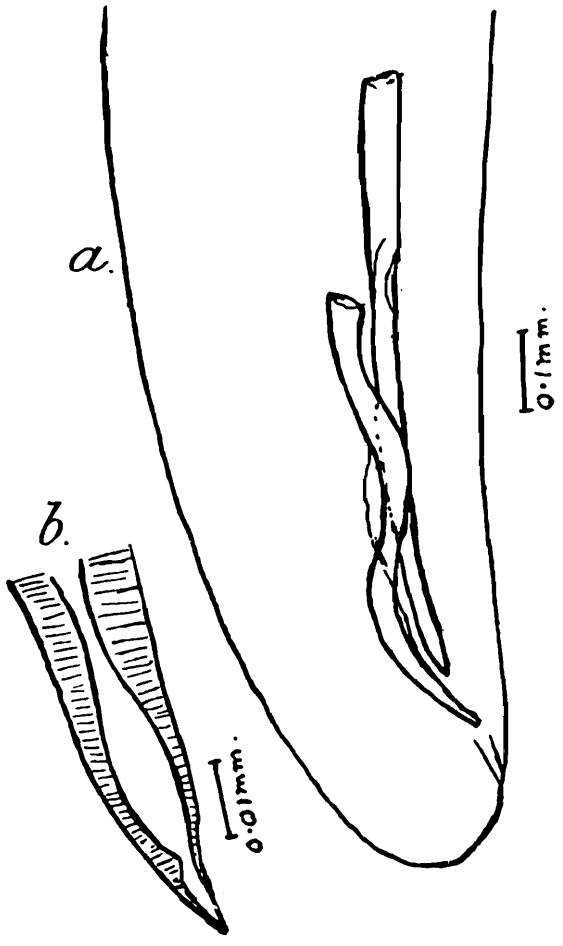
The members of the genus *Diplotriaenia* are for the most part closely allied, but the present species is characterised by the flat anterior end in dorso-ventral view, and in the male the posterior end is rounded, from whichever angle it is examined. In most species the anterior end is rounded from any aspect, and the posterior end of the male is rounded in lateral view, but truncate in ventral view. It is accordingly proposed to name this species *Diplotriaenia graculi*, n. sp.

Host.—*Graculus eremita.*

The type-specimens are in the Indian Museum, Calcutta.

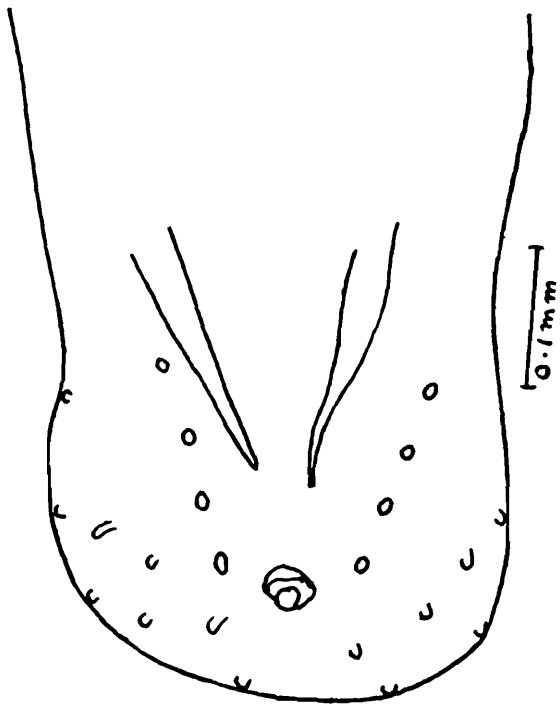
Diplotriaenia dubia, n. sp.

In one of the birds from which the above species (*D. graculi*) was obtained, a single male specimen of apparently a different species was found.



TEXT-FIG. 42.—*Diplotriaenia dubia*, n. sp. (*a*) Posterior end, male, lateral view. (*b*) Tip of short spicule.

The anterior end of the worm is indistinguishable from that of *D. graculi*, as it was the same size and shape and the tridents appeared to be the same. The length of this worm is 8·55 mm. and the diameter at the posterior end of the oesophagus is 0·693 mm. The total length of the oesophagus is 1·5 mm. The posterior end is rounded in lateral view (fig. 42), but when rolled to obtain a ventral view it is seen to be truncate, and slightly expanded laterally (fig. 43). The postcloacal portion of the ventral surface is covered with rather pointed papilla-like prominences, and there are four precloacal papillae on each side (fig. 43). The right



TEXT-FIG. 43.—*Diplotriaenia dubia*, n. sp. Posterior end, male, ventral view.

spicule is 0·812 mm. in length, and it is straight. The left spicule is 0·594 mm. in length and shows a broad double curve (fig. 42).

Although the anterior ends of this worm and of *D. graculi* are apparently identical, the posterior end and the spicules are clearly different from those of the latter, and in addition it is about twice the length of the male of *D. graculi*. It is therefore proposed to name this species *Diplotriaenia dubia*, n. sp.

Female.—Unknown.

Host.—Graculus eremita.

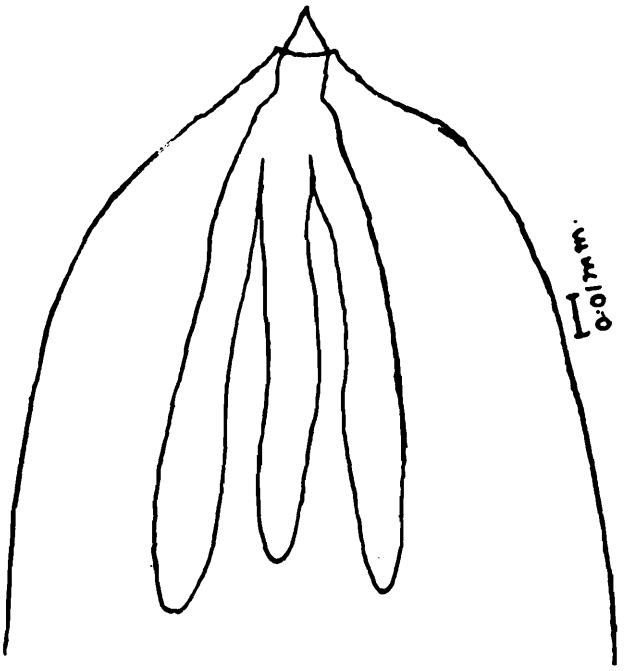
The type-specimen is in the Indian Museum, Calcutta.

As there are no differences apart from those of the males, whereby to distinguish this species from *D. graculi*, and as one of these characters is that of size it might be thought that the largest females of the collection belong to *D. dubia*. But the two largest females were found in bird 1 along with a single male of *D. graculi* and the remaining worms all came from bird 2, these consisted of five females and two males of *D. graculi*, and the single male of *D. dubia*. It seems probable that the females of *D. dubia* will be very much larger than those of *D. graculi*, as the male of the former is twice the length of the male of the latter species.

Diplotriaenia urocissae, n. sp.

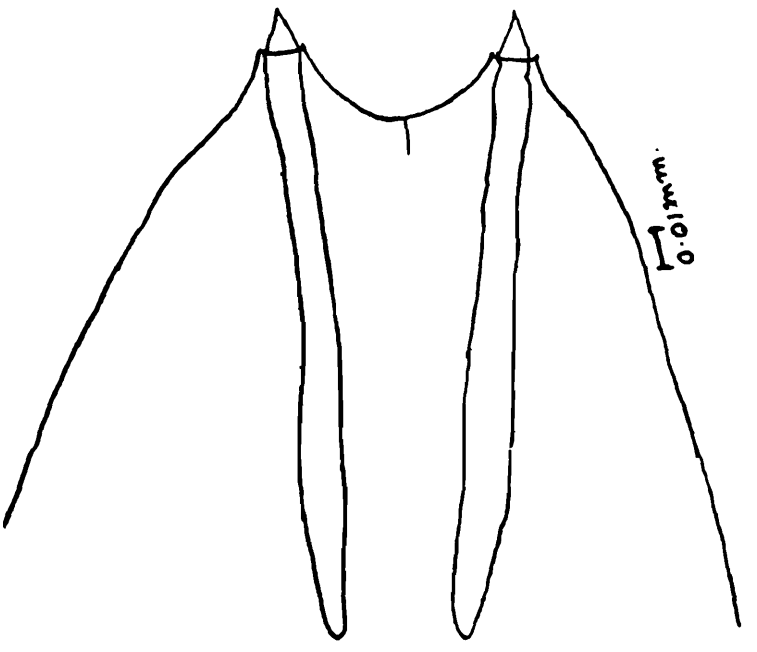
A single male specimen of this worm was found in the sub-peritoneal tissue of the body cavity of a Yellow-billed Blue Magpie (*Urocissa flavirostris*).

The worm is 18·2 mm. in length and 0·515 mm. in maximum diameter. The tridents are 0·148 mm. in length from base to tip. The anterior end of the tridents projects beyond the cuticle in a sharp point. Laterally the head appears rounded with the sharp root of the trident projecting from its anterior border (fig. 44). Dorso-ventrally the anterior ex-



TEXT-FIG. 44.—*Diplotriaenia urocissae,* n. sp. Anterior end, lateral view.

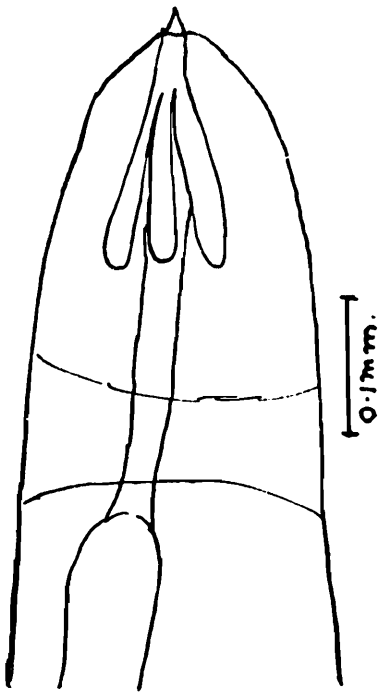
tremity is in the form of a broad curve concave anteriorly, with the tridents projecting anteriorly on each side of it (fig. 45). The oesophagus



TEXT-FIG. 45.—*Diplotriaenia urocissae,* n. sp. Anterior end, dorso-ventral view.

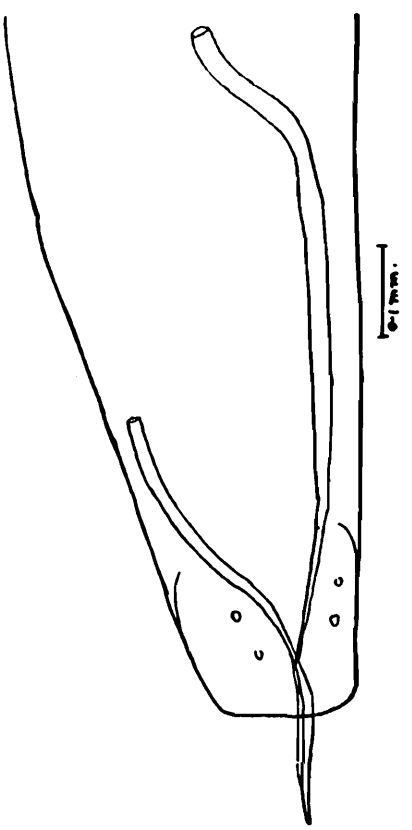
is divided into two parts (fig. 46), the anterior part being 0·257 mm. and the posterior part 2·2 mm. in length. The tail is truncate in the

ventral aspect, and there are two papillae on each side just anterior to the cloaca. The right spicule is 0·713 mm. in length, it is curved near



TEXT-FIG. 46.—*Diplotriaenia urocissae*, n. sp. Anterior end, lateral view.

its base, the remainder being straight. The left spicule is 0·495 mm. in length, and shows a broad S-shaped curve involving its whole length (fig. 47).



TEXT-FIG. 47.—*Diplotriaenia urocissae*, n. sp. Posterior end, male, ventral view.

The anterior extremity of this worm is similar to that of *D. pungens* (Schneider, 1866) according to the description of this species by

Boulenger (1928), but the anterior projection of the tridents are blunt and not so prominent in this species as they are in my specimen. The dimensions of the worms are very different as practically all the measurements of *D. pungens*, except those of the spicules, are about twice that of my worm. The spicules in the two species are different, as in *D. pungens*, the short spicule is spirally twisted, whereas it is only curved in my specimen. It is accordingly proposed to name this worm *Diplotriaenia urocissae*, n. sp.

Female.—Unknown.

Host.—Urocissa flavirostris.

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

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PART 6. THE GENUS *KALICEPHALUS* IN INDIAN REPTILES.

Kalicephalus indicus Ortlepp, 1923.

Kalicephalus bengalensis Maplestone, 1929 was described by me as a new species because, from the limited material then available, it appeared to have definite differences from *K. indicus* Ortlepp, 1923. Since that time I have obtained large numbers of these worms, and study of this material has shown that the worm is subject to a certain amount of variation, which indicates that the differences noted are not constant characters. For instance the sharp points in which the bursa ends ventrally and the apparent prebursal papillae in *K. bengalensis* are only artefacts due to pressure of the cover-glass. In the female the degree of prominence of the vulva and the size of the post-vulval swelling vary considerably. The posterior ovejector in a very few instances runs directly dorsally as figured by Ortlepp, it nearly always forms a loop posterior to the vulva which extends from 0·2 to 0·5 mm. before curving forwards. The size of the eggs measured in utero is also of no diagnostic value, and the dimensions given by Ortlepp really represent the minimum size of apparently mature eggs.