# A REVIEW OF THE NEMATODES OF THE GENUS HASTOSPICULUM, WITH DESCRIPTIONS OF TWO NEW SPECIES

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The genus *Hastospiculum* was proposed by Skrjabin (1923) for a filarid (*H. varani*) found underneath the peritoneal lining of a lizard (*Varanus griseus*). To this genus Yorke and Maplestone (1926) added a second species (*H. gouldi*), from *Varanus gouldi*; and Chandler (1929) added a third (*H. spinigerum*), from *Varanus flavescens*, and pointed out that *Filaria bipinnata* von Linstow probably also belongs to *Hastospiculum*. Baylis (1930) redescribed *Filaria macrophallos* Parona as a member of this genus.

In the present paper two new species of *Hastospiculum* are described. The first was collected by Dr. E. W. Price on October 14, 1929, from a python (*Python reticulatus*), which died in the National Zoological Park, and the second was taken by the writer from two specimens of a boa (*Constrictor imperator*), which died in the same park on January 19, 1931, and February 12, 1931, respectively. In addition, *H. spinigerum* Chandler is herein redescribed, and brief descriptions of the other species of the genus are brought together into a form in which comparisons can be made. As Baylis points out, some of the species may be synonyms, but until further information can be obtained they must be regarded as valid species.

## HASTOSPICULUM SETIFERUM, new species

Plate 1, Figures 1–4

*Description.—Hastospiculum:* The mouth opening is elongate dorsoventrally and surrounded by a raised, thickened region of the cuticle. A pair of blunt, lateral, liplike projections arise from the outer surface of the cuticular elevation, each of which bears at its base a single inward-projecting process. The external manifestations of the amphids, or so-called lateral papillae, are small round pores around which the surface is perceptibly elevated. They are

located farther posteriorly than the above-mentioned lips and are situated nearly in the same circle with eight submedian papillae. The esophagus is divided into an anterior, short, muscular portion, about 610$\mu$ in length, and a posterior, wide, less muscular portion of which the exact length was not determined because of the opacity of the specimens. The nerve ring surrounds the posterior fourth of the anterior part of the esophagus in both sexes.

*Male*, 75 mm. long by 550$\mu$ wide, the diameter practically uniform throughout. The cuticle is finely striated, but not annulated as in the female. Testis single, reflexed; tail surrounded by a cuticular expansion in the form of a pair of alae supported by four pairs of preanal papillae and one pair of postanal papillae. There are three pairs of sessile, cone-shaped, subventral papillae near the end of the tail; the tail is cone-shaped and bears minute denticles. The spicules are unequal, the left one being 2.35 mm. long by 12.5$\mu$ in diameter, and the right one 280$\mu$ long and 52$\mu$ in maximum width.

*Female*, 520 mm. to 540 mm. long and 1.8 mm. to 2 mm. in maximum diameter. Both extremities are bluntly rounded, the posterior being slightly more attenuated than the anterior. The cuticle is marked by fine striations, as well as by irregular annulations, which fuse with one another and do not extend completely around the body. The vulva is situated 800$\mu$ from the anterior end of the body. There are two ovaries; the anterior one twists about the intestine and esophagus, while the posterior one extends nearly to the end of the body. The anus is apparently atrophied. The uterus is filled with embryonated eggs, which are nearly spherical and are 80$\mu$ long by 69$\mu$ wide.

*Host.—Python reticulatus* (Schneider).

*Location.*—Under the peritoneum.

*Distribution.*—National Zoological Park, Washington, D. C.

*Type specimens.*—U. S. N. M. Helm. Coll. No. 29265; paratypes, No. 30767.

### HASTOSPICULUM ONCHOCERCUM, new species

PLATE 2

*Description.—Hastospiculum*: Mouth opening surrounded by a cuticular elevation as in *H. setiferum*, but elevation not set off so distinctly dorsally and ventrally as in the foregoing species. The blunt, paired, lateral, liplike projections, which arise from the outer margin of the elevation, are quite square. The subcuticular tissues form a structure that might be likened to an epaulette. The amphids, which are prominent, open in the distal portion of the lateral projections of the "epaulette." Eight submedian papillae are present; the four external submedian papillae have their bases in the dorsal

and ventral projections of the "epaulettes," while the four internal submedian papillae are distinctly set off from them. The cuticle is marked in both sexes with coarse elevations or annulations, which do not pass completely around the body but join one another to form a network. Finer intra-annular striations are also present. The annulations are most marked in the mid-region of the body, becoming less conspicuous at the posterior end and often disappearing near the head.

*Male*, 38 mm. to 55 mm. long and 500$\mu$ to 600$\mu$ in maximum diameter. The nerve ring surrounds the esophagus 80$\mu$ to 100$\mu$ from the anterior end of the body. The anterior muscular portion of the esophagus is 380$\mu$ to 420$\mu$ in length and has a maximum diameter of 60$\mu$ to 120$\mu$. The posterior portion of the esophagus is 7.4 mm. to 8.8 mm. in length and has a maximum diameter of 260$\mu$ to 390$\mu$. Testis single, reflexed. Tail surrounded by a bursalike pair of alae supported by five pairs of pedunculate papillae, four pairs of which are preanal and one pair postanal. There are also two pairs of smaller sublateral papillae slightly anterior to a pair of ventral cone-shaped ones. The latter are situated very slightly anterior to the tip of the tail, which is rounded and does not bear denticles. The left spicule is 1.84 mm. to 2.2 mm. long, its proximal portion being wider (20$\mu$ wide) than the distal portion, from which it is set off by a slight twist at a point 400$\mu$ to 480$\mu$ from the proximal end; the distal portion is delicately filiform and about 12$\mu$ wide, and terminates in an exceedingly fine point. The right spicule is short and curved, 240$\mu$ to 280$\mu$ long, and about 20$\mu$ in maximum width.

*Female*, 170 mm. to 350 mm. long and 2.4 mm. to 2.8 mm. in maximum diameter. The nerve ring surrounds the esophagus approximately 280$\mu$ from the anterior end of the body. The muscular portion of the esophagus is 600$\mu$ to 650$\mu$ long and has a maximum diameter of 120$\mu$ to 160$\mu$. The posterior part of the esophagus is 15 mm. to 18 mm. long and 500$\mu$ to 600$\mu$ wide. The anus is apparently atrophied. The tail is bluntly rounded. The vulva is located posterior to the base of the muscular portion of the esophagus, 850$\mu$ to 1 mm. from the anterior end of the body. Eggs embryonated, spherical, and 44$\mu$ to 48$\mu$ long by 40$\mu$ to 44$\mu$ wide; shell simple.

*Host.—Constrictor imperator* (Daudin).

*Location.*—Under the peritoneal covering of the stomach and intestine.

*Distribution.*—National Zoological Park, Washington, D. C.

*Type specimens.*—U. S. N. M. Helm. Coll. No. 30759; paratypes, No. 30740.

### HASTOSPICULUM VARANI Skrjabin, 1923

PLATE 3, FIGURES 6, 7

*Description.—Hastospiculum*: Large filarids characterized by a special ornamentation of the head; mouth oval, bearing on each side a distinct lip arising from a wide base. Surrounding the mouth there is an epaulettelike structure situated dorsoventrally, bearing, according to Skrjabin, 10 papillae, of which 2 are the so-called lateral papillae or amphids, and 8 are the submedian papillae. The epaulettes are joined dorsally and ventrally by a cuticular band. The cylindrical esophagus is 17 mm. in length.

*Male*, 135 mm. to 140 mm. long and 680$\mu$ maximum breadth. Tail surrounded by a pair of alae supported by six pairs of preanal papillae (the last two pair may be adanal) and two pairs of postanal papillae. Skrjabin does not state whether the latter also support the alae. Spicules unequal; the left is 4.4 mm. long, bearing lancelike expansion at the tip, and the right is 660$\mu$ long and is bow-shaped. From the figure one would judge that the left spicule is comparatively strong and not delicate as in *H. setiferum* and *H. gouldi.*

*Female*, unknown.

*Host.—Varanus griseus.*

*Location.*—Under the peritoneal lining.

*Distribution.*—Russian Turkestan.

### HASTOSPICULUM GOULDI Yorke and Maplestone, 1926

PLATE 3, FIGURES 8–11

*Description.—Hastospiculum*: Mouth opening, arrangement of papillae, and other head structures as in *H. varani.*

*Male*, about 180 mm. long. Anterior portion of the esophagus 300$\mu$ long, posterior portion 9.4 mm. long. Spicules unequal, the longer (left) being 1.1 mm. long and the shorter (right) 200$\mu$ long. Left spicule slender, delicate, and filiform or setaceous. A pair of caudal alae meet posteriorly and surround the tail. There are three pairs of large pedunculated preanal papillae, two pairs of smaller preanal papillae situated more subventrally, and one pair of large pedunculated postanal papillae. On the midventral line there are two conical processes, the first near the cloaca, the second near the tip of the tail. From the figure, as given by Yorke and Maplestone, there appear to be other papillae on each side of the posterior conical process.

*Female*, about 180 mm. long. Anterior portion of esophagus about 300$\mu$ long; posterior portion of esophagus, 16 mm. long,

glandular. Vulva approximately 1 mm. from the anterior extremity. Anus atrophied.

*Host.—Varanus gouldi.*

*Location.*—Presumably under the peritoneum.

*Distribution.*—Not given; probably Australasia.

*Remarks.*—Baylis (1930) states that *H. gouldi* may be a synonym of *H. macrophallos* Parona, but this seems unlikely since the left spicule of the latter species is very strong as compared with that of *H. gouldi*. *H. gouldi* is probably more closely related to *H. setiferum* and *H. onchocercum*, but it differs from these two species in the arrangement and number of caudal papillae of the male, length of spicules, length of body, and position of vulva in the female.

### HASTOSPICULUM BIPINNATUM (von Linstow, 1899) Chandler, 1929

PLATE 3, FIGURES 4, 5

*Synonym.—Filaria bipinnata* von Linstow, 1899.

*Description.—Hastospiculum:* The head bears two small projections, which may be interpreted as being identical with the lateral liplike organs of *H. varani*. In both sexes the ends of the body are bluntly rounded, the posterior end tapering a little more than the anterior end.

*Male*, 32 mm. long by 590$\mu$ wide. Esophagus $\frac{1}{27}$ and tail $\frac{1}{382}$ of the body length; spicules unequal, the larger being 1.01 mm. long, and the smaller 190$\mu$ long. Six pairs of caudal papillae, four of them preanal and two postanal.

*Female*, 145 mm. long. Vulva $\frac{1}{72}$ of the body length from the anterior end. The embryonated eggs are 65$\mu$ long by 47$\mu$ wide.

*Host.—Varanus griseus.*

*Location.*—Lying loose under the peritoneum of the gut.

*Distribution.*—North Africa.

*Remarks.*—The data for this description were obtained from von Linstow's (1899) description and figures. He failed to state which of the spicules is the longer, and his figures do not show this; presumably the left is the longer. Skrjabin (1923) pointed out that *H. bipinnatum* differed from *H. varani* in length of body, length of esophagus, size of spicules, and number of preanal papillae.

### HASTOSPICULUM SPINIGERUM Chandler, 1929

PLATE 1, FIGURES 5, 6

*Description.—Hastospiculum:* An anterior view of the head shows that the subrectangular mouth is surrounded by a cuticular elevation, which is not distinctly epaulettelike in contour, and that paired lateral projections arise from the outer margin of this circumoral eleva-

tion. There are three smaller papillate structures at the inner side of the base of each of these projections; they may, however, be under the surface. Eight submedian papillae, in addition to the paired lateral organs or amphids, are present.

*Male* (incomplete specimen), 75 mm. long by 560$\mu$ wide. The tail is provided with a pair of caudal alae. The larger left spicule is 2.75 mm. long and 42$\mu$ wide. The right spicule is only 420$\mu$ long. The single specimen is in poor condition, and the caudal papillae are somewhat difficult to see. There are five papillae supporting the right side of the caudal alae. The most posterior of these might be considered adanal. On the left side there are seven pedunculate papillae of which the most posterior two might be considered adanal. Toward the end of the tail there is a group of at least three sessile cone-shaped papillae, two on the right and one on the left side of the cone-shaped tail; the tail does not bear denticles.

*Female*, 220 mm. long by approximately 2 mm. wide. Anterior part of the esophagus 550$\mu$ to 570$\mu$ long and about 220$\mu$ wide; posterior part 520$\mu$ wide, length not determined. Vulva 850$\mu$ from the anterior end of the body. Opisthodelphous; the embryonated eggs present in the uterus measure 50$\mu$ to 52$\mu$ by 33$\mu$ to 34$\mu$ and are provided with an operculumlike structure at both ends. Tail bluntly rounded; anus somewhat atrophied, situated at the end of the tail.

*Host.—Varanus flavescens.*

*Location.*—Under the peritoneum.

*Distribution.*—Calcutta Zoological Gardens, Calcutta, India.

*Type specimens.*—U.S.N.M. Helm. Coll. No. 8009; paratypes, No. 8010.

*Remarks.*—This description was made from a restudy of the type specimens. The most outstanding differences between *H. spinigerum* and *H. gouldi*, *H. setiferum*, and *H. onchocercum* are in the relative coarseness of the left spicule. *H. spinigerum* might well be identical with *H. macrophallos*, as shown by Baylis, but there are important differences in the relative lengths of the spicules and in the number and position of the papillae on the tail of the male.

### HASTOSPICULUM MACROPHALLOS (Parona, 1889) Baylis, 1930

PLATE 3, FIGURES 1–3

*Synonym.—Filaria macrophallos* Parona, 1889.

*Description.—Hastospiculum*: Mouth elongate dorsoventrally, surrounded by a circumoral elevation bearing a pair of laterally placed truncate teeth or liplike organs. There appear to be three finger-like processes converging toward the base of each of the toothlike structures. Baylis states that these may possibly be the attachments

of muscles, and is of the opinion that at least in *H. macrophallos* the so-called epaulettelike structure is not superficial but rather is a manifestation of subcuticular bodies. Only four submedian papillae are described. Concerning the presence of four additional submedian papillae Baylis states: "There is a faint indication of a structure of some kind, suggesting a papilla, near each corner of the 'epaulettes,' but this does not appear to be superficial, and it seems possible that it may be the point of attachment of a muscle or some other subcuticular structure." Lateral organs, or amphids, are situated in a position similar to that occupied by the same structures in other members of the genus.

*Male*, 80 mm. long, according to Parona (1889); maximum diameter 0.041 (probably meant to be 0.41 mm.). Spicules unequal, the left being 2 mm. long and 0.042 mm. wide, and the right 0.051 mm. long, according to Parona, or 0.04 mm., according to Baylis. Baylis suggests that the decimal point is misplaced in Parona's figure for the length of the right spicule. Parona figures four pairs of large pedunculated papillae, while Baylis figures only three, two preanal and one postanal. There are also three pairs of smaller, subventral, preanal papillae and two pairs of conical, postanal papillae. The figure of the tail of the male given by Parona shows the left spicule quite heavy, as would be expected from his measurement; Baylis's figure is not quite so clear in this respect.

*Female*, 250 mm. long by 1.4 mm. wide, according to Baylis and Daubney (1922), who found females that they described as *Filaria macrophallos*. The esophagus consists of a short, narrow, muscular portion 600$\mu$ long, and a long, glandular portion 30 mm. long; the nerve ring surrounds the esophagus caudad of the middle of the anterior portion. Vulva 1.15 mm. from the anterior end. Tail bluntly rounded, bearing a pair of papillae at its extremity; anus terminal. Eggs embryonated, barrel-shaped, 50$\mu$ long by 30$\mu$ wide, with thick shells possessing annular thickenings. Parona (1889) had males only and hence gave no description of the female in proposing this species.

*Hosts.—Varanus* (*Hydrosaurus*) *salvator*, *V. nebulosus*, and *V. niloticus*.

*Location.*—Among the abdominal muscles.

*Distribution.*—Burma, India.

## DISCUSSION

On the basis of characters of the ova, one would regard *Hastospiculum spinigerum* as at least very closely related to *H. macrophallos*. The relative thickness of the left spicule also presents a simi-

larity. However, the number of submedian head papillae for *H. macrophallos*, as given by Baylis, is four, while the number in the other members of the genus in which it is known is eight. *H. varani* and *H. bipinnatum* are too poorly described for conclusions to be drawn as to their possible identity with either of the above forms. Having only the present inadequate information as to the variation of the body length, the length of the spicules, and the number of tail papillae, one can not consider that any two of these species are identical. The above four species have one point in common, the relatively thick left spicule. On the other hand, *H. gouldi*, *H. setiferum*, and *H. onchocercum* have in common a narrow, delicate left spicule.

After a study of the literature and the three available species, it appears necessary to emend slightly the generic diagnosis as given by Yorke and Maplestone (1926), as follows:

### HASTOSPICULUM Skrjabin, 1923

*Generic diagnosis.*—Filariidae: Mouth elongate dorsoventrally, more or less rectangular in outline, surrounded by a heavy cuticular elevation, which may or may not give the appearance of epaulettes, depending on the distinctness of the cuticular and subcuticular tissues; paired, lateral liplike organs projecting from the outer margin of the circumoral elevation, and smaller papillate structures sometimes present at the base of the latter; paired, lateral organs (amphids) and at least four, usually eight, submedian papillae; esophagus composed of a shorter, anterior, muscular portion and a longer, relatively wide, glandular, posterior portion. Vulva anterior, in the esophageal region; opisthodelphous; oviparous. Anus in the female more or less atrophied. Male with a single testis, spicules unequal, the left much longer than the right; tail surrounded by a pair of caudal alae supported by pedunculated papillae.

*Type species.*—*Hastospiculum varani* Skrjabin, 1923.

#### KEY TO THE SPECIES OF THE GENUS HASTOSPICULUM

For the purpose of separating the species described in this paper from those previously described, the following key is given:

1. Left spicule as wide as right ..... 2
   Left spicule not so wide as right ..... 5
2. Male 135 mm. to 140 mm. long; left spicule 4.4 mm. long, right spicule 660$\mu$ long; female unknown ..... varani
   Male less than 100 mm. long; left spicule not more than 2.75 mm. long, right spicule not more than 510$\mu$ long; female known ..... 3

3. Male 32 mm. long; left spicule 1.01 mm. long, right spicule 190$\mu$ long; female 145 mm. long; vulva 2 mm. from anterior end--- **bipinnatum**
   Male 75 to 80 mm. long; female more than 200 mm. long---------- 4
4. Left spicule 2.75 mm. long; six pairs of preanal papillae; vulva 850$\mu$ from anterior end---------- **spinigerum**
   Left spicule 2 mm. long; five pairs of preanal papillae; vulva 1.15 mm. from anterior end---------- **macrophallos**
5. Male 75 mm. long; left spicule 2.35 mm. long, right spicule 280$\mu$ long; four pairs of preanal papillae; females 520 mm. to 540 mm. long, vulva 800$\mu$ from anterior end---------- **setiferum**
   Males not more than 56 mm. long; females not more than 350 mm. long---------- 6
6. Left spicule 1.1 mm. long, right spicule 200$\mu$ long; five pairs of preanal papillae---------- **gouldi**
   Left spicule 1.84 mm. to 2.20 mm. long; right spicule 240$\mu$ to 280$\mu$ long; four pairs of preanal papillae---------- **onchocercum**

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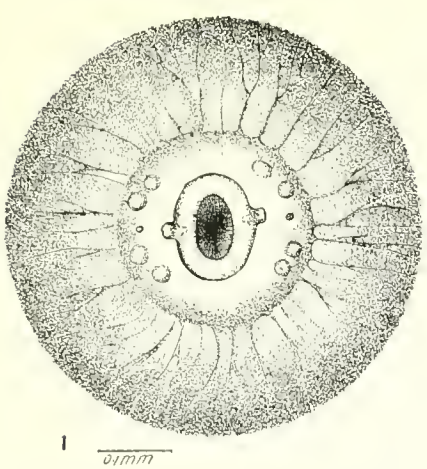
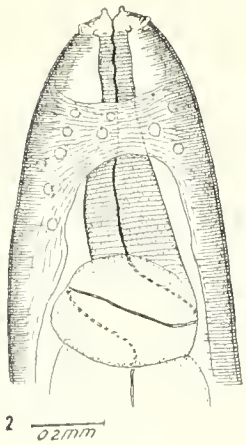
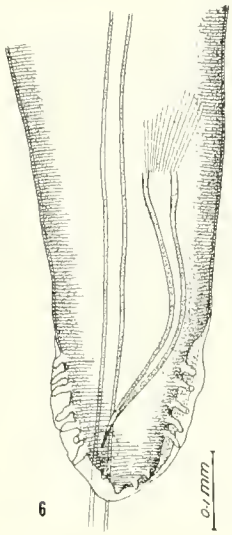
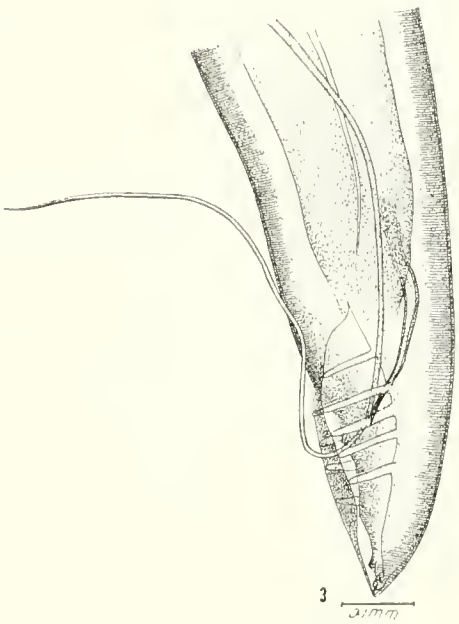
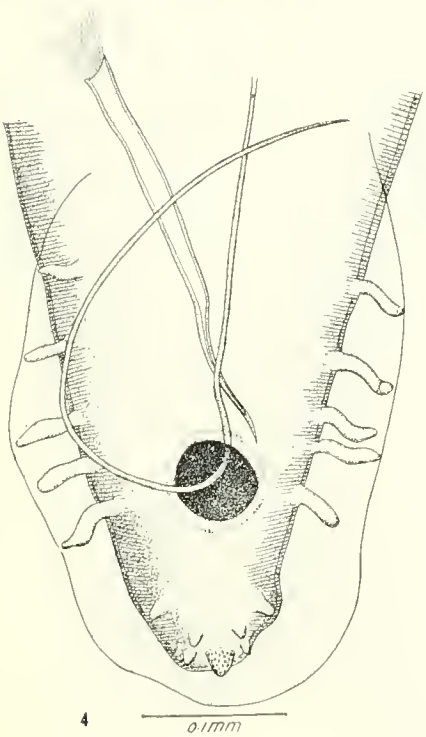
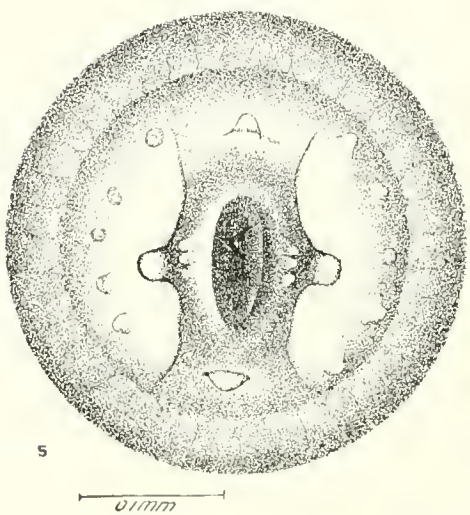


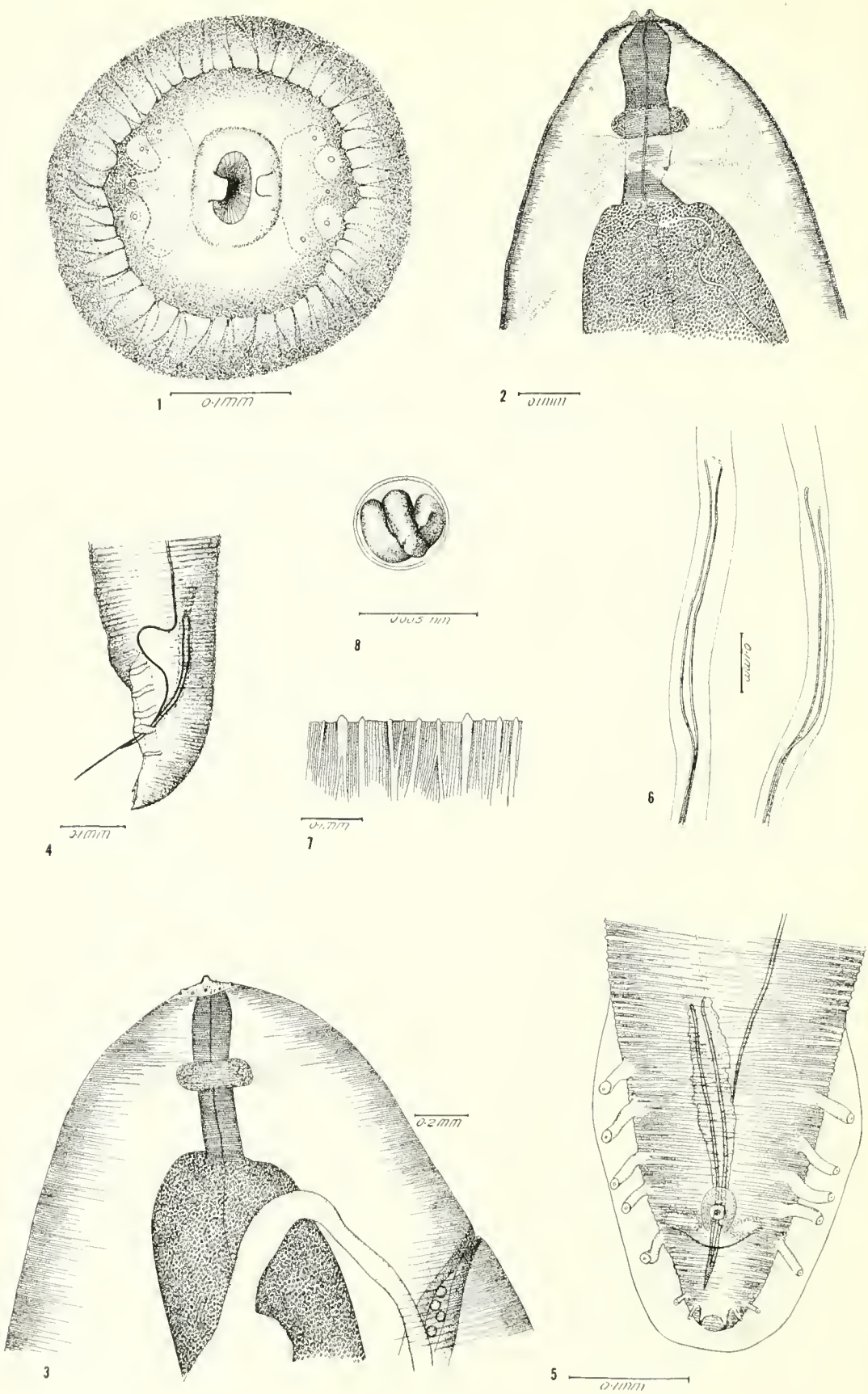



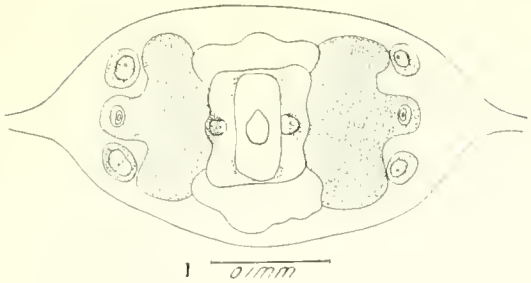

HASTOSPICULUM SETIFERUM, NEW SPECIES, AND H. SPINIGERUM

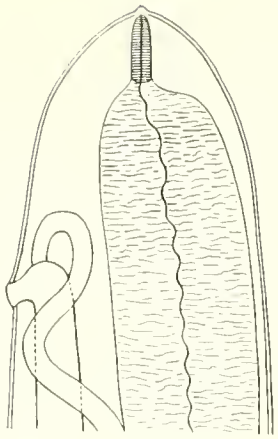
1–4, *Hastospiculum setiferum:* 1, Anterior view of head; 2, lateral view of anterior end of male; 3, lateral view of tail of male; 4, ventral view of tail of male.
5, 6, *H. spinigerum:* 5, Anterior view of head; 6, dorsal view of tail of male.




HASTOSPICULUM ONCHOCERCUM, NEW SPECIES

1, Anterior view of head; 2, lateral view of head of male; 3, lateral view of head of female; 4, lateral view of tail of male; 5, ventral view of tail of male; 6, anterior portion of left spicule, two views; 7, detail of cuticle; 8, egg.



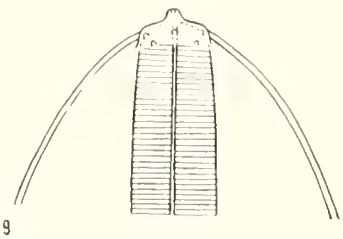



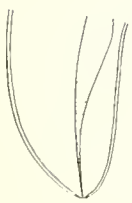


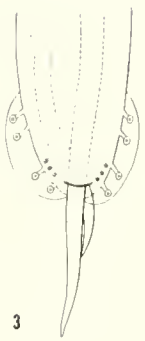


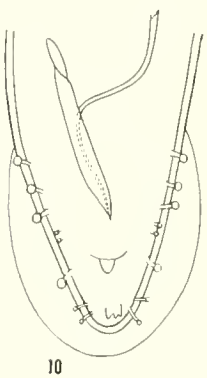


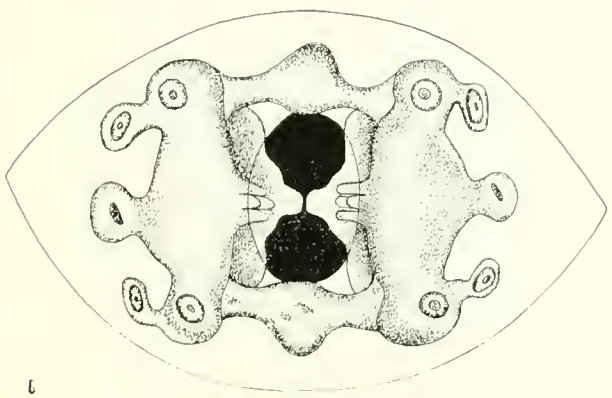


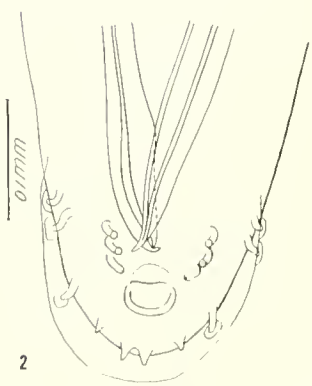



SPECIES OF HASTOSPICULUM

1–3, *Hastospiculum macrophallos:* 1, Anterior view of head (after Baylis, 1930); 2, ventral view of tail of male (after Baylis, 1930); 3, ventral view of tail of male (after Parona, 1889).
4, 5, *H. bipinnatum:* 4, Lateral view of head; 5, ventral view of tail of male. (After von Linstow, 1899.)
6, 7, *H. raraui:* 6, Anterior view of head; 7, lateral view of tail of male. (After Skrjabin, 1923.)
8–11, *H. gouldi:* 8, Lateral view of anterior end of female; 9, lateral view of head; 10, ventral view of tail of male; 11, tail of female. (After Yorke and Maplestone, 1926.)