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On Some Helminths from the "Nylghiae"—*Boselaphus tragocamelus* (Pall) with Observations on the Parasitic Larval Stages of the Stomach Worm *Ashworthius martinagliai* sp. n.

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THROUGH the kindness of Dr. G. Martinaglia, Veterinarian to the Municipality of Johannesburg, two nematode and two trematode species collected from the "Nylghiae" were placed at the disposal of the writer for study. The host was a very recent importation from India and had to be destroyed soon after arrival at the Johannesburg Zoological Gardens because of injuries it had received in transit. The writer wishes to express his appreciation to the donor for having placed this interesting material at his disposal.

Class: **NEMATODA** Rudolphi, 1808.

Superfam.: STRONGYLOIDEA Weinland, 1858.

Fam.: TRICHOSTRONGYLIDAE Leiper, 1908.

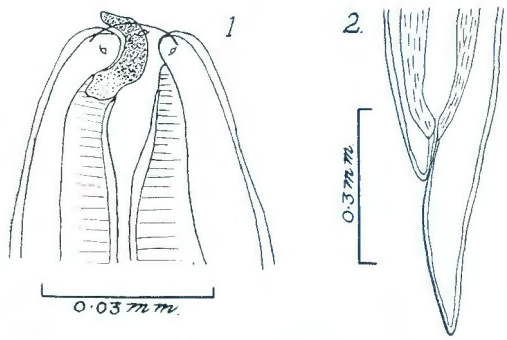
Sub.-fam.: TRICHOSTRONGYLINAE Leiper, 1908.

ASHWORTHIUS MARTINAGLIAI *sp. n.*

Numerous specimens of this species were collected from the abomasum of the Nylghiae. They were in a much shrunken condition, but fortunately they straightened out and appeared to have resumed their normal shape after immersion in lacto-phenol for a day. Superficially they closely resemble the common stomach worm of the sheep (*Haemonchus contortus*), the females showing the characteristic barber-pole markings of this species.

The body is slender in both sexes and is attenuated towards the anterior extremity; this attenuation is most marked from about the level of the cervical papillae to the anterior end, which in the mature males has a diameter of only 0·025 to 0·026 m.m., and in the mature females of 0·027 to 0·028 m.m. The whole body shows very fine cuticular annulations 0·001·5 to 0·002 m.m. apart. The cervical papillae are very prominent, laterally placed, 0·26 to 0·33 m.m. from the anterior end. The excretory pore is found in a ventral transverse groove and is situated from 0·22 to 0·27 m.m. from the anterior end.

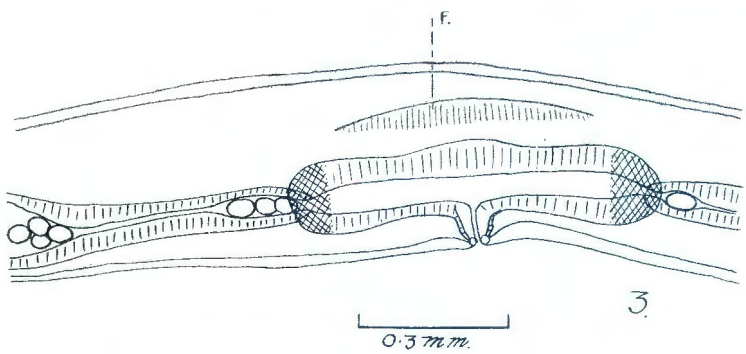
The mouth (Fig. 1) is bounded by four inconspicuous lips of which the dorsal and the ventral are small. The six circum-oral papillae are all carried by the lateral lips, the two laterals being placed slightly anterior of the sub-ventrals and sub-dorsals. The buccal cavity is small and is not tilted dorsally as in the genotype. There is a conspicuous buccal lancet arising from the dorsal segment of the oesophagus and bent dorsally after emerging from the mouth. Its roots are similar to those of the genotype, triangular in a dorsal and somewhat rectangular in a lateral view.



Ashworthius martinagliai sp. n.

Fig. 1.—Anterior extremity, lateral view.
Fig. 2.—Posterior extremity of female.

The oesophagus is long and claviform, increasing in diameter from 0·022 m.m. at the anterior end to 0·14 m.m. at its posterior end; in the females it varies in length from 1·77 to 1·8 m.m., in the males from 1·49 to 1·52 m.m.; it is encircled by the nerve ring just anterior to the level of the excretory pore.

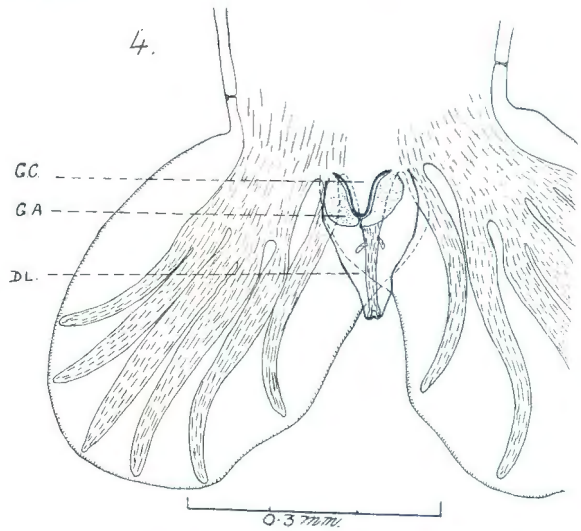


Ashworthius martinagliai sp. n.

Fig. 3.—Vulva and associated organs, showing cuticular flange F.

Female.—Adult specimens, containing eggs, vary in length from 17·5 to 19 m.m. with a maximum thickness just anterior of the vulva of 0·37 to 0·4 m.m. The body tapers towards both extremities and terminates posteriorly in a pointed tail 0·28 to 0·34 m.m. long (Fig. 2) with two conspicuous caudal papillae about 0·1 m.m. from its tip.

The vulva is a small transverse slit situated in the posterior half of the body at about the junction of the fourth and last fifth; in most cases it is only very slightly protuberant. It is encircled by a cuticular ring lying just below the cuticular body covering. A linguiform process is entirely absent, but lateral of the vulva there may be one or two small ring-like expansions of the cuticle (Fig. 3); in twelve specimens six had this ring on the left side only, three on the right side only, two on both sides, and one had none. Adjacent to the vulva there is a small papilla limited to the *right* side only. The vagina is short and transverse and leads directly into the straight ovejectors measuring from 0·7 to 0·9 m.m. inclusive of the sphincters. The ovaries are wound round the intestines as in *Haemonchus contortus*. The eggs are oval and thin-shelled and are segmented *in utero;* they vary in size from 0·07 to 0·073 m.m. long by 0·038 to 0·044 m.m. broad.

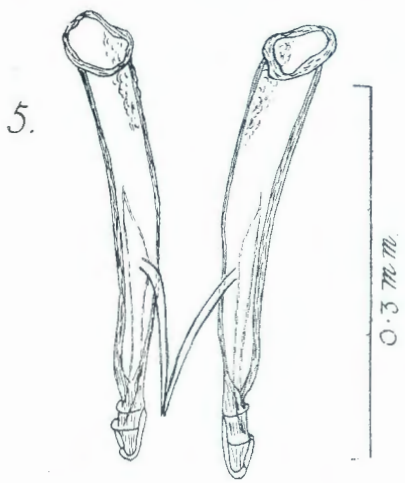


Ashworthius martinagliai sp. n.

Fig. 4.—Ventral view of bursa. GC=genital cone; GA=genital appendage; DL=dorsal lobe.

Male.—Fully grown males vary in length from 11 to 13 m.m. with a maximum thickness just anterior of the bursa 0·23 to 0·26 m.m. The bursa is ample and consists of two elongate lateral lobes with finely serrated edges, which overlap each other at their bases on the dorsal side (Fig. 4). The dorsal lobe is relatively small and symmetrical and lies ventral to the overlapping portions of the lateral lobes; it is somewhat heart-shaped and carries only the dorsal ray, the externo-dorsals being lodged in the lateral lobes; its tip is slightly notched and its edges are not serrated. The ventral and lateral rays have a common stout stem, which sub-divides into three branches: a ventral, median, and dorsal. The ventral branch divides to form the two ventral rays, of which the ventro-ventral is smaller; it runs adjacent to the latero-ventral for about half its length, after which it is slightly bent towards the ventral side; only the tip of the latero-ventral is bent ventrally. The median branch gives rise to

externo-lateral and medio-lateral rays; the former is the largest of the bursal rays and passes straight to the edge of the bursa; the medio-lateral runs parallel to it for about two-thirds of its length, after which it becomes slightly arched dorsalwards. The dorsal branch forms the postero-lateral ray only; its proximal half lies more or less parallel to the postero-lateral rays, but its distal half is more strongly arched dorsalwards. The externo-dorsal ray takes its origin from the base of the dorsal ray before it enters into the dorsal lobe; it is slightly arched and rib-shaped. The dorsal ray is straight and has a stout base; it tapers towards its distal extremity, which is divided into two short branches; at about its middle it gives off two short branches on its ventral side; these bend ventralwards and terminate in the ventral surface of the dorsal lobe. The spicules are stout and dark brown in colour (Fig. 5). Their dimensions are 0·315 to 0·372 m.m. long by 0·044 to 0·048 m.m. broad at their proximal ends. Each spicule carries two transverse ridges towards its tip; these are limited to its dorsal and outer faces, and when viewed from either the dorsal or ventral aspect the spicule appears to carry two barbs; these are situated some 0·038 and 0·06 m.m. respectively from the somewhat blunt spicular tip. At about the junction of its third and fourth-fifths each spicule gives rise to a spike which arises from the dorsal surface of the spicule, somewhat more towards its inner face; it passes backwards along the dorsal side of the spicule to about the level of the proximal " barb-like " ridge.



Ashworthius martinagliai sp. n.

Fig. 5.—Ventral view of spicules after removal from body.

On the ventral surface each spicule carries two longitudinal ridges, which converge and meet proximally, but terminate distally each in one of the barb-like ridges.

A gubernaculum is absent; but a delicate prebursal papilla is lodged on either side just anterior to the base of the bursa.

There is a well-developed genital cone 0·062 to 0·078 m.m. long, somewhat pyramidal in shape, and flanked on its lateral side by two conspicuous genital appendages, which are slightly curved over its distal end.

Discussion.

The genus *Ashworthius* was created by le Roux (1930) for the reception of a stomach worm *A. partoni*, le Roux (1930) from the bushbuck (*Tragelaphus sylvaticus*), Zululand. The species described above agrees with the genotype in that it carries a buccal tooth, has a symmetrical dorsal bursal lobe and has no gubernaculum in the male or linguiform process in the female. It differs from it, however, in its much smaller head, entire separation of the dorsal bursal lobe from the lateral lobes, differently shaped spicules, larger ventroventral rays, presence of a papilla on the right side of the vulva and usual presence of one or two cuticular flanges on the body at the sides of the vulva. These differences may, with the increase of our knowledge of the genotype, perhaps warrant the creation of a separate genus for its reception; unfortunately, the material of the genotype is at present too meagre to allow of a more detailed comparison.

In 1922 Baylis and Daubney described *Haemonchus cervinus* from the spotted deer (*Cervus axis*), India. Unfortunately their material was in a poor condition, and the only male present had an incomplete bursa, which was thus not described; this species agrees with that described above in its very small head (0·023 to 0·025 m.m.), and in the absence of a linguiform process in the female; it differs from it, however, in its smaller size (13-15 m.m.), its longer female tail (0·37 m.m.), absence of a papilla on the right side of the vulva and absence of cuticular flanges lateral of the vulva.

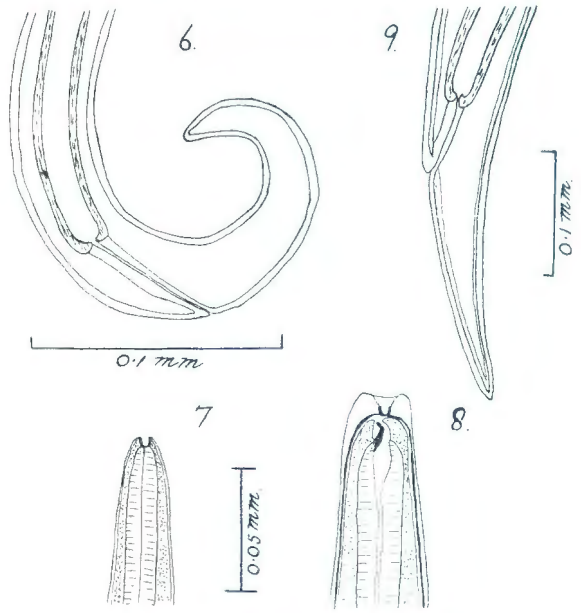
Larval Stages.

Among the adult specimens of this parasite there were several examples of early fourth-stage larval stages and a few examples of the final female fourth stage. The early fourth-stage larvae are small and slender and vary in length from 2·23 m.m. to 2·76 m.m., with a maximum thickness of 0·044 to 0·047 m.m. The cuticle carries very fine annulations, which extend from just behind the oral aperture up to almost the top of the tail. The body is straight and of a more or less uniform thickness, except for the two extremities which are tapered; the tail (Fig. 6) is pointed and is twisted dorsalwards and varies in length from 0·09 to 0·11 m.m. There are two distinct and peg-like cervical papillae lodged from 0·15 to 0·18 m.m. from the anterior extremity.

The larval buccal capsule is small, but quite distinct, and is somewhat bowl-shaped, its depth being equal to its breadth (Fig. 7), being about 0·005 m.m. in both dimensions. It leads into a simple club-shaped oesophagus, 0·37 to 0·42 m.m. long, which is about 0·01 broad at its anterior and 0·029 m.m. broad at its posterior end. It is encircled by the nerve ring just anterior to the level of the cervical papillae, and the excretory pore is found about midway between the levels of these two structures.

The genitalia are still undifferentiated and still consist of a lens-shaped group of cells situated ventral of the intestine at about the junction of the third and fourth body fifths.

Two female specimens representing the final fourth stage were present. Both are ensheathed, the one showing the provisional buccal capsule only, while the other already shows the final mouth with its buccal lancet (Fig. 8). The former is 4·57 m.m. long, with a maximum thickness of 0·1 m.m., and the tail is pointed and 0·16 m.m. long (Fig. 9). These three measurements for the other larvae are 4·3 m.m., 0·1 m.m., and 0·19 m.m. respectively. The position of the future vulva is indicated by a ventral swelling 0·94 and 0·97 m.m. from the tip of the tail in the two larvae respectively; the vagina, however, has not yet acquired its external opening. In both



Ashworthius martinagliai sp. n.

Fig. 6.—Tail of early fourth-stage larva.
Fig. 7.—Cephalic extremity of early fourth-stage larva.
Fig. 8.—Cephalic extremity of ensheathed fourth-stage larva.
Fig. 9.—Caudal extremity of ensheathed fourth-stage female larva.

worms the development of the internal genitalia is at about the same stage and consists of a short transverse vagina leading into an unpaired hollow and longitudinal portion, which at both ends joins on to the ovejectors; these in turn are followed by a short uterine portion which finally join on the short ovarian portion, which at this stage consists of a simple rod of single cells.

The material unfortunately contained no fourth-stage males. The smallest fifth-stage male is a single specimen 4·5 m.m. long and 0·12 m.m. broad just anterior of its bursa. It shows all the characteristics of the adult, except that the lateral bursal lobes are relatively much shorter, and in consequence the unpaired dorsal lobe is of the same length as the lateral lobes.

Superfam.: TRICHUROIDEA Railliet, 1916.
Fam.: TRICHURIDAE Raill., 1915.
Sub-fam.: TRICHURINAE Ransom, 1911.

TRICHURIS GLOBULOSUS (v. Linst., 1901).

Six specimens (three males and three females) of this species were obtained from the caecum. They agree in all essentials with Sprehn's redescription of this species, except with regard to the breadth of the spicule. Sprehn's gives the spicule as 0·08-0·09 m.m. broad. In my specimens the spicule is 0·038-0·04 m.m. broad. Representative material, from sheep, in this laboratory has spicules varying in breadth from 0·038 to 0·044 m.m. These measurements are more in agreement with those given by Baylis (1932) (0·0325-0·05 m.m.) and Gebauer (0·032 m.m.).

Class **TREMATODA.**

Super-fam.: PARAMPHISTOMOIDEA Stiles and Goldberger, 1910.
Fam.: PARAMPHISTOMIDAE Fischoeder, 1901.
Sub-fam.: PARAMPHISTOMINAE Fischoeder, 1901.

COTYLOPHORON COTYLOPHORON (Fisch, 1901) Stiles and Goldb., 1910.

This species was represented by ten specimens collected, with the following species, from the Rumen.

Fam.: GASTROTHYLACIDAE Stiles and Goldberger, 1910.
Sub-fam.: GASTROTHYLACINAE Stiles and Goldberger, 1910.

GASTROTHYLAX CRUMENIFER (Creplin, 1847), Poirier, 1883.

About two dozen specimens were present, varying in length from 6 to 10 m.m.

RÉSUMÉ.

Four helminths are recorded from the Nylghiae (*Bosclaphus tragocamelus*), India. One of these—*Ashworthius martinagliai*—a trichostrongylid stomach-worm, is new to science. Its morphology is described, together with the early fourth stage and late fourth stage female larva. *Trichuris globulosus*, *Cotylophoron cotylophoron* and *Gastrothylax crumenifer* are recorded from this host.

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ADDENDUM.

Since writing the above the writer has seen an article by SCHULZ (1933)* wherein he describes *Ashworthius sidemi* sp.n. from *Pseudaxis hortulorum*. This species differs from the writer's principally by the shape of its spicules, the origin of its ventro-ventral bursal ray, and the presence of a linguiform process in front of the vulva.

* SCHULZ, R. ED. (1933). *Ashworthius sidemi* n.sp. (Nematoda, Trichostrongylidae) aus einem Hirsch (*Pseudaxis hortulorum*) des fernen Ostens. *Zeit. Parasitk.*, Vol. 5, Nos. 3/4, pp. 735-739, Berlin.