

South African Helminths.—Part V.

Some Avian and Mammalian Helminths.

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IN the ensuing pages some helminths are described and discussed which were recovered from six species of birds and three species of mammals. Of particular interest is the multiple infection encountered in the Reed Cormorants and Giant Bustard; in one case of the former seven different kinds of worms were present, namely *Prosthogonimus cuneatus* (Rud., 1809), *Harvardia sandgroundi* Baer, 1932 and *Parphostomum radiatum* Duj., 1845 (Trematoda); *Ligula intestinalis* Linn., 1758, *Paradilepsis delachauxi* (Fuhrm., 1909) and *Hymenolepis cormoranti* sp. n. (Cestoda); and the nematode *Contracaecum carlislei* sp. nov. The Giant Bustard harboured eight different worm species, the majority of which appear to be new to science; these helminths were *Schistometra conoideis* (Bloch, 1782), *Schistometra* sp., *Idiogenes kori*, sp. nov. and *Idiogenes kolbei* sp. nov. (Cestoda) and *Subulura otidis* sp. nov., *Acuaria semei* sp. nov., *Histiocephalus chorioidis* sp. nov. and two immature female specimens of a *Habronema* sp. (Nematoda).

Class **TREMATODA.**

Prosthogonimus cuneatus (Rud., 1809).

On opening up the cloaca of a Reed Cormorant under water a single specimen of this species floated out into the water; in consequence it is not possible to say whether its location was the bursa fabricii or the cloaca.

The species is tentatively referred to the above species because from the mounted specimen (Fig. 1) no character was observed by which it could be differentiated from Rudolph's species. In the unpressed condition the total length is 2.5 mm. and the maximum breadth 1.7 mm., the oral sucker has a diameter of 0.31 mm. and the ventral sucker measures 0.68 mm. across. The much convoluted uterus is packed with numerous eggs of which about half are brownish and appear to be mature.



Fig. 1.—*Prosthogonimus cuneatus*. Ventral view of toto mount.

As far as the writer could ascertain this is the first record of a member of this genus from the Union.

Host: *Microcarbo africana africanoides* (A. Smith).

Location: Cloaca (? Bursa fabricii).

Locality: Pretoria district.

Class **CESTODA.**

Ligula intestinalis Linneus, 1758

Two of three Reed Cormorants yielded four and two adult specimens respectively; they were allowed to die in cold water and were then fixed in cold 70 per cent. alcohol-glycerine with slight stretching; the two largest specimens measured 225 and 240 mm. in length with a maximum breadth of 5 and 5.5 mm. respectively. The anterior portion for a length of 25 to 35 mm. is very muscular and its lateral margins are provided with about 45 serrations on either side. These help to keep the worm in position and this portion may be compared to a metascolex, in that, although a scolex is present, it and its bothridial grooves are so small that it is doubtful whether they play any part as an organ for attachment. In transverse sections of the "metascolex" it is seen that the musculature is very well developed consisting of numerous bundles of longitudinal muscles arranged in 7 to 10 layers separated by sheets of transverse muscles; these sheets run more or less parallel to each other but they may join up to others immediately adjacent; the individual bundles are for the most part separated from each other by bundles of well developed dorso-ventral muscles. This extensive

development of these muscles has caused the medulla to be represented by only a thin layer of parenchyma. Genital organs are present only in the posterior fifth of the "metascolex" and here two tocostomes, one in front of the other, are present opposite each lateral serration. In the remaining portion of the strobila, which becomes narrower posteriorly, the musculature is arranged somewhat similarly except that its degree of development decreases, until in the posteriormost portion bundles appear to be absent and only isolated fibres are found.

The genitalia are similar to those described by Baer (1933). The eggs are operculate and measure 0.052 to 0.06 by 0.047 to 0.05 mm.

Host: *Micracarbo africana africanoides* (A. Smith).

Location: Small intestine.

Locality: Pretoria district.

The writer is tentatively referring to this species some plerocercoids recovered from the body cavity of a fresh water fish, *Engraulicypris whitei*—collected from the Hartebeestpoort Dam by Miss Doreen Stewart of the Zoological Department, University of the Witwatersrand and placed at the writer's disposal for determination. These larvae vary in length from 20 to 30 mm. with a maximum breadth of 4 mm. Developing genitalia are present in their posterior two-thirds.

Raillietina (S.L.) *thryonomysi* sp. nov.

This species, collected from a Cane Rat, was represented by about half a dozen specimens all of which were unfortunately immature; they were from 9.5 to 16 mm. long with a maximum thickness of 0.5 to 0.6 mm. and consisted of a head, neck and from 64 to 114 segments.

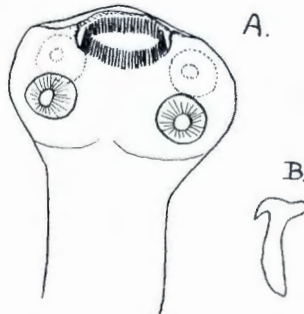


Fig. 2.—*Raillietina* (S.L.) *thryonomysi* sp. nov. A = scolex; B = hook.

The scolex (Fig. 2A) is prominent and measures from 0.42 to 0.48 mm. across; the suckers are rounded and unarmed and have a diameter of 0.115 to 0.12 mm. The rostellum is retracted in all cases and measures 0.18 to 0.192 mm. across; it carries a double row of about 100 typical hooks (Fig. 2B), the hooks of the anterior

and posterior rows measuring respectively 0.04 and 0.036 mm. in length. The base of the rostellum is covered by innumerable small spines; the fact that these spines and rostellar hooks are present on all the scolices makes the absence of spines from the suckers appear to be a normal occurrence and not due to their loss. The neck is fairly long and may reach 1.6 mm. in length; its breadth varies from 0.228 to 0.252 mm.

The genital pores are unilateral and situated in the anterior quarter of the segment. The cirrus sac is somewhat pear-shaped and reaches 0.12 mm. in length by 0.066 mm. thick; it crosses the ventral excretory canal (Fig. 3). There are about 50 to 60 rounded testes of which 15 to 20 are poral in position and the rest aporal; they are from 0.03 to 0.039 mm. in diameter; the area between these testicular groups is occupied by the somewhat centrally placed female glands, which in the material available, have not yet attained maturity. The oldest segment are 0.516 mm. broad by 0.168 mm. long to 0.6 mm. broad by 0.216 mm. long.

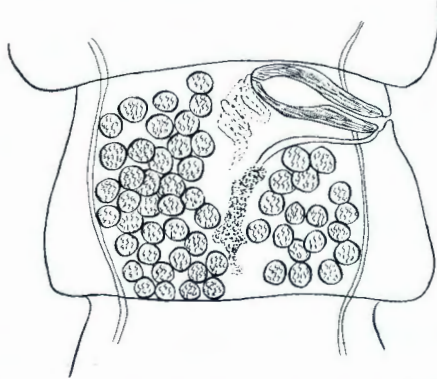


Fig. 3.—*Raillietina* (S.L.) *thryonomysi* sp. nov. Segment showing male genitalia.

Affinities.—The fairly large rostellar hooks, the collar of rostellar spines, the unarmed suckers and unilateral genital pores suggest that these parasites belong to the genus *Houttuynia* Fuhrmann, 1920. The absence of frayed endings to the handle of the hooks, the somewhat central position of the female glands, the presence of a cirrus sac which crosses the excretory canal and because of the lack of ripe segments showing the nature of the egg capsules has caused the writer to refer his material to the genus *Raillietina* Fuhrmann 1920 (S.L.).

Among the mammalian forms of Davaineinae there is no species which combines the characters enumerated above, and although the material is immature the writer thinks that the characters shown are sufficient to warrant the creation of a new species for its reception.

Specific diagnosis.—Davaineinae having a fairly large head, unarmed suckers, about 100 rostellar hooks arranged in two circles, anterior hooks 0.04 and posterior hooks 0.036 mm. long. Neck present, genital pores unilateral; cirrus sac crosses the ventral

excretory canal; about 50 to 60 testes arranged in an aporal group and a poral group of 15 to 20 testes; between them the centrally placed female glands.

Host: *Thryonomys swinderianus variegatus* Ptrs.

Location: Small intestine.

Locality: Zululand, Natal.

Types in the Onderstepoort Helminthological Collection.

Idiogenes kori sp. nov.

About 50 specimens of this species were collected from the small intestine of a Giant Bustard; the acephalus strobilae vary in length from 7 mm. to 60 mm. with a maximum thickness of 0.72 mm. towards their posterior extremity. The strobilae are thin and delicate and in most cases are semitransparent. The anterior segments, of which at least eight are involved, are modified to form a pseudoscolex (Fig. 4); in these the segments are tent-shaped with



Fig. 4.—*Idiogenes kori* sp. nov. Pseudoscolices.

their posterior margin standing away in an angle from the axis of the strobila and having this margin deeply indented in its middorsal and midventral lines; these indentations are less marked towards the posterior end of the pseudoscolex. In two strobilae, which were composed of 120 and 170 strobilae each, the genital organs appeared in the following segments respectively:—first genital primordia in 50th and 72nd segment; 1st ovarian primordia in 85th and 100th segment; mature segments in 98th to 104th and 130th and 137th segments; 1st appearance of paruterine organs in 112th and 146th segments and the last few segments of each strobila appeared to have fully formed paruterine organs, these organs reaching a length of 0.3 mm. by 0.19 mm. wide; no eggs however, had, entered these organs.

The genital pores are non-protuberant and are situated at the junction of the first and second body thirds. The cirrus sac is large, long and club-shaped (Fig. 5) and generally it extends obliquely inwards and forwards to reach the midline of the anterior margin of the segment; its wall consists of only a thin muscular sheath,

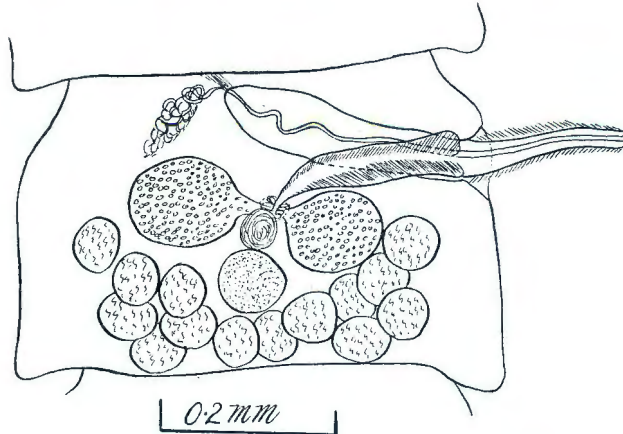


Fig. 5.—*Idiogenes kori* sp. nov. Mature segment.

and its length varies from 0.27 to 0.3 mm. by 0.07 to 0.078 mm. in diameter. A bunch of retractor muscles are attached to its anterior apex. The cirrus is massive and when fully exerted it reaches a length of 0.198 mm. and its base has a thickness of 0.039 mm. it is densely covered with prominent needle-like spines directed inwards; the spines being from 0.015 to 0.018 mm. long. When the cirrus is retracted the vas deferens is thrown into loops inside the cirrus sac, but when the cirrus is exerted the vas deferens is more or less straight; a vesicula seminalis interna appears to be absent. The testes, of which there are from 12 to 15 in each segment, are all situated behind the ovary; they are arranged in two layers in the medulla, and are rounded with a diameter of 0.06 mm. The vagina opens to the exterior immediately ventral of the cirrus pouch; it is practically straight with only its inner tip bent backwards; it is massive, having a maximum thickness of 0.045 mm. near its external orifice and being about 0.03 mm. thick at its proximal end; the whole length of its lumen is lined by prominent inwardly directed spines. The two rounded ovarian lobes are placed one on either side of the midline in about the centre of the segment, the aporal lobe is generally slightly larger than the poral; their outline is generally smooth, but in some cases their edge appears slightly crenated; their diameters are about 0.09 and 0.11 mm. for the poral and aporal lobes respectively. A rounded and centrally placed receptaculum seminis is present. The vitelline gland lies immediately behind the receptaculum seminis; it is rounded to slightly oval, and its diameter is only slightly greater than that of the testes. The uterus first makes its appearance as a transverse tube behind the ovary; it rapidly becomes U-shaped but this shape is not apparent in older segments, because with the development of the

paruterine organ, this organ presses on the anterior face of the uterus causing it to appear to consist of two isolated bags, one on either side of the paruterine organ; in no segment were there any eggs seen inside the paruterine organ. As the oldest segments available contained no mature eggs, it would appear as if they only ripen after detachment of the segments and also only then entered the paruterine organ.

Affinities.—Three species of this genus have so far been described from otidiform birds; these are *I. grandiporus* Cholodkovsky, 1905, *I. nana* Fuhrmann, 1925 and *I. otidis* Krabbe, 1867. The former species differs from the writer's in that it normally carries a scolex in the adult, the number of testes is greater (30) and the genital ducts open into a large and conspicuous cloaca. Fuhrmann's species differs in being much smaller (less than 10 mm. long), the pseudoscolex is formed of the first five segments, the testes are fewer (9-11) and the vagina is much longer, thinner and coiled. The above described species has its closest relative in *I. otidis*, which species differs from it, however, by its thinner and coiled vagina which from the figures available, is also unarmed; in that the pseudoscolex is formed of the first four segments and in that the cirrus sac is much shorter in length (0.15 mm.).

Specific diagnosis.—Idiogeninae reaching a length of 60 mm.; scolex absent in adult and replaced by a pseudoscolex formed by at least the anterior eight segments. Genital pores unilateral; cirrus large, up to 0.3 mm. long; cirrus massive and densely covered by large spines; 12 to 15 rounded testes in posterior half of segment. Vagina massive and straight, its lumen lined by strong spines. Ovarian lobes rounded, centrally placed on either side of midline. Uterus an inverted U, but pressure of paruterine organ on its anterior face causes it later to appear as two bags lateral of this organ.

Host: *Choriotis kori* (Burch.).

Location: Small intestine.

Locality: Northern Transvaal.

Types in the Onderstepoort Helminthological Collection.

Scolex of *Idiogenes kori*.

The writer is also tentatively referring to the above species six small strobilae carrying scolices, which were also present among the materials of the above described species. The longest strobila (Fig. 6B) is 1.8 mm. long, carries a scolex, 17 segments and a caudal appendage nearly half the length of the entire strobila; the other five strobilae are similar, only smaller and have less segments. In the figured strobila it appears as if the 3rd to 8th segments are beginning to assume the shape of the segments of the pseudoscolex, and if this is the case then either the 1st and 2nd segments, which in this strobila are not yet dilated, are shed with the scolex, or else they only assume the characteristic shape of those of the pseudoscolex at a later period.

The scolex, which is very similar to that described for the next species, is roughly acorn-shaped, the acorn being represented by the large rostellum which is separated from the scolex proper by a constriction. The rostellum has a diameter of 0.174 to 0.21 mm. and carries a double crown of 44 to 50 hammer-shaped hooks (Fig. 6B) of which those of the anterior row are 0.046 to 0.048 mm. long and those of the posterior row 0.036 mm. long. The axis of the blade of the longer hooks forms an obtuse angle with the axis of the handle, whereas in the smaller hooks these axes form roughly a right angle. The whole rostellum, posterior of its hooks, is covered by innumerable minute spines. The scolex has a diameter across the suckers of 0.24 to 0.3 mm. and the four somewhat spherical suckers are unarmed and protuberant and have a diameter of 0.09 to 0.102 mm. The neck varies in length from 0.3 to 0.36 mm. and has a breadth of 0.102 to 0.19 mm.

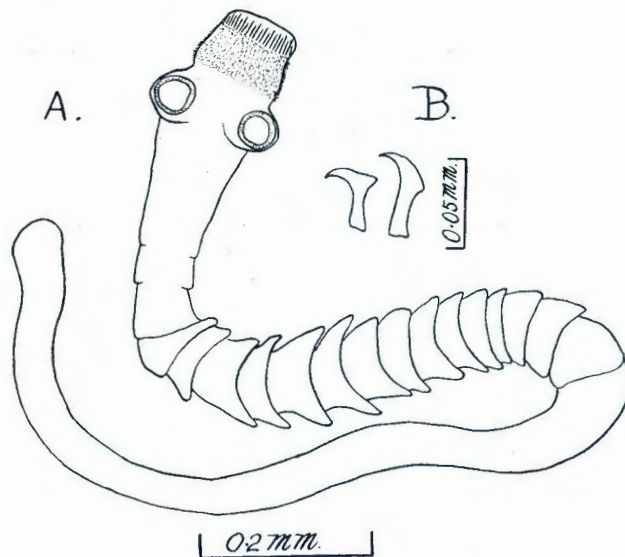


Fig. 6.—*Idiogenes kori* sp. nov. A = young strobila with scolex; B = hooks.

The shape of the scolex, the presence of hammer-shaped rostellar hooks, and collar of minute spines round the rostellum, the protuberant suckers, presence of a caudal appendage, and differentiation of the anterior segments, all these characters are very similar to those of the larval stages of *I. nana* figured by Fuhrmann (1925); also the scolex is very similar to that described for the next species and that figured by Cholodokovsky (1905) for *I. grandiporus*. In consequence of these similarities the writer is fairly confident that these small strobilae are very young stages of the species described above; this view is further supported by the fact that all the other cestode species harboured by this host had their scolices, so that these scolices had either to belong to the species described above or belong to a different species of cestode with which this host had only recently become infected.

Should further material prove that the view expressed above is correct, then the size and shape of the rostellar hooks would definitely show that this species is different to all the hitherto described species of this genus.

Idiogenes kolbei sp. nov.

From the same host which harboured the preceding species about 60 specimens of the above species were recovered; on examination it was noted that about 20 of these still carried their heads, but most of them had partially or completely lost their hooks; those without heads showed no signs of pseudoscolex and a cursory examination easily showed that their scolices had been separated and lost during collection.

The strobilae vary considerably in length, the longest reaching a length of 32 mm. with a maximum breadth of 0.54 mm.; they taper considerably towards their anterior ends and, in those specimens which are well extended, the strobilae are semi-transparent.

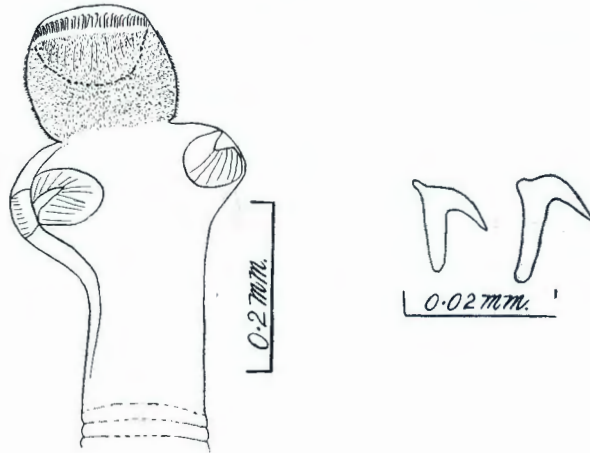


Fig. 8.—*Idiogenes kolbei* sp. nov. Hooks.

Fig. 7.—*Idiogenes kolbei* sp. nov. Scolex.

The head (Fig. 7) is very similar in shape to that described for the preceding species; across the suckers its breadth varies from 0.22 to 0.27 mm.; the rostellum, when fully exerted is prominent, 0.12 to 0.16 mm. thick and carries a double crown of typical hammer-shaped hooks (Fig. 8); these hooks appear to vary in number from 120 to 140 and the larger ones measure 0.015 to 0.016 mm. in length and the smaller ones 0.012 to 0.013 mm. The suckers are relatively small, unarmed and rounded and have a diameter of 0.06 to 0.078. As in the preceding species the base of the rostellum is covered by innumerable minute spines. A short neck is present, from 0.15 to 0.21 mm. long by 0.114 to 0.132 mm. broad.

The longest strobila (32 mm.) consisted of 153 segments, but the most segments (183) were encountered in a strobila 31 mm. long. In two strobilae 31 and 24 mm. long with 176 and 150 segments each the organs appeared in the following segments respectively: first appearance of genital primordium 58th and 70th segment; first appearance of ovary 100th and 92nd segment; mature segments 125 to 133 and 112 to 121; first appearance of paruterine organ 141st and 132nd segment; mature eggs in 171st to 176th segments and 146th to 150th segments. No strobila carried mature segments in which the eggs had entered the paruterine organ.

The unilateral genital pores are situated in the anterior half of the segment, generally at about the junction of the first and second thirds; as a rule they are very prominent (Fig. 9A). The cirrus sac is large and extends obliquely forwards to about the middle of the anterior margin of the segment; it is weakly muscular, 0.19 to 0.21 mm. long by 0.066 mm. broad. The cirrus, which when extended has a thickness of 0.024 mm., is densely covered with small spines 0.006 mm. long; the vas deferens forms a few coils inside the

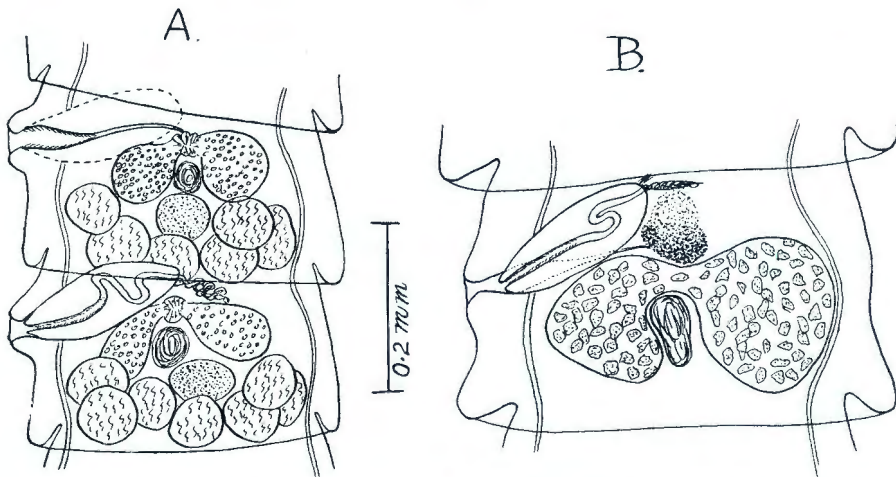


Fig. 9.—*Idiogenes kolbei* sp. nov. A = mature segments (the male duct has been omitted in the anterior and the female duct has been omitted in the posterior segment); B = nearly ripe segment.

cirrus and on emerging from it is thrown into numerous closely packed loops. A vesicula seminalis interna is absent. The testes are large and round and become mature before the ovary; they number from six to eight, have a diameter of about 0.06 mm. and are situated in the posterior half of the segment behind the ovary and between the excretory canals. The vagina opens immediately ventral of the opening of the cirrus sac; it is more or less straight, not forming any loops and its terminal third has its lumen widened to 0.024 mm. and is lined by small spines. The ovary is more or less centrally placed in the anterior half of the segment, and consists of two rounded to oval wings up to 0.12 mm. long by 0.06 mm. across; a small shell gland is situated at the junction of the two ovarian

lobes. The rounded receptaculum seminis is situated between the ovarian wings and has a diameter of about 0.045 mm. The yolk gland is generally oval, 0.066 mm. by 0.042 mm. and is generally centrally placed behind the receptaculum seminis; however, this latter organ may displace it slightly to the right or to the left of the midline. The uterus arises as an inverted U-shaped structure in the area occupied by the ovary; as it enlarges it fills up most of the space between the excretory canals and the cirrus sac leaving the space between its limbs free where the receptaculum seminis is found to persist (Fig. 9B). Soon after the paruterine organ makes its appearance as a darkly staining cell mass in the middle of the anterior half of the segment; it grows backwards and compressing the anterior and posterior walls of the uterus on to the receptaculum seminis causes the uterus to lose its U-shape and assume the appearance of two isolated lateral bags. In the hindmost segments the eggs appear to be mature but no eggs have entered the paruterine organ; it would thus appear that their entrance only takes place after the end segments have been shed. The eggs are thin-walled and round, and have a diameter of 0.038 to 0.042 mm. and the hexacanth hooks are 0.018 mm. long.

Affinities.—This species is easily differentiated from the preceding species in that a pseudoscolex is not formed, a scolex being normally present in the adult; the testes are fewer; the cirrus and vagina are not so massive and their spines are considerably smaller. The absence of a pseudoscolex distinguishes this species from *I. otidis* Krabbe, 1867 and *I. nana* Fuhrmann, 1925, and the smaller and greater number of rostellar hooks, fewer testes and absence of large genital atrium differentiates it from *I. grandiporus* Cholodk, 1905.

Specific diagnosis.—Idiogeninae reaching 32 mm. in length by 0.54 mm. broad. Scolex normally present in the adult; pseudoscolex absent. 120 to 140 rostellar hooks of typical shape and about 0.013 and 0.016 mm. long. Rostellum covered by innumerable small spines. Genital pores unilateral. Cirrus sac large, reaching 0.21 mm. in length; cirrus covered with small spines; vagina straight, its end third has a widened lumen lined with small spines. Testes six to eight in posterior half of segment. Ovary two-lobed; uterus U-shaped. Eggs rounded, and do not enter paruterine organ while segment is still attached to strobila.

Host: *Choriotis kori* (Buch.).

Location: Small intestine.

Locality: Northern Transvaal.

Types in the Onderstepoort Helminthological Collection.

The writer has much pleasure in naming this species in honour of Mr. F. F. Kolbe, B.Sc., Officer in Charge of the Zoological Survey in the field, who was personally responsible for collecting all the material from this host.

Schistometra connoideis (Bloch, 1782).

About a dozen full-grown specimens were recovered from a Giant Bustard shot in the Northern Transvaal. In addition about 50 immature specimens were present ranging in length from about 10 mm. to 60 mm. with a maximum breadth of 4 mm. The longest mature specimens were from 150 to 175 mm. long with a maximum breadth of 9 mm.

This species was first recorded from this host by Beddard (1912) as *Otiditaenia eupodotidis* gen. and sp. nov. The writer fully agrees with Skrjabin (1914) that this species is conspecific with Bloch's (1782) species (syn. *S. togata* Cholodk, 1912) as an examination of the writer's material shows. The suckers each carry two muscular appendages, each about 0.06 mm. long. The rostellum carries about 500 small and typical hammer-shaped hooks, in two regular circles; those of the anterior row are 0.01 mm. long and those of the posterior row 0.0085 mm. long. The base of the rostellum is densely covered with minute spines. The ovary is small and

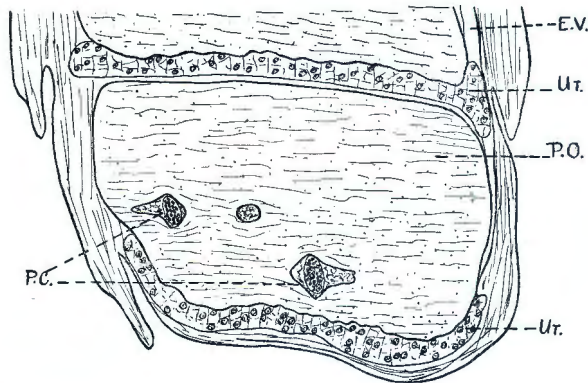


Fig. 10.—*Schistometra connoideis*. Horizontal section of hindmost segment. E.V.= excretory vessel; P.C.= paruterine capsules; P.O.= paruterine organ; U.T.= uterus.

decidedly poral in position, being located just internal to the poral ventral excretory canal and anterior of the testes. The receptaculum seminis is fusiform and increases in size posteriorwards; in mature segments it is about 0.18 mm. long by 0.06 mm. thick and in the hindmost segments 0.48 mm. long by 0.1 mm. thick. The uterus arises as a transverse canal immediately anterior of the testes and extends across the whole segment between the excretory canals; near the excretory canals it becomes enlarged; its cavity in ripe segments is traversed by trabeculae which divide it into cavities extending antero-posteriorly; these cavities are again sub-divided to form irregular cavities each containing a single egg. In sections of the last few segments of three worms (Fig. 10) it was noted that the eggs had entered the paruterine organs in the last two segments of each worm. When entering this organ three or four flask-shaped paruterine capsules are formed for the reception of a considerable

number of eggs. These capsules arise from the posterior face of the paruterine organ and become connected with the uterus; after having received their eggs they become severed from the uterus and pass forwards to lie separately in the posterior half of the paruterine organ. The capsules have a fibrous wall, and consist of a "body" and "neck", the latter generally kinked (Fig. 11A); the whole capsule has an overall length of about 0.42 mm. of which 0.2 mm. represents the neck and the remainder forms the body measuring about 0.22 by 0.26 mm. The "body" is filled by a considerable number (roughly about 60) of oval and thin-walled eggs having an average size of 0.042 by 0.025 mm. and the hexacanth hooks measure 0.014 mm. (Fig. 11B). The whole mass of eggs

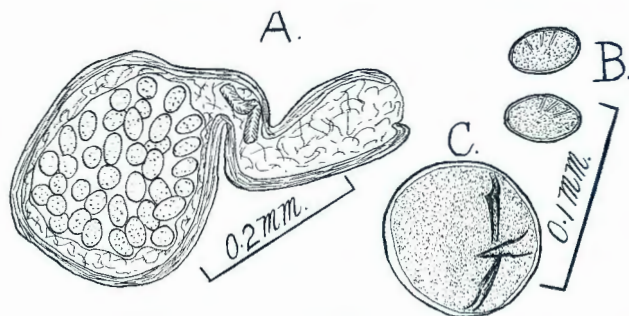


Fig. 11.—*Schistometra conoideis*. A = section of paruterine capsule with eggs; B = eggs from paruterine capsule; C = eggs from uterus of same segment (B and C are equally enlarged).

is enclosed in a thin membrane separating them from the "body" of the capsule. From the literature available the writer has not been able to find any definite reference to these paruterine capsules. Beddard (1914) is unfortunately not clear on this point, in that when discussing the ultimate fate of the uterus he states (p. 218) "the eggs are at the very end grouped into many more or less isolated but not well marked causples"; whether he refers to the uterine or paruterine capsules is not clear, although on the previous page he states that there is a "tendency for the fibrous parenchyma to enwrap the bundles of eggs" which would suggest that these egg bundles were lodged in the paruterine organ. His figure of a section of a ripe segment (Fig. 30) shows groups of eggs in the paruterine organ but these do not appear to be enclosed by fibrous capsules.

A remarkable feature of the eggs in the paruterine capsules is that they are very much smaller than the apparently ripe eggs still present in the uterus and the hexacanth hooks are also much smaller; eggs in the uterus of the same segment containing paruterine capsules were globular, had a thin and smooth shell, measured from 0.066 to 0.084 mm. in diameter and their hexacanth hooks were from 0.037 to 0.039 mm. long (Fig. 11c). How this change takes place, especially in the size of the hexacanth hooks, the writer is unfortunately not able to say, as he did not observe any capsules into which the eggs were in the process of entering. The possibility

of two types of eggs being present in the uterus is also excluded as a careful search of a number of sections through different uteri only showed the presence of round large eggs.

A curious feature of the paruterine capsules is that the neck contains a short coiled duct, about 0.015 mm. in diameter and having its internal surface lined by short spines.

The arrangement of the testes is typical for the genus consisting of a vertical sheet at the hind end of the segment; there are from 25 to 34 testes in a transverse row and there are five or six of these rows one above the other. A vesicula seminalis is absent, but the vas deferens is much coiled after emerging from the cirrus sac which reaches but does not cross the excretory canal; this latter organ is about 0.24 mm. long by 0.09 to 0.01 mm. thick (Skrjabin says 0.6 mm. long by 0.2 to 0.25 mm. broad). In all the transverse sections, obtained from different parts of two adult worms, no trace of a dorsal excretory canal was seen. The genital ducts passed dorsal of the ventral excretory canal and nerve.

Host: Choriotis kori (Buuch.)

Location: Small intestine.

Locality: Northern Transvaal.

Schistometra sp.

The writer is tentatively referring to this genus two very immature strobilae obtained in association with the preceding species. The strobilae are respectively 10 and 15 mm. long. The head is very similar to that of *S. korhaani* Ortlepp 1938; its rostellum is covered by minute spines and also a double circle of about 500 hooks arranged in a zig-zag and having a break at each lateral corner; the hooks, however, are longer than in this species being 0.021 and 0.018 mm. long for the anterior and posterior row respectively. Each sucker is provided with two muscular appendages.

Host: Choriotis kori (Buuch.)

Location: Small intestine.

Locality: Northern Transvaal.

Hymenolepis cormoranti sp. nov.

About a dozen specimens of this delicate cestode were collected from two or three Reed Cormorants. Only two worms still had their solices present but a few additional detached scolices were recovered from scrapings of the intestine.

The total length reaches 150 mm. with a maximum thickness of 0.6 mm. at the posterior end; the strobila is thin, especially in its anterior half which has the appearance of a thread of white cotton.

The head is small and only reaches 0.138 mm. across; it is somewhat spindle-shaped. In all cases the rostellum is retracted and its sac extended backwards for about 0.13 mm. posterior of the level of the suckers; it carries a single row of ten small hooks (Fig. 12A) 0.024 to 0.025 long, having a long handle and a blade only 0.006 mm. long. The suckers are slightly oval and small and measured 0.054 by 0.06 mm. across.

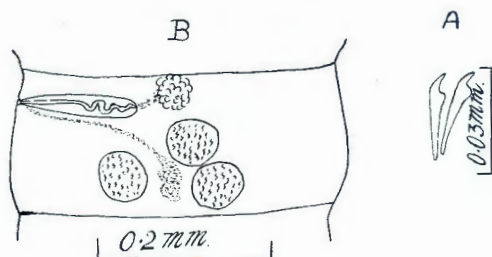


Fig. 12.—*Hymenolepis cormoranti* sp. nov. A = rostellar hook; B = segment with mature testes.

The genital pores are unilateral and situated in the anterior quarter of the segment's margin. The cirrus sac is elongate and tubular, crosses the excretory canal and reaches the poral testes and sometimes extends beyond it; it is about 0.15 mm. long by 0.03 mm. in thickness, but in older segments it may even reach a length of 0.17 mm.

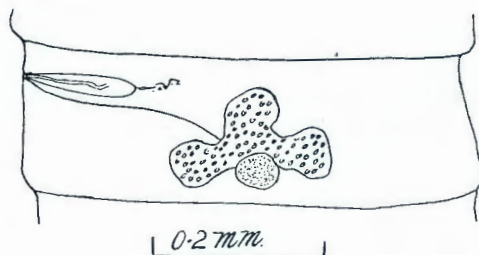


Fig. 13.—*Hymenolepis cormoranti* sp. nov. Segment with mature ovary.

The three testes, which are rounded and have a diameter of 0.045 to 0.06 mm., are arranged in the form of a triangle, one poral and two aporal (Fig. 12B); the anterior aporal testes is situated slightly more internal than that behind it. In segments, where the testes had attained maturity, the female glands are only represented by a darkly staining mass of cells; as the testes begin to disintegrate the ovary begins to assume a definite shape, and further back when the testes have completely disappeared the ovary and its associated glands become mature; in these segments (Fig. 13) the ovary is trilobed and measured from 0.17 to 0.2 mm. across by about 0.08 in length. The yolk gland lies immediately behind the ovary, it is rounded and has a diameter of about 0.05 mm.

Affinities.—Baer (1933) identified fragments of a cestode obtained from the same host as *H. phalacrocorax* (Woodland, 1929), although he noted that his material showed several differences from Woodland's description based on material obtained from an Indian Large Cormorant (*Phalacrocorax carbo*). Although Woodland found no hooks or rostellum on the one available scolex, it is not certain whether this species is normally unarmed as this scolex was much distorted. Baer's material unfortunately contained no scolex. Apart from the armed scolex the writer's specimens differ from both Woodland's and Baer's specimens in that the testes are not found external of the excretory vessels, in that the cirrus sac is a simple muscular tube and not the complicated structure described for Woodland's species, and in that the ovary is trilobed; from Baer's specimen it differs in that the cirrus sac is much longer and extends almost to the middle of the segment, the peculiar structure of the vagina was not noted, and the testes are much smaller.

The number, size and shape of the rostellar hooks easily distinguishes this species from the species *H. ficticia* (Meggett, 1929), *H. magniuncinata* Meggett, 1927, *H. parvicirrosa*, Meggett, 1927, and *H. medici* (Stossich, 1890), from Pelicaniformes; *H. parviuncinata* Meggett, 1927, also from this group of birds, has the same number of hooks (10) as in the writer's species, but they are much smaller (0·013 to 0·018 mm.) and their shape is also different.

Specific diagnosis.—Hymenolepididae attaining a length of 150 mm. or more by 0·06 mm. broad; scolex small, 0·138 mm. across; rostellum with 10 hooks 0·024 to 0·025 mm. long having a long handle and small blade. Genital pores unilateral. Three testes, one poral and two aporal, disappear before appearance of female glands; cirrus long, crosses excretory canal and reaches poral testes. Ovary trilobed, large; yolk gland round; uterus a transverse bag, extends across excretory canal to edge of segment.

Host: *Microcarbo africana africanoides* (A. Smith).

Location: Small intestine.

Locality: Pretoria district, Transvaal.

Types in the Onderstepoort Helminthological Collection.

Class NEMATODA.

Contracaecum carlislei sp. nov.

The Reed Cormorants from which this species was obtained were shot by Mr. Carlisle of this Institute and placed at the writer's disposal for section: the writer has much pleasure in naming this species after Mr. Carlisle in recognition of his services for having from time to time placed materials for section at his disposal.

The above species was represented by about two dozen specimens, representing fourth stage larvae, adolescent and mature worms. They were found firmly attached to the inner lining of the oesophagus and stomach.

The worms are creamy yellow in colour and attenuated towards both extremities; the mature worms reach a length of 10 mm. by 0·5 mm. broad for the males and 27 mm. by 1 mm. thick for the females. The three lips are separated from the body by a constriction and each is somewhat rectangular, being slightly longer than broad and each is bilobed anteriorly having the lateral corner of each lobe drawn out into a point (Fig. 14); in the males they reach a length of 0·075 mm. and in the females 0·84 mm.; their pulps are provided with two swollen processes which extend one into each of the anterior lobes of the lips. The dorsal lip carries two single papillae but the sub-ventral lips each carry a ventral double and a dorsal single papilla. The interlabia are large and curved, being almost as long as the lips. Dentiginous ridges are absent.



Fig. 14.—*Contracaecum carlislei* sp. nov. Dorsal lip.

The body is transversely striated, those striae just behind the lips being more prominent and giving this portion of the body a serrated appearance. The tail is short and conical in both sexes, being about 0·25 mm. long in the male and 0·24 to 0·264 mm. long in the female. Lateral alae are absent.

The oesophagus is 3·1 to 3·7 long and increase slightly in thickness posteriorly; in the male its anterior and posterior diameters are 0·084 and 0·12 mm. and in the female 0·108 and 0·192 mm. respectively; its ventral caecum is 0·78 mm. long in the male and 0·86 mm. long in the female. The intestinal caecum is long and extends to almost 0·5 mm. behind the level of the nerve ring, being 2·76 mm. long in male 2·25 mm. long in the female. The nerve ring is 0·48 to 0·52 from the anterior end and the two small cervical papillae are situated about 0·1 to 0·12 mm. behind the nerve ring.

The tail of the male carries no alae; there are 6 pairs of post cloacal papillae (Fig. 15); the first two pairs are longer and ventro-lateral in position; they are situated close together and only a careful examination reveals the fact that they are two separate papillae and not a single doubled one; the remaining four pairs are small, and situated in the posterior half of the tail, two pairs being lateral and two pairs ventral. The spicules are equal 2·2 to 2·4 mm. long by 0·036 mm. broad at their proximal ends; they are alate in their posterior half. There are 30 or more pairs of precloacal papillae extending forwards on either side from the cloaca. A gubernaculum is absent.

The vulva is slightly protuberant and situated in the anterior body half; its position divides the body roughly into the ratio of 2 : 3; the vagina is about 1.2 mm. long by 0.15 mm. thick and its lumen has a diameter of 0.06 mm.; it may extend transversely across the body and then bend backwards in a right angle, or it may first pass obliquely forwards for about 0.5 mm. and then bend backwards.

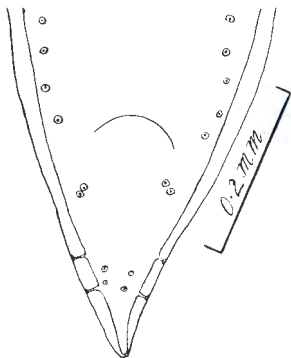


Fig. 15.—*Contracaecum carlislei* sp. nov. Ventral view of male tail.

The numerous eggs are rounded and relatively thin shelled; they are from 0.051 to 0.054 mm. in diameter and their shells are 0.003 to 0.004 mm. thick.

Affinities.—The nature of the labial papillae and the arrangement of the male postcloacal papillae shows that this species is closely related to *C. rodhaini* (Geddoelst, 1916) from *Plotus rufus*; the only difference being that in Geddoelst's species the subventral lips each carry only a double papilla and the first postcloacal papilla is double; however, more important differences are that in *C. rodhaini* the spicules are much longer (3.6 mm.), the vulva is more anterior in position (divides body into ratio of 3 : 7), the male tail is shorter (0.75 mm.), the female tail is longer (0.336 mm.), and the bases of the lips are more cut-in than in the writer's species.

The size and shape of the spicules and position of the vulva are very similar to those of *C. microcephalum* (Rud., 1809), but this species has two double papillae to each dorsal lip and a single double papilla to each sub-lateral lip; in addition the arrangement of the post-cloacal papillae are also different.

The size of the spicules distinguishes the writer's species from the recently described species *C. torquatum* Yamaguti, 1935, *C. milvi* Yamaguti, 1935 and *C. hagedashiae* Sandground, 1933.

Specific diagnosis.—Anasakinae reaching a length of 15 mm. for the males and 27 mm. for the females. Three lips somewhat rectangular and bilobed anteriorly; inter-labia large and curved; dorsal lip with two single papillae and subventral lips each with a double and a single papilla. Intestinal caecum long. Tail in both sexes about 0.25 mm. long. Spicules equal, alate, 2.2 to 2.4 mm. long; gubernaculum absent; 30 or more pairs of precloacal papillae

and six pairs of postcloacal papillae of which the papillae of the 1st and 2nd pairs are close together but not forming a double papillae. Vulva divides body into ratio of 2 : 3. Eggs round and thin-shelled.

Host: *Microcarbo africana africanoides* (A. Smith).

Habitat: Oesophagus and stomach.

Locality: Pretoria district, Transvaal.

Types in the Onderstepoort Helminthological Collection.

Porrocaecum spathulespiculum sp. nov.

The materials on which the following description is based consists of two males and one female, all mature, from one bird host (unidentified), and two males and two females (all mature) and two immature females from another bird host (unidentified). They are creamy white in colour and are attenuated towards both extremities in both sexes. The males are from 32 to 44 mm. long with a maximum thickness in their middle of 1.17 mm. and the females are 34 to 65 mm. long with a maximum thickness behind the vulva of 1.6 mm. The cuticle is transversely striated, and cervical and caudal alae are absent.

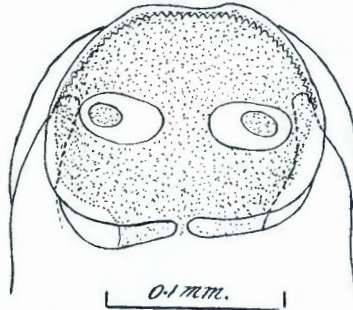


Fig. 16.—*Porrocaecum spathulespiculum* sp. nov. Dorsal lip.

The three lips are rounded and slightly indented anteriorly and are deeply cut in at their bases (Fig. 16); their length varies from 0.145 mm. to 0.16 mm.; the labial papillae are all simple, large and dome-shaped, two being present on the dorsal lip and one on each subventral lip. Each lip carries an internal dentigerous ridge whose denticles are largest towards the apex of each lip. The pulp of the dorsal shows no special peculiarities and simply follows the outline of the lip. The interlabia are large and prominent and about two-thirds the length of the lips. The oesophagus, including its ventriculus, is from one-tenth to one-twelfth of the total body length and increases slightly in thickness posteriorly, where it may reach a thickness of 0.45 mm.; its ventriculus is about 0.75 mm. long. The intestinal caecum is small and inconspicuous and only reaches 0.18 mm. in length. In a male 32 mm. long the nerve ring was 0.6 mm. from the anterior end, and the small cervical papillae were situated 0.24 mm. behind the nerve ring.

The vulva is non-protuberant and situated in the anterior body half, its position dividing the body into the ratio of 8 : 11. The vagina is relatively short and soon leads into a large egg reservoir passing posterior-wards; two uteri originate from its posterior end. The eggs are oval and have pitted shells; they are from 0.084 to 0.1 mm. long by 0.06 to 0.072 mm. in thickness; their shells are from 0.003 to 0.004 mm. thick. The tail is somewhat stumpy and is from 0.74 to 0.84 mm. long (Fig. 17).

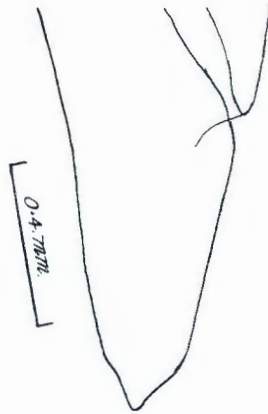


Fig. 17.—*Porrocaecum spathulespiculum* sp. nov. Female tail.

The caudal extremity of the male is pointed and the tail is from 0.33 to 0.43 mm. long (Fig. 18A); there are five pairs of postcloacal papillae, that immediately behind the cloaca being double; the remaining four pairs are equidistant from each other and placed further back. There are 12 to 14 pairs of precloacal papillae. The two spicules (Fig. 18B) are equal, robust, slightly arched and alate, the alae extending from just behind the head to the tip and giving the spicule the shape of a flour scoop; they are from 0.78 to 0.792 mm. long by 0.098 mm. broad at their head. A gubernaculum is absent.



Fig. 18.—*Porrocaecum spathulespiculum* sp. nov. A = ventral view of male tail; B = side view of spicule.

Affinities.—The nearest relatives of the above described species appear to be *P. angusticolle* (Molin, 1860) and *P. depressum* (Zeder, 1800), both of which possess a pair of double papillae immediately

behind the cloaca and four additional pairs of single papillae; the former species differs from the writer's in that its interlabia are small, its spicules are longer and non-alate and its intestinal caecum is much longer; Zeder's species differs from the writer's by the shape of the pulp of its dorsal lip, the conical tail appendage in the male and its small interlabia.

Specific diagnosis.—Anisakinae reaching a length of 44 mm. in the male and 65 mm. in the female. Lips somewhat rounded and deeply cut in at their bases; pulp of dorsal lip simple; dentigerous ridges present; two simple papillae and one simple papilla on the dorsal and subventral lips respectively; interlabia large. No cervical alae. Intestinal caecum very small. Vulva in anterior body half. Eggs oval and pitted. Five pairs postcloacal and 12 to 14 pairs precloacal papillae in male; first postcloacal papillae double. Spicules, equal, alate and scoop-shaped. Gubernaculum absent.

Host: Bird (unidentified).

Location: Small intestine.

Locality: Transvaal.

Types in the Onderstepoort Heminthological Collection.

Subulura otidis sp. nov.

Numerous specimens were recovered from a single Giant Bustard. Unfortunately all the females were still immature, and consequently the measurements given below must be taken as applying only to young individuals which have not attained maturity.

The body is whitish in colour and is strongly arched dorsalwards at the anterior end. The body is thickest at the level of the junction of the oesophagus and intestine; from this point the body becomes thinner towards both extremities, this attenuation being less marked towards the anterior than towards the posterior end. In the females the body becomes very much attenuated posteriorly to end in a long and finely pointed tail; in the male, as far as the cloaca, the attenuation is not so marked, but in the tail region the body becomes considerably thinner to terminate in an elongate tail spike. The body cuticle shows fine annulations and also carries two long lateral alae which extend down the body for about two-fifths of its length; they are from 0.025 to 0.036 mm. high and are vertically striated. The mouth is simple and leads into a buccal capsule having thickened cuticular walls (Fig. 19); it has a diameter of 0.021 to 0.024 mm. at its anterior end and 0.040 to 0.045 mm. at its posterior end, and its average depth is 0.03 mm. Protruding into its base are three prominent teeth lodged on the apices of the three oesophageal segments. There are two wart-like lateral papillae and four small and dome-shaped submedian papillae round the mouth. The oesophagus is typical in shape and is from 1.27 to 1.34 mm. long in the males and 1.44 to 1.54 mm. in the females.

The length of the females is 9.0 to 11.6 mm. with a maximum thickness of 0.264 mm. The tail (Fig. 20A) is long, slender and pointed and averages 1.0 mm. in length. The vulva is inconspicuous and situated in the anterior body half, dividing the body roughly into the ratio of 4:5. The ovejector (Fig. 20B) is very short, its total length being from 0.516 to 0.544 mm.; its vestibule is bent sharply forwards and is from 0.17 to 0.17 mm. long; the sphincter measures only 0.7 mm. in length and the trompe is from 0.26 to 0.3 mm. long. As the material is still immature no eggs are present.

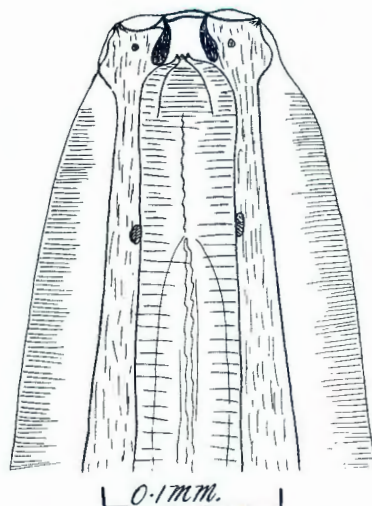


Fig. 19.—*Subulura otidis* sp. nov. Anterior extremity, dorsal view.

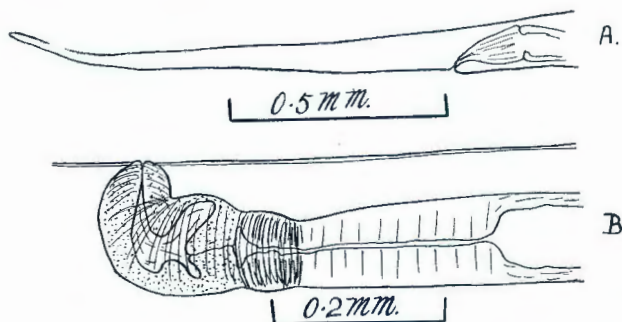


Fig. 20.—*Subulura otidis* sp. nov. A = female tail; B = ovejector.

The males are from 7.7 to 9 mm. long and have a maximum thickness of 0.24 mm. The caudal extremity (Fig. 21) is hooked ventralwards and is provided with very narrow alae. There are 10 pairs of caudal papillae of which two are precloacal, three circumcloacal and five post cloacal on the anterior half of the tail; a pair of small caudal pores is situated just anterior of the last pair of caudal papillae. The tail is relatively long, being from 0.36 to 0.4 mm. in

length, and carries a long caudal appendage. The spicules are equal and similar, measuring 0.676 to 0.7 mm. in length; they are alate and their sharp tips are hooked ventralwards. The triangular gubernaculum is from 0.06 to 0.066 in length. The sucker is not very muscular and is situated 0.3 to 0.36 mm. anterior of the cloacal aperture.

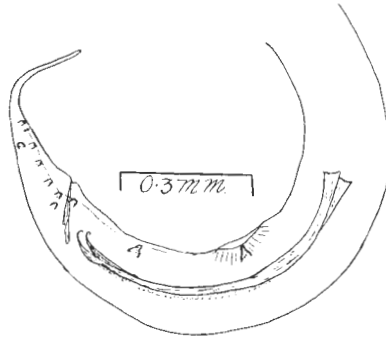


Fig. 21.—*Subulura otidis* sp. nov. Male tail, lateral view.

Affinities.—Of the species *Subulura* only the following have no lips and equal spicules less than 0.5 mm. long namely, *S. poculum* (v. Linstow, 1909), *S. forcipata* (Rud, 1819), and *S. noctuae* (Seurat, 1914). These species differ from the writer's in that the cervical alae are practically limited to the oesophageal region of the body. The long cervical alae appear to ally the writer's species to *S. leprincei* (Gendre, 1909) but this species differs in that it is stated to possess 13 pairs of caudal papillae, the spicules are 1 to 1.4 mm. long and the ovejector is very long.

Three species of this genus have, as far as the writer has been able to ascertain, been recorded from otididiform birds, namely *S. halli* Barreto, 1918 (= *S. forcipata* (Rud.) of Seurat, 1914), from *Otis tetrax*, *S. rima* (v. Linstow, 1906) from *Otis houbara* (= *Houbara undulata* and *S. suctoria* (Molin, 1860) from *Houbara macquennii*. The first and last of these differ from the above described species in that the spicules exceed 1.0 mm. in length. *S. rima* differs in that it is reported to have six oesophageal teeth, nine pairs of caudal papillae in the male and the spicules are unequal in length.

Specific diagnosis.—Subulurinae having a whitish colour in the preserved state and reaching a length of at least 9 mm. for the males and 11.6 mm. for the females. Lips absent. Cuticularized buccal capsule present. Cervical alae long extending to posterior quarter of body. Vulva in front of middle. Ovejector very short. Female tail long and pointed. Caudal alae of male very narrow. Ten pairs of caudal papillae. Spicules equal, similar and alate reaching 0.7 mm. in length.

Host: *Choriotis kori* (Burch.).

Location: Caeca.

Locality: Northern Transvaal.

Types in the Onderstepoort Helminthological Collection.

Cooperiodes hepaticae sp. nov.

This species is represented by 13 males and 9 females all collected from small nodules on the terminal portions of the bile ducts of an Impala. They are slender worms having a reddish colour. All the worms appear to be fully grown notwithstanding the fact that no female contained any eggs. The peculiar habitat of these worms is probably the reason for this, and it would suggest that this is not their normal location.

The head (Fig. 22A) is slightly swollen and is provided with four inconspicuous lips, carrying four submedian and two lateral papillae which show up as bright refringent dots when the worms are cleaned in creosote; the head of the female is up to 0.055 mm. broad and that of the male up to 0.05 mm. and the length of the cephalic swelling reaches 0.026 mm. in the female and 0.025 mm. in the male; in the two sexes the diameter of the neck, immediately behind the cephalic swelling, is 0.052 mm. and 0.043 mm. respectively; the neck is encircled by 8 to 10 coarse annulations, and behind these the cuticle shows the normal fine striations. Extending from behind the neck almost to the posterior end of the body the cuticle carries 10 longitudinal alae showing very regular and distinct vertical markings; these alae are from 0.01 to 0.017 mm. high, and the two alae immediately lateral to the vulva may in this region reach a height of 0.028 mm. Cervical papillae are absent.

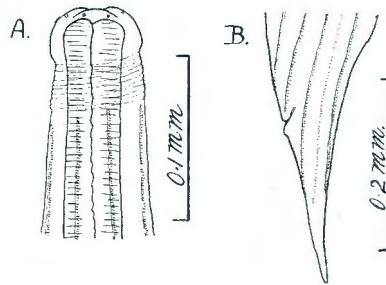


Fig. 22.—*Cooperiodes hepaticae* sp. nov. A = anterior extremity; B = female tail.

Female.—The females are from 15 to 17 mm. long with a maximum thickness of 0.29 mm. just in front of the vulva in the longest female. The tail (Fig. 22B) is pointed and is from 0.16 to 0.175 mm. long. The club-shaped oesophagus is from 0.72 to 0.754 mm. long and has a maximum thickness of 0.064 mm. at its posterior end; the excretory pore is situated 0.523 to 0.551 mm. from the anterior end and the nerve ring is situated about 0.075 mm. in front of the excretory pore. The vulva is not prominent and is found in the posterior body sixth; it is from 0.25 to 0.26 mm. from the tail tip and is bordered laterally by the enlarged cuticular alae. The ovejectors are of the usual trichostrongylid type and their combined length in the largest female is 0.638 mm. Eggs are entirely absent.

Males.—The males are from 11 to 13 mm. long and have a maximum thickness of 0.215 just anterior to the bursa. The oesophagus is 0.625 to 0.64 mm. long, and the excretory pore is 0.425 mm. from the anterior end; the nerve ring is situated 0.7 mm. anterior of the excretory pore. The caudal bursa consists of two large lateral lobes with numerous small tubercles on their ventral surfaces, and a small median lobe; the entire length of the lateral bursal lobes reach 0.32 mm. and the dorsal lobe 0.145 mm. The arrangement and proportions of the rays are best seen in the accompanying figures (Fig. 23A and B). The spicules are dark brown and equal in length and each is provided with a dorsal spur 0.05 mm. long (Fig. 23c); the body of the spicules end in a blunt tip tilted ventralwards; a thin membrane is supported by the spur and also by the spicule itself. The spicules are from 0.172 to 0.203 mm. long and have a maximum thickness at their anterior end just behind the head of 0.02 mm. A gubernaculum and prebursal papillae are absent.

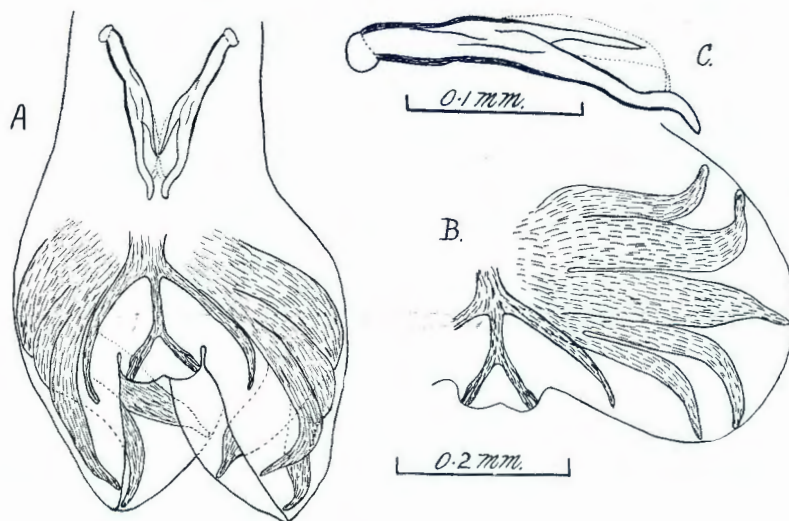


Fig. 23.—*Cooperiodes hepaticae* sp. nov. A = dorsal view of bursa; B = lateral lobe of bursa; C = spicule.

Affinities.—This species is closely related to *Cooperiodes hamiltoni* (Mönnig, 1933) from the same host as shown by the similar spicules and arrangement of the lateral and ventral rays; however, it, can be easily distinguished from this species by its larger size and by its much shorter dorsal ray and consequent smaller dorsal bursal lobe.

Specific diagnosis.—Trichostrongilidae reaching a length of 17 mm. in the female and 13 mm. in the male. Head swollen, about 0.05 mm. thick. Body carries 10 longitudinal alae extending from the neck to the anal region, each ala ornamented by numerous coarse vertical markings. Vulva in the posterior body sixth. Tail pointed. Bursa with two large lateral lobes and much smaller dorsal lobe;

bursal rays as in *C. hamiltoni* (Mönnig) but dorsal ray is much smaller. Spicules equal and each carries a dorsal spur; they are alate and from 0.172 to 0.203 mm. long. Gubernaculum absent.

Host: *Aepyceros melampus melampus* (Licht.)

Location: Small nodules on terminal portion of bile ducts.

Locality: Northern Transvaal.

Types in the Onderstepoort Helminthological Collection.

Trichonema (Cylicocyclus) gyalocephaloides sp. nov.

About 45 specimens, of which four were males, were present in a collection of helminths recovered from a zebra. Unfortunately every specimen, except one male, had burst, and consequently the lengths given below are smaller than the parasites would have been had they been entire. The worms have a brownish red colour and the intestine shows through the body wall as a dark line; the females are 13 to 15 mm. long, are attenuated towards both ends and have a maximum thickness of 0.6 to 0.72 mm. at about the middle of the body. The entire male is 14 mm. long by 0.53 mm. in its middle.

The anterior extremity is slightly swollen and resemble in shape that of *Gyalocephalus capitalus* (Fig. 24A). The mouth collar is

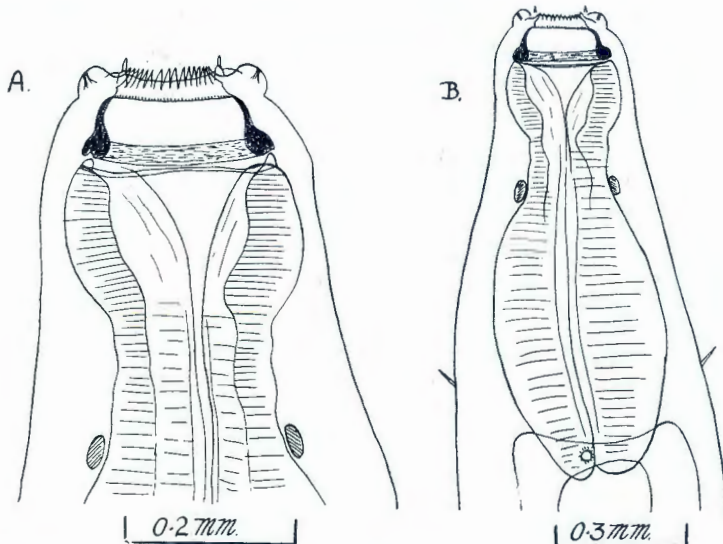


Fig. 24.—*Trichonema (Cylicocyclus) gyalocephaloides* sp. nov. A and B = anterior extremities.

rounded and flattened and measures 0.23 to 0.245 mm. across by about 0.03 mm. high; externally it carries two wart-like lateral papillae and four submedian papillae with nipple-like ends. The buccal capsule is large and somewhat barrel-shaped with a conspicuous hoop round its posterior edge; its anterior opening is slightly

less than its posterior and its maximum diameter is just anterior of its middle; it is from 0.075 to 0.09 mm. deep and its maximum diameter is from 0.186 to 0.204 mm. The external leaf crown originates about midway up the mouth collar and consists of 44 pointed elements about 0.03 mm. long; they project slightly above the anterior margin of the mouth collar. The internal leaf crown consists of numerous (Ca. 200) small elements, about 0.01 mm. long, inserted along the anterior edge of the buccal capsule. The excretory pore is situated at the level of the junction of the oesophagus and intestine, and the spike-like cervical papillae are inserted 0.12 mm. anterior of this level. The oesophagus is strikingly club-shaped (Fig. 24B) in that its anterior or head end is much enlarged to accommodate a cup-shaped oesophageal funnel; this portion measures 0.27 to 0.3 mm. across by about 0.2 mm. long, and its cavity is from 0.12 to 0.15 mm. deep by 0.18 to 0.19 mm. broad; its internal surface is lined by cuticle forming longitudinal folds. The following portion or oesophageal neck is considerably narrower and measures from 0.14 to 0.18 mm. in thickness; the nerve ring encircles it at its junction with the following much thicker oesophageal portion; this latter is from 0.33 to 0.42 mm. thick. The whole organ is from 1.03 to 1.14 mm. long.

The caudal bursa consists of a long median and two large lateral lobes (Fig. 25). The former is supported by the dorsal ray which is split almost from its base, and each limb carries three main branches which extend to the bursal edge. The externo-dorsal takes its origin from the dorsal ray just after its division into its two main limbs; it is curved and does not reach the edge of the

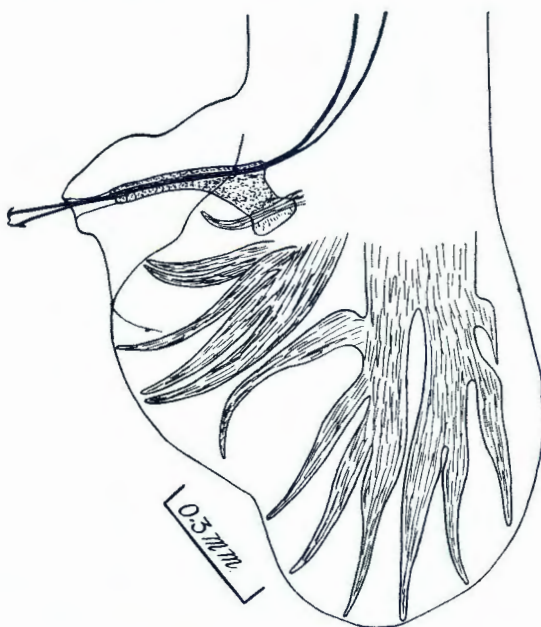


Fig. 25.—*Trichomena (Cyllococyclus) gyaloccephaloides* sp. nov. Dorso-lateral view of bursa.

bursa. The postero-lateral and medio-lateral rays are more or less parallel, and the antero-lateral diverges slightly. The ventral rays are closely apposed to each other except for their tips. A large prebursal papilla is present. The genital cone is large, about 0.45 mm. long and carries two teat-like papillae 0.048 mm. long by 0.03 mm. thick at their base. A large and boot-shaped gubernaculum is present measuring 0.3 to 0.37 mm. length; its under surface (sole) is grooved to accommodate the two spicules which are long and slender and terminate in double hooked tips; they are 2.1 to 2.2 mm. long with a maximum thickness of 0.01 mm. and their terminal portions carry small alae.

The posterior extremity of the female is bent dorsalwards and a prominent swelling on its ventral surface gives it the characteristic appearance of a human foot (Fig. 26). This swelling causes a slight twisting of the "foot" towards the left side and consequently the vulva and anus come to lie on the right side of the foot. The tail is short and conical and is from 0.2 to 0.24 mm. long. The vulva is situated 0.18 to 0.24 mm. anterior of the tail tip and leads into a long and straight vagina 1.1 to 1.2 mm. long by 0.11 mm. thick with lumen 0.066 mm. in diameter; the ojectors each measure 0.9 mm. in length and are parallel. The eggs are oval and thin-shelled and morulated *in utero*; they measure 0.089 to 0.091 mm. in length by 0.048 to 0.053 mm. across.

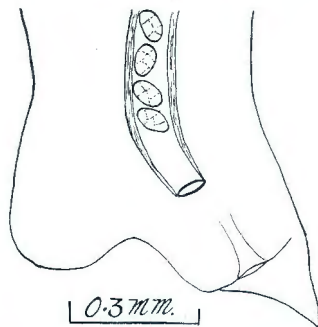


Fig. 26.—*Trichonema (Cylicocyclus) gyalocephaloides* sp. nov. Female tail.

Affinities.—The posterior hoop-like thickening of the buccal capsule and the numerous and small elements of the internal leaf crown originating from the anterior border of the buccal capsule, places this species in Ihle's sub-genus *Cylicocyclus*. However, it differs from all the members of this sub-genus, in the great development of its oesophageal funnel, the shape of the terminal portion of the female body, and in that the vulva and anus are not ventral but lateral in position. Except for these points and the absence of long cephalic papillae, this species is otherwise very similar to *T. (Cylicocyclus) auriculatum* (Looss).

Specific diagnosis.—Trichoneminae reaching 14 mm. in length or longer. Head swollen; buccal capsule barrel-shaped with prominent posterior hoop; 44 external and numerous internal leaf elements. Oesophagus club-shaped, its head enlarged to accommodate

a large funnel. Male bursa typical. Spicules just over 2 mm. long, slender, each terminating in a double hook. Posterior extremity of female shaped like a human foot. Vulva and anus lateral in position.

Host: Hippotigris sp.

Location: Colon.

Locality: Tanganyika.

Types in the Onderstepoort Helminthological Collection.

Trichonema (Cylicocyclus) auriculatum (Looss, 1902).

In association with the foregoing species there were six specimens of the above species consisting of three males and three females. All had unfortunately burst. This species is very similar to the foregoing but differs in having long horn-like lateral cephalic papillae and the oesophageal funnel is smaller; the posterior extremity of the female is not bent dorsalwards, but this may be due to shrinkage as a result of bursting.

Habronema numidae sp. nov.

Eight males and seven females were recovered from under the gizzard lining of guinea-fowls; they were reddish in colour and showed a tendency to become coiled into a loose spiral. The males are from 11 to 13 mm. long and the females 18 and 19 mm. long; the former attain their maximum thickness of 0.18 to 0.21 mm. just anterior of the caudal alae, and the latter are thickest (0.3 to 0.36 mm.) just anterior of the vulva.

The mouth is surrounded by four lips which are small and inconspicuous; the longest are the two lateral lips, each of which has a somewhat rectangular body with a dorsal and ventral horn-like process arising from its anterior corners (Fig. 27); its free face is slightly trilobed and it carries a small papilla towards its base. The dorsal and ventral lips are indented in their middle and carry

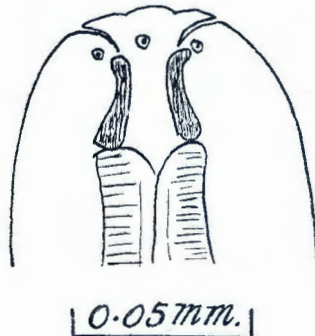


Fig. 27.—*Habronema numidae* sp. nov. Cephalic extremity.

keel-like thickenings extending into the mouth cavity on their inner surfaces; each carries two small sub-ventral pappillae. The mouth leads into a buccal capsule about 0.03 mm. deep in the males and 0.036 mm. deep in the females and having an internal diameter of 0.01 and 0.012 mm. in the two sexes respectively; its wall consists of thickened chitin which is thickest at its base. The oesophagus consists of an anterior muscular and a posterior glandular portion; the muscular portion is 0.27 to 0.3 mm. long by 0.024 mm. thick in the male and 0.33 mm. long by 0.026 mm. thick in the female. In the male the glandular oesophagus is 1.7 to 2 mm. long and in the female 2.4 to 2.6 mm. long; its maximum thickness, at its posterior end, is 0.06 and 0.065 mm. for the two sexes respectively. The nerve ring is from 0.21 to 0.24 mm. from the anterior end, and the excretory pore 0.25 to 0.29 mm. from the anterior end. Cervical papillae were not seen.

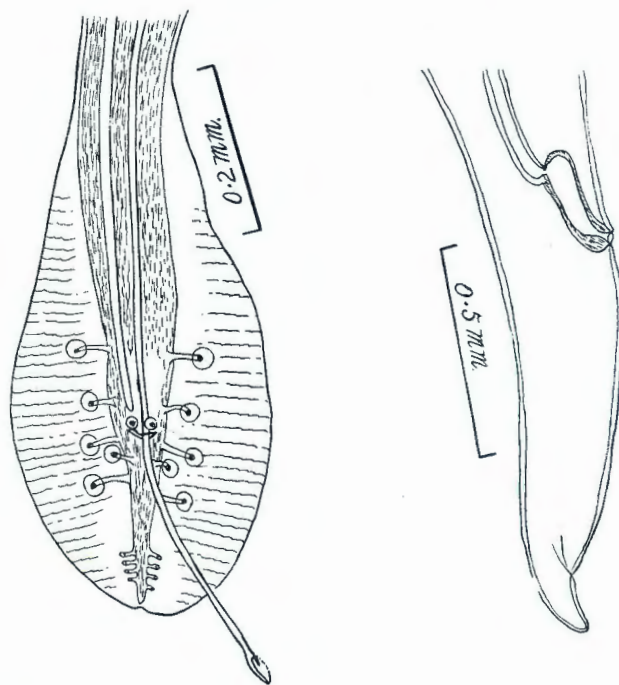


Fig. 28.—*Habronema numidae* sp. nov. Posterior extremity of male, ventral view.

Fig. 29.—*Habronema numidae* sp. nov. Female tail.

The caudal alae of the males are from 0.42 to 0.52 mm. long and the whole expansion measures about 0.275 mm. across at the level of the cloaca (Fig. 28); its posterior end is rounded. The alae show numerous wavy markings extending from its outer edge to the body wall. There are 10 pairs of caudal papillae; four pairs are lateral and pedunculate, of which two are precloacal and two

post cloacal; one pedunculate pair is ventral and situated midway between the two post cloacal pedunculate papillae; a pair of sessile papillae is situated just anterior to the cloaca; the remaining four pairs are small and situated laterally towards the posterior end of the tail. The spicules are well developed and unequal; the left is 1.08 to 1.11 mm. long and has its tip slightly bent and alate; its proximal end is 0.015 mm. thick and its distal portion just anterior of the bend is 0.012 mm. thick. The right spicule is 0.42 to 0.438 mm. long, has a uniform thickness of about 0.015 mm. and ends in a bluntly rounded tip. A gubernaculum is present, measuring about 0.07 mm. long.

The posterior extremity of the female (Fig. 29) tapers off to form a blunt tail 0.126 to 0.13 mm. long. The vulva is not prominent and is located towards the posterior end, about 0.75 mm. anterior of the anus. A very short vagina leads into the somewhat pyriform vestibule about 0.25 mm. long by 0.06 mm. in diameter; a long unpaired trompe—0.78 mm. long—arises from its dorsal side and passes forwards to join the two parallel uteri. The numerous eggs are oval, thick shelled and embryonated *in utero*; they measure 0.042 to 0.045 mm. long by 0.024 mm. thick and the shell has a thickness of 0.003 mm.

Affinities.—Of the avian members of the genus *Habronema* which possess no cervical alae and in which the vulva is situated near the posterior extremity, the above described species approaches most closely the species *H. eurycerca* (Seurat, 1914) and *H. parroti* (Seurat, 1917). The arrangement of the male caudal papillae in these two species and in the writer's is practically identical and the lengths of the spicules are also very similar. *H. eurycerca* differs from the writer's species in that the vestibule is joined to the vulva by a long neck and the lips are more complicated, and *H. parroti* differs especially in the structure of the lips which have a digitiform appearance when viewed laterally and they bear small teeth on their inner surface.

Specific diagnosis.—Spirurinae reaching a length of 19 mm. in the female and 12 mm. in the male. Four lips of which the two lateral have horn-like processes at their anterior corners. Cervical alae absent. Nine pairs stalked papillae on male tail (two pairs pre-cloacal) and one sessile pair on anterior lip of cloaca. Spicules unequal, 1.1 and 0.44 mm. long. Gubernaculum present. Vulva near anus. Vestibule short, no neck; common trompe long. Uteri parallel. Eggs oval and thick-shelled, 0.042 to 0.045 mm. long by 0.024 mm. thick; embryonated *in utero*.

Host: *Numida mātata* Pall. and *Numida* sp.

Habitat: Under gizzard lining.

Locality: Nyasaland, Transvaal and Swaziland.

Types in the Onderstepoort Helminthological Collection.

Habronema fischeuri Seurt 1916, var. *elanii* nov.

The material which the writer has determined as a variety of Seurat's species consisted of seven males and more than a dozen females; they were obtained from the stomach of a Black-shouldered Kite—*Elanus caeruleus*—shot at Onderstepoort; some of the worms were totally embedded under the mucosa.

Although this material originates from a member of the Falconidae whereas Seurat obtained his from a member of the Ardeidae, the two materials, except for a few minor points, appear to be identical. They agree in their size, structure of the lips, coarse body annulations, ornamentation of the male caudal extremity (Fig. 30), position of the vulva, structure of the female

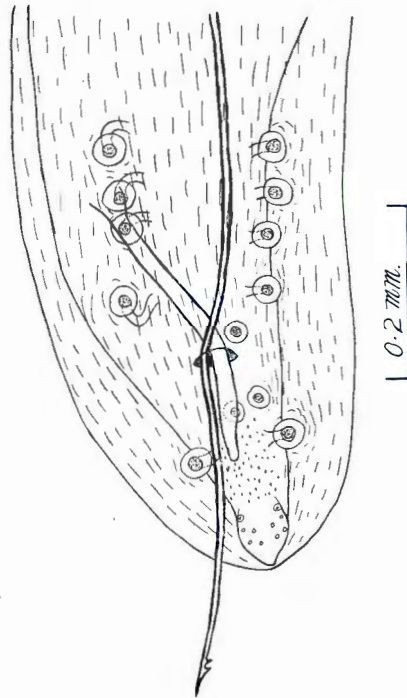


Fig. 30.—*Habronema fischeuri elanii* var. nov. Posterior extremity of male, ventral view.

genitalia and size of the eggs. The only differences which the writer could find are that the left spicule is slightly shorter in his material (0.9 to 1.08 mm. against 1.27 mm.), the terminal hooks are placed one anterior to the other and not on either side of the left spicule as drawn by Seurat, and the writer was able to find only two labial

teeth and not three as observed by Seurat. These differences the writer considers to be of minor importance and not of specific significance.

Host: *Elanus caeruleus* (Desf.).

Location: Stomach.

Locality: Pretoria district, Transvaal.

Types in the Onderstepoort Helminthological Collection.

Acuaria semei * sp. nov.

One male and ten females of this species were collected from a Giant Bustard; some of the specimens were brownish in colour whereas the remainder were cream-coloured. The body is attenuated in both sexes, the attenuation, however, being more marked in the anterior body half of the females. The male is 12 mm. long by 0.36 mm. wide just anterior of the cloaca and the females vary in length from 10 mm. to 19.5 mm. with a maximum thickness just anterior of the vulva of 0.36 to 0.4 mm. All the specimens were mature.

The cuticle is finely annulated and the mouth is bordered by two lateral triangular lips, each carrying a triangular tooth at its apex and two sub-median papillae towards their bases. Two small cervical papillae are present, situated just behind the level of the junction of the pharynx and oesophagus. Four pairs of cordons originate between the lips, two pairs emerging on their dorsal and ventral sides respectively; the cordons run in pairs and pass straight down along the submedian lines of the body to about the level or just posterior of the vulva in the female, and in the male they terminate about 0.24 mm. anterior of the cloaca.

The mouth leads into cylindrical pharynx which is generally slightly bent; it is about 0.36 mm. long by 0.036 mm. broad in the females, and 0.3 mm. long by 0.03 mm. wide in the male. The oesophagus is relatively very long reaching a length of over 5 mm. in the females, and 3.9 mm. in the male; in the former the muscular portion of the oesophagus is about 0.72 mm. long by 0.12 mm. broad at its posterior end, and in the latter it is 0.54 mm. long. The nerve ring encircles it near its anterior extremity. The glandular oesophagus reaches a length of 4.68 mm. in females and is 3.36 mm. long in the male; its initial portion is 0.24 and 0.2 mm. thick at its anterior extremity and 0.266 and 0.23 mm. broad at its posterior end in the two sexes respectively. The excretory pore is situated about 0.25 mm. behind the level of the nerve ring in both sexes.

The posterior extremity of the male is spirally coiled and terminates in a conical tail 0.4 mm. long. Caudal alae are practically absent (Fig. 31). There are four pairs of symmetrically placed sessile precloacal papillae and six pairs of sessile postcloacal papillae; the posterior three pairs of these are arranged slightly

* "Seme" is the Zulu name for the Giant Bustard.

closer to each other than the anterior three pairs. The two spicules are massive and slightly unequal; the left is 0.354 mm. long by 0.32 mm. wide at its base and the right is 0.24 mm. long and 0.045 mm. wide and terminates in a broad, rounded and alate tip. A gubernaculum is absent.

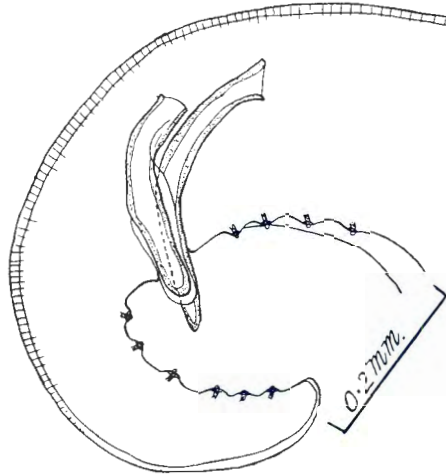


Fig. 31.—*Acauria semei* sp. nov. Posterior extremity of male, lateral view.

In the females the vulva is situated towards the posterior end of the body, about 1.6 to 2 mm. from the anus (Fig. 32); it leads into an elongate vagina 1.0 to 1.2 mm. long by 0.12 to 0.14 mm. thick, which is more or less straight and passes obliquely forwards. The uteri extend forwards and are filled with numerous smooth, oval and embryonated eggs measuring 0.043 to 0.045 mm. long by 0.024 to 0.026 mm. broad. The tail is conical, about 0.26 mm. long and is sharply bent dorsalwards, giving the end of the body a hooked appearance.

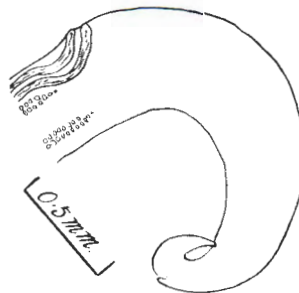


Fig. 32.—*Acauria semei* sp. nov. Posterior extremity of female.

Affinities.—The great length of the cordons distinguishes this species from all the known members of this genus except from *A. lata* Maplestone, 1931. Maplestone's species differs, however, in

that the cordons do not extend quite so far back, being about three-quarters of the body length, and its vulva is situated just behind the middle of the body.

Specific diagnosis.—Acuariinae reaching a length of 12 mm. in the male and 19.5 in the female. Four pairs of very long cordons, extending to near the cloaca and vulva in the two sexes respectively. Caudal alae practically absent in the male. Four pairs precloacal and six pairs postcloacal papillae, all sessile. Spicules short and stout, right spicule 0.24 mm. long and terminates in a broad rounded tip; left spicule thinner, 0.354 mm. long. Vulva near posterior end, about two mm. from tail tip. Vagina straight, passes obliquely forwards. Uteri directed anteriorly. Tail bent sharply dorsalwards. Eggs oval, smooth and embryonated *in utero*.

Host: *Choriotis kori* (Burch.)

Location: Under gizzard lining.

Locality: Northern Transvaal.

Types in the Onderstepoort Helminthological Collection.

Cheilospirura gruveli (Gendre, 1913) Cram, 1927.

This species was represented by two males and one female recovered from under the gizzard lining of a francolin (*Pternistes swainsoni*) (A. Smith) shot at Onderstepoort. The female was 32 mm. long, its cuticular cordons 0.72 mm. long and its eggs measured 0.036 by 0.023 mm.; the two males were 10 and 11 mm. long and their spicules measures 0.6 and 0.12 and 0.53 and 0.144 mm. for the left and right respectively. In all other respects the writer's material agreed with the data given by Cram (1927).

Histiocephalus chorioidis sp. nov.

Three mature specimens of this species were recovered from under the gizzard lining of a Giant Bustard; unfortunately only females were present.

The specimens are brownish red and are attenuated towards both extremities; two of the specimens were each 12 mm. long by 0.36 and 0.39 mm. thick respectively, the third specimen was too coiled for measuring.

The mouth is bounded by four lips, the two laterals being relatively large and rectangular with their free margin indented, and the dorsal and ventral being small and pointed (Fig. 33); the lateral lips are about 0.03 mm. high and 0.09 mm. broad; posteriorly each carries a chitinous flange which is cut up to form six appendages each terminating in one to four projections; each appendage is from 0.042 to 0.045 mm. long. Each dorsal and ventral lip carries two large papillae lateral and behind their bases. A constriction encircles the body behind the head, and immediately

posterior to this groove the cuticle is inflated to form a collar about 0.075 mm. long by 0.165 mm. across; the collar is supported by a number of external longitudinal cuticular ridges. The mouth leads into a pharynx which is laterally compressed; it is about 0.06 mm. deep, its internal diameter about 0.027 mm. and its cuticular wall has a thickness of about 0.003 mm. No teeth were observed on the inner surface of the lips.

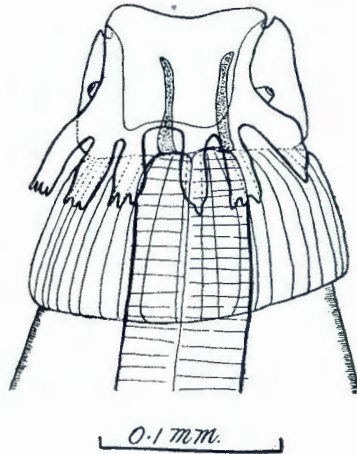


Fig. 33.—*Hystiocephalus chorioidis* sp. nov. Anterior extremity.

The oesophagus is relatively long and consists of an anterior muscular and a posterior glandular portion; the former is about 0.54 mm. long and increases in diameter from 0.06 to 0.078 mm.; the nerve ring encircles it about 0.22 mm. behind its anterior end; the glandular oesophagus is from 3.5 to 3.7 mm. long by 0.12 to 0.2 mm. in diameter.

The vulva is a rounded non-protuberant aperture situated in the oesophageal region, 2 to 2.25 mm. from the anterior end; the details of the vagina and uteri could not be made out as they were obscured by the numerous eggs; the initial portion of the vagina has a diameter of 0.07 mm. and the remaining portion of it appears to be long and undifferentiated. The eggs are oval, smooth, thick-walled end embryonated *in utero*; they measure 0.054 to 0.057 mm. long by 0.039 mm. thick and the shell has a thickness of nearly 0.003 mm. The tail is short and conical and is from 0.1 to 0.12 mm. long.

Affinities.—Only two species of nematode have been assigned to this genus with certainty, namely *H. laticaudatus* (Rud., 1819) and *H. tridens* Gendré, 1912, both having been recovered from Otidiform birds. The female of the species described above appears to be closely related to both these species, but differs from the former in having 12 cuticular appendages instead of 20 to 24 and from the latter in that the lips are not trilobed and the appendages do not terminate in single points.

Specific diagnosis.—Schistotrophinae reaching 12 mm. in length, possessing six cuticular appendages behind each lateral lip, each appendage terminating in one to four points. Oesophagus over one-third of total body length. Vulva in oesophageal region 2.0 to 2.5 mm. from anterior end. Tail short and bluntly conical.

Host: *Choriotis kori* (Burch.)

Location: Under gizzard lining.

Locality: Northern Transvaal.

Types in the Onderstepoort Helminthological Collection.

*Trichuris vondwe** sp. nov.

One of two cane rats, sent alive to this institute, was on post mortem found to harbour five male and six female specimens of the above species; only two of the females appear to be mature and contain fully developed eggs.

The thickened portion in the males is from 15 to 16 mm. long with a maximum thickness of 0.336 mm. for the smallest to 0.432 mm. for the largest specimens; in the two mature females these measurements are respectively 16 and 20 mm. in length by 0.58 and 0.62 mm. in breadth. The posterior extremity of the male is bluntly rounded and carries a cone-like papilla on either side (Fig. 34); in the female the posterior end is pointed.

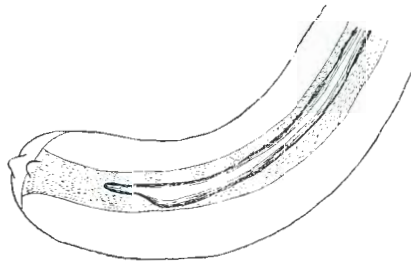


Fig. 34. —*Trichuris vondwe* sp. nov. Posterior extremity of male.

The spicule varies in length from 1.98 to 2.58 mm. and is completely retracted in all the males; its proximal end, just behind its head, has a diameter of 0.057 to 0.069 mm.; posteriorwards it becomes thinner until about 0.1 mm. from its tip it has a thickness of 0.02 to 0.025 mm.; immediately posterior it enlarges to a thickness of 0.03 to 0.035 mm. and then suddenly becomes narrower to form a bluntly rounded tip 0.06 to 0.07 mm. long; this sudden narrowing of the spicule tip gives the spicule a characteristic shape which is constant in all five the males. The spicular sheath is

* "Vondwe" is the Zulu name for the Cane Rat.

retracted in all the males, and in this position is from 0.78 to 0.96 mm. in length; it is densely covered by fine spines which are longest at its distal end, i.e. if the spicule was fully everted the largest spines would be nearest the body and the smallest away from the body. The cloaca varies in length from 1.8 to 2.27 mm. and is straight; the large spicular tube enters it about 0.6 to 0.66 mm. from its proximal end; the distance from the proximal end of the spicular sheath to the entrance of the spicular tube into the cloaca varies from 0.43 to 0.69 mm. The ejaculatory duct is large and straight and measures from 6.5 to 8.14 mm. in length; a slight narrowing forms the junction between it and the vas deferens, whose wall is much thinner and lumen larger; the vas deferens passes forwards, forming kinky loops, to just behind the level of the end of the oesophagus; in this kinked condition it occupies 4.6 to 6.3 mm. of the body length; the testis, which pass backwards dorsal of and parallel to the vas deferens and ejaculatory duct, is thrown into closely packed kinks up to about 0.15 mm. from its distal end; this end position is straight and lies opposite the proximal portion of the cloaca.

In the two mature females the vagina passes backwards for 6.9 and 7.1 mm. respectively; it is wavy and its lumen carries no spines, but the cells lining its lumen are spike-like and these increase in robustness towards its posterior end; at its opening the lumen has a diameter of 0.06 mm., about one-third of its length down a diameter of 0.084 mm. and at its posterior end its diameter is 0.36 mm. A constriction joins the vagina to the smooth walled uterus which extends to the posterior end of the body and is filled with eggs.

The eggs are oval and thick-shelled, and measures 0.06 to 0.66 mm. in length, including the plugs, by 0.032 to 0.033 mm. in breadth.

Affinities.—As the peculiar shape of the spicule tip was present in all the five males, this character can be taken to be of specific significance. This shape of the spicule tip plus the kinked nature of the vas deferens, the presence of two caudal papillae in the male and the simple but wavy nature of the vagina separate this species from all the known whip-worms from rodents and ruminants in which these organs have been described. Caudal papillae are also present in *T. gazellae* Gebauer, 1933, from Damagazelles, *T. muris* (Schrank, 1788) from various rodents and *T. parvispiculum* Ortlepp, 1937 from Goats, but in the former species the spicule is much longer (4.15 mm.) and in the second and last species much shorter (0.76 mm. and 0.85 to 1.07 mm. respectively).

Specific diagnosis.—Trichuridae with the thickened portion of the body up to 16 mm. long in the male and 20 mm. long in the female. Spicule well chitinized and 1.98 to 2.58 mm. long; tip cut out on one side and bluntly pointed. Two caudal papillae, one on either side of cloaca. Cloaca 1.8 to 2.27 mm. long and spicular tube enters it about 0.6 mm. from its proximal end. Spicular sheath with numerous small spines. Ejaculatory duct straight 6.5 to 8.4 mm. long. Vas deferens kinked and occupies 4.6 to 6.3 mm.

of body. Vagina simple and wavy, with no spines but cells lining lumen are spike-like. Eggs 0.6 to 0.66 mm. long, including plugs, by 0.032 to 0.033 mm. broad.

Host: *Thyromys swinderianus variegatus* Ptrs.

Location: Large intestine.

Locality: Zululand, Natal.

Types in the Onderstepoort Helminthological Collection.

RESUME.

In the preceding pages the writer discusses twenty species of helminths of which fourteen are described as new. These are *Hymenolepis cormoranti* sp. nov. and *Contracaecum carlislei* sp. nov. from Reed Cormorants; *Idiogenes kori* sp. nov., *I. kolbei* sp. nov. *Subulura otidis* sp. nov., *Acuaria semei* sp. nov., and *Histiocephalus chorioidis* sp. nov. from a Giant Bustard; *Habronema numidae* sp. nov. from a guinea fowl; *Habronema fischeuri* var. *elanii* nov. from a Black-shouldered Kite; *Porrocaecum spathulispiculum* sp. nov. from an unidentified bird; *Raillietina (S.L.) thyromysi* sp. nov. and *Trichuris vonduei* sp. nov. from Cane Rats; *Cooperiodes hepaticae* sp. nov. from an Impala and *Trichonema (Cyclicocyclus) gyalcephaloides* sp. nov. from a Zebra.

REFERENCES.

- BAER, J. G. (1933). Contribution a l'etude de la Faune helminthologique africaine. *Rev. Suisse Zool.*, Vol. 40, pp. 31-84. Geneva.
- BAYLIS, H. A. (1929). Parasitic nematoda and Acanthocephala collected in 1925-1927. *Discovery Repts.*, Vol. 1, pp. 541-560. Cambridge.
- BAYLIS, H. A., AND DAUBNEY, R. (1921). Report on the parasitic nematodes in the collection of the Zoological Survey of India. *Mem. Ind. Mus.*, Vol. 6, pp. 263-347. Calcutta.
- BEDDARD, F. E. (1912). Contributions to the anatomy and systematic arrangement of the Cestoidea. III. On a New Genus of tapeworms (*Otiditaenia*) from the Bustard (*Eupodotis kori*). *Proc. Zool. Soc.*, pp. 194-221. London.
- CANAVAN, W. P. N. (1929). Nematode parasites of Vertebrata in the Philadelphia Zoological Gardens and Vicinity. *Parasit.*, Vol. 21, pp. 63-102. Cambridge.
- COOPER, A. R. (1918). North American Pseudophyllidian Cestodes. *Illin. Biol. Monogr.*, Vol. 4, pp. 1-542. Illinois.
- CHANDLER, A. C. (1930). Specific characters in the genus *Trichuris*, with a description of a new species, *Trichuris tenuis*, from a Camel. *Jl. Parasit.*, Vol. 16, pp. 198-206. Urbana.
- CRAM, E. B. (1927). Bird Parasites of the Nematode suborders Strongylata, Ascaridata and Spirurata. *Smiths. Inst. U.S. Nat. Mus.*, Bull. 140, pp. 1-465. Washington.
- DIETZ, E. (1910). Die Echinostomiden der Vögel. *Zool. Jahrb.*, suppl. 12 (3), pp. 265-512. Jena.
- FUHRMANN, O. (1906). Die Tänien der Raubvogel. *Centlb. Bakt.*, 1e abt. orig., Vol. 42, pp. 79-89 and 212-221. Jena.

SOUTH AFRICAN HELMINTHS.

- FUHRMANN, O. (1906). Die Hymenolepis-Arten der Vögel. *Centrb. Bakt.*, 1e abt. orig., Vol. 41, pp. 352-358 and 440-452. Jena.
- FUHRMANN, O. (1906). Die Hymenolepisarten der Vögel. II. Allgemeiner Teil. *Centrb. Bakt.*, 1e abt. orig., Vol. 42, pp. 620-628 and 730-755. Jena.
- FUHRMANN, O. (1932). Les Ténias des Oiseaux. *Mém. Univ. Neuchâtel*, Vol. 8, pp. 1-381. Neuchâtel.
- GEBAUER, O. (1932). Zur Kenntnis der Parasitenfauna der Gemse. *Zeitschr. Parasitk.*, Vol. 1, pp. 147-219. Berlin.
- GEDOELST, L. (1916). Notes sur la faune parasitaire du Congo Belge. *Rev. Zool. Afr.*, Vol. 5, pp. 1-90. Brussels.
- HALL, M. C. (1916). Nematode Parasites of Mammals of the orders Rodentia, Lagomorpha, and Hydracoidea. *Proc. U.S. Nat. Mus.*, Vol. 50, pp. 1-258. Washington.
- HSC, H. F. (1933). Some species of *Parrocacum* (Nematoda) from birds in China. *Jl. Parasit.*, Vol. 19, pp. 280-286. Urbana.
- JOYEUX, C., AND BAER, J. (1935). Notices helminthologiques. *Bull. Soc. Zool. Fr.*, Vol. 60, pp. 482-501.
- JOYEUX, C., BAER, J., AND MARTIN, R. (1936). Sur quelques Cestodes de la Somalie-Nord. *Bull. Soc. Path. Exot.*, Vol. 29, pp. 82-96. Paris.
- JOYEUX, C., GENDRE, E., AND BAER, J. (1928). Recherches sur les helminths de l'Afrique occidentale Française. *Coll. Soc. Path. Exot.*, Monogr. 11, pp. 1-120. Paris.
- LENT, H., AND DE FREITAS, J. F. T. (1936). Sobre o Trichuris da Nutria. *Ann. Acad. Brasil Sc.*, Vol. 8, pp. 319-322.
- MACY, R. W. (1934). Studies on the Taxonomy, Morphology and Biology of *Prosthogonimus mucrorchis* Macy, a common oviduct Fluke of Domestic Fowls in North America. *Agr. Expt. Stn. Univ. of Minnesota*. Tec. Bull. 98, pp. 1-71. St. Paul.
- MAPLESTONE, P. A. (1931). Parasitic Nematodes obtained from animals dying in the Calcutta Zoological Gardens, Parts 4-8. *Rec. Ind. Mus.*, Vol. 33, pp. 71-171. Calcutta.
- MAPLESTON, P. A. (1932). Parasitic Nematodes obtained from animals dying in the Calcutta Zoological Gardens, Parts 9-11. *Rec. Ind. Mus.*, Vol. 34, pp. 229-261. Calcutta.
- MEGGITT, F. J. (1924). The Cestodes of Mammals, pp. 1-282. London.
- MEGGITT, F. J. (1927). Report on a collection of Cestoda, mainly from Egypt. Part I. Families Anoplocephalidae, Davaineidae. *Parasit.*, Vol. 19, pp. 311-327. Cambridge.
- MEGGITT, F. J. (1927). Report on a collection of Cestoda, mainly from Egypt. Part II. Cyclophyllidea: family Hymenolepididae. *Parasit.*, Vol. 19, pp. 420-450. Cambridge.
- MEGGITT, F. J. (1929). On Cestodes collected in Burma. *Parasit.*, Vol. 21, pp. 141-153. Cambridge.

- MEGGITT, F. J., AND SUBRAMANIAN, K. (1927). The tapeworms of rodents of the subfamily Murinae, with special reference to those occurring in Rangoon. *Jl. Burma Res. Soc.*, Vol. 17, pp. 190-237. Rangoon.
- MOGHE, M. A., AND INAMDAR, N. B. (1934). Some new species of Avian Cestodes from India with a description of *Biuterina intricata* (Krabbe, 1882). *Rec. Ind. Mus.*, Vol. 36, pp. 7-16. Calcutta.
- MÖNNIG, H. O. (1933). Wild Antelopes as carriers of Nematode parasites of Domestic Ruminants—Part III. *Onderstepoort Jl. Vet. Sc. and An. Ind.*, Vol. 1, pp. 77-92. Pretoria.
- NEVEU-LEMAIRE, M. (1936). *Traité d'Helminthologie Médicale et Vétérinaire*, pp. 1-1514. Paris.
- ORTLEPP, R. J. (1937). Whipworms from South African Ruminants. *Onderstepoort Jl. Vet. Sc. and An. Ind.*, Vol. 9, pp. 91-100. Pretoria.
- ORTLEPP, R. J. (1938). South African Helminths. Part III. Some Mammalian and Avian Cestodes. *Onderstepoort Jnl. Vet. Sc. and An. Ind.*, *This Journal*.
- RANSOM, B. H. (1911). The Nematodes parasitic in the alimentary tract of Cattle, Sheep and other Ruminants. *U.S. Dept. Agr. Bur. Anim. Ind. Bull.* 127, pp. 1-132. Washington.
- LE ROUX, P. L. (1930). An *Acuaria* (*Acuaria martinaglia* sp. nov.) from a South African Weaver. (*Hyphantornis* sp.) *16th Rept. Dir. Vet. Ed. An. Ind.*, pp. 211-215. Pretoria.
- SANDGROUND, J. H. (1933). Reports on the Scientific Results of an Expedition to the South Western Highlands of Tanganyika Territory. VI. Parasitic Nematodes from East Africa and Southern Rhodesia. *Bull. Mus. Comp. Zool.*, Vol. 75, pp. 263-293. Cambridge, U.S.A.
- SEURAT, L. G. (1914). Sur *Habronema* (*Spiroptera*) *leptoptera* (Rud.). *C.R. Soc. Biol.*, Vol. 76, pp. 21-24. Paris.
- SEURAT, L. G. (1914). Sur un nouveau parasite de la Perdix rouge. *C.R. Soc. Biol.*, Vol. 76, pp. 390-393. Paris.
- SEURAT, L. G. (1914). Sur un nouveau spiroptère des Rapaces. *C.R. Soc. Biol.*, Vol. 76, pp. 427-429. Paris.
- SEURAT, L. G. (1914). Sur un nouveau parasite de l'Outarde houbara. *Bull. Soc. Hist. Nat. l'Afr. Nord*, 6th year, pp. 117-119. Algiers.
- SEURAT, L. G. (1914). Sur un nouveau parasite du Perconoptère. *Bull. Soc. Hist. Nat. l'Afr. Nord*, 6th year, pp. 149-153. Algiers.
- SEURAT, L. G. (1914). Sur quelques Heteraks d'Oiseaux. *Bull. Soc. Hist. Nat. l'Afr. du Nord*, 6th year, pp. 195-202. Algiers.
- SEURAT, L. G. (1914). Sur deux nouveaux Heterakis du Sud-algérien. *Bull. Soc. Hist. Nat. l'Afr. Nord*, 6th year, pp. 222-225. Algiers.
- SEURAT, L. G. (1916). Sur un nouvel *Habronema* du *Babulcus lucidus* Raf. *C.R. Soc. Biol.*, Vol. 79, pp. 295-297. Paris.
- SEURAT, L. G. (1917). Nématodes de la Perdix de roche. *Bull. Soc. Hist. Nat. l'Afr. du Nord*, Vol. 8, pp. 208-215. Algiers.

SOUTH AFRICAN HELMINTHS.

- SKRJABIN, K. J. (1914). Vergleichende Charakteristik deur Gattungen *Chapmania* Mont. und *Schistometra* Cholodk. *Centrb. Bakt.*, org. abt. 1, Vol. 73, pp. 397-405. Jena.
- SPAUL, E. A. (1929). Two new Nematode bird parasites from Central Asia. *Ann. Mag. Nat. Hist.*, ser. 10, Vol. 4, pp. 451-460. London.
- THEILER, G. (1923). The Strongylid and other Nematodes parasitic in the Intestinal Tract of South African Equines, pp. 1-175. Pretoria.
- WALTON, A. C. (1927). A Revision of the Nematodes in the Leidy Collection. *Proc. Acad. Nat. Sc. Philad.*, Vol. 79, pp. 49-163. Philadelphia.
- WEHR, E. E. (1931). A new species of nematode worm from the Sage Grouse. *Proc. U.S. Nat. Mus.*, Vol. 79, pp. 1-3. Washington.
- WILLIAMS, O. L. (1929). A Critical Analysis of the Specific Characters of the genus *Acuaria*, nematodes of Birds, with descriptions of new American species. *Univ. Calif. Pub. Zool.*, Vol. 33, pp. 69-107. Berkeley.
- WOODLAND, N. F. (1929). On some new Avian Cestodes from India. *Parasit.*, Vol. 21, pp. 168-179. Cambridge.
- YAMAGUTI, S. (1935). Studies on the Helminth Fauna of Japan. Part 6. Cestodes of Birds I. *Jap. Jl. Zool.*, Vol. 6, pp. 183-232. Tokio.
- YORKE, W., AND MAPLESTONE, P. A. (1926). The Nematode Parasites of Vertebrates, pp. 1-536. London.