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OBSERVATIONS ON CESTODE PARASITES OF GUINEA-FOWL FROM SOUTHERN AFRICA

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At Onderstepoort there are several collections of cestodes from guinea-fowl from various parts of Southern Africa. In most instances they were killed and fixed in either dilute formalin or alcohol. As no special precautions were taken to flatten or straighten them the majority are much shrunken and coiled, rendering their study difficult. It is, however, possible to determine the more important characteristics of the several species present.

Guinea-fowl are gallinaceous birds indigenous to Africa and Madagascar. According to Roberts (1940) there are five genera, two widespread over the African continent, two confined to West Africa and one to North East Africa. They are very popular game birds and have had their numbers reduced by gunmen. Recently, however, it has been realised that they are of value to the agriculturalist in the control of insect pests and they now enjoy protection and many farmers are reluctant to allow shooting on their properties. As a result of this and their prolific breeding habits it is not unusual to see huge flocks on many farms.

In Southern Africa there are two species, viz. the crested guinea-fowl, *Guttera edouardi* (Hartlaub) and the crowned guinea-fowl, *Numida meleagris* Linnaeus. The former is a localised species occurring in the coastal and low-lying forests from Durban northwards, and the latter is widely distributed throughout the summer rainfall area.

Seventeen species of cestodes have been reported from guinea-fowl, three of which may be considered as typical parasites of domestic fowls and turkeys, viz. *Raillietina* (*Raillietina*) *tetragona* (Molin), *R.* (*Skrjabinia*) *cesticillus* (Molin) and *Metroliasthes lucida* Ransom. None of these three species occurs in the Onderstepoort collection from guinea-fowl. Of the remaining 14, which have been described from guinea-fowl only, seven are present in the collections studied, as also four species considered to be new.

DAVAINEIDAE

Davainea nana Fuhrmann, 1912

The only record of this parasite found in the literature available is the original description of Fuhrmann, which is based on a single worm collected from *Numida ptilorhyncha* from Northern Africa. In the Onderstepoort collection there are ten specimens of this species, collected from a crested guinea-fowl from Northern Rhodesia. They occurred together with three other tapeworm species. As it was found that several characters in the Northern Rhodesian material did not agree with Fuhrmann's observations the species is redescribed below. In this description Fuhrmann's findings, where they disagree with ours, are placed in brackets.

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Five of the specimens are fully mature, i.e. the last segment of each contains fully developed eggs. In one specimen the eggs in the terminal segment are not fully mature while in the three specimens the end segments contain only partially developed eggs. In the posterior segment of the tenth worm, the genital organs are still immature. The length varies from 5·0 to 7·5 mm (10 mm) with a maximum breadth of 0·7 to 0·75 mm. Segmentation follows a very short neck and the number of segments for each worm varies from eight to 11 (15). The youngest segments are broader than long, but when older they are elongate, so that the terminal ones are much longer than broad (Fig. 1). The ripe segments in different worms vary in length from 1·5 to 3·9 mm with a maximum breadth of 0·75 mm.

The head is acorn-shaped when the rostellum is extruded and varies in thickness from 0·315 to 0·4 mm (0·32 mm). The neck is 0·27 to 0·3 mm broad. The four unarmed, circular suckers have a diameter of 0·062 to 0·078 mm (0·068 mm). The extruded rostellum varies in thickness from 0·15 to 0·21 mm (0·128 mm); at its base it carries two circles of hammer-shaped hooks. Many of these hooks on the extruded rostella have been lost, but in the retracted condition their number is estimated at about 160 (170–200); their size varies from 0·015 to 0·018 mm.

The musculature is poorly developed and consists of about 20 to 25 irregular, anastomosing, small bundles of longitudinal fibres.

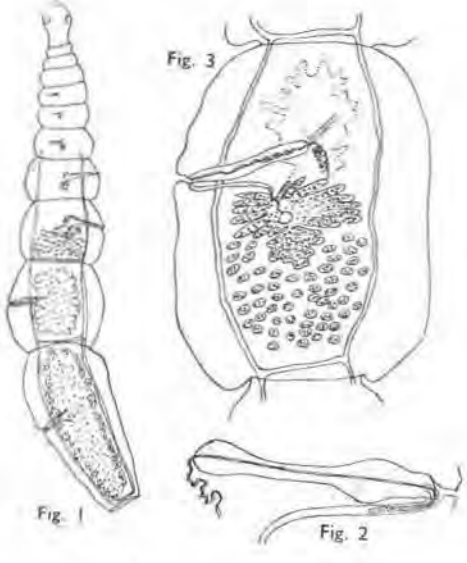

FIG. 1-3.—*Davainea nana*. 1. Entire worm. 2. Mature segment. 3. Cirrus sac.

The rudimentary stages of the genitalia make their appearance as darker staining areas in the 3rd or 4th segments (7th); mature genitalia are seen in the 8th, 9th or 10th segments. Only one segment in each strobila can be considered to be mature. In two instances the extruded cirri are bent sharply back and inserted into the adjacent vagina. The genital pores are located immediately anterior to the middle of the segment. In eight of the nine specimens in which they can be located in a continuous series they alternate irregularly. In the other specimen their alternation is regular as is the case in Fuhrmann's specimen. The elongate, tubular, thin-walled

cirrus sac opens into a short genital sinus about 0·045 mm deep; the sac varies from 0·36 to 0·42 mm (0·34 mm) in length and has a diameter of about 0·05 mm throughout its length. In two mounted worms, however, its internal end is dilated and vesicular-shaped and about 0·06 mm thick and its outer end is also thickened and somewhat pear-shaped with a maximum thickness of 0·075 mm (Fig. 2). A bundle of retractor muscles is attached to its inner end and these muscles extend obliquely forwards across the segment as far as the excretory canal. The long cirrus, when not extruded, is coiled within the cirrus sac and armed with numerous small spines. No internal or external vesicula seminalis is present. The vas deferens after emerging from the cirrus sac passes inwards and backwards with only a few loose coils. There are about 50 to 70 round to oval testes in each mature segment, located in a broad band between the excretory canals and behind the ovary (Fig. 3). The ovary is placed centrally. It has two wings and consists of transversely elongated lobules which stretch across the segment, filling the area between the excretory canals in front of the testes and behind the level of the genital pore. A large and somewhat triangular-shaped, lobulated yolk gland is centrally placed behind the ovary and in front of the testes. The thin-walled vagina opens into the genital sinus immediately behind the opening of the cirrus sac. It runs parallel to the sac for nearly half its length and then bends backwards to end in a small centrally placed, circular receptaculum seminis in front of the anterior border of the yolk gland. Its internal lining stains deeply with haematoxylin. The uterus develops rapidly in the segment immediately following the mature one, taking the form of a ramifying sac with its branches visible between the testes which are still present. The ovary has virtually disappeared in this segment. The uterus fills the whole ripe segment between the excretory canals and the eggs tend to be aggregated in groups within its branches. The round to somewhat oval eggs, with poles slightly pointed, measure 0·013 to 0·016 mm by 0·012 to 0·15 mm, the shell is about 0·001 mm thick. The hexacanth hooks are 0·006 mm long.

Two well defined and relatively large ventral excretory canals are present. They vary in diameter from 0·008 to 0·012 mm. No signs of dorsal excretory canals can be seen.

Host: *Guttera edouardi* (Hartlaub).

Location: Intestine.

Locality: Northern Rhodesia (Mazabuku).

Donor: Dr. P. L. le Roux.

Cotugnia transvaalensis sp. nov.

This species from the crowned guinea-fowl was collected on two occasions from Northern Transvaal. The much contracted specimens reach a length of 25 mm with a maximum breadth of slightly over 2 mm at their posterior ends. Viewed *en face* the head is quadrangular and measures 0·8 by 0·7 mm. The rounded suckers situated at the corners of the quadrangle have a diameter of 0·2 to 0·25 mm. The oval rostellum is about twice as broad as deep; across its anterior face it measures 0·5 by 0·24 mm; it carries a double row of about 500 to 620 hammer-shaped hooks, 0·015 to 0·018 mm long. These are implanted roughly in the form of a rectangle. On four of the heads examined these rows of hooks are interrupted for a distance of about 0·012 mm in the middle of each short limb of the rectangle (Fig. 4).

The segments are much broader than long and relatively thick; this thickness is probably due to the contracted nature of the specimens. Mature segments are about 1·5 mm broad, 0·15 mm long and 1·0 mm thick; ripe segments are slightly over 2 mm broad and 0·35 mm long. The strongly developed, longitudinal muscles are arranged in three layers separated from each other by a thin layer of circular muscles; the innermost layer fills about a third to a half of the cortical parenchyma and consists of somewhat irregular muscle columns of 10 to 25 fibres each. The middle layer is about half as thick as the innermost and consists of irregularly arranged small groups of three to ten muscle fibres. The outermost layer consists of isolated fibres scattered between the middle layer and outer lining of the segment (Fig. 5).

The genital apertures are in the anterior third of the segment's margin; they lead into a long sinus, about 0·09 mm deep, with the genital ducts opening into its base. The cirrus sac is tubular and weakly muscular; its length varies from 0·21 to 0·28 mm with a diameter of about 0·03 mm. In general it reaches or crosses the nerve but does not reach the excretory canals. The vas deferens after emerging from the cirrus sac, forms a dense mass of dorso-ventral loops both poral and aporal of the excretory ducts. At least 100 testes are present in each segment, forming a continuous band across the segment and extending outwards to beyond the excretory vessels (Fig. 6); they are arranged in a row posterior to the ovary

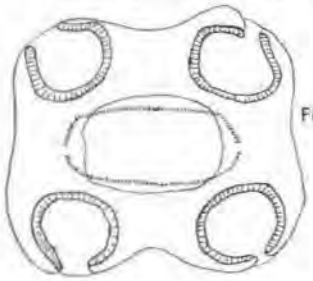

Fig. 4

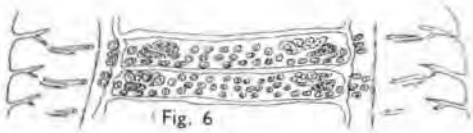

Fig. 6

Fig. 5

FIG. 4–6.—*Cotugnia transvaalensis*. 4. Scolex *en face*, showing arrangement of rostellar hooks. 5. Transverse section of segment showing longitudinal muscle layers and testes surrounding excretory canal. 6. Horizontal section of mature segments.

and a ring round the excretory canals (Fig. 5). Between the ovaries the arrangement is two or three deep and fills the whole inter-ovarian area of the medullary parenchyma; some are observed to be pushed in between the muscle columns of the innermost muscle layer; antero-posteriorly they are arranged roughly in three or four rows. They are about 0·072 by 0·06 mm in size.

The vaginal opening is immediately behind and somewhat ventral to that of the cirrus sac; the vagina is slightly more muscular than the sac; its glandular outer surface is deeply stained. The vagina, and the vas deferens, pass dorsally over the nerves and the excretory canals and terminate in the ovary as an oval receptaculum seminis. The two ovaries, each about 0·18 mm broad and 0·075 mm deep, are coarsely lobed and situated immediately within the excretory ducts. The yolk glands, measuring about 0·09 by 0·05 mm occupy a ventral position between the ovary and the excretory ducts. In its early stages the uterus develops as an irregular transverse sac which soon disappears. The eggs after release become embedded individually in a fibrous capsule. In ripe segments these capsules not only replace the medullary parenchyma but they also extend laterally over the excretory canals almost to the edge of the segment. They may even be pushed in between the longitudinal muscle bundles of the innermost muscle layer, as described by Fuhrmann (1909b) for his species *C. crassa*. The round to oval capsules measure 0·036 to 0·06 mm. The embryo within the capsule measures from 0·027 to 0·03 mm and the hexacanth hooks about 0·01 mm.

The excretory system is represented by two large lateral canals with large transverse connections; they attain a diameter of 0·05 mm and are situated about 0·35 mm from the edge in mature segments. No signs of the presence of dorsal excretory canals can be seen.

Host: *Numida meleagris* Linnaeus.
Location: Intestine.
Locality: Transvaal (Zoutpansberg).
Types: In the Onderstepoort collection.

Specific diagnosis

Davaineidae: Contracted specimens up to 25 mm long and 2 mm broad. Rostellum oval, 0·05 by 0·24 mm across. Hooks 500 to 620, 0·015 to 0·018 mm long implanted roughly in the form of a rectangle. All segments broader than long. Longitudinal muscles strongly developed, in three layers, fibres of innermost layer in somewhat columnar groups of 10 to 25 fibres each. Testes about 100 or more in a continuous band, extending laterally over excretory canals and present behind ovary, two to three layers deep. Cirrus sac tubular, its muscles weak and it does not cross the excretory ducts. Egg capsules fill whole segment and pass between bundles of longitudinal muscles. Dorsal excretory canals absent.

Discussion

Two species of *Cotugnia* have been described from guinea-fowl, viz. *C. crassa* Fuhrmann 1909, from *Numida rikwae* (=*N. meleagris rikwae*) from Lake Rukwa, Tanganyika and also reported from *N. ptilorhyncha* from the White Nile (Fuhrmann, 1909) from *Numida* sp. S.W. Africa (Baer, 1925) and a guinea-fowl, East Africa (Hudson, 1934), and *C. meleagridis* Joyeux, Baer and Martin, 1936, from *N. meleagris* from Northern Somaliland. *C. transvaalensis* resembles *C. meleagridis* in having a somewhat oval rostellum, and a comparable number of rostellar hooks

of about the same size, and the same number of testes; *C. meleagridis* differs from the present species, however, in that its longitudinal muscles are not arranged in layers, its testes form a single horizontal sheet, its cirrus sac may pass over the excretory canals, its egg capsules do not pass into the cortical parenchyma; dorsal excretory canals are present; [no mention of these canals is made in the text by Joyeux, Baer & Martin (1936) but they are shown in their figure].

Cotugnia gutterae sp. nov.

This species is represented by three complete specimens collected from a crested guinea-fowl from Moçambique. The maximum length is 40 mm with a breadth of 2·5 mm. The specimens are not as contracted as those of the previously described species, but all segments, except the last, are broader than long; the largest last segment is 1·65 mm long and 1·4 mm broad.

The head is relatively large and square and measures from 0·54 to 0·6 mm across and about 0·36 mm long. The four rounded suckers have a diameter of 0·18 to 0·21 mm. The rostellum is round and 0·16 mm in diameter; it carries about 800 hooks, 0·01 to 0·012 mm long, of typical shape in two ranges; in all three specimens these ranges are in the form of a Maltese cross (Fig. 7). The dorsal and ventral ranges are separated laterally by a break of about 0·04 mm where no hooks are present.

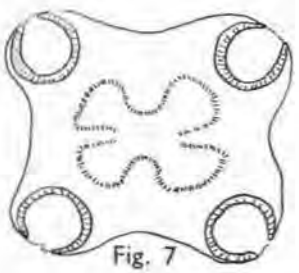

Fig. 7

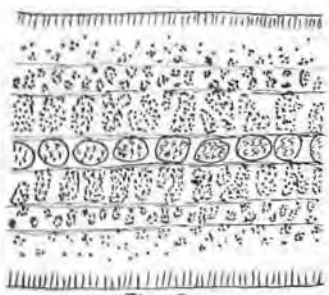

Fig. 8

FIG. 7–8.—*Cotugnia gutterae*. 7. Scolex *en face*, showing arrangement of rostellar hooks. 8. Transverse section of segment showing muscle layers and testes in single sheet.

A very short neck, about 0·18 mm thick follows the head. As in the previous species the musculature is strongly developed; the longitudinal muscles are also arranged in three layers, viz. an outermost layer about 0·11 mm thick of relatively few isolated fibres, a middle layer about 0·05 mm thick arranged in groups of from

10 to 20 fibres each, and an inner layer about 0·14 mm thick. In the inner layer the fibres are aggregated in large groups of from 20 to 75; each group is somewhat columnar in shape. Thin layers of circular muscles separate these layers from each other as well as from the medullary parenchyma. (Fig. 8).

The genital openings on each segment are directed forwards and situated at about the middle of the segment's margin. The mature segments are about 1·7 mm broad, 0·15 mm long and 0·55 mm thick. The muscular cirrus sacs (Fig. 9) are elongate and somewhat pear-shaped, 0·16 to 0·18 mm long and 0·054 to 0·08 mm thick; these do not reach the excretory canals and are situated almost wholly in the lappet or collar portion of the segment. The cirrus is unarmed and when not extruded the vas deferens forms a few coils within the cirrus sac; no vesicula seminalis interna is present. The vas deferens after emerging from the sac, forms a few conspicuous dorso-ventral coils in the medullary parenchyma on the poral side of the excretory canals, and crosses them dorsally. As these coils are somewhat inflated and filled with spermatozoa it can be assumed that they function as an external vesicula seminalis. The testes occupy the whole area across the segment as in *C. transvaalensis* sp. nov. but differ from this species in that they are arranged in a single sheet; they pass beyond the excretory canals, extend laterally as far as the inner margins of the cirrus sacs and are present both anteriorly and posteriorly to the level of these sacs (Fig. 10). They number from about 50 to 60, each with a diameter of about 0·09 mm. In general the vagina, which is only about 0·01 mm long, opens ventrally to the male aperture; occasionally the opening is found dorsally on one side and ventrally on the other. The vagina is followed by a relatively long and inflated receptaculum seminis, which undulates dorsally over the excretory canal and nerve, and then bends backwards to join the somewhat small ovaries. The yolk gland lies ventral to and towards the poral side of the ovary. The uterus soon disappears and each egg is inclosed in its own fibrous capsule. The distribution of the eggs in the ripe barrel-shaped segments, is similar to that found in *C. transvaalensis* sp. nov. Each capsule measures about 0·045 mm; the embryo 0·024 mm. Dorsal excretory canals are absent; the ventral canals, however, are large and may reach a diameter of 0·04 mm; their transverse connections are very prominent.

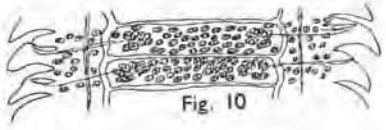

FIG. 9–10.—*Cotugnia gutterae*. 9. Cirrus sac and vagina. 10. Horizontal section of mature segments.

Host: *Guttera edouardi* (Hartlaub).
Location: Intestine.
Locality: Moçambique (Amaramba).
Types: In the Onderstepoort collection.
Donor: Dr. J. A. Travassos Santos Dias.

Specific diagnosis

Davaineidae. Length up to 40 mm; about 800 hooks implanted in form of Maltese cross on the scolex; hooks 0·01 to 0·012 mm long. Segments broader than long, except hindmost, ripe segments which are barrel-shaped and longer than broad. Longitudinal muscles well developed, in three layers; innermost layer consists of large bundles each containing up to 75 fibres. About 50–60 testes in single horizontal sheet extending laterally over excretory canals. Cirrus sacs up to 0·018 mm long and pear-shaped, lodged entirely in lappet portion of segment and not reaching exretory ducts. Eggs singly distributed in capsules which fill whole segments and penetrate between longitudinal muscles. Dorsal excretory canals absent, ventral canals large.

Discussion

This species is very similar to *C. transvaalensis* sp. nov. in its size and general body shape, distribution of longitudinal muscles, penetration of egg capsules between the muscle bundles, and absence of dorsal excretory canals. They differ, however, in the shape of the rostellum, number and size of rostellar hooks and manner in which they are implanted, and in that the testes in *Cotugnia gutterae* sp. nov. form a single horizontal layer.

In *C. crassa* Fuhrmann 1909, the rostellar hooks measure 0·011 to 0·013 mm long, and number from 250 to 300. According to Fuhrmann's figure, however, they are arranged in a circular crown. The body musculature is strongly developed; the testes number 150 to 200 embedded three to four deep in the medullary parenchyma; the yolk glands are lateral and lie between the ovary and excretory canals and not immediately behind the ovary. Fuhrmann does not mention the excretory system, but in his figure of a transverse section there is a large ventral but no dorsal canal. It is thus inferred that a dorsal excretory canal system is absent in *C. crassa*. Fuhrmann's species agrees with the present species in that the testes form a continuous band across the segment passing laterally over the excretory canals, and egg capsules are also present between the muscle bundles in mature segments. The number and size of the hooks and their mode of implantation differentiate *C. gutterae* from *C. transvaalensis* and *C. meleagridis*.

The main characteristics of the four species of *Cotugnia* described from guinea-fowl are summarised in Table 1.

TABLE 1.—*The main characteristics of four* Cotugnia *spp. described from guinea-fowl*

Item	*C. crassa*	*C. meleagridis*	*C. transvaalensis*	*C. gutterae*
Number of hooks.....	250–300	550	500–620	About 800
Size of hooks.....	0·011–0·013*	0·015–0·017	0·015–0·018	0·01–0·012
Shape rostellum.....	Round	Oval	Oval	Round
Number of testes.....	150–300	42–48	Over 100	50–60
Arrangement testes....	3–4 deep	Single layer	2–3 deep	Single layer
Length cirrus sac.....	0·16	0·25–0·3	0·21–0·28	0·16–0·18
Muscles.....	At least 3 layers	1 layer	3 layers	3 layers
Egg capsules.....	Enter muscles	?	Enter muscles	Enter muscles

*All measurements in mm

Raillietina (Raillietina) steinhardti Baer, 1925

Several complete worms recovered from crested guinea-fowls are classified under the above species notwithstanding that they differ in several respects from the single specimen on which Baer based his description. The chief differences in the characteristics as noted by Baer and in the present specimens are briefly indicated in Table 2. In the Onderstepoort material well extended, complete worms, carrying ripe segments vary in length from 65 to 135 mm with a maximum breadth of 1·6 to 1·9 mm. The head varies in thickness from 0·142 to 0·24 mm, but in one of the specimens the head with its rostellum everted and without hooks on its rostellum or suckers, has a thickness of 0·3 mm. The four oval suckers, about 0·09 mm broad and 0·12 mm long, are heavily armed with about 15 rows of prominent spines, the largest of which reaches a length of 0·012 mm. The rostellum is retracted in most instances and has a transverse diameter of 0·06 to 0·078 mm. Two circles of typical hammer-shaped hooks are present at its base, their number is estimated at about 160. Two of the heads have been squashed and as a result the rostellar hooks are detached and lie flat. The length of these hooks varies from 0·01 to 0·012 mm whereas hooks *in situ* on cleared heads appear to have a maximum length of only 0·008 mm. The larger measurements can be taken to represent their normal size.

The head is followed by a neck, 0·9 to 1·2 mm long and from 0·1 to 0·18 mm thick. Well extended, mature segments are almost square, being from 0·58 to 0·6 mm long by 0·6 to 0·63 mm broad. In a slightly shrunken specimen the mature segments are twice as broad as long, being 0·3 mm long and 0·64 mm broad. The unilateral genital pores are centrally placed or immediately posterior of the centre of the lateral margin. A short genital sinus, about 0·045 mm deep, leads to the openings of the genital ducts. The lobed ovary is centrally placed and is surrounded laterally and posteriorly by the testes (Fig. 11); it is about 0·18 mm long and 0·12 to 0·15 mm broad; a lobulated yolk gland measuring 0·075 by 0·045 mm is situated at its posterior border. A small receptaculum seminis is lodged in the centre of the ovary; from it the vagina curves outwards to open immediately posterior to the male genital opening; its terminal portion, for about 0·1 mm, is thick-walled and has a diameter of about 0·024 mm. In general the testes form a single horizontal layer round the lateral and posterior margins of the ovary extending forwards to immediately beyond its anterior level on the aporal side. In six stained and mounted complete specimens their number is found to vary from 25 to 32 and all are confined to the area between the excretory canals. The cirrus sac has a very characteristic structure, being markedly muscular and thick-walled throughout its whole length and not thin along its inner curvature as in *R. (R.) pintneri* (Klaptocz) and its variety *R. (R.) p. polyorchis* Baer (Fig. 12). It is somewhat pear-shaped, varies in length from 0·126 to 0·18 mm with a maximum diameter of 0·07 to 0·09 mm; in the centre its musculature is thickened, thus constricting its cavity and giving it a somewhat hourglass-shape; here the wall reaches a thickness of 0·03 mm, whereas the rest of the wall including the inner curvature is 0·025 mm thick; it does not reach the excretory vessels. An internal vesicular seminalis is apparently absent. No fully extruded cirri were seen, but those partially everted are 0·06 mm long and 0·007 mm thick, their ends being slightly swollen; they appear to be unarmed. The genital ducts pass over the nerve between the excretory canals. The ventral excretory canals are relatively large and attain a diameter of 0·03 to 0·06 mm, while the dorsal vessels are only 0·005 to 0·009 mm thick. The latter are easily seen in the anterior segments in *in toto* mounts; their presence is difficult to see in older and ripe segments but can be followed in some specimens. Both pairs of canals are united by transverse vessels.

Ripe segments are slightly longer than broad and may become barrel-shaped; they measure from 1·5 to 1·7 mm long by 1·1 to 1·3 mm broad. Each segment carries from 23 to 34 egg capsules which extend over the excretory canals; each capsule encloses from 15 to 30 eggs. The embryos measure 0·01 mm.

Fig. 11

Fig. 12

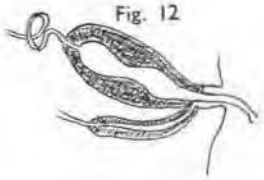

FIG. 11–12.—*Raillietina* (*R.*) *steinhardti*. 11. Mature segments. 12. Cirrus sac and vagina.

Host: *Guttera edouardi* (Hartlaub).
Location: Intestine.
Locality: Northern Rhodesia and Moçambique.
Donors: Drs. P. L. le Roux and J. A. Travassos Santos Dias.

In addition this species was also recovered from *Numidae meleagris* from Kaalplaas, Onderstepoort.

TABLE 2.—*Comparison of characteristics of* R. (R.) steinhardti *as noted by Baer and by Ortlepp*

Item	*R. (R.) steinhardti* (From Baer, 1925)	*R. (R.) steinhardti* (Present observations)
Size	45 × 1·7*	65–135 × 0·6–1·7
Diameter head	0·23	0·142–0·3
Sucker	0·095 × 0·076(a)	0·09 × 0·12
Sucker hooks	Very small	Coarse—up to 0·012 long
Rostellum	0·076(a)	0·06–0·078
Rost. hooks	160, 0·006–0·007	About 160, 0·01–0·12
Vent. Ex. C.	Diam. 0·32	Diam. 0·03–0·06
Dorsal Ex. C.	Diam. 0·011	Diam. 0·005–0·009
Testes	About 20	25–32
Distribution testes	Lat. & post. of ovary	Lat. & post. of ovary
Cirrus sac	0·15–0·17 × 0·06	0·126–0·18 × 0·07–0·09
Musculature sac	0·0076 thick(b)	0·025–0·03 thick
Cirrus	Armed—0·03 thick	Smooth—0·007 thick
Vagina	?	Terminal portion muscular
Ovary	Lobed, central	Lobed, central
Yolk gland	Central, behind ovary	Central, behind ovary
Egg capsules	Over 40, according to figure	23–34
Dist. egg. cap.	Do not extend over exc. canals; confined to anterior portions of segment	Extend beyond exc. canals; distributed over whole segment

*All measurements in mm

(*a*) Baer gives ten times these sizes which figures must be a misprint

(*b*) As Baer states " Sa paroi est trés musculeuse " this figure is probably incorrect

Discussion

From the above description and Table 2 it can be seen that the significant differences between the two sets of specimens concern the size of the rostellar hooks, number of testes, thickness of musculature of cirrus sac, nature of the cirrus and distribution of the egg capsules. The difference in size of the hooks is probably due to their positioning when measured. As Baer had only a single worm at his disposal his measurements are probably based on hooks *in situ*, whereas the present measurements are based on detached hooks which are lying flat. The difference in the number of testes can be explained as due to species variation, although in the Onderstepoort specimens there are never less than 25. No explanation can be offered for the difference in structure of the cirrus sac and cirrus, nor for the differences in the number and in the distribution of the egg capsules; in all the specimens examined the capsules, even in their earliest development, tend to extend over the whole segment and beyond the excretory canals. However, it is considered that the differences are outweighed by the presence of a highly muscular cirrus sac in both sets of specimens, by the absence in both of a small pouch near the terminal portion of the cirrus, as described and figured by Fuhrmann (1909) for *R.* (*R.*) *pintneri* (Klaptocz) and by the distribution of the testes round the lateral and posterior margin of the ovary. The size of the hooks (0·0096 to 0·0112 mm) and the number of testes (25 to 30) appear to ally *R.* (*R.*) *pintneri* var. *polyorchis* Baer, 1925, with the present specimens; the anatomy of this variety, according to Baer (1925b) is identical with that of *R.* (*R.*) *pintneri* except for the size of the rostellar hooks and the number of testes. As Baer (1925a) figures the testes of this latter species as being absent behind the ovary, it is legitimate to assume that they are also absent from this area in his variety; also the weak muscular structure of the cirrus sac and presence of a small sac in the cirrus must be common to both for the same reason. These differences thus serve to differentiate the present material from Baer's variety.

R. (*R.*) *tetragona* (Molin, 1858) differs from the *R.* (*R.*) *steinhardti* in that it possesses only about 100 smaller rostellar hooks arranged in an apparently single circle, the genital ducts pass dorsally over the excretory canals and the number of egg capsules in each segment varies from 50 to 100, each of which carries only 6 to 12 eggs.

R. (*R.*) *tetragonoides* Baer, 1925, is very similar to *R.* (*R.*) *tetragona* except that it carries more hooks (160 to 180) in two circles and the number of testes does not exceed 20 for each segment.

Raillietina (Raillietina) pintneri (Klaptocz, 1906)

The original description of this species is not available; this identification is based on the data given by Furhmann (1909a), Joyeux (1923), Baer (1925a) and the fuller description provided by Neveu Lemaire (1936). The Onderstepoort material, however, does not agree in all respects with the description given by these authors.

Superficially the Onderstepoort specimens of this species resemble *R.* (*R.*) *steinhardti* although in general it may be stated to be slightly more slender. Complete worms may reach a length of 60 mm with a maximum breadth of 1·5 mm. The suckers are well armed, the spines reaching a maximum length of 0·01 mm. Two circles of small hammer-shaped hooks encircle the base of the rostellum; they are from 0·006 to 0·007 mm long; their precise number was not determined but it is estimated that they number about 200. Mature segments are much broader

than long, their breadth varying from 0·9 to 1·5 mm and their length from 0·24 to 0·26 mm. The unilateral genital pores are situated towards the anterior quarter of the segment, and give access to a small genital sinus about 0·05 mm deep. The rounded testes number from 15 to 45 for each segment; they are generally arranged in two groups, a poral group of five to seven and an aporal group of from 12 to 35. Sometimes the two groups are united by two or three testes in a row behind the ovary; they form two layers which are limited laterally by the excretory canals. The cirrus sac is pear-shaped, from 0·144 to 0·18 mm long by 0·072 to 0·09 mm in maximum thickness; its outer wall is provided with a weak musculature and is nowhere thicker than 0·004 mm (Fig. 13). Fuhrmann (1909) figures it as having a thicker wall in its poral half, whereas aporally its wall is very thin. This weak structure of the cirrus sac is in marked contradistinction to that found in *R.* (*R.*) *steinhardti* where the musculature reaches a thickness of 0·03 mm. The unarmed cirrus does not carry a small posterior pouch towards the terminal portion of its canal—a feature to which Fuhrmann (1909) drew special attention. After leaving the cirrus, the vas deferens is slightly convoluted in the cirrus sac and its inner portion becomes much swollen and filled with sperm thus functioning as an internal vesicula seminalis; after leaving the sac it becomes much coiled, these coils extending more than half-way across the segment in front of the testes. The centrally placed and slightly lobulated ovary occupies the anterior portion of the segment; the area immediately behind the ovary is occupied by the yolk gland. The female aperture is located immediately posterior to that of the male. Porally the vagina is slightly thickened and muscular and it takes a deep stain. The vagina and the vas deferens pass inwards between the excretory ducts. The uterus extends across the segments; it soon breaks down, the contained eggs becoming enclosed in fibrous capsules in groups of about 10 to 15 eggs each. These capsules, 22 to 32 in each segment, eventually fill the whole segment extending laterally over the excretory canals. In the material from the crested guinea-fowl from Northern Rhodesia, however, there are only from 18 to 25 capsules in each segment and in ripe segments they do not extend beyond the outer limits of the excretory canals.

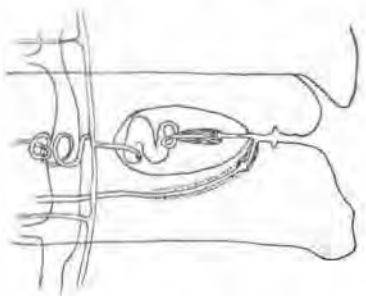

FIG. 13.—*Raillietina* (*R.*) *pintneri*. Cirrus sac and poral organs.

The usual two pairs of longitudinal excretory canals are present, the ventral ones are fairly large and reach a diameter of 0·036 mm, whereas the dorsal, although easily seen, are only 0·006 to 0·008 mm across. A thinner transverse canal unites the two dorsal ducts in each segment.

Comparing the present findings with those of Fuhrmann (1909a) and Baer (1925a) one notes that Fuhrmann stated that 30 to 40 testes are present in each segment. He does not mention their distribution; neither does Baer, but his figure of a mature segment shows only 15 testes arranged in two groups and none connecting

the two groups behind the ovary. Neveu Lemaire (1936) gives their number as 13 to 24. One thus concludes that their arrangement is as in the Onderstepoort material and that there is a considerable range of variation in their number. Baer also figures the vas deferens as heavily coiled anterior to the testes as in the present material; in addition the number and size of the rostellar hooks are about the same in both sets of specimens.

Hosts: *Guttera edouardi* (Hartlaub).
Numida meleagris Linnaeus.

Location: Intestine.

Locality: Northern Rhodesia (*Guttera*).
Moçambique (*Guttera*).
Republic of South Africa [Pretoria, Potchefstroom
Zoutpansberg (*Numida*)].
Swaziland (*Numida*).

Raillietina (Raillietina) angusta sp. nov.

This species is represented by several fragments collected from crowned guinea-fowl from Kaalplaas, Onderstepoort. Its narrow strobila readily differentiates it from the other species of this subgenus. The largest fragment is about 100 mm long, the total body length probably does not exceed 200 mm. Ripe segments are less than a millimetre broad. In a number of fragments the segments are somewhat rounded and these fragments give the appearance of a row of small beads. Only two heads were recovered with sufficient of the strobila attached to identify to species level; these heads measure 0·3 and 0·27 mm across; they are somewhat rounded and each carries four slightly oval suckers which measure 0·15 mm long by 0·09 to 0·12 mm across; most of the armature have been lost, but a sufficient number of hooklets remain on some of the suckers to show that they are relatively small and arranged in several rows. The rostellum is retracted in both heads and measures 0·075 mm across; each carries about 200 small hammer-shaped hooks, about 0·009 mm long and arranged in two circles. The neck is relatively broad and measures 0·2 and 0·24 mm across in the two specimens. In most instances the mature segments are broader than long; where the strobila has undergone some stretching, these segments are slightly longer than broad; apparently normal, mature segments are from 0·675 to 0·75 mm broad and 0·38 to 0·45 mm long; in stretched segments these measurements are 0·45 and 0·48 mm respectively. The unilateral genital openings are situated immediately anterior to the middle of the segment's margin; a genital sinus is absent, the male and female aperture being practically flush with the surface. The pear-shaped cirrus sac is from 0·15 to 0·18 mm long and 0·045 to 0·05 mm thick; it extends obliquely forwards. In stretched segments it reaches the excretory vessels but this does not happen as a rule. Its musculature is well developed, but by no means as well as in *R.* (*R.*) *steinhardti*; the maximum thickness at about the middle reaches 0·015 mm and at its inner curvature this thickness diminishes to about 0·009 mm. The cirrus is comparatively massive and in many mature segments it is inserted into the adjacent vagina; at its base it is 0·03 mm thick and its still inverted lumen is lined with small spikes. The vas deferens is thrown into several loops before emerging from the cirrus sac; after emerging it makes a few small loops in its course obliquely forwards towards the centre of the segment; here it makes a number of large antero-posterior loops. The testes from 18 to 24 in number are arranged in a semicircle round the lateral and posterior margins of the centrally placed ovary; aporally they extend forwards,

to almost the anterior level of the vas deferens; porally they are present only as far as the hind margin of the vagina; in depth they form two or three layers. They mature before the ovary. The vagina opens immediately behind the apertures of the cirrus sac; its outer extremity is thickened and muscular for a distance of 0·1 mm; the rest of the vagina passes inwards in an arc and terminates in the centre of the ovary as a small oval receptaculum seminis. The ovary has equal lobes on each side of the midline. The vitellarium is also centrally placed immediately behind the ovary and anterior to the posterior row of testes. The uterus is soon replaced by 30 to 40 egg capsules in each segment; when ripe each capsule contains about 25 eggs. These capsules fill the whole segment; it looks as if they do not extend beyond the excretory canals but that they push these outwards so that they come in contact with the lateral body wall.

The ventral excretory canals are relatively thin and only about 0·003 to 0·005 mm in diameter; in some segments they suddenly swell out and may reach a diameter of 0·03 mm. The minute dorsal canals can only be made out with difficulty. The genital canals pass inwards, apparently between the dorsal and ventral canals and over the nerve trunk.

Host: *Numida meleagris* Linnaeus.
Location: Intestine.
Locality: Kaalplaas, Onderstepoort.
Types: In Onderstepoort collection.

Specific Diagnosis

Davaineidae. Slender thin worms probably not longer than 200 mm with a maximum thickness of one millimetre. Head up to 0·3 mm broad. Rostellar hooks about 200 in two ranges, each hook about 0·009 mm long. Suckers armed. Genital pores open level with surface. Cirrus sac up to 0·18 mm long, moderately muscular. Testes lateral and posterior to central ovary, 18 to 24 in number. Thirty to forty egg capsules in each ripe segment, each capsule with about 25 eggs.

Discussion

The chief characters which serve to differentiate this from other species of *Raillietina* from guinea-fowl are its slender strobila, moderately developed musculature of the cirrus sac and the arrangement of its testes lateral and posterior to the ovary; the last two characteristics ally this species with *R.* (*R.*) *steinhardti* but the marked difference in length and thickness of its strobila and the moderate development of the musculature of its cirrus sac easily differentiate it from *R.* (*R.*) *steinhardti*.

Raillietina (Paroniella) numida (Fuhrmann, 1912)

This species is represented by four lots of specimens, two from the Cape Province and two from the Transvaal. In addition some specimens identified as *R.* (*P.*) *magninumida* Jones, 1930, presented to this Institute by the United States Bureau of Animal Industry, are also available. All were collected from the crowned guinea-fowl.

In the Onderstepoort material these small cestodes reach a maximum length of 35 mm with a posterior breadth of a little under 1 mm. Fuhrmann's (1912) specimens are shorter, whereas Hudson (1934) found his specimens reached a length of 100 mm. Jones (1930) gives the length as 100 to 150 mm; her specimens were

also broader, attaining a breadth of 1·3 mm. The strobila in this species easily become abnormally stretched with the result that the segments are elongate. Normally the segments, except for the posterior ones, are broader than long; in the various worms examined the hindmost segment containing eggs, vary in length from 0·7 to 1·05 mm with a breadth of 0·65 to 0·95 mm.

The chief characteristics found by the various workers are indicated in Table 3.

TABLE 3.—*The characteristics of* Raillietina (Paroniella) numida *as recorded by Fuhrmann, Jones, Hudson and Ortlepp*

Item	Fuhrmann	Jones	Hudson	Ortlepp
Size	20 × 0·24*	150 × 1·3	100 × 0·8	35 × 1·0
Head	0·16	0·21	—	0·12–0·21
Sucker	0·045	0·06	—	0·06–0·072 × 0·54–0·06
Rostellum	0·08	—	—	0·065–0·09
Rost. hooks	160–180	150–160	—	160–200
Size hooks	0·009–0·01	0·008–0·01	—	0·01–0·012
Cirrus sac	0·14–0·16	0·35	—	0·15–0·165
Hooklets of cirrus	0·009	0·024	—	0·015
Testes	7–10	13–18	9–18	7–10

*All measurements in mm

The testes never number more than 10 in the Onderstepoort material, whereas in the United States material the number reaches 18. The average number is 7 or 8. Except in the greater number of testes and in the larger cirrus sacs, Jones' specimens agree with the Onderstepoort specimens. Since Hudson, 1934, also found as many as 18 testes in his specimens from Uganda, he relegated Jones' 1930 specimens to synonomy with *R.* (*P.*) *numida*; this synonymity is supported by the present findings.

Hosts: *Numida meleagris* Linnaeus.

Localities: Cape Province (Grahamstown and Lady Grey).
Transvaal (Pretoria and Onderstepoort).

Porogynia paronai (Moniez, 1892) Raill. & Henry, 1909.

This fairly large and characteristic cestode of guinea-fowls was first described under the name *Taenia paronai* by Moniez. In 1901 Fuhrmann had at his disposal a cestode without its head which he considered unknown; he described it under the name *Linstowia lata*; later (1908) when he was able to examine specimens with heads he found that the scolex was armed with typical davaineid hooks arranged in three series; it thus belonged to the family Davaineidae and not to the Anoplocephalidae and he placed it in a new genus and renamed it *Polycoelia lata*. As this generic name had already been used by King (1840) for a coelenterate, Railliet and Henry (1909) created the genus *Porogynia* for its reception. They also showed that this species was the same *Taenia paronai* of Moniez.

The material at the disposal of the above workers originated from North African hosts. In 1934 Baylis examined cestodes from Uganda; among these were two

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specimens which he considered new and described as *Raillietina* (*Paroniella*) *woodlandi*. A study of this description has convinced the writer that his specimens are co-specific with those of Moniez and that his name must thus be considered synonymous to that of Moniez.

The present study is based on many mature and immature specimens of this species from various regions of Southern Africa; this abundant material allows of a study of its variations, especially those applying to the arrangement of its rostellar hooks.

Fuhrmann (1932) characterised the genus *Porogynia* as: davaineids armed with three crowns of rostellar hooks, segments generally broader than long, musculature strongly developed, dorsal excretory vessels absent and ventrals very large, genital pores unilateral, female glands very poral in position with yolk gland aporal of ovary, testes arranged in a single layer internal of female glands and eggs lodged singly in parenchymatous capsules.

Many of the Onderstepoort specimens are unfortunately much shrunken and twisted. The length of the largest complete specimens is nearly 20 cm with a maximum breadth in the anterior third of about 7 mm. [Fuhrmann (1901) gave the size as 240 by 10 mm and 400 by 4·5 mm and Baylis (1934) as 270 by 6·5 mm]. The posterior half of complete worms becomes much attenuated and tail-like, the breadth diminishes to less than 1 mm at the posterior end. The anterior mature segments are much broader than long, being only about 0·28 mm long, whereas in the hindmost the breadth only slightly exceeds the length being 1·5 to 1·6 mm broad by about 1·0 mm long. In Fuhrmann's specimens the hindmost segments are slightly longer.

Practically all the scolices have retracted rostella; in these the scolex has a breadth of 0·5 to 0·66 mm; Fuhrmann gives its size as 0·45 and 0·58 mm and Baylis as 0·7 mm. The four unarmed, oval suckers measure 0·15 to 0·18 mm long and 0·135 to 0·145 mm across. The retracted rostella measures 0·21 to 0·24 mm across in optical section at the level of the hooks. In a scolex (Fig. 14) with extruded rostellum the measurements are: scolex 0·52 mm across, suckers 0·162 by 0·138 mm, rostellum 0·228 mm broad and 0·18 mm long. Several retracted scolices were halved transversely, cleared and mounted with their anterior faces upwards under slight pressure in either gum arabic, polyvinyl alcohol or canada balsam; a few heads were teased to break up the rostella and release the hooks. On these rostella the hooks number from 163 to 204; Baylis estimates their number as not less than 240; they are relatively large and typically hammer-shaped (Fig. 14B). They vary in length from 0·054 to 0·066 mm. The hammer and claw measure 0·033 to 0·035 mm across and the claw about 0·012 mm. The arrangement of the hooks shows considerable variations; on most rostella they are all regularly arranged in two circles. In others, however, portions only of the rostellum carry two distinct circles, whereas on the other portions three circles can be seen (Plate I). In two instances portions of the rostellum in one head have three to four circles; in the other head four or five series can be seen. Of 11 heads thus examined *en face* seven have two regular circles each, two have two to three each, one has three to four and one has three to five series (Fig. 14C). The basic arrangement thus appears to be two series. Since the hooks are large and the space they occupy is limited, some of them especially those of the anterior circle, are pushed forward and thrust out of alignment giving the impression of more than two series. It is a remarkable coincidence that such careful observers as Baylis and Fuhrmann should independently have had at their disposal only specimens with three circles of hooks.

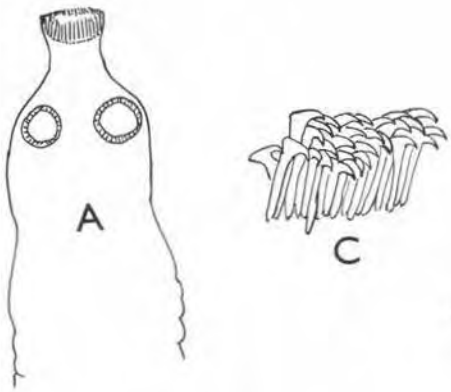
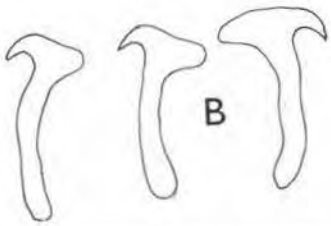


FIG. 14.—*Porogynia paronai*. A. Scolex with extruded rostellum. B. Rostellar hooks. C. Rostellar hooks in 3 to 5 ranges.



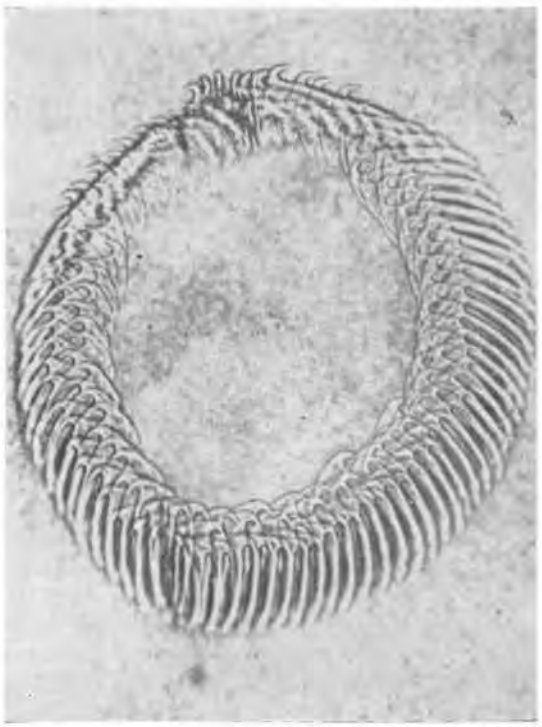


PLATE I.—*Porogynia paronai*. Arrangement of rostellar hooks chiefly in two ranges.

There is nothing special to add to the descriptions of the anatomy of the mature and ripe segments given by Fuhrmann (1902) and by Baylis (1934), except that in some of the present specimens the testes extend over the aporal excretory vessels and almost reach the large nerve chord which lies about midway between the edge of the segment and the excretory canal.

In Table 4 a summary is given of findings of the different observers.

TABLE 4.—*Summary of the findings of the different observers*

Item	Fuhrmann	Baylis	Woodland	Ortlepp
Size	200–400 × 4·5–6*	270 × 6·5	50 × 3·7	200 × 7
Ripe segment	2·4 × 1·7	—	—	1·0 × 1·6
Scolex	0·45–0·58	0·7	0·81	0·52–0·66
Rostellum	0·18	0·27	0·23	0·21–0·24
Suckers	0·16–0·2	0·16–0·17	0·166	0·15–0·18
Hooks	Large No.; 3 series	240; 3 series	80	163–204, 2 series gen.
	0·044–0·056	0·054–0·066	0·06	0·054–0·066
Muscles	Strong, inner bundles large	As under Fuhrman	As under Fuhrman	As under Fuhrman
Bundles	About 500 fibres	—	50–80 fibres	40–90 fibres
D. Ex. c.	Absent	Absent	Absent	Absent
V. Ex. c.	Large	Large	Large	Large
Nerve	Large	Large	Large	Large
G. pores	Unilateral	Unilateral	Mostly unil.	Unilateral
C. sac	0·45	0·2–0·24	0·19	0·21–0·24
Testes	?	Not less than 150	Over 100	About 150–200
	?	1 layer deep	2–3 layers deep	2–3 layers deep
	?	Bet. exc. canals	Bet. exc. canals	May pass over aporal exc. c.
Ovary	Markedly poral	Markedly poral	Markedly poral	Markedly poral
Yolk gl.	Aporal of ovary	Aporal of ovary	Aporal of ovary	Aporal of ozary
Eggs	0·036	0·032–0·04	—	0·036–0·042
Hex. hooks	—	0·018–0·02	—	0·018–0·021

*All measurements in mm

Hosts: *Guttera edouardi* (Hartlaub).
Mazabuku, N. Rhodesia.
Numida meleagris Linnaeus.
Pienaars River, Transvaal.
Zoutpansberg, Transvaal.
Motali, Transvaal.
Grahamstown, Cape Province.
Hoopstad, Orange Free State.
Kroonstad, Orange Free State.
Big Bend, Swaziland.

Raillietina (Skrjabinia) deweti Ortlepp, 1938

Ortlepp (1938) described this species from material recovered from a crowned guinea-fowl from Lady Grey, Cape Province. Since this description this species has not again been recovered. There is thus nothing to add to the published description.

Ascometra numida (Fuhrmann, 1909) Baer, 1955

This very common parasite of guinea-fowl is present in almost all the collections at Onderstepoort; these were made from widely separated areas of Southern Africa. It has also been reported from various areas in North and Central Africa. In most cases this species was collected from crowned guinea-fowls, but one lot of worms originiated from a crested guinea-fowl from Northern Rhodesia. The study of these specimens shows considerable variations in morphology. The head thickness varies from 0·39 to 0·54 mm and the oblong suckers from 0·18 to 0·26 mm long by 0·16 to 0·24 mm broad. In some worms the sucker lappets are very conspicuous, whereas in others they are recognised only with difficulty. Complete, mature worms vary in length from 37 to 90 mm and maximum breadth from 1·0 to 2·0 mm. A striking variation is in the size of the cirrus sacs; the shortest sacs are found in the specimens from the crested guinea-fowl and in the specimens collected from crowned guinea-fowls in the Pretoria district and at Kaalplaas, Onderstepoort. In these worms the sacs vary in length from 0·24 to 0·33 mm i.e. these measurements agree with those given by Baer (1955) for *A. gutterae* (Baylis, 1914), but the heads are much smaller than the sizes given by Baer for this species, namely 0·6 to 0·7 mm. In the present specimens the largest head measures 0·54 mm across, the majority of heads being smaller; i.e. 0·4 to 0·48 mm; these sizes are more in agreement with Baer's figures for *A. numida* viz. 0·5 to 0·53 mm. The length of the suckers in the present specimens, viz. 0·21 to 0·26 mm are also more in agreement with Baer's and Fuhrmann's (1909) measurements, viz. 0·2 and 0·21 mm respectively for Fuhrmann's species. The specimens from the other crowned guinea-fowls have cirrus sacs which vary in length from 0·33 to 0·66 mm and the head thickness is from 0·39 to 0·6 mm. The spatial arrangement of the testes in Onderstepoort specimens is very similar and conforms to the figures given by Fuhrmann for his species and by Baer for both species viz. *A. numida* and *A. gutterae*, i.e. no testes extend transversely across the segment in front of the genital ducts. Baylis (1914) in the description of *Octopetalum gutterae* = *Ascometra gutterae*, wrote that they occupied " practically the whole of the space in all directions which is not taken up by the ducts and female organs ", and in his Figure 2 the testes are shown as encircling these organs except for a narrow poral passage through which the genital ducts pass. Baer (1955 Fig. 9 and 10) shows the testes as absent across the segment anterior to these ducts for both his *A. numida* and *A. gutterae*, notwithstanding that in his text for *A. gutterae* he wrote that they surround the female glands as in *A. vestita* Cholodkovsky, 1913. In his Figure 6 for this species he shows the testes as present across the segment anterior to the ovary and vas deferens, as also featured in Baylis (Figure 2) for his species. Further Baylis states that the coils of the vas deferens pass over the excretory vessel to enter the cirrus sac which is immediately lateral to the excretory duct, i.e. the cirrus sac does not cross the excretory vessel. This condition is figured in his drawing (Fig. 2) where the cirrus sac is shown as not passing inwards beyond this vessel. Baylis' species, *A. gutterae*, is thus characterised by the presence of testes round the ovary except for a poral passage and the cirrus sacs do not cross the excretory canal. Baer's (1955) descriptions and figures do not satisfy these criteria; his Figures 9 and 10 for *A. gutterae* and *A. numida* respectively are very similar except that in the latter figure the cirrus sac is longer and extends inwards as far as the middle of the segment. In both figures no testes are shown across the segment anterior to the vas deferens and in both the cirrus sacs cross the excretory canals. In view of the variations in length of the cirrus sacs noted in the present study, it can be concluded that Baer did not have representatives of both species at his disposal and that his descriptions are based on variants of the same species, viz. *A. numida*.

The comparative study of the abundant material from many sources leads to the conviction that all the Onderstepoort specimens are referable to the same species, viz. *A. numida* (Fuhrmann, 1909). Further that in this species the size of the worms and length of the cirrus sacs are subject to considerable variation, that the spatial arrangement of the testes is constant, none being present anterior of the coils of the vas deferens and finally that Baylis studied a rare species which has not again been recovered in Africa. Baylis' species shows a resemblance to *A. vestita* Cholodkowsky, in that in both these species the testes practically surround the ovary and the cirrus sac does not cross the excretory canal; they differ from one another, however, in that fewer testes, about 50 to 60, are present in *A. gulterae* as against 200 to 250 in *A. vestita*.

In the diagnosis of the genus *Ascometra* Baer (1955) states that the genital ducts pass dorsally over the excretory canals and nerve. In the present specimens these canals pass dorsally over the nerve, but between the dorsal and ventral canals.

Hosts: *Guttera edouardi* (Hartlaub).
Mazabuku, N. Rhodesia.
Mkuzi Game Reserve, Natal.
Numida meleagris Linnaeus.
Pretoria Zoo, Transvaal.
Pretoria District, Transvaal.
Rietvlei, Pretoria, Transvaal.
Kaalplaas, Onderstepoort, Transvaal.
Zoutpansberg, Transvaal.
Potchefstroom, Transvaal.
Motali, N.E. Transvaal.
Hoopstad, Orange Free State.
Albany, Cape Province.
Fish River, Cape Province.
Big Bend, Swaziland.
South West Africa.

HYMENOLEPIDIDAE

Hispaniolepis multiuncinata sp. nov.

One complete specimen, six specimens complete except for their scolices and many fragments of this very delicate and membranous cestode in one batch, and many fragments among which were ten with scolices entwined with other cestodes collected from crested guinea-fowls, were submitted for identification. The one complete specimen is 66 mm long and the other six varied from 60 to nearly 100 mm in length; their maximum breadth, excluding their appendages, is 0·8 to 0·9 mm.

The heads have their rostella fully extruded (Fig. 15A); they are 0·16 mm wide and 0·12 mm long; the four rounded, unarmed suckers have a diameter of 0·06 mm. The rostella are oval in shape with a length of 0·06 mm and a maximum breadth of 0·048 mm; they are connected to the head by a stalk about 0·02 mm thick. A striking feature is the manner in which the rostellar hooks are implanted which is quite different from that found in other members of this family. They are arranged in four or five circles covering the central half of the rostellum, the anterior and posterior portions being devoid of armature. About 70 hooks are present, giving an average of about 14 for each circle; the hooks have the shape of a primitive bone fish-hook of which the shaft is embedded in the rostellum, the barb

being free (Fig. 15B); the length is about 0·007 mm and the shaft is slightly flattened transversely. The oval rostellar sac in the head is 0·075 mm long and 0·06 mm across.

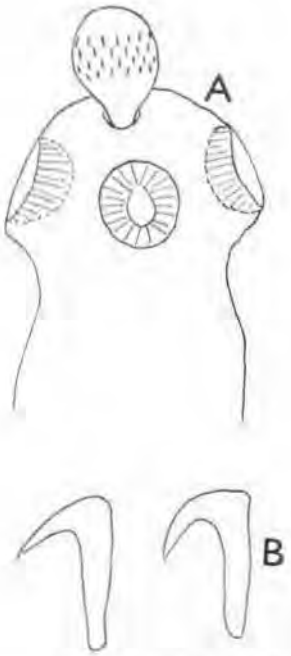


FIG. 15.—*Hispaniolepis multiuncinata*. A. Scolex with extruded rostellum, showing arrangement of hooks. B. Rostellar hooks.

A relatively long neck follows the head; this portion, up to the first signs of segmentation, is about 3·5 mm long; it increases in breadth from about 0·06 mm behind the head to 0·12 mm. About 1·5 mm behind the head the first signs of a developing appendage on the left side of each segment can be seen; these appendages increase in length towards the posterior end of the worm. In mature segments their length is about 0·15 mm, and in ripe segments 0·45 to 0·53 mm. The first signs of developing genitalia appear about 4·5 mm behind the head, where the segments are about 0·14 mm broad; when the segments attain a breadth of 0·4 mm they are mature. Here the segments are from 0·06 to 0·08 mm long. Ripe segments filled with mature eggs have a length 0·12 to 0·15 mm.

The unilateral and highly muscular cirrus sac (Fig. 16C) is oval to almost tubular in shape; it varies in length from 0·09 mm to 0·16 mm, with a breadth of from 0·018 to 0·042 mm; the change from oval to tubular takes place gradually from the front to the rear. It extends inwards as far as the ventral excretory canals which it overlies but does not extend further inwards. The cirrus canal is wavy to straight depending on the length of the cirrus sac; no vesicula seminalis interna is present. After emerging from the sac the vas deferens forms a single loop, and then widens to form a large transverse external vesicula seminalis, about 0·09 mm long and 0·03 mm thick. Three rounded testes are arranged in a row towards the posterior border of each segment (Fig. 16A); they are about 0·036 mm in diameter and two are poral and one aporal in position. Between these two groups the bilobed ovary develops with a slightly oval yolk gland, measuring 0·018 to 0·036 by 0·012 to 0·03 mm towards its posterior and ventral aporal corner. It develops

to maturity only after the maturation of the testes. In segments in which it appears to be fully functional the testes consist of only an outer membrane enclosing a few cellular elements. An oval receptaculum seminis 0·06 mm broad by 0·03 mm long can be seen. The vagina is very weakly developed and extends outwards immediately behind the cirrus sac and opens into the genital sinus ventral to the cirrus sac. The uterus develops as a transverse sac which passes over the excretory canals on the poral side and extends posterior to the cirrus sac; on the aporal side it is limited by the excretory ducts; in ripe segments (Fig. 16B) it fills the whole segment except for a clear strip on the aporal side external to the excretory ducts. Mature eggs are large and round; the external covering has a diameter of 0·06 0·07 mm, the intermediate covering measures about 0·036 mm across and the embryo measures 0·018 to 0·02 mm. The hexacanth hooks are small and inconspicuous and attain a length of only 0·007 mm.

The excretory system consists of the usual two pairs of longitudinal canals united by a ring canal at the base of the rostellar sac. In a portion of the strobila the dorsal canal is outside the ventral on the poral side and its diameter only 0·002 mm; it passes under the cirrus sac at about the level of its internal third. Aporally it is situated internally to the ventral canal and has almost the same diameter (about 0·01 to 0·015 mm as against a diameter of 0·018 to 0·021 mm for the ventral canal). The ventral canals are not regularly connected by transverse canals at the base of each segment. These connections in a portion of strobila embracing 50 segments are separated by the following number of segments: 2, 6, 0, 1, 1, 5, 6, 9, 0, 4, 2 and 2. The dorsal canals are connected by transverse canals at much greater intervals. The genital canals pass dorsally over the excretory ducts.

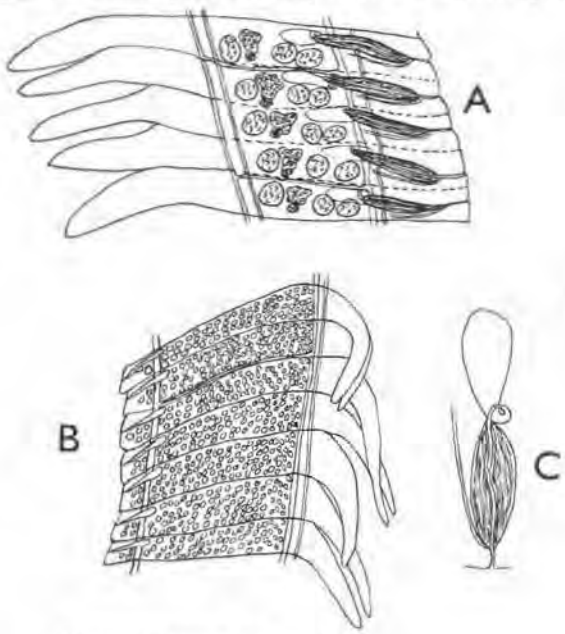


FIG. 16.—*Hispaniolepis multiuncinata*. A. Mature segments. B. Ripe segments. C. Cirrus sac.

Host: *Guttera edouardi*.
Location: Intestine.
Locality: Northern Rhodesia (Mazabuka).
Type: In Onderstepoort collection.
Donor: Dr. P. L. le Roux.

Discussion

Yamaguti (1959) placed hymenolepid cestodes provided with antiporal appendages into two genera viz. *Hispaniolepidoides* n. gen. and *Hispaniolepis* Lopez-Neyra, 1942. In the former genus the cirrus sac is small and two testes are antiporal, whereas in the latter the cirrus sac is large and two testes are poral in position. The present specimens belong to the second genus. Yamaguti further subdivided this genus into two subgenera, *Hispaniolepis* with wrench-shaped rostellar hooks, and *Otidilepis* with wedge-shaped hooks. According to Wolffhügel (1900), who studied the type of this genus, viz. *Hymenolepis villosa* Bloch, the rostellum carries 14 wrench-shaped hooks, 0·03 mm long, apparently in a single circle. Hilmy (1936) examined large numbers of Meggitt's (1927) closely related species, *H. falsata*, and stated that 20 hooks, 0·036 mm long, were present. Unfortunately he did not describe their shape or mention how they were arranged; neither did Meggitt (1927) state how they were implanted, but in his figures the hook is wrench-shaped. In the present specimens the arrangement of the hooks and their shape are totally different from that in the species mentioned above. In Hilmy's publication cestodes devoid of scolices collected from a crowned guinea-fowl are provisionally identified as *Hym. tetracis* Cholodkowsky, the type species of Yamaguti's subgenus *Otidilepis*. From Yamaguti's publication it appears that this material was regarded as distinct by Skrjabin & Mathevossian (1942) and renamed *Hym. hilmyi*. Yamaguti transferred it to the genus *Hispaniolepis*. In addition Yamaguti lists the crowned guinea-fowl as a host of *H. fedtschenkowi* (Solowiow, 1911) from Ethiopia. A description of this species is not available, but Hilmy tabulates a few characteristics among which the number of hooks is given as 14 and their size as 0·011 mm. Because of these two characteristics the specimens under study cannot belong to *H. fedtschenkowi*. The question now arises whether Hilmy's and the present specimens are co-specific. Their heads and armature can unfortunately not be compared, a scolex in Hilmy's specimens being absent. The general anatomy of the mature and ripe segments in the two sets of specimens, however, appear to be very similar. Judging from Hilmy's figures there are several differences, viz. the outer poral testes lie behind the inner half of the cirrus sac in Hilmy's material and internal to the cirrus sac in the material under study; further it would appear as if the poral testes in Hilmy's material and the cirrus sac extend beyond the ventral excretory canal, which they do not do in the present specimens; only in those segments where the cirrus sac is long and tubular does it just pass over the ventral excretory canal. In Hilmy's material the eggs measure 0·033 mm and the embryo 0·016 mm as against the present measurements of 0·06 to 0·07 mm and 0·018 to 0·02 mm respectively. Because of these slight differences, but especially the armature of the rostellum it is deemed advisable to create a new species for its reception rather than identify it with Hilmy's species.

Specific Diagnosis

Hymenolepididae. Delicate membranous cestodes with unilateral appendages on segments; rostellum armed with about 70 hooks arranged in about five circles; hooks appear to be shaped like a primitive bone fish-hook. Cirrus sac oval to tubular, 0·09 to 0·16 mm long, and generally not crossing ventral excretory canal. Testes in poral group of two and aporal of one with ovary between groups. Uterus saccular, extending behind cirrus sac porally and as far as excretory canals aporally. Ventral excretory canals not regularly united by transverse canals behind each segment; dorsal excretory canals with occasional transverse canals. Eggs large, 0·06 to 0·07 mm in diameter.

Summary

The various cestode species from guinea-fowls in the collection at Onderstepoort have been studied. The following species are either described or discussed: *Davainea nana* Fuhrmann, 1912, *Cotugnia transvaalensis* sp. nov., *Cotugnia gutterae* sp. nov., *Raillietina (Raill.) steinhardti* Baer, 1925, *R. (R.) pintneri* (Klaptocz, 1906), *R. (R.) angusta* sp. nov., *R. (Paroniella) numida* Fuhrmann, 1912, *R. (Skrjabinia) deweti* Ortlepp, 1938, *Porogynia paronai* (Moniez, 1892), *Ascometra numida* Fuhrmann, 1909, and *Hispaniolepis multiuncinata* sp. nov.

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