

A NEW CESTODE FROM AN AFRICAN BUSTARD.

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Among the collections of the Smithsonian African expedition, 1909-10, there are some specimens of tapeworms collected July 4, 1909, from the lower intestine of a bustard, *Neotis caffra* (Lichtenstein), by Mr. J. Alden Loring, at N'garri, Narok River, British East Africa (original number 233). These specimens, about a dozen in number, are in a poor state of preservation. Notwithstanding their poor condition it has been possible to establish certain facts relative to their morphology which show that they belong to a species of the family Davaineidæ hitherto undescribed. Furthermore, the worms are not only of a new species but on account of several characteristics not in accord with any genus heretofore recognized, they also represent a new genus, for which the name *Sphyroncotænia* (σφύρα, a hammer; ὄγκος, a hook) is proposed. To the species is given the name *Sphyroncotænia uncinata*.

Genus SPHYRONCOTÆNIA Ransom, 1911.

GENERIC DIAGNOSIS.—Superfamily Tænioidea, family Davaineidæ, subfamily Idiogeninæ: Rostellum armed with numerous hammer-shaped hooks arranged in 10 to 12 rows. Suckers unarmed. Cortical parenchyma and longitudinal musculature greatly developed, with numerous muscle bundles. Genital pores unilateral. Genital canals pass ventral of the longitudinal excretory vessel and nerve. Testicles numerous. Female glands on the pore side of the median line. Eggs in uterus become more or less isolated by ingrowths of the uterine wall. A para-uterine organ is present in gravid segments in front of the uterus. Adults in birds.

Type-species.—*Sphyroncotænia uncinata* Ransom, 1911.

SPHYRONCOTÆNIA UNCINATA Ransom, 1911.

SPECIFIC DIAGNOSIS.—*Sphyroncotænia* (type): Length, 22 to 37 cm.; breadth at middle of strobila, 1 to 2 mm.; breadth at posterior end, 2 to 3 mm.; maximum breadth, 3.5 to 4 mm. at a point 1 to 4

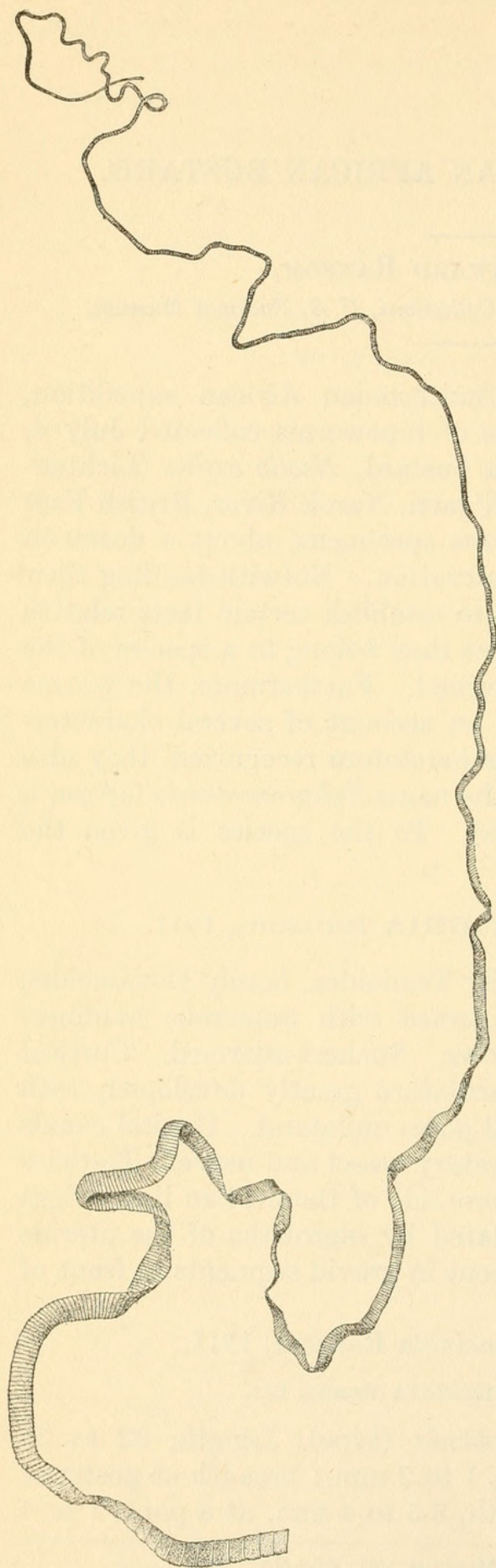


FIG. 1.—SPHYRUNCOTENIA UNCINATA. ENTIRE WORM.
NATURAL SIZE.

cm. from the posterior end (alcoholic material). Segments several hundred in number, broader than long except at the posterior end of the strobila where they may be slightly longer than broad. (Fig. 4.) Head (fig. 2), 400 to 450 μ broad by 280 to 300 μ long. Suckers unarmed, 175 to 200 μ in diameter. Rostellum simple, truncate conical in shape, 150 to 175 μ long by 190 to 200 μ broad at its base, armed with numerous hammer-shaped hooks (fig. 3), 25 to 30 μ long, arranged in 10 to 12 rows. Retracted rostellum lies within a cavity whose inner surface is lined with an armature of very numerous short spines, which evidently form a spiny zone back of the rostellum when the latter is protracted. Unsegmented neck region practically nil. Just back of the head the breadth of the strobila is slightly less than that of the head, varying with the state of contraction. Posterior borders of each segment, except in the posterior region of the strobila, overlap the succeeding segment nearly half way. Genital pores unilateral. (Fig. 4, *g. p.*) The genital pore in younger segments is located in the lateral margin just posterior of the edge of the posterior border of the preceding segment. In gravid segments (fig. 4) the posterior borders overlap the succeeding segments but slightly, and the genital pore is located a short

distance posterior of the middle of the lateral margin of the segment. (Fig. 4, *g. p.*) The cortical parenchyma and longitudinal musculature are well developed, in sexually mature segments comprising two-thirds of the thickness of the strobila. (Fig. 5.) Transverse musculature well developed (fig. 5, *t. m.*) Lateral longitudinal nerves prominent. (Figs. 5, 6, *l. n.*). Ventral excretory vessels (figs. 4, 5, *ex.*) large, located a considerable distance from the edge of the strobila, and connected by a transverse commissure in the posterior portion of each segment. Dorsal excretory vessels absent or so much reduced in size as to be no longer apparent in sexually mature segments. Genital canals (fig. 5) pass ventral of the excretory vessel and nerve.

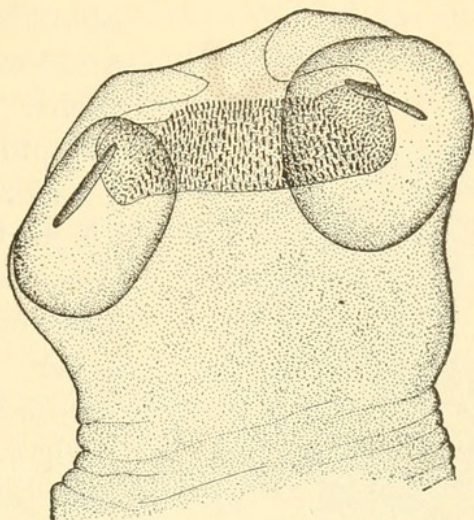


FIG. 2.—SPHYRONCOTÆNIA UNCINATA. HEAD, CONSIDERABLY FLATTENED BY PRESSURE. ENLARGED.

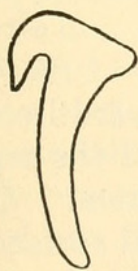


FIG. 3.—SPHYRONCOTÆNIA UNCINATA. HOOK FROM ROSTELLUM. ENLARGED.

Male reproductive organs.—Testicles (fig. 5, *t.*) numerous (over 80), confined to the median portion of the medullary parenchyma; the mass of testicles, extending from the transverse excretory vessel forward nearly to the anterior limits of the segment, is dorsal in portion except posteriorly where it occupies the ventral as well as the dorsal portion of the medullary parenchyma. Vas deferens (fig. 5, *v. d.*) forms a mass of coils on the median side of the ventral longitudinal excretory vessel a short distance in front of the plane of the genital pore, then passes outward and backward on the ventral side of the excretory vessel and enters the base of the cirrus pouch. (Figs. 5, 6, *c. p.*) Cirrus pouch elongated, pyriform, about 250 μ long. Cirrus when evaginated measures about 50 μ in diameter, armed with numerous curved spines 10 to 12 μ long. Cirrus pouch opens into the bottom of a deep genital cloaca which measures 150 μ or more in depth.

Female reproductive organs.—Vagina (figs. 5, 6, *vag.*) opens into the bottom of the genital cloaca ventral and posterior of the cirrus pouch, passing in a nearly straight course on the ventral side of the ventral longitudinal excretory vessel and on the posterior side of the mass of coils of the vas deferens. Near its inner end, the vagina is enlarged to form the seminal receptacle (fig. 5, *sem. rec.*), oval in shape, situated originally on the median side of the mass of coils of the vas deferens,

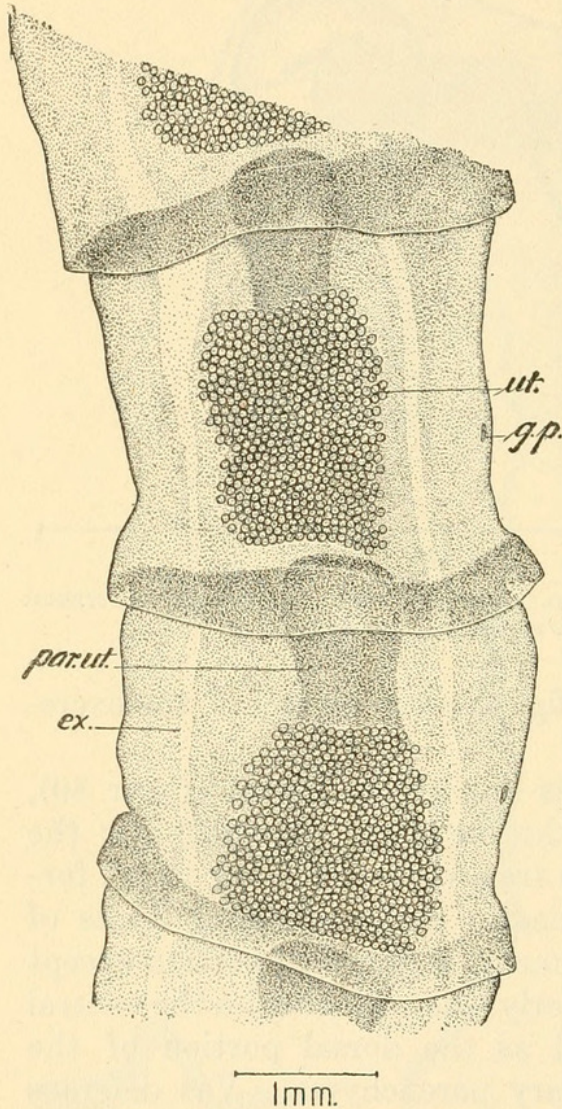


FIG. 4.—SPHYRONCOTENIA UNCINATA. GRAVID SEGMENTS FROM POSTERIOR PORTION OF STROBILA. *ex.*, EXCRETORY VESSEL; *g. p.*, GENITAL PORE; *par. ut.*, PARA-UTERINE ORGAN; *ut.*, UTERUS. ENLARGED.

about midway between the dorsal and ventral surfaces of the segment. At the height of its development the seminal receptacle measures $125\ \mu$ or more in length. In gravid segments it is pushed dorsalward by the uterus against the ventral surface of the dorsal layer of transverse muscles. Mediad from the seminal receptacle the vagina is prolonged for a distance of 40 or $50\ \mu$, and at its termination joins the oviduct.

The ovary (fig. 5, *ov.*) is located ventrally in the medullary portion of the segment on the median side of the coils of the vas deferens, and extends a variable distance toward or beyond the median line of the segment. The oviduct passes from the ovary in a diagonal direction laterally (i. e., toward the pore side of the segment) and dorsally and after joining the inner end of the vagina, continues in an inward (i. e. toward the median line of the segment) and dorsal direction. Curving around the ventral surface of the shell gland (fig. 5, *s. g.*) it enters the

latter on its median side. The shell gland measures about $150\ \mu$ in diameter and is situated in the dorsal portion of the medullary parenchyma, near the seminal receptacle, dorsal of the latter and nearer the median line of the segment. Shortly before or after entering the shell gland the oviduct is joined by the yolk duct. After passing through the shell gland the oviduct runs in the ventral direction and presumably joins the uterus. The yolk gland (fig. 5, *y. g.*) is a rounded body about $100\ \mu$ in diameter situated in

about the same frontal and horizontal planes as the seminal receptacle, and about half way between the latter and the median line. The uterus (fig. 5, *ut.*) develops on the dorsal side of the ovary. When fully developed the uterus (fig. 4, *ut.*) occupies most of the medullary portion of the segment in the posterior half, extending laterally almost to the longitudinal excretory vessels. Numerous infoldings or proliferations from the wall of the uterus penetrate among and surround the eggs in such a manner that they appear in some cases to be inclosed in separate chambers. In the anterior portion of the segment the medullary parenchyma becomes modified to form a para-uterine organ (fig. 4, *par. ut.*), which laterally extends a variable distance on each side toward the longitudinal excretory

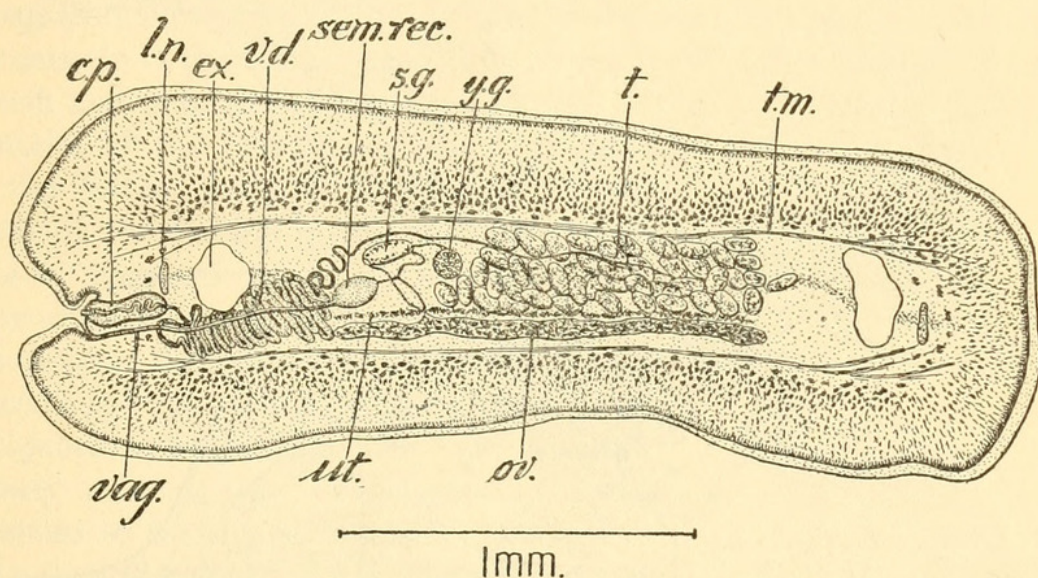


FIG. 5.—SPHYRONCOTENIA UNCINATA. TRANSVERSE SECTION OF SEXUALLY MATURE SEGMENT. *c. p.*, CIRRUS POUCH; *ex.*, EXCRETORY VESSEL; *l. n.*, LATERAL LONGITUDINAL NERVE; *ov.*, OVARY; *sem. rec.*, SEMINAL RECEPTACLE; *s. g.*, SHELL GLAND; *t.*, TESTICLES; *t. m.*, TRANSVERSE MUSCLES; *ut.*, PRIMORDIUM OF UTERUS; *vag.*, VAGINA; *v. d.*, VAS DEFERENS; *y. g.*, YOLK GLAND. ENLARGED.

vessels and antero-posteriorly from the anterior limits of the uterus to the anterior end of the segment. The tissue of the para-uterine organ contains numerous calcareous corpuscles. Whether the para-uterine organ is functional to the extent that the eggs are finally pressed into it from the uterus and become encapsuled by it, is uncertain, as this condition does not obtain in any of the specimens examined. The eggs (fig. 7) are round or oval with thin shells, at least two in number, an outer shell measuring 70 by 40 μ to 80 by 55 μ in diameter, and an inner shell, measuring 45 by 35 μ to 64 by 40 μ in diameter, thinner than the outer shell, and closely investing the oncosphere. The hooks of the oncosphere measure 25 to 30 μ in length.

Host.—*Neotis caffra* (Lichtenstein).

Location.—Lower intestine.

Locality collected.—British East Africa.

Type-specimens.—United States National Museum, Helminthological collections, No. 7319, collected by Mr. J. Alden Loring, July 4, 1909, at N'garri, Narok River.

As to the taxonomic position of *Sphyrnocoetænia uncinata*, the presence of hammer-shaped hooks on the rostellum is a character which by itself may be considered sufficient to establish the species in the family Davaineidæ, although heretofore no species of this family has been known which possesses more than three rows of hooks on the rostellum. Of the three subfamilies of the Davaineidæ, Ophryocotylinæ is excluded from consideration on account of differences in the

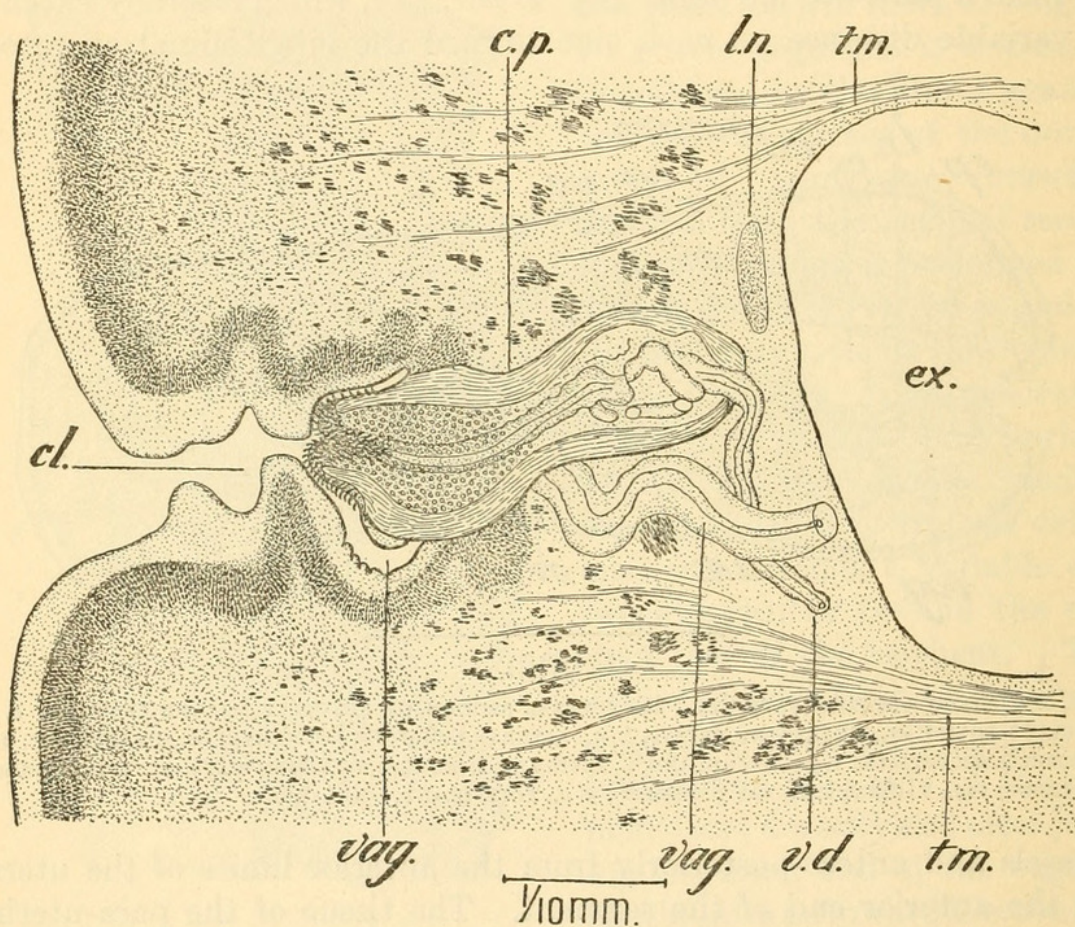
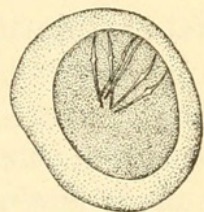


FIG. 6.—SPHYRNOCOTÆNIA UNCINATA. TRANSVERSE SECTION THROUGH GENITAL PORE, CIRRUS POUCH, AND NEIGHBORING STRUCTURES. *cl.*, GENITAL CLOACA; *c. p.*, CIRRUS POUCH; *ex.*, EXCRETORY VESSEL; *l. n.*, LATERAL LONGITUDINAL NERVE; *t. m.*, TRANSVERSE MUSCLES; *vag.*, VAGINA; *v. d.*, VAS DEFERENS. ENLARGED.

rostellum, and the absence of para-uterine organs. The subfamily Davaineinæ is also excluded on account of the absence of para-uterine organs. The third subfamily, Idiogeninæ, is characterized especially by the presence of a single set of reproductive organs in each segment, a sac-like uterus more or less lobed or much branched which is not persistent and from which the eggs finally pass into a para-uterine organ. *Sphyrnocoetænia uncinata* possesses all of these characters and may therefore be placed in the subfamily Idiogeninæ. Two genera have heretofore been recognized in this subfamily, namely the type genus, *Idiogenes* Krabbe, 1868, and *Chapmania* Monticelli, 1893.

In the former genus four species are known—*Idiogenes otidis*¹ Krabbe, 1868, which is the type of the genus, *Idiogenes flagellum*² (Goeze, 1782) Kholodkovski, 1905, *Idiogenes grandiporus* Kholodkovski, 1905, and *Idiogenes horridus* Fuhrmann, 1908.

In certain respects *Sphyrnecotænia uncinata* resembles the genus *Idiogenes*. The hammer-shaped rostellar hooks, the unilaterality of the genital pores, and the presence of a para-uterine organ are characters common to both. Distinct differences, however, are seen in the arrangement of the hooks on the rostellum (10 or 12 rows in the one case and 2 rows in the other), in the comparatively large size of the strobila and the great development of the musculature of *Sphyrnecotænia uncinata* and the small size of the strobila and weak development of the musculature of *Idiogenes*, in the small size of the cirrus pouch relative to the size of the segment and absence of retractor muscle in the former case and the relatively large size of the cirrus pouch and presence of retractor muscle in the latter, in the numerous testicles of the former and the few testicles of the latter, and in the distinct displacement of the female glands toward the pore side of the segment in *Sphyrnecotænia uncinata* and their practically median position in *Idiogenes*. Although the resemblances between *Sphyrnecotænia uncinata* and the genus *Idiogenes* indicate that they are somewhat closely related, they exhibit too many differences to be placed together generically.



1/10 mm.

FIG. 7.—SPHYRNECOTÆNIA UNCINATA. EGG. ENLARGED.

In the other genus of Idiogeninæ mentioned above two species have been recognized, namely, *Chapmania tauricollis*³ (Chapman, 1876) Monticelli, 1893, which is the type species of *Chapmania* and *Chapmania tapika*⁴ Clerc, 1906.

Sphyrnecotænia uncinata resembles the genus *Chapmania* in a number of characters, as follows: It is a comparatively large species, with well-developed cortical parenchyma and musculature. It has rostellar hooks of similar shape. The genital pores are unilateral, as in the type species of *Chapmania*. The cirrus pouch does not extend inward beyond the limits of the cortical parenchyma. The vas deferens is without seminal vesicle and is much convoluted. The

¹ Kowalewski (1906, 683–686) and Fuhrmann (1908, 49) consider *Idiogenes otidis* and *I. grandiporus* to be identical but Kholodkovski (1905; 1906) and Clerc (1906, 724) hold to the view that two distinct species may be recognized. Under the circumstances it seems necessary to recognize both species until more certain evidence of their identity can be obtained, the evidence thus far available not being sufficient to prove that the two species are the same.

² Synonyms: *Tænia flagellum* Goeze, 1782; *Halysis flagellum* (Goeze) Zeder, 1803; *Tænia mastigophora* Krabbe, 1879; *Idiogenes mastigophora* (Krabbe) Kholodkovski, 1905; *Davainea* (*Chapmania*) *longicirrhosa* Fuhrmann, 1906.

³ Synonyms: *Tænia tauricollis* Chapman, 1876; *Tænia argentina* Zschokke, 1888; *Davainea tauricollis* (Chapman) Fuhrmann, 1896; *Capsodavainea tauricollis* (Chapman) Fuhrmann, 1901.

⁴ Synonym: *Idiogenes tapika* Clerc, 1906.

testicles are numerous. The eggs become more or less separated from one another by ingrowths from the wall of the uterus.¹ A para-uterine organ develops in front of the uterus and into this the eggs presumably pass and become inclosed in a single egg capsule.

At least one important difference from *Chapmania* is exhibited by *Sphyrnecotænia uncinata*, namely, the arrangement of the hooks on the rostellum in ten to twelve rows. Less important is the lack of hooks on the suckers of *S. uncinata*, which, moreover, may be due simply to their loss in the specimens examined. The lack of a dorsal longitudinal excretory vessel may be only an apparent and not an actual condition. The location of the female glands toward the pore side of the medullary parenchyma though different from the condition in the type species of *Chapmania* is paralleled by the slight displacement in that direction in *C. tapika*. The eggs in *Sphyrnecotænia uncinata* are apparently without parenchymatous or connective tissue envelopes outside the second shell, but it is possible that such envelopes are present, as in *C. tauricollis*, the condition of the material examined being such that this point could not be definitely determined.

As already noted, with regard to the uterus and para-uterine organ *Sphyrnecotænia uncinata* and *Chapmania* are very similar, the resemblance of *S. uncinata* to *C. tapika* being closer than to *C. tauricollis* if Fuhrmann is correct in his statement that in the latter species the uterus breaks down and the eggs become enveloped by parenchymal tissue before they enter the para-uterine organ.

The similarities in the structure of *S. uncinata* and *Chapmania* indicate a relationship between them, but as the former is widely different from the latter in the arrangement of the rostellar hooks, the arrangement of these hooks being given great weight under the present system of classification in the separation of genera throughout the entire superfamily Tænioidea, the necessity of erecting a separate genus for *S. uncinata* is clearly apparent.

Sphyrnecotænia uncinata is much like *Porogynia lata* (Fuhrmann, 1901), the type and only known species of *Porogynia* Railliet and Henry, 1909, though this species is at present classed in a different

¹ In *C. tapika* the cavity of the uterus becomes more or less separated into chambers, which, however, always remain in communication, and contain groups of two to six eggs (Clerc, 1906). According to Fuhrmann (1908) the uterus in the genus *Chapmania* breaks down and the eggs become surrounded by parenchymatous capsules, after which they are pressed into a para-uterine organ which develops in front of the uterus, and in gravid segments, after their release from the strobila, this para-uterine organ transforms into a single large egg capsule. It would seem, however, both from Clerc's (1906) description and Fuhrmann's (1909) description of *C. tapika* that in this species the eggs pass directly from the uterus into the para-uterine organ. It may perhaps be considered an open question whether in *C. tauricollis* the uterus actually breaks down, the eggs then becoming surrounded by envelopes of parenchymatous origin, or whether the uterus as a result of extensive proliferation from its wall becomes more or less divided up into little chambers, the outer envelopes of the eggs then being added as a secretion from or a direct transformation of the ingrowths of the wall of the uterus. If the latter supposition be true, the eggs might apparently be contained in individual capsules, yet all of them still be within the cavity of the uterus, and completely surrounded by its peripheral wall.

subfamily (Davaineinæ) from that in which *S. uncinata* evidently belongs. *Porogynia lata*, according to Fuhrmann (1902; 1908; 1909), is a rather large species, reaching a length of 24 to 40 cm. with a maximum breadth of 6 to 10 mm. The suckers apparently are unarmed. The cortical parenchyma of the strobila is very thick and the musculature greatly developed. Dorsal longitudinal excretory vessels are absent. The genital pores are unilateral. The cirrus pouch does not extend inward as far as the lateral nerve. The vas deferens is much coiled without seminal vesicle. The testicles are numerous. The female glands are not median but are located in the medullary parenchyma toward the pore side of the segment, the ovary near the longitudinal excretory vessel and the yolk gland between the ovary and the median line. In all these characters *Porogynia lata* closely resembles *S. uncinata*. If Fuhrmann be correct in his original opinion (1902) as to the orientation of the segment, there is another important character in which *P. lata* resembles *S. uncinata*, namely, the passing of the sexual canals on the ventral side of the longitudinal excretory vessel and nerve. More recently, however, Fuhrmann (1908, 47) has decided that he was mistaken in his first interpretation, and that the side of the strobila which he originally looked upon as ventral is really the dorsal side. *Porogynia lata* is furthermore somewhat like *S. uncinata* in the possession of more than two rows of hooks on the rostellum. These two species are the only ones in the entire family known to possess more than two rows of rostellar hooks, and might on this account be placed together generically, though *P. lata* possesses only three rows (Fuhrmann, 1908; 1909) whereas *S. uncinata* has 10 to 12 rows. With regard to the uterus *Porogynia lata* presents characters which preclude the generic association of this form with *S. uncinata*, unless the present system of classification is materially modified. The uterus of *Porogynia lata* is described (Fuhrmann, 1902) as having very thin walls which early disappear, the eggs becoming inclosed singly in parenchymatous capsules and occupying the entire medullary portion of the segment. No para-uterine organ is developed and on this account the genus *Porogynia* is excluded from the subfamily Idiogeninæ.

By means of the following key *Sphyrnecotænia uncinata* and the various species of tapeworms which it most closely resembles may be readily distinguished.

KEY TO THE FAMILY DAVAINIIDÆ.

1. Para-uterine organs present in gravid segments.....(Idiogeninæ) 4.
 Para-uterine organs absent.....2.
2. One to three rows of hooks on the rostellum; uterus not persistent, eggs becoming
 inclosed in numerous egg capsules.....(Davaineinæ) 3.
 Two rows of hooks on the rostellum; rostellum very broad; uterus persistent.....Ophryocotylinæ

DAVAINEINÆ.

3. One or two rows of hooks on the rostellum.....Genera *Davainea* and *Cotugnia*.
 Three rows of hooks on the rostellum; cortical parenchyma and musculature greatly developed; genital pores unilateral; dorsal excretory vessels absent; testicles numerous; cirrus pouch 450 μ long, not extending inward as far as the excretory vessels; female glands not median, displaced toward the pore side of the segment; eggs with two or three membranes in addition to an outer parenchymatous envelope; size of strobila 24 to 40 cm. in length by 6 to 10 mm. in maximum breadth; recorded as parasitic in *Numida ptilorhyncha*, Africa.....*Porogynia lata*.

IDIOGENINÆ.

4. Two rows of hooks on the rostellum.....5.
 Ten to twelve rows of hooks (25 to 30 μ long) on the rostellum; retracted rostellum in a cavity whose inner surface is thickly covered with spines; suckers unarmed; cortical parenchyma and musculature greatly developed; dorsal excretory vessels absent or very small; genital pores unilateral; sexual canals pass ventral of ventral excretory vessel and nerve; cirrus pouch about 250 μ long not extending inward as far as the excretory vessel; testicles numerous; female glands displaced laterally toward the pore side of the medullary parenchyma; eggs with two thin shells; para-uterine organ supplied with rather numerous calcareous corpuscles; strobila 20 to 37 cm. long with a maximum breadth of about 4 mm.; recorded as parasitic in *Neotis caffra*, Africa.....*Sphyronecotænia uncinata*.
5. Strobila not over 7 cm. long and not over 2 mm. in maximum breadth; not more than 200 hooks on rostellum; suckers unarmed; cortical parenchyma and musculature weakly developed; genital pores unilateral or arranged in alternate series of 8 to 10 on each side of the strobila; cirrus pouch relatively large, crossing the nerve and excretory vessels and extending far into the medullary portion of the segment, and supplied with a retractor muscle; testicles few (less than 20); female glands practically median; eggs pass from uterus into an anterior para-uterine organ.....(*Idiogenes*) 6.
 Strobila 20 cm. or more in length and over 3 mm. in maximum breadth; more than 300 hooks on rostellum; suckers armed; cortical parenchyma and musculature greatly developed; genital pores unilateral or alternating; cirrus pouch small, compared to the size of the segment, either not crossing the excretory vessels or extending beyond them only slightly; testicles numerous; female glands median or displaced slightly toward the genital pore; eggs pass anteriorly into a para-uterine organ from the uterus either directly or after the disappearance of the uterine wall and the envelopment of the eggs in individual parenchymatous capsules.....(*Chapmania*) 9.

Idiogenes.

6. Genital pores unilateral.....7.
 Genital pores arranged alternately in series of 8 to 10 on each side of the strobila; strobila 15 to 25 mm. long and 0.3 mm. in maximum breadth; genital cloaca small, funnel shaped; testicles 10 to 15 in number; eggs with three thin shells; recorded as parasitic in *Otis tarda*, *Tetrax tetrax*, and *Houbara undulata*.....*Idiogenes otidis*.
7. Rostellar hooks 150 or more in number, about 10 μ long; length of strobila not over 3 cm., maximum breadth not over 0.5 mm.....8.

- Rostellar hooks about 100 in number, 22 to 30 μ long; strobila 6 to 7 cm. long with a maximum breadth of 1.2 mm; genital cloaca very large, spherical, its diameter equal to about one-third the length of the segment; testicles apparently 15 to 20 in number; eggs with three thin shells; recorded as parasitic in *Tetrax tetrax*.....*Idiogenes grandiporus*
8. Testicles 10 to 12 in number; yolk gland directly behind the middle of the ovary; recorded as parasitic in *Milvus milvus*, *Milvus korschun*, and *Milvus melanotis*.....*Idiogenes flagellum*.
- Testicles 7 to 9 in number; yolk gland behind the ovary but displaced toward the pore side of the segment; recorded as parasitic in *Cariama cristata*.
Idiogenes horridus.

Chapmania.

9. Rostellar hooks about 8 μ long; genital pores unilateral; cirrus pouch 0.5 mm. or more in length, supplied with a retractor muscle; testicles about 80 in number; eggs with two thin shells; recorded as parasitic in *Rhea americana*.
Chapmania tauricollis.
- Rostellar hooks 10 to 15 μ long; each sucker bears two conical processes, one on either side of the opening; genital pores irregularly alternating; cirrus pouch 240 to 280 μ long; testicles 200 or more in number; recorded as parasitic in *Tetrax tetrax*.....*Chapmania tapika*.

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