

ON TWO NEW CATENOTAENIA TAPEWORMS FROM A SOUTH AFRICAN  
RAT WITH REMARKS ON THE SPECIES OF THE GENUS

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The materials on which the following observations are based consist of three lots of tapeworms, all collected from the red veld rat, *Rattus (Aethomys) chrysophilus* from different parts of the Transvaal. One rat sacrificed and examined by Mr. P. S. Visser of the Bilharzia Research Unit, Nelspruit, was caught at Kaapmuiden, Eastern Transvaal; it carried a massive infection of tapeworms consisting of about 60 specimens of the species first described below and about a dozen specimens of the second species. The specimens were in an excellent state of preservation and were fully extended. My thanks are due to Mr. Visser for the care taken in the collection and preservation of this material. In addition, the first described species was also collected from the same host but from the Pafuri area of the Kruger National Park by Mr. C. G. Coetzee of the Medical Ecology Centre, South African Department of Health. Mr. D. H. S. Davis, Chief of the same Centre provided me with some live red veld rats from the Roodepoort area; from one of these a single specimen of this species was also obtained. My thanks are also due to these gentlemen for their assistance.

The specimens collected by Mr. Visser, on which the following descriptions are mostly based, were killed and fixed together so that any differences in shape and length of the worms or arrangement of internal organs cannot be due to different methods of killing and fixing. On examination at the laboratory the two species could be easily separated from each other by naked eye examination; the first described species was more opaque and shorter whereas the other was elongate and more transparent.

CATENOTAENIA COMPACTA SP. NOV.

Short stoutish worms reaching a maximum length of 21 mm. by 1·8 mm. broad (Plate 1A). Anterior end cone-shaped with dorsal and ventral longitudinal grooves separating the lateral suckers. Suckers circular 0·2 to 0·3 mm. in diameter. No apical sucker present. Distinct neck absent, first signs of segments evident immediately behind head, represented by rudiments of genitalia; anterior segments much broader than long, increasing in length towards posterior end, and terminal segments much longer than broad. Counting the first genital rudiments as representing segments the strobila consists of six to 13 segments; in 16 worms the number of segments was six in five, seven in three, eight in four and nine, ten, 11 and 13 in one worm each. Mature segments almost square or slightly longer than broad; segments reach maturity at early stage, being mature in the third, fourth or fifth segment from front depending on number of segments in strobila. Genital pore regularly alternating in all worms examined, situated near anterior corner of segment. Ovary large, centrally placed and much branched (Fig. 1A), with few branches on poral side. Yolk gland lobulate, lateral of ovary behind vagina; vagina slightly curved, terminates in a striking vesicle just before entering genital atrium in mature

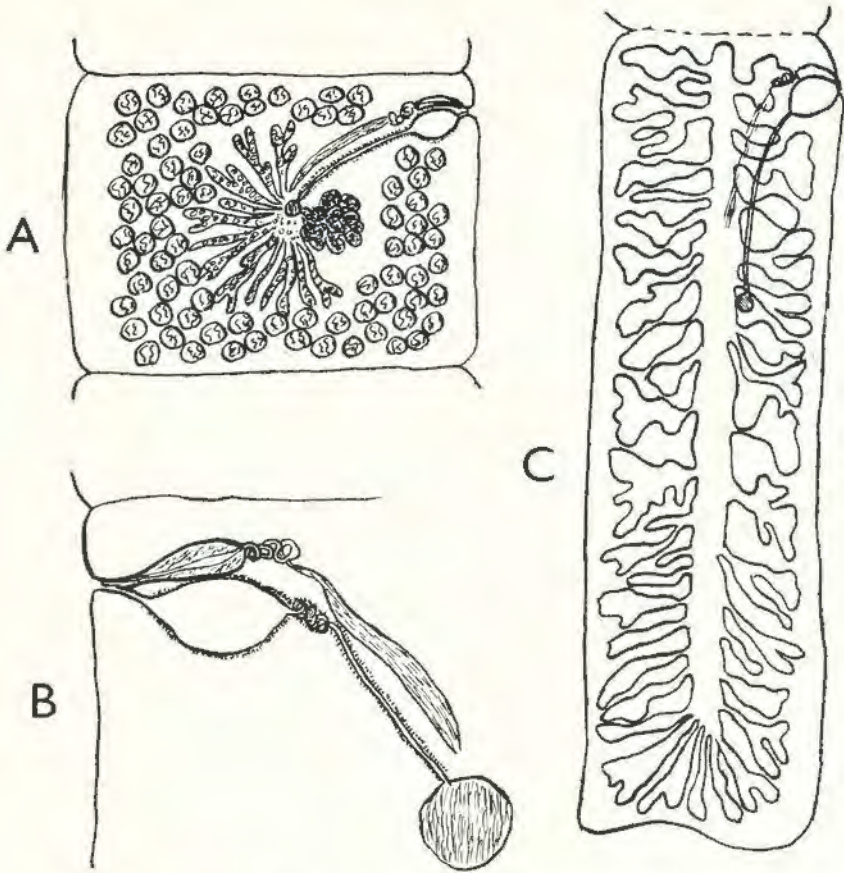


FIG. 1.—*Catenotaenia compacta*, sp. nov.

A = mature segment; B = terminal portions of genital ducts; C = uterus in gravid segment.

and gravid segments; vesicle oval, 0.3 to 0.36 mm. long by 0.18 to 0.28 mm. in diameter and present in all specimens examined (Fig. 1B); makes its first appearance in segment immediately anterior of mature segment. Receptaculum seminis round to oval about 0.12 mm. in diameter. Uterus makes its appearance in segment immediately behind mature segment, consists of longitudinal stem with from 12 to 20 branches on each side (Fig. 1C), each lateral branch may give rise to further smaller terminal branches. In some ripe segments the posterior branches may be elongated backwards. Embryophore small, oval with well defined hyaline shell 0.015 to 0.018 mm. long by 0.010 to 0.012 mm. broad. External envelope thin and of various shapes, often collapsed and drawn out towards one pole of embryophore to form a kind of tail-like appendage, otherwise of irregular shape surrounding embryophore. Hexacanth hooks small, about 0.003 mm. long. In posterior-most gravid segments of some worms no eggs were present, although eggs were present in segment immediately anterior; possibly the eggs are liberated before separation of last segment.



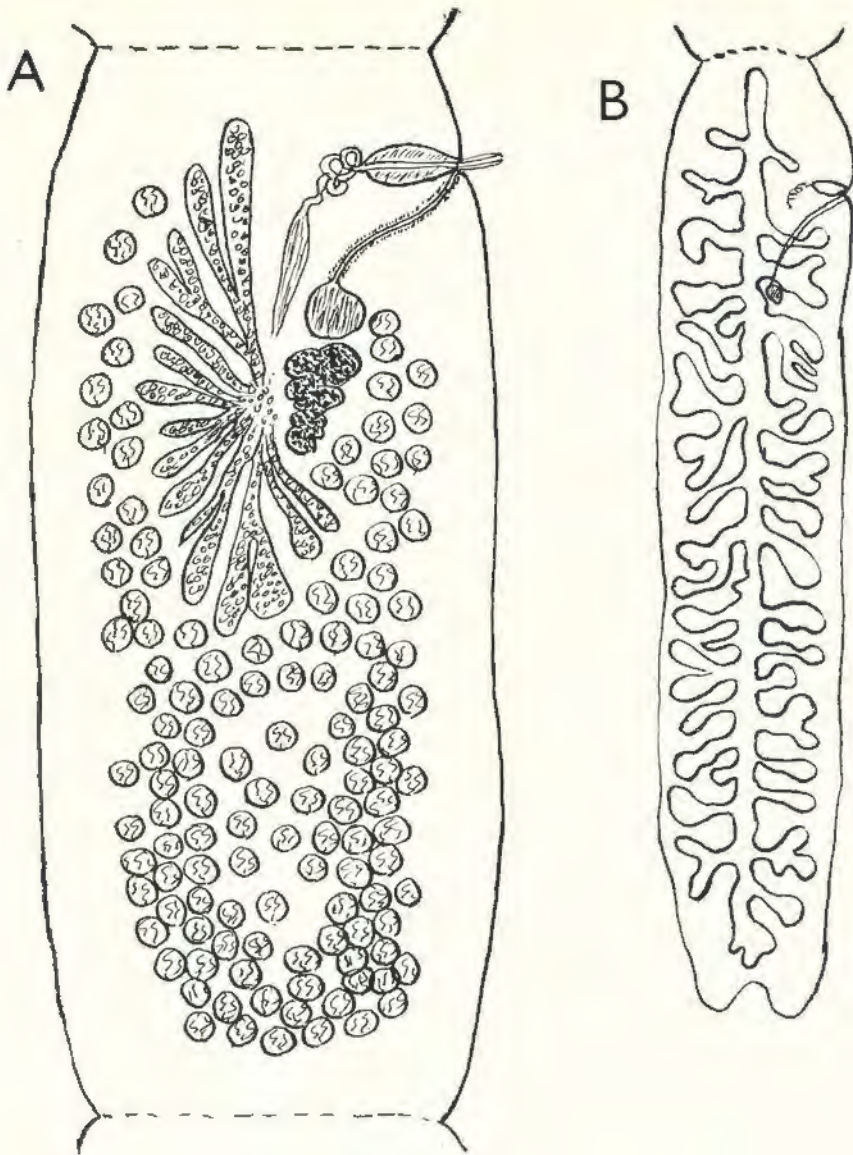


FIG. 2.—*Catenotaenia lucida* sp. nov.

A = mature segment; B = uterus in gravid segment.

Testes encircle female glands and vary in number from about 100 to 180 in each segment; they fill up the whole segment except for area occupied by female glands (Fig. 1A and Plate 1B); when mature they are round, about 0.09 to 0.12 mm. in diameter and arranged in one to two layers in medulla. Cirrus sac elongate, somewhat pear-shaped, 0.27 to 0.3 mm. long by 0.06 to 0.08 mm. in maximum

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thickness. No definite vesicula seminalis interna present, although in some segments the vas deferens is slightly enlarged before entering the cirrus; vas deferens much coiled after leaving cirrus sac and then passes obliquely backwards towards centre of segment as a straight and inflated tube filled with sperms; this portion thus acting as an external vesicula seminalis. Smooth cirrus leaves cirrus pouch just anterior of vaginal opening; about 0.03 mm. thick.



PLATE I.—*Catenotaenia compacta* sp. nov.

A.—Microphotograph of four complete specimens.

Excretory system consists of several anastomosing longitudinal dorsal and ventral canals embedded in the parenchyma mostly at junction of cortex and medulla.

*Host*: *Rattus (Aethomys) chrysophilus* (de Winton, 1897).

*Habitat*: Small intestine.

*Location*: Transvaal (Kaapmuiden, Pafuri and Roodepoort).

*Types*: In Onderstepoort Helminthological Collection.

*Type locality*: Kaapmuiden.



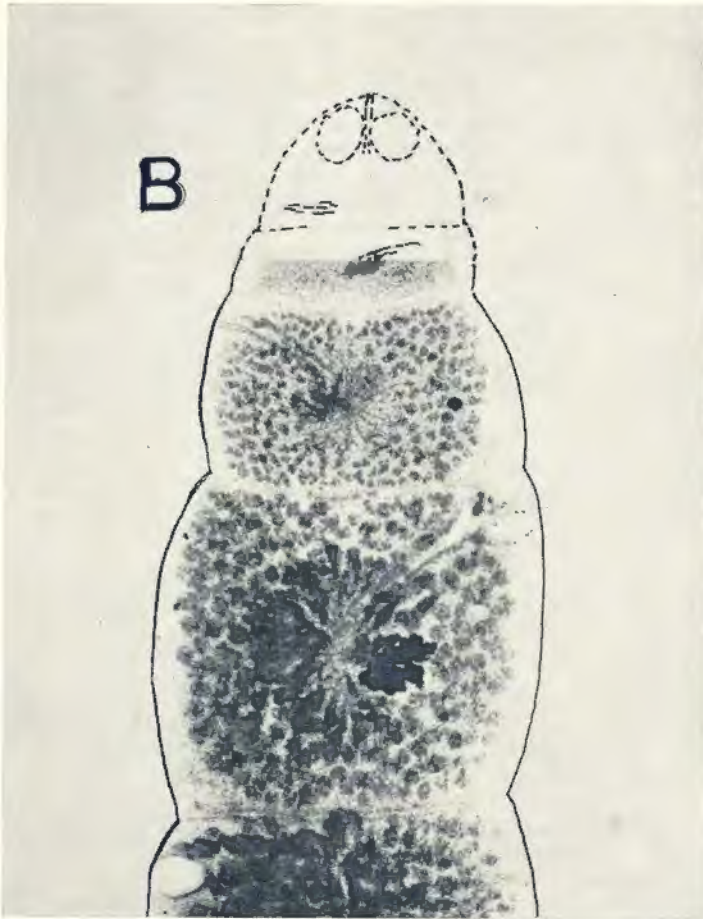


PLATE I.—*Catenotaenia compacta* sp. nov.

B.—Microphotograph of mature segment showing distribution of testes and vaginal vesicle.

*Affinities.*—The reticulated excretory canals relate this species with *C. lobata* Baer, 1927, *C. capensis* Ortlepp, 1940 and *C. elongata* sp. nov. The circumovarian distribution of the testes, regularly alternating genital pores and presence of vaginal vesicle, however, separate it from these species.

CATENOTAENIA LUCIDA SP. NOV.

Elongate, semi-transparent worms up to 45 mm. long by 1.3 mm. broad, carrying up to 18 segments of which 11th to 13th are mature; except for few anterior-most segments all segments longer than broad, mature and ripe segments being cucumber-seed shaped, gravid segments up to 7 mm. long. Suckers circular, 0.12 to 0.14 mm. in diameter; no apical sucker present in 12 heads examined. No distinct neck, segmentation begin immediately after cone-shaped head, represented

by rudiments of genital organs. First segments much broader than long, but these increase rapidly in length posteriorwards and mature segments up to three times as long as broad and gravid segments up to six times. Genital pores irregularly alternating, anteriorly situated in first seventh or eighth of segment length. Ovary centrally placed in anterior half of segment (Fig. 2A) consists of long lobes; yolk gland lobular, lateral of ovary on poral side; vagina extends obliquely forwards from ovary to genital pore and opens behind male aperture in small genital sinus. Receptaculum seminis round, 0.12 to 0.16 mm. in diameter, enlarging posteriorwards. Uterus appears in posterior mature segment, consists of longitudinal stem extending through length of segments with 19 to 22 lateral branches on each side (Fig. 2B); because of elongated narrow mature segments these branches are relatively short and not elongated backwards in the posterior portion of segment as in *C. compacta*. Eggs in mature segments appear immature although hexacanth hooks are discernible; embryophore about 0.015 mm. in diameter and enclosed by thin shell round which a loose and very thin membrane of irregular shape is present. Testes vary in number from about 90 to 200, situated behind and lateral of ovary; may extend forward to level of genital pore on poral side and anterior level of ovary on aporal side. No testes extend across segment anterior of ovary. Where testes are relatively few in number those behind ovary tend to be concentrated in two lateral bands united behind. Mature testes round 0.07 to 0.09 mm. in diameter; cirrus sac elongate and club-shaped, 0.27 to 0.3 mm. long by 0.05 to 0.07 mm. thick, cirrus unarmed and 0.04 mm. thick when extended. Vas deferens makes a few coils in cirrus pouch but no definite vesicula seminalis interna present. Vas deferens coiled after leaving cirrus sac, passes inwards and then obliquely backwards as almost straight and inflated tube filled with sperms, thus serving as external vesicula seminalis.

Excretory system consists of 12 or more longitudinal wavy canals distributed over breadth of segment on both dorsal and ventral sides. In toto mounts no branching was observed but in horizontal sections it was seen that these canals are branched forming a reticular network.

*Host*: *Rattus (Aethomys) chrysophilus* (de Winton 1897).

*Habitat*: Small intestine.

*Locality*: Eastern Transvaal (Kaapmuiden).

*Types*: In Onderstepoort Helminthological Collection.

The branched excretory system relates this species to *C. lobata* Baer, 1927, *C. capensis* Ortlepp, 1940 and *C. compacta* sp. nov.; this last species differs from it for the reasons already stated. It differs from the other two species by its shape and in having elongate cucumber seed-like segments; by the concentrations of its testes behind the ovary and not laterally; by its long uterine stem with relatively short side branches and by its larger cirrus sac.

*Discussion*: With the exclusion of *Catenotaenia symmetrica* Baylis, 1927, which has been correctly referred by Meggitt (1934) to the genus *Oochoristica*, and the inclusion of *Rajotaenia gerbilli* Wertheim, 1954, which, but for a few described differences, conforms to the requirements of the genus *Catenotaenia*, this genus is represented in the literature by 18 species; of these *C. laguri* Smith, 1954 and *C. peromysci* Smith, 1954, are referred to the species *C. dendritica* (Goeze, 1782) by Wolfgang (1956); both Smith (1954) and Schad (1954) showed that *C. linsdalei* MacIntosh, 1941 was also the same as *C. dendritica*; further Fuhrmann & Baer (1943) referred to this species the form described by Yamaguti in 1942 as *C. ris*.



Of the remaining 14 species Yamaguti (1959) lists *C. capensis* Ortlepp, 1940 as a synonym of *C. lobata* Baer, 1925\*; no reasons are given. Unfortunately Ortlepp's original description was based on a single available specimen and since then no additional material for further study has become available from the type host and locality. A close relationship between these two species is admitted, but after a re-examination of the type specimen, the writer considers that for the present the two species must be regarded as distinct for the reasons given in his original description.

From a study of the materials at the writer's disposal and of the available literature the following key is submitted for the determination of these 14 species plus the two described above.

## KEY TO SPECIES OF CATENOTAENIA

- |  |   |
|--|---|
| 1. Short bizarre worms, with not more than six segments; posterior segment much broader than long..... | 2   |
| Body longer, of normal shape, more segments and posterior segments longer than broad.....              | 4   |
| 2. Posterior segment up to ten times as broad as long; strobila of one or two segments only.....       | <i>C. baeri</i> (Lynsdale, 1953).         |
| Posterior segment broad and V-shaped; strobila of four to six segments                                 | 3   |
| 3. Excretory system branched; strobila up to four segments.....  | <i>C. gerbilli</i> (Wertheim, 1954).      |
| Excretory system unbranched; strobila up to six segments.....  | <i>C. aegyptica</i> Wolfgang 1956.        |
| 4. Excretory system branched.....  | 5   |
| Excretory system unbranched.....   | 8   |
| 5. Testes surround ovary; genital pores alternate regularly..  | <i>C. compacta</i> n. sp.                 |
| No testes anterior of ovary; genital pores alternate irregularly.....                                  | 6   |
| 6. Testes lateral of ovary only.....   | <i>C. capensis</i> Ortlepp, 1940.         |
| Testes lateral and behind ovary.....   | 7   |
| 7. Testes mostly lateral of ovary.....   | <i>C. lobata</i> (Baer, 1925).            |
| Testes mostly behind ovary.....  | <i>C. lucida</i> n. sp.                   |
| 8. Vagina large and coiled.....  | 9   |
| Vagina normal and not coiled.....  | 10  |
| 9. Apical sucker present; about 20 × 2 uterine branches.....   | <i>C. chabaudi</i> Dollfus, 1953.         |
| Apical sucker absent; about 40 × 2 uterine branches.....   | <i>C. geosciuri</i> Ortlepp, 1938.        |
| 10. Testes lateral of ovary only.....  | <i>C. oranensis</i> Joyeux & Foley, 1950. |
| Testes behind ovary only.....  | 11  |
| 11. Dorsal excretory canal absent.....   | <i>C. californica</i> , Dowell, 1953.     |
| Dorsal excretory canal present.....  | 12  |
| 12. Cirrus pouch large, 0.32 to 0.49 mm. long....  | <i>C. reggiae</i> Rausch, 1951.           |
| Cirrus pouch smaller, not over 0.3 mm. long.....   | 13  |

\* Dollfus (1953) states that in A. A. Spassky's monograph on Anoplocephaloidea *C. capensis* is considered as a synonym of *C. lobata*. This monograph in Russian is not available to the writer.

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13. Testes numerous, up to 400; 18 to  
 22 × 2 uterine branches..... **C. rhombomydis** Schulz & Landa, 1934.  
 Testes not more than 200..... 14
14. Testes less than 100; uterine branches 9 to 13 × 2... **C. pusilla** (Goeze, 1782).  
 Testes more than 100..... 15
15. Testes up to 140 in two lateral bands, 35 to 45 × 2  
 uterine branches..... **C. dendritica** (Goeze, 1782).  
 Testes up to 200 in compact group;  
 20 to 38 × 2 uterine branches..... **C. cricetorum** (Kirschenblatt, 1949).

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## ADDENDUM

Since writing the above an abstract of a paper by Tenora (1959) has appeared in *Helminthological Abstracts*, XXIX (2), 1960. In this abstract Tenora splits the genus *Catenotaenia* into two genera, namely *Catenotaenia* v. Janicki, 1904 and *Skrjabinotaenia* n.g. on the basis as to whether the uterus has a long or a much abbreviated stem respectively. According to Dollfus (1953) the genus had already been divided into the same two genera by Akhumyan in 1946, the basis being the position of the testes whether they are wholly or mostly behind the female glands and usually not divided into two groups united posteriorly (*Catenotaenia*), or whether they are divided wholly or for the most part into two groups by the female glands (*Skrjabinotaenia* n.g.). In both cases the authors have selected the same type species for their new genus, namely *C. oranensis* Joyeux & Baer. Tenora's genus is thus invalid and becomes a synonym of Akhumyan's genus.

Tenora further subdivides the genus *Catenotaenia* as understood by him into three new subgenera, namely *Catenotaenia* "in which the testes lie at the posterior end of the proglottis behind the other genitalia" (type: ? *C. pusilla*); *Spasskyela* "in which the testes are also found at the sides of the female genitalia" (type: ? *C. lobata*); and *Meggittina* "in which the testes lie in the anterior portion of the segment in front of the ovary and anteriorly may reach to the sides of the segment" (type: *C. baeri*). As Wolfgang (1956) has correctly argued there is no necessity for the subdivision of this genus, neither does the writer accept the further subdivision of the genus into subgenera on the grounds laid down by Tenora. The apparently anterior position of the testes in *C. baeri* is due, as pointed out by Wolfgang, to the fact that the posterior border of the ripe segment is enormously stretched lateralwards so that "lateral characters lie anterior in the gravid proglottid". A similar broadening of the posterior edges of gravid segments in *C. aegyptica*, *gerbilli*, *oranensis* and others would bring about a similar apparently anterior position of the testes.

Whether the testes are all behind the female glands with some also lateral in some cases or whether they are wholly lateral does not appear to the writer to be sufficient ground for the acceptance of the other two subgenera. To the writer a subdivision of the genus into subgenera, if necessary, would be more valid when based on the branched or unbranched nature of the excretory system and not on the spathial arrangement of the testes.

According to the abstract Tenora described a new species and a new subspecies. The new species *C. (Spasskyela) kratochoeli* from *Apodemus flavicollis* has a uterus of ten to 14 simple branches on each side; there are 190 to 220 testes which are lateral in position but unite at the posterior end in all proglottids. If the excretory system is branched, this species would appear to be related to *C. lobata*. In the new subspecies *C. (Spasskyela) cricetorum glareolica* from *Clethrionomys glareolus* the hermaphrodite (? mature) segments are broad, testes number 100 to 140, uterus has 19 to 24 lateral branches on each side, each of which can be further subdivided.