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Andrya kalelai sp. n. and (?) *Anoplocephaloides* sp., Cestoda, Anoplocephalidae, parasites of *Clethrionomys*-rodents in Finland

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Two new cestode species, *Andrya kalelai* sp. n. and (?) *Anoplocephaloides* sp. are described from rodents of the genus *Clethrionomys* (Arvicolidae). They belong to the group of species with irregularly alternating genital pores. The differential diagnosis of the taxons is given, and the important characters in determining the species in the genera *Andrya*, *Paranoplocephala* and *Anoplocephaloides* are discussed.

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1. Introduction

The first records of tapeworms of the family Anoplocephalidae parasitizing rodents in Finland were published in our previous papers (Tenora et al. 1983, Tenora et al. in press a, b). This paper deals with the taxonomy of two hitherto undescribed cestode species, *Andrya kalelai* sp. n. and (?) *Anoplocephaloides* sp., recovered from the rodents of the family Arvicolidae. The former species was named in honour of prof. Olavi Kalela for his pioneering work on population biology of rodents. The single (?) *Anoplocephaloides* specimen we have so far found is described, because it differs entirely from the related species. The ecology of *Andrya kalelai* in its main host *Clethrionomys rufocanus* will be analyzed elsewhere (Haukisalmi et al. in prep.).

2. Materials and methods

Our material has been collected in two localities, Pallasjärvi in W and Kilpisjärvi in NW Finnish Lapland. After dissection the helminths were relaxed in water, and then fixed in 70% ethanol or 4% formaldehyde. The helminths were stained with Mayer's haematoxyline and mounted in Canada balsam or Euparal. All measurements are in millimetres.

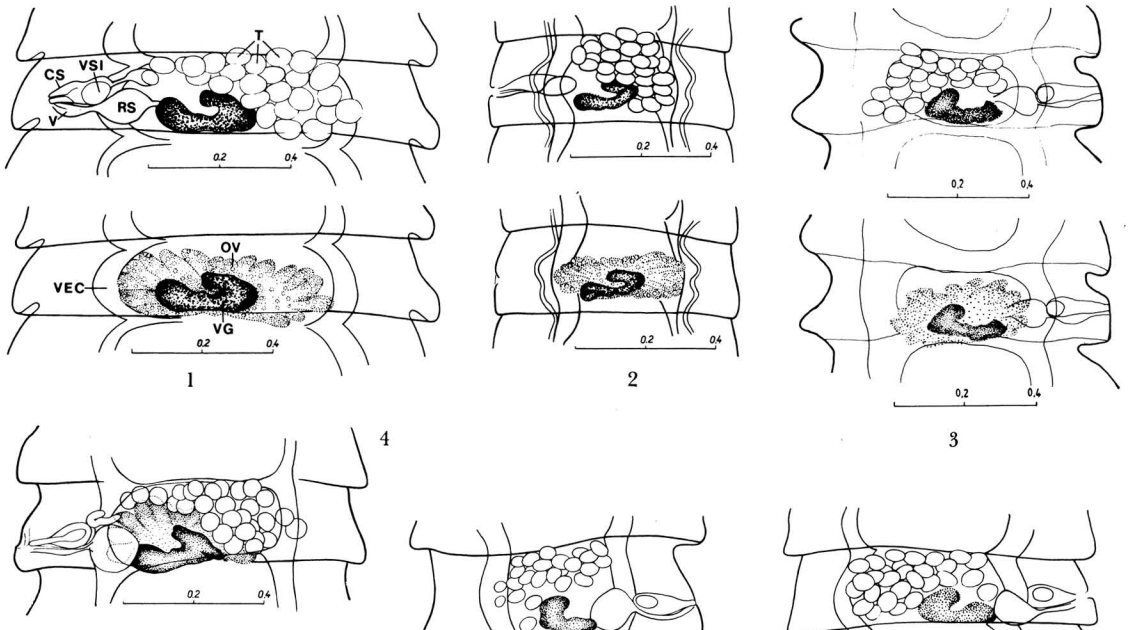
3. Results

3.1. *Andrya kalelai* sp. n.

Type host: grey-sided vole, *Clethrionomys rufocanus*, Sundevall, 1846.
Type locality: Pallasjärvi, Lapland, Finland, (68° 03'N, 24°09'E).
Other hosts and localities: bank vole *Clethrionomys glareolus*, Pallasjärvi; *C. rufocanus*, *C. rutilus*, Kilpisjärvi, Lapland, Finland, (69° 03'N, 20° 55'E).
Location: small intestine.
Holotype: No 20500, from *C. rufocanus*, deposited in the Zoological Museum, University of Helsinki, Finland.
Paratypes: 20501, 20502, from *C. rufocanus*, deposited in the Zoological Museum, University of Helsinki, Finland.
Material studied: 35 specimens from *C. rufocanus* and 5 from *C. glareolus*.

Description of typical series (Figs. 1-11)

In the following we include measurements only from gravid individuals. Length of strobila 66-191, maximum width 1.1-2.3. Length:width ratio in mature segments 1:3-6. Scolex 0.53-1.16 in diameter, well developed, motile. Suckers 0.20-0.40 in diameter. Neck thin, long or very long, length 0.5-2.1. Genital pores irregularly alternating. Ventral and dorsal excretory canals present, ventral one 0.07-0.16. Maximum length of cirrus sac 0.14-0.24, usually not crossing beyond ventral



Figs. 1-6. *Andrya kalelai* sp. n. Mature segments. 1-4, host *C. rufocanus*, Pallasjärvi. 5, host *C. glareolus*, Pallasjärvi. 6, host *C. rufocanus*, Kilpisjärvi. 3, holotype. Scale in mm. — O, opening of genital organs; V, vagina; RS, receptaculum seminalis; CS, cirrus sac; C, cirrus; VSI, vesicula seminalis interna; VSE, vesicula seminalis externa; T, testes; OV, ovary; VG, vitelline gland; VEC, ventral excretory canal; DEC, dorsal excretory canal.

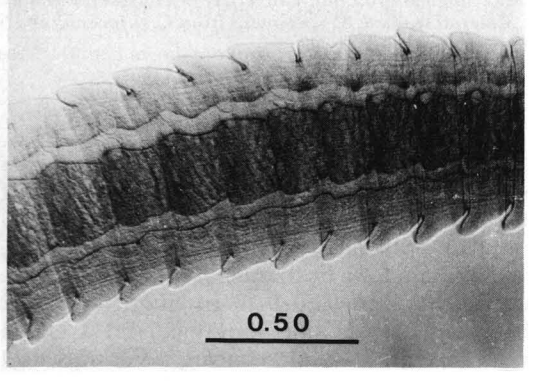


Fig. 7. Andrya kalelai sp. n. Mature segments. Host *C. rufocanus*, Pallasjärvi. Scale in mm.

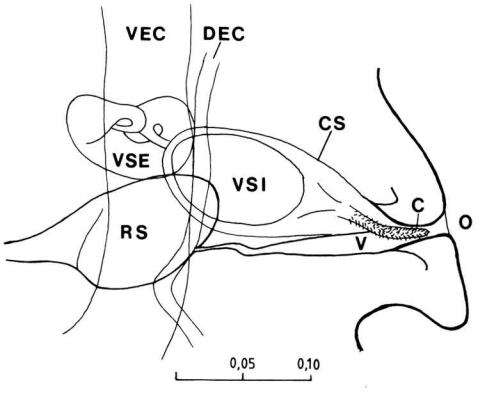


Fig. 8. *Andrya kalelai* sp. n. Detailed view of part of mature segment. Host *C. rufocanus*, Pallasjärvi. Scale in mm.

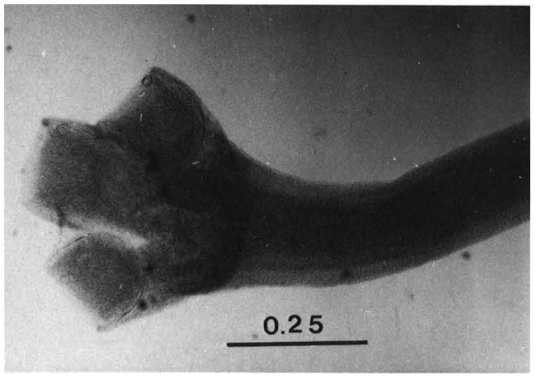


Fig. 9. *Andrya kalelai* sp. n. Scolex. Host *C. rufocanus*, Pallasjärvi. Scale in mm.

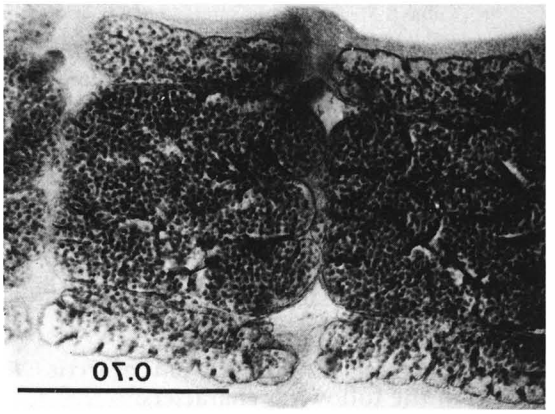


Fig. 11. *Andrya kalelai* sp. n. Fully developed uterus. Host *C. rufocanus*, Pallasjärvi. Scale in mm.

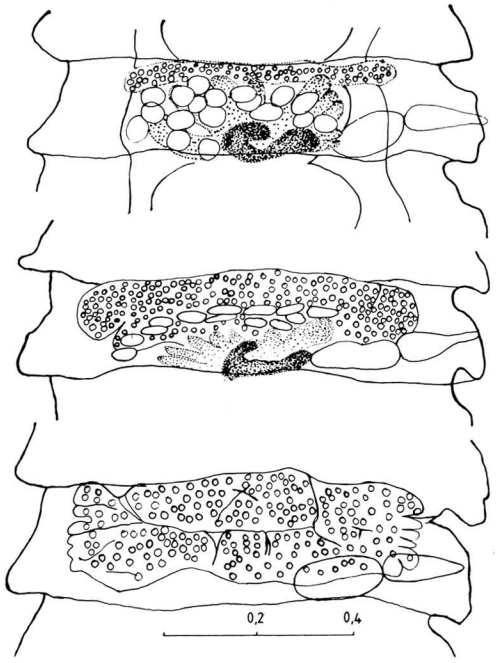


Fig. 10. *Andrya kalelai* sp. n. Development of uterus in the holotype. Host *C. rufocanus*, Pallasjärvi. Scale in mm.

excretory canal. Cirrus spinose. Internal seminal vesicle 0.5–0.9. External seminal vesicle present. Testes spherical or subspherical, 22–35 in number, 0.05–0.07 in diameter. Distribution of testes: from poral ventral excretory canal to aporal ventral excretory canal, across aporal ventral excretory canal, not beyond it. More than half of testes situated in aporal half of segments. Length of vagina 0.10–0.18, posterior to cirrus sac. Vagina thin-walled, diameter of vagina in the first third on the aporal side clearly smaller than in the other two thirds on the poral side. Seminal receptacle 0.14–0.23, spherical or subspherical. Ovary lobed and filling the whole space between ventral excretory canals in mature segments. Length of vitelline gland 0.14–0.23, width 0.07–0.12. Uterus overlapping ventral excretory canals bilaterally. Uterus in gravid segments fenestrated and forming anterior and posterior sacculations. No transverse tube-like formation visible in the development of uterus (Fig. 10) (cf. Rausch 1976, Tenora et al. 1981–82). Eggs 0.027–0.043, pyriform apparatus well developed.

Above we have given ranges for the measurements in the total material. There were, however, some consistent differences in the measurements of strobila, scolex and suckers between host species and localities. These trends are given in Table 1.

Differential diagnosis

A. kalelai sp. n. belongs to the group of species in the genera *Andrya* and *Paranoplocephala* with irregularly alternating genital pores. This group consists of the following species: *P. omphalodes* (Herman, 1783), *A. rhopalocephala* Riehm, 1881, *A. cuniculi* Blanchard, 1891, *A. gundii* Joyeux, 1923, *A. neotomae* Voge, 1946, *A. sciuri* Rausch, 1947, *A. microti* Hansen, 1947, *A. ondatrae* Rausch, 1948, and *A. arctica* Rausch, 1952. Within this group, *A. kalelai* sp. n. is most closely related to *A. arctica*.

Table 1. Measurements (mm, $\bar{x} \pm SD$) of strobila, scolex and suckers in *A. kalelai*, according to locality and host species. Diameter of suckers based on the median of 4 suckers. *F*-statistics (one-way anova) are also given.

Host species Locality Sample size	*C.rufocanus* Pallasjärvi 17	*C.rufocanus* Kilpisjärvi 18	*C. glareolus* Pallasjärvi 5	*F*	*P*
Strobila, length	128 ±35	113 ±25	96 ±39	2.4	~0.1
Stobila max. width	1.7 ±0.3	1.6 ±0.3	1.4 ±0.2	3.2	0.05<*P*<0.1
Scolex, diameter	0.77±0.15	0.67±0.08	0.72±0.06	3.3	<0.05
Suckers, diameter	0.31±0.04	0.29±0.04	0.28±0.2	1.8	>0.1

A. kalelai sp. n. differs from nearctic *A. arctica* in the following characters:
- number of testes: 40-50 in *A.a*; 22-35, exceptionally 42 in *A. k.*
- distribution of testes: markedly beyond aporal ventral excretory canal in *A. a.*; overlapping but not beyond aporal ventral excretory canal in *A. k.*
- situation of seminal receptacle: mostly outside poral ventral excretory canal in *A. a.*; mostly overlapping ventral excretory canal in *A. k.*
- size of eggs: 0.040-0.072 in *A.a.*; 0.027-0.043 in *A. k.*
- length and position of cirrus sac: 0.196-0.352, across and markedly beyond poral ventral excretory canal in *A. a.*; 0.140-0.240, exceptionally only slightly overlapping poral ventral excretory canal in *A.k.*

A. kalelai sp. n. should be distinguished from *Andrya bialowiezensis* Soltys, 1949, which it resembles in the distribution of the testes. Soltys (1949) in his description of *A. bialowiezensis* assumes that it is very closely related to *A. microti* Hansen, 1947. However, according to the figure published by Soltys (1949), it is more similar to *A. macrocephala*, of which *A. bialowiezensis* was regarded as a synonym by Żarnowski (1955-56) and Rausch (1957). *A. bialowiezensis* appears rather as a nomen nudum. The description is quite confused; e.g. the number of testes in the Polish text differs from that in the English text, and it is not known whether the genital pores are irregularly alternating or unilateral, etc. Moreover, the original material is not available.

A. kalelai should be differentiated from *Paranoplocephala kirbyi* Voge, 1948, which is regarded by Rausch (1952) — in our opinion erroneously beause of the distribution of the testes and irregularly alternating genital pores — as a synonym of *A. macrocephala*. *A. kalelai* sp. n. differs from *P. kirbyi* regarding the testes, which are distributed only in aporal half of segments in *P. kirbyi*, but in both the poral and aporal halves of segments in *A. kalelai* sp. n. like in *A. macrocephala*.

3.2. (?) *Anoplocephaloides* sp.

Host: Grey-sided vole *Clethrionomys rufocanus*
Locality: Kilpisjärvi, Lapland, Finland (69° 03'N, 20° 55'E).
Location: small intestine.
Material studied: 1 specimen.

Description (Figs 12-15)

Length of strobila 46, maximum width 1.6. Strobila widening posteriad, strobilar margin serrate. All segments wider than long. Length:width ratio in mature segments about 1:11. Scolex 0.49. Suckers well developed, 0.28. Neck very short. Genital pores irregularly alternating. Ventral and dorsal excretory canals clearly visible, ventral one 0.04-0.07 in width. Cirrus sac well-developed, 0.12-0.16 × 0.06-0.08. Cirrus sac not crossing ventral excretory canal. Cirrus spinose. Internal seminal vesicle 0.06-0.08 long. External seminal vesicle present. Testes about 20 in number, distributed dorsally, near anterior margin of segments, almost in a single line, from the poral ventral excretory canal to the aporal ventral excretory canal. Vagina consisting of thin-walled tube, 0.13 in length, opening into genital atrium, ventral to orifice of male duct. Seminal receptacle large, measuring 0.28-0.34 in length and 0.10-0.14 in width. Ovary lobed, in mature segments filling the whole space between aporal and poral ventral excretory canals. Uterus overlapping beyond ventral excretory canals in both parts. The development of the uterus cannot be exactly described as it was not clearly visible in our single preparation. Uterus forming

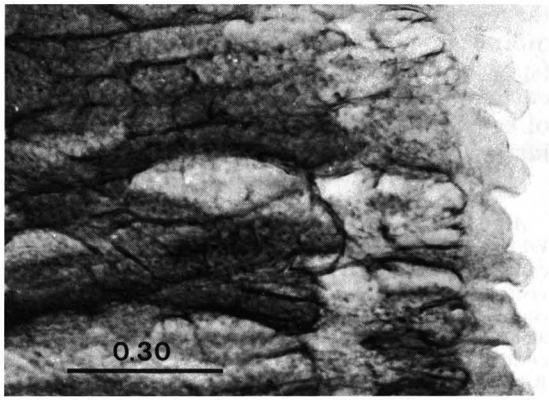


Fig. 12. *Anoplocephaloides* sp. Scolex. Host *C. rufocanus*, Kilpisjärvi. Scale in mm.

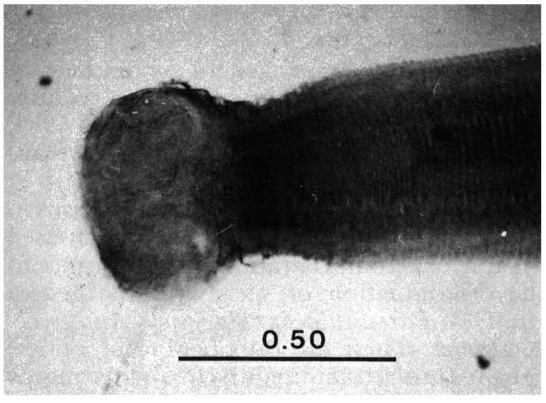


Fig. 15. *Anoplocephaloides* sp. Uterus. Host *C. rufocanus*, Kilpisjärvi. Scale in mm.

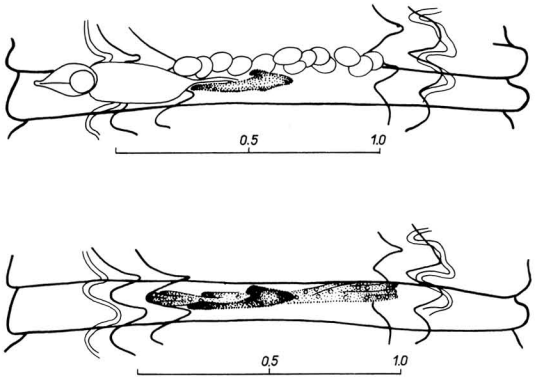


Fig. 13. *Anoplocephaloides* sp. Mature segments. Host *C. rufocanus*, Kilpisjärvi. Scale in mm.

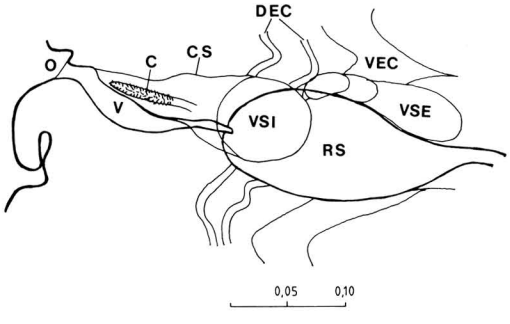


Fig. 14. *Anoplocephaloides* sp. Detailed view of genitals. Host *C. rufocanus*, Kilpisjärvi. Scale in mm. For abbreviations, see Fig. 1.

anterior and posterior sacculations in gravid segments. Eggs 0.035–0.037, spherical. Pyriform apparatus well developed.

Discussion

If the development of the uterus is not visible, it is very difficult to decide whether the specimen belongs to the genus *Andrya* Railliet, 1893, *Paranoplocephala* Lühe, 1910, or *Anoplocephaloides* Baer, 1923 (compare Rausch 1976). We have tentatively assigned the species to the genus *Anoplocephaloides*. Furthermore, we consider it necessary to clearly differentiate our (?) *Anoplocephaloides* sp. from related species of all the three named genera.

Our (?) *Anoplocephaloides* sp. does not closely resemble any known species in the genus *Andrya*. Compared to the tapeworms in the genus *Anoplocephaloides*, our specimen is most closely related to the group possessing irregularly alternating genital pores and parasitizing rodents. However, (?) *Anoplocephaloides* sp. markedly differs from all of these species in the number and distribution of testes, body size and measurements of body organs. Compared to the tapeworms in the genus *Paranoplocephala*, (?) *Anoplocephaloides* sp. somewhat resembles *P. blanchardi* Moniez, 1892, but clearly differs in the distribution of the testes.

Although only one specimen of (?) *Anoplocephaloides* sp. was available, we consider the existence of a new species probable.

4. Remarks

Because the exact generic characters of *Paranoplocephala* and *Andrya* are not yet fully clear (see Rausch 1976, Tenora & Murai 1980, Tenora et al. a, b, in press), in our text we have left each species (with the exception of *P. blanchardi* and *P. omphalodes*) in the genus in which it was first described. We have stressed the role of certain characters of significance to the determination of species in the genera *Andrya, Paranoplocephala* and *Anoplocephaloides*: These are the opening of genital organs (unilateral, irregularly alternating or alternating in series), and the distribution of the testes in relation to other body organs. The morphology of the seminal receptacle (spherical or bottle-shaped), marked differences in the vagina:cirrus sac ratio and the size of eggs are also important taxonomical characters.

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