On Andrya Railliet, 1893 and Paranoplocephala Lühe, 1910 (Cestoda, Monieziinae)

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ABSTRACT. In this study a survey is given of all the hitherto described species of the genus Andrya and Paranoplocephala. Critical comments on all the species are included. There is an identification key to the species at the end of each chapter. The diagnosis of the genera Andrya and Paranoplocephala are emended, as well as the criteria for the identification of the species are analysed. The generic composition of the subfamily Monieziinae is evaluated.

KEY WORDS: Andrya, Paranoplocephala, Cestode, Monieziinae.

The tapeworms which are the subject matter of this study, systematically belong to the family Anoplocephalidae, subfamily Monieziinae. Even though this subfamily is not always recognized by all taxonomists (a survey of authors e.g. in RAUSCH, 1976; TENORA, MURAI and VAUCHER, 1984; SCHMIDT 1986) it has lately been fully acknowledged as a complete subfamily (see e.g. RAUSCH, 1980).

The subfamily Monieziinae is essentially formed by a group of genera, with two lines: one is characterized by a simple reproductive system, the other by a duplicated one.

The distinguishing criterion of the tapeworms of the subfamily Monieziinae, which have a duplicated reproductive system, is whether both the vesicula seminalis externa and interna are present: genus Diandrya, if both are absent: the genera Moniezia, Fuhrmanella, Eranuides, Cittotaenia. If both the vesicula seminalis externa and interna are absent then to state the differences among the genera is very difficult (compare in BAER, 1927; SPASSKY, 1951; SEMENOVA, 1972; TENORA, 1976; BEVERIDGE, 1978, SCHMIDT, 1986). The genus Pseudocittotaenia formerly incorrectly classified in the subfamily Monieziinae (see TENORA, 1976) belongs to the subfamily Anoplocephalinae (see BEVERIDGE, 1978).

The genus Andrya, together with the genera Sudarikovina, Paranoplocephala and Monoecocestus, belongs to the tapeworms of the subfamily Monieziinae having a simple reproductive system. A significant morphological criterion which characterizes the genus Sudarikovina is the position of the testes, in the genus Monoecocestus it is the opening and position of the vagina in relation to the cirrus sac. In connection with the findings of RAUSCH (1976), TENORA, VAUCHER and MURAI (1980-1981) and TENORA, MURAI, VAUCHER (1984), we come to the problem of what significant criterion distinguishes the genus Andrya from the genus Paranoplocephala.

RAUSCH (1976) is of the opinion that: "If the pattern of the development of the uterus in the latter species (A. rhopalocephala) does not differ from that in P. omphalodes and A. macro-

cephala, the genera Paranoplocephala Lühe, 1910 and Aprostatandrya Kirschenblat, 1938 would become synonyms of Andrya Railliet, 1893."

As far as "the pattern of the development of the uterus" is concerned, this criterion has not yet been used for distinguishing the genera in the subfamily Moniezíinae. On the contrary, where the pattern of the development of the uterus is identical (e.g. in Andrya and Diandrya), another criterion was used for the distinction: the simple reproductive system (Andrya) vs. duplicated reproductive system (Diandrya).

TENORA, VAUCHER and MURAI (1981-1982) and TENORA, MURAI and VAUCHER (1984) proved that the pattern of the development of the uterus of Andrya and Paranoplocephala was different but that in the final stages of development it was the same: - a network in gravid segments (Figs 34-45).

Based on these findings we can state that they are two very closely related groups which can, however, be considered as separate genera. It is not being said that this opinion must be generally accepted by all taxonomists.

Identification key to the genera of the subfamily Moniezíinae

1. Simple reproductive system 2
- duplicated reproductive system 5
2. Vagina in anterior position to cirrus sac ..... Monoecocestus Beddard, 1914
- vagina in posterior position to cirrus sac 3
3. Testes situated laterally and posterior ovarium ..... Sudarikovina Hunkeler, 1972
- another position of testes 4
4. Uterus formed anteriorly near ovary, situated ventrally, positioned transversally, gradually pushed back the testes and forms an organ with network structure ..... Paranoplocephala Lühe, 1910
- uterus first and agregation near ovary, not positioned transversally, suddenly proliferated among the testes forming the network uterus ..... Andrya Railliet, 1893
5. Vesicula seminalis externa and interna present ..... Diandrya Darrah, 1930
- vesicula seminalis externa and interna absent 6
6. Uterus duplicated, in two lateral groups ..... Eranuides Semenova, 1972
- uterus not duplicated 7
7. Parasites of Rodentia in south Africa ..... Fuhrmanella Baer, 1925
- parasites of other Vertebrata 8
8. Vagina lies ventral to cirrus sac on both sides of strobila, parasites of Lagomorpha and Chinchillidae ..... Cittotaenia Riehm, 1881
- vagina lies ventral to cirrus sac on right hand side of strobila, dorsal to it on left hand side, parasites of different Vertebrata ..... Moniezia Blanchard, 1891

I. HISTORY OF THE GENUS ANDRYA Railliet, 1893

RIEHM (1881) described two new tapeworm species found as parasites of mammals of the family Leporidae in Germany: Taenia rhopalocephala Riehm, 1881, T. rhopaliocephala Riehm, 1881.

BLANCHARD (1891) declared the name T. rhopaliocephala RIEHM, 1881 as a homonym of the species T. rhopalocephala Riehm, 1881 and substituted the name T. rhopaliocephala with Anoplocephala cuniculi Blanchard, 1891. In the same year (1891), BLANCHARD transferred the species T. rhopalocephala to the genus Anoplocephala.

RAILLIET (1893) formed the genus Andrya for the species A. rhopalocephala and A. cuniculi.

Later, a number of species of the genus Andrya were described from hosts from the nearctic region. Only sporadically are descriptions of tapeworms of this genus known from the palaearctic, ethiopian and/or neotropical regions. In contradistinction to the species formerly classified as the genus Andrya, whose hosts were mammals of the order Lagomorpha, the tapeworms of the genus Andrya described since 1915 are parasites of mammals of the order Rodentia (see DOUTHITT, 1915; JOYEUX, 1923; JOYEUX and BAER, 1936; KIRSCHENBLAT, 1938, 1941; VOGE, 1946, RAUSCH, 1947, 1948, 1952; HANSEN, 1947; SCHAD, 1953; HUNKELER, 1972; TENORA, HAUKISALMI and HENTTONEN, 1985).

It should be mentioned that since 1915, when the first new species of the genus Andrya was described, in all cases a pedunculated prostatic gland was found (in later descriptions given as the prostatic gland) which has, since the time of RAILLIET (1893), been considered to be the most important morphological feature characterizing the genus Andrya.

KIRSCHENBLAT (1938) proposed that the species of the genus Andrya in which no prostatic gland was found, be grouped into the subgenus Aprostatandrya.

SPASSKY (1951) gave the tapeworms of the subgenus Aprostatandrya a generic rank and he divided this genus into two subgenera, i.e. Aprostatandrya a. str. and Sudarikovina subg. n.

In the family Anoplocephalidae, SPASSKY (1951) formed the subfamily Monieziinae characterized by a net-like uterus. Into this subfamily he grouped, among others, also the genera Andrya and Aprostatandrya.

HUNKELER (1974) promoted the subgenus Sudarikovina to a genus.

TENORA (1976) impugned the prostatic gland as a criterion characterizing a taxon of a generic value. In the same study (TENORA, 1976, p. 14) he questioned the existence of the prostatic gland as such.

RAUSCH (1976) proved that tapeworms of the genus Andrya have no prostatic gland (i.e. a feature which had so far been used to distinguish tapeworms of the genus Andrya from the other genera of the subfamily Monieziinae). It is a character which must be correctly indicated as the vesicula seminalis externa (cf. in RAUSCH, 1976). He came to the conclusion that the genus Aprostatandrya is a synonym of the genus Paranoplocephala.

TENORA, MURAI and VAUCHER (1984, 1985) fully endorsed the opinion of RAUSCH (1976) that the genus Aprostatandrya is a synonym of the genus Paranoplocephala.

In his studies of the tapeworm Diandrya composita Darrah, 1930, RAUSCH (1980) indirectly also explained the structure of the development of the uterus in tapeworms of the genus Andrya. It is necessary to fully endorse his opinion that the genus Diandrya appears to have derived from Andrya from which it differs only in the doubling of the reproductive organs. If we compare Fig. 1 as given in his study (RAUSCH, 1980, structure of the uterus and other organs in mature segments of the genus Diandrya) with the structure of the mature segments in species of the genus Andrya (A. rhopalocephala, A. cuniculi), we will find no difference. However, if we compare the structure of the uterus in mature segments of the species of the genus Andrya (and/or Diandrya) with the structure of the uterus in mature segments of P. omphalodes (and other species of the genus Paranoplocephala), then the difference is distinct (see Figs 1, 2, and 3).

All the above-mentioned circumstances force us to give new characteristics for the genus Andrya.

Andrya Railliet, 1893 emend

Diagnosis: Monieziinae Spassky, 1951. Strobila ribbon-like, with numerous segments. Scolex unarmed. Excretory system simple, with dorsal and ventral canals bilaterally connected with one anastomose. Genital pores alternating in sets or irregularly. Vagina opening in genital atrium posterior to orifice of male duct. External and internal seminal vesicle present. Testes numerous, distributed aporelly or between ventral excretory canals, sometimes overlapping ventral excretory canals. Uterus between ventral excretory canals or beyond this, at first mucose, near ovarium, ventrally, not transverse, becoming expressively reticulate in mature segments and filling the gravid segments. Eggs with pyriform apparatus. Parasites of Lagomorpha, ? Rodentia.

Structure of the genus Andrya Railliet, 1893

1. Andrya rhopalocephala (Riehm, 1881) Railliet, 1893 (Fig. 5 and 34-39).
   Syn.: Taenia rhopalocephala Riehm, 1881, Anoplocephala rhopalocephala (Riehm, 1881) Blanchard, 1891.
   Original host: Lepus timidus, Europe.
   Holotype: does not exist.

Comments:

The species is known from many hosts of the genus Lepus and Oryctolagus, distributed in Europe, North Africa and Central Asia (for more details see SPASSKY, 1951). It is still the only described species in the genus Andrya whose uterus is not across or is not beyond the ventral excretory canals. Since its original description the species A. rhopalocephala has been re-described many times, see e.g. STILES (1896), BAER (1927), JOYEUX and BAER (1936), SPASSKY (1951), GVOZDEV, KONTRIMAVICHUS, RHYZIKOV, SHALDYBIN (1970), TENORA and MURAI (1978). The species is conspicuous in its external morphological variability of the mature segments (compare e.g. BAER, 1927; GVOZDEV et al., 1970, TENORA and MURAI, 1978).

2. Andrya cuniculi (Blanchard, 1891) Railliet, 1893 (Figs 3 and 4).
   Syn.: Taenia rhopaliocephala Riehm, 1881, Anoplocephala cuniculi Blanchard, 1891, Moniezia cuniculi (Blanchard, 1891) Blanchard, 1893, Paranoplocephala cuniculi (Blanchard, 1891) Tenora et Murai, 1980.
   Original host: Oryctolagus cuniculus, Europe West.
   Holotype: does not exist.

Comments:

The species has been re-described well e.g. in the studies of STILES (1896), ARNOLD (1938), BAER (1927), most recently in the study of TENORA, MURAI, VALERO and CUTILLAS (1981-1982). It is conspicuous in its external morphological variability of the mature segments (compare e.g. BAER, 1927; SPASSKY, 1951; TENORA, MURAI, VALERO and CUTILLAS, 1981-1982). From the ecological point of view it is interesting that (provided it has not been introduced) predominant are findings of this parasite in mammals of the genera Lepus and Oryctolagus in the western part of the palaeartic region.

According to some authors (e.g. ERHARDOVÁ, 1958) it is very difficult to distinguish the species A. rhopalocephala and A. cuniculi. It was TENORA and MURAI (1980) - even though they incorrectly classified the species A. cuniculi into the genus Paranoplocephala - who were the first to define exactly the differences between the above-mentioned species (the uterus beyond the ventral excretory canals in A. cuniculi, the uterus not across, not beyond the ventral excretory canals in A. rhopalocephala). The recent study of TENORA and CUTILLAS (1983) provides more detailed data about the species A. cuniculi.

Notes:

In one of earlier studies (see TENORA, MURAI and VAUCHER, 1984) we drew attention to the fact that our transferring some species of the genus Andrya in the genus Paranoplocephala

could be only a provisional solution. In addition, we want to state that in the material of tapeworms deposited in the Muséum Histoire Naturelle, Geneva, there are tapeworms of rodents of a character given in this study for the genus Andrya. We received a similar communication from HAUKISALMI and HENNTONEN (1986) on material from Finland. In this sense it is necessary to carry out further detailed studies (compare our paper and SCHMIDT, 1986).

KEY FOR THE IDENTIFICATION OF THE SPECIES OF THE GENUS ANDRYA RAILLIET, 1893

1. Uterus not beyond ventral excretory canals, testes in poral part of segments not across level of poral part of ovary (Fig. 5) ..... Andrya rhopalocephala (Riehm, 1881)
2. Uterus beyond ventral excretory canals, testes in the poral part of segments beyond level of poral part of ovary (Figs 3 and 4) ..... Andrya cuniculi (Blanchard, 1891)

II. HISTORY OF THE GENUS PARANOPLOCEPHALA Lühe, 1910

The history of the above-mentioned genus has been discussed at great lengths in several papers (see RAUSCH, 1976; TENORA, MURAI and VAUCHER, 1984, 1986). A completely new opinion about the position of the genus Paranoplocephala given in the above-mentioned study was due to two fundamental facts:

- The main one is in the finding of RAUSCH (1976) that: "A comparison of P. omphalodes with A. macrocephala from rodents in North America has revealed no morphological differences that I consider to have taxonomic significance at the generic level." It was also RAUSCH (1976) who was the first to note that Aprostatandrya Kirschenblat, 1938 is a synonym of Paranoplocephala Lühe, 1910.

- The second fact is an important communication from TENORA and MURAI (1980), and later from TENORA, VAUCHER and MURAI (1981-1982) reporting that the species P. omphalodes has a network-like uterus.

Due to the above-mentioned facts the genus Paranoplocephala was transferred into the subfamily Monieziinae. Thus an opinion which had lasted for more than half a century was revalued, a tradition about the character and development of the uterus of the species P. omphalodes which had perpetuated in all the generally used journals (compare e. g. BAER, 1927; JOYEUX and BAER, 1936, SPASSKY, 1951; LOPEZ-NEYRA, 1954; YAMAGUTI, 1959; TENORA, 1976). The studies of RAUSCH, 1976; TENORA, VAUCHER and MURAI (1981-1982); TENORA, MURAI and VAUCHER (1984, 1985) give more detailed data about this problem. The authors further present a diagnosis of the genus Paranoplocephala Lühe, 1910 and the species structure of this genus. Contrary to SCHMIDT (1986) they range in Paranoplocephala wide spectrum of species.

Paranoplocephala Lühe, 1910
Syn.: Aprostatandrya Kirschenblat, 1938

Diagnosis: After RAUSCH (1976) emend. Monieziinae Spassky, 1951. Strobila of medium size with numerous segments sometimes small. Segments usually wider than long, with relative length increasing posteriad, usually wider than neck. Scolex usually with prominent, motile suckers. Excretory system simple, with dorsal and ventral canals bilaterally, with posterior anastomose. Genital pores unilateral or irregularly alternating, sometimes in sets. Genital ducts passing dorsal to excretory canals. Vagina opening posterior to orifice of male duct. External and internal seminal vesicle present. Testes numerous, distributed a) aporally, b) aporally and anterior to ovary, c) anterior between the ventral excretory canals or beyond these canals, d) aporally, anterior and porally to ovary. Uterus first mucose, ventrally (anteriorly) later transversally, forming an aggregation which gradually pushes back the testes

and forming an organ with network-like structure with uterine diverticula. Egg with piriform apparatus. Parasites of rodents.

Type species: Paranoplocephala omphalodes (Hermann, 1783)

Structure of the genus Paranoplocephala Lühe, 1910

1. Paranoplocephala omphalodes (Hermann, 1783) Lühe, 1910.
   Syn.: Taenia omphalodes Hermann, 1783, Halysis omphalodes (Hermann, 1783), Zeder, 1803, Anoplocephala omphalodes (Hermann, 1783) Janicki, 1904, Bertiella omphalodes (Hermann, 1783) Meggitt, 1921.
   Original host: ? Microtus arvalis, Germany, Hermann 1783: "... in gewöhnlichen kleinen Feldmaus, die aber einen etwas dicker Kopf hat...".
   Holotype: does not exist. Neotype deposited in the Humboldt Museum, Berlin, No. 1889.

Comments:

This species, whose original description is very imperfect, has been re-described many times (see e.g.: DUJARDIN, 1845; STIEDA, 1862; LINSTOW, 1878; JANICKI, 1906; BAER, 1927; JOYEUX and BAER, 1936; SOLTYS, 1949; ERHARDOVÁ and RYSAVY, 1955; SPASSKY, 1951; RAUSCH, 1952; SCHMIDT, 1961; MURAI, 1970; COLINS, 1972; RYZHIKOV et al., 1978; TENORA and MURAI, 1980; GENOV, 1984; TENORA, HAUKISALMI and HENTTONEN, 1985; and others). However, the re-descriptions are frequently very different so that it is very difficult to prove that the above-mentioned authors studied the same species. This fact is markedly evident in the study of COLINS (1972) who re-described P. omphalodes. In this study, the species P. acanthocirrosa Baer, 1924 is incorrectly considered to be a synonym of the species P. omphalodes. In the case of the former species it is a bona species in the genus Anoplocephaloides. In addition, in studying the description of the species L. omphalodes as given by COLINS (1972), we have come to the conclusion that this material does not represent the given species and that they can be representatives of a new genus since the vesicula seminalis interna and externa are absent. TENORA and ZEJDA (1974) and GENOV (1984) also draw attention to the fact that the species P. omphalodes was sometimes mistaken for the species A. macrocephala. RAUSCH (1976) and TENORA, MURAI, VAUCHER (1986) give more exact data on their rich comparative material.

Numerous species of rodents are given as hosts of the species P. omphalodes, distributed both in the palaearctic and nearctic regions (RAUSCH, 1982).

The main characters of the species P. omphalodes are given in the key. The considerable morphological and anatomical variability of the species P. omphalodes shows that it is a complex of forms and it is not yet clear whether they are separate species.

2. Paranoplocephala blanchardi (Moniez, 1891).
   Syn.: Taenia blanchardi Moniez, 1891, Anoplocephala blanchardi (Moniez, 1891) Janicki, 1904, Anoplocephaloides blanchardi (Moniez, 1891) Baer, 1924, Paranoplocephala blanchardi (Moniez, 1891) Baer, 1927.
   Host of the neotype: Microtus arvalis, Europe.
   Holotype does not exist, the neotype is deposited in the Muséum Histoire Naturelle, Geneve, No. 974254.

Comments:

This species, very frequently discussed in the literature, is known as a parasite of rodents of the family Arvicolidae (see e.g. MONIEZ, 1891; JANICKI, 1906; BAER, 1972; DOLLFUS, 1961; ISHIMOTO, 1974; RAUSCH, 1976; TENORA and MURAI, 1980; GENOV, 1984; TENORA, HAUKISALMI and HENTTONEN, 1985a, TENORA, MURAI and VAUCHER, 1985). Since the original description was very modest, characters distinguishing this species from other related species are very difficult to find. This species has very often seen considered to be a synonym of the species P. omphalodes (see e.g. BAER, 1932; CAMERON and PARNELL,

1933; JOYEUX and BAER, 1936; SPASSKY, 1951; RYZHIKOV et al., 1978), sometimes it is considered to belong to the genus Anoplocephaloides (see e.g. RAUSCH 1976; TENORA, HAUKISALMI and HENTTONEN, 1985a).

In their study, TENORA, MURAI and VAUCHER (1985) give detailed morphological, anatomical and metric characteristics of the species P. blanchardi. Their concept is that the above species is characterized by a very short vagina (of about one half of the cirrus sac), has an elongated seminal receptacle and testes distributed in the aporal half of the segments only. It is also characterized by a very strict one-sided opening of the reproductive organs.

As in the case of the species P. omphalodes, we do not exclude, that in the publications (dealing with the species P. blanchardi - until 1985 -) is published complex of forms representing more species of different genera (Paranoplocephala, Anoplocephaloides).

3. Paranoplocephala campestris (Cholodkowsky, 1913), Tenora et Vaucher, 1983.
Syn.: Anoplocephala campestris Cholodkowsky, 1913, Paranoplocephala blanchardi (Moniez, 1891), sensu Baer, 1927 pro parte.
Original host: Arvicola campestris = M. arvalis, Poland.
Holotype: does not exist.

Comments:

A species with one-sided genital openings, found only once. Since than it has only been reclassified into various genera, or as a synonym of already known species. TENORA and VAUCHER (1983) considered that material to be the species P. campestris which TENORA and MURAI (1980) had classified as P. blanchardi. TENORA, MURAI and VAUCHER (1985) again returned to the problem of a more exact identification of the above-mentioned material. They concluded that it was the species P. omphalodes.

Based on the pictures drawn by CHOLODKOWSKY (1912), it is possible to say that P. campestris whose testes are not across, not beyond the aporal ventral excretory canal. It is a species with strikingly enormous suckers and markedly elongated segments in the right-left direction.

Only new material from M. arvalis in Poland could explain P. campestris as a bona species.

Since it was only found once and, in addition, only some fragments and since it will be necessary to detail its description, at the present time it can conveniently be considered to be a species inquirenda (see TENORA, MURAI and VAUCHER, 1985).

4. Paranoplocephala macrocephala (Douthitt, 1915) Rausch, 1976.
Syn.: Andrya macrocephala Douthitt, 1915, Andrya translucida Douthitt, 1915.
Original host: Geomys bursarius, North America.
Holotype: deposited in the Helminthological Collection of the U.S. National Museum.

Comments:

Since the time of its description from the original host (1915), this species has been reported only as a parasite of various species of rodents of the family Arvicolidae in the USA and in Europe. In their studies, RAUSCH (1948), RAUSCH and SCHILLER (1949) and RAUSCH (1952) give their opinions on the taxonomic position of the species A. macrocephala. The two latter studies reported that the species P. macrocephala (in material from the USA) has a considerable morphological and metric variability. Of the same opinion is e.g. ZARNOWSKI (1955-1956), based on material from Poland.

Even though we do admit that the original findings of the species P. macrocephala in Geomys bursarius were incidental and that the original hosts of this tapeworm species are, in fact, rodents of the family Arvicolidae, it does not seem to be probable that all the forms of the species P. macrocephala given in the study of RAUSCH and SCHILLER (1949) belong to only

one species. According to our opinion, typical for the species P. macrocephala are such individuals as given by DOUTHITT (1915) and RAUSCH (1948). We must fully agree with the opinion of RAUSCH (1976) that "P. macrocephala is the least host-specific and the most variable morphologically, which suggests that it represents a complex of species" and that "The infection of experimental animals would seem to provide the best means to establish the limits of morphologicals variation and host-specificity in these cestodes" (RAUSCH 1976, page 553).

In the key and in the table we give the main characters which distinguish the species P. macrocephala from other related species. The question remains whether A. translucida is the synonym of P. macrocephala.

5. Paranoplocephala communis (Douthitt, 1915) Tenora, Murai et Vaucher, 1984.
   Syn.: Andrya communis Douthitt, 1915.
   Original host: Evotomys gapperi galei, North America.
   Holotype: deposited in the Helminthological Collection of the U. S. National Museum.

Comments:

The taxonomic position of this species is very vague. BAER (1927) considers it to be a synonym of the species A. primordialis. Similar statements can be found in the studies of RAUSCH and SCHILLER (1949), SPASSKY (1951), RAUSCH (1952, 1957).

On the basis of comparisons of the original description and pictures of the species P. communis with other species of the genus Paranoplocephala, we came to the conclusion that it is a species very closely related to P. macrocephala. However, it fundamentally differs from this species in its very short cirrus sac and markedly long vagina.

With regard to the fact that since its original description this species has never been found again and that its description is incomplete from the viewpoint of present taxonomy, the species P. communis must be considered as a species inquirenda.

6. Paranoplocephala primordialis (Douthitt, 1915) Tenora, Murai et Vaucher, 1984.
   Syn.: Andrya primordialis Douthitt, 1915.
   Original host: Sciurus hudsonicus, North America.
   Neotype: deposited in the Helminthological Collection of the U. S. National Museum, No. 47801.

Comments:

At present there exists only little material of this species (see RAUSCH 1952). In spite of this fact it is evident that it is a bona species. The length of the cirrus sac and vagina, the character of the seminal receptacle, and the distribution of the testes distinctly distinguish this species from all the so far named species of the genus Paranoplocephala which had been described before 1915.

According to our opinion, however, the material indicated as A. primordialis = P. primordialis and found in mammals of the genus Microtus (see data in RAUSCH and SCHILLER 1949, RAUSCH 1952) should be checked.

7. Paranoplocephala gundii (Joyeux, 1923) Tenora, Murai et Vaucher 1985.
   Syn.: Andrya primordialis var. gundi Joyeux, 1923, Andrya gundii (Joyeux, 1923) Spassky, 1951.
   Original host: Ctenodactylus gundi, Africa.
   Holotype: deposited in the Muséum Histoire Naturelle, Geneva.
   Paratype: deposited at the Faculté des Sciences et Techniques, Sfax, Tunisia, Laboratoire de Zoologie, MNHN Sf 52 et SF 61.

Comments:

The species is very close to the species P. primordialis and Baer (1927) considers it as syn-

onym of this. It distinctly differs from the later in the larger number of testes which are always distributed in the aporal and poral half of the segments beyond the ventral excretory canal. This species is strictly bound to its host (C. gundi) and its zoogeographical distribution (Africa). For a good re-description of this species, see QUENTIN (1979).

8. Paranoplocephala caucasica (Kirschenblat, 1938) Tenora, Murai et Vaucher, 1984.
   Syn.: Andrya caucasica Kirschenblat, 1938, Aprostatandrya caucasica (Kirschenblat, 1938) Spassky, 1951.
   Original host: Microtus socialis, USSR.
   Holotype: the place of deposition is not known.

Comments:

This species is given as a parasite of many species of rodents (see RYZHIKOV et al. 1978). In his original description of this species, KIRSCHENBLAT (1938) showed that the previously much preferred character for the identification of the species (alternating opening of genital organs: genital openings one-sided) do not hold true in the case of the species A. caucasica. The reason was that in the population of the species A. caucasica, he found individuals characterized by both possibilities.

The species P. caucasica is very close to the species P. omphalodes. It differs only in a smaller number of testes.

9. Paranoplocephala montana (Kirschenblat, 1941) Tenora, Murai et Vaucher, 1984.
   Syn.: Andrya montana Kirschenblat, 1941.
   Original host: not given by the author, two species are given, that is Microtus arvalis transcaucasicus and Chionomys nivalis, USSR.
   Holotype: does not exist.

Comments:

The species is known only in the territory of the USSR (see RYZHIKOV et al. 1978). It is characterized in a relatively small scolex and different distribution of testes in the premature and mature segments. RAUSCH (1957) brings together the species P. montana with the species P. primordialis.

10. Paranoplocephala neotomae (Voge, 1946) Tenora, Murai et Vaucher, 1984.
    Syn.: Andrya neotomae Voge, 1946, Aprostatandrya neotomae (Voge, 1946) Spassky, 1951.
    Original host: Neotoma fuscipes, North America.
    Holotype: deposited in the Helminthological Collection of the U.S. National Museum.

Comments:

The species is characteristic in several specific characters: testes are distributed in the poral and aporal part of segments, the seminal receptacle is prominently elongated, the testes are not beyond the ventral excretory canals, the cirrus is strictly beyond the ventral excretory canal.

11. Paranoplocephala sciuri (Rausch, 1948) Tenora, Murai et Vaucher, 1984.
    Syn.: Andrya sciuri Rausch, 1947, Aprostatandrya sciuri (Rausch, 1947) Spassky, 1951.
    Original host: Glaucomys sabrinus macrotis, North America.
    Holotype: deposited in the Helminthological Collection of the U.S. National Museum.

Comments:

This species belongs to species related to P. neotomae. It expressively differs from this species in the distribution of the testes (lying markedly beyond the ventral excretory canals). The differences alsow in the number of testes and the host (G. sabrinus macrotis), distinctly characterize the species P. sciuri.

12. Paranocephala microti (Hansen, 1947) Tenora, Murai eg Vaucher, 1984.
Syn.: Andrya microti Hansen, 1947, Aprostatandrya microti (Hansen, 1947) Spassky, 1951.
Original host: Microtus onchrogaster, North America.
Holotype: deposited in the Helminthological Collection of the U. S. National Museum.

Comments:

The species is extremely close to the species P. omphalodes from which it differs only in a smaller number of testes. However, the species P. microti is even closer to the species P. caucasica. RAUSCH (1948) states: "Since A. microti and A. caucasica are so similar morphologically, and since both are parasites of voles, the possibility of their specific identity should be considered." The same results are in RAUSCH and TINER (1949).

We do not exclude that P. microti and P. caucasica are synonyms of P. omphalodes.

13. Paranoplocephala kirbyi Voge, 1948.
Original host: Microtus californicus, North America.
Holotype: deposited in the Helminthological Collection of the U. S. National Museum.

Comments:

This species is very close to the species P. microti and P. caucasica. VOGE (1948) had not known the study of HANSEN (1947) and that is why she did not give the characters distinguishing the species P. kirbyi from P. microti. It is also interesting that, the similarly to the species P. caucasica and P. microti, VOGE in 1948 found such individuals in the P. kirbyi population which had a tendency to have one-sided genital openings, as well as ir ividuals with alternating genital openings, mostly in sets.

RAUSCH (1952) relates the species P. kirbyi with P. macrocephala. However, according to our opinion the species P. kirbyi fundamentally differs from the species P. macrocephala in the distribution of the testes.

We do not exclude that the species P. kirbyi is only one form of the species P. omphalodes. On the other side, the original description of Paranoplocephala kirbyi Voge, 1948 shows some signs of the genus Anoplocephaloides: "The uterus in early mature proglottids is composed of two narrow tubes the end of which project beyond the median excretory ducts; a small duct from the region of the shell gland connects the transverse tubes just anterior to the ovary. In more posterior mature segments the end of the uterine tubes become forked and the main tubes give off side branches. In gravid segments the sac-like uterus fills entire segment, and no other structure but the excretory ducts remains." - See VOGE (1948), p. 302 and the figures 2, 3, p. 301. Only new material from U. S. A. can explaine more exactly the generic position of P. kirbyi.

14. Paranoplocephala ondatrae (Rausch, 1948) Tenora et Murai, 1980.
Syn.: Andrya ondatrae Rausch, 1948, Aprostatandrya macrocephala (Douthitt, 1915) sensu Rausch et Schiller, 1959 pro parte, Aprostatandrya ondatrae (Rausch, 1948) Spassky, 1951.
Original host: Ondatra zibethicus, North America.
Holotype: deposited in the Helminthological Collection of the U. S. National Museum.

Comments:

This species is a characteristic parasite of Ondatra zibethicus. RAUSCH and SCHILLER (1849) consider it to be a synonym of the species A. macrocephala. The approach of SPASSKY, ROMANOVA and NAJDENOVA (1951) was the same.

RAUSCH and SCHILLER (1949), who consider P. ondatrae to be a synonym of A. macrocephala, on page 309 of their study report the following: "testes across entire field, over excretory canals on both sides, sometimes beyond aporal canal." However, on page 313, in Fig. 14 the same authors drew the testes only across the entire field, not over the excretory canals.

SPASSKY (1951) and TENORA and MURAI (1980) consider the species P. ondatrae to be a bona species.

The characters distinguishing the species P. ondatrae from other species are evident from the key for the identification of the species of the genus Paranoplocephala.

15. Andrya bialowiezensis Soltys, 1949.
Original host: Microtus arvalis, Poland.
Holotype: does not exist.

Comments:

The features of this species correspond with the characteristics given for the genus Paranoplocephala. ZARNOWSKI (1955-1956) considers it to be a synonym of the species A. macrocephala. RAUSCH's (1957) approach the same. TENORA, HAUKISALMI and HENTTONEN (1985b) state that the species A. bialowiezensis is a nomen nudum (for details see the latter study).

16. Paranoplocephala arctica (Rausch, 1952) Tenora, Murai et Vaucher, 1984.
Syn.: Andrya arctica Rausch, 1952.
Original host: Dicrostonyx groenlandicus rubricatus, North America.
Holotype: deposited in the Helminthological Collection of the U. S. National Museum, No. 37356.

Comments:

This species is very close to the species P. primordialis. It differs fundamentally in the strongly developed cirrus sac, which is expressively beyond the ventral excretory canal. As an auxiliary additional criterion, can serve the fact that the genital pores in P. arctica are irregularly alternate whereas in P. primordialis the genital openings are one-sided.

RAUSCH (1952) also states: "It is possible that adaption to host species (it is predominantly a parasite of lemmings) and geographical distribution (arctic North America) also have some specific significance."

17. Paranoplocephala bairdi (Schad, 1953) Tenora, Murai et Vaucher, 1984.
Syn.: Andrya bairdi Schad, 1953.
Original host: Microtus crotorrhinus, Canada.
Holotype: deposited in the Helminthological Collection of the U. S. National Museum, No. 48758.

Comments:

A species with metrical-morphological characters which distinguish it relatively distinctly from the known species of the genus Paranoplocephala. They are: oval seminal receptacle, testes distributed in the aporal side of segments only, small scolex (0.30 mm), small suckers (0.021 mm) and a relatively long strobila (about 200 mm).

18. Paranoplocephala dasymidis (Hunkeler, 1972) Tenora, Murai et Vaucher, 1984.
Syn.: Andrya dasymidis Hunkeler, 1972, Aprostatandrya dasymidis (Hunkeler, 1972) Hunkeler, 1974.
Original host: Dasymys incomtus rufulus, Africa.
Holotype: place of deposition is not given.

Comments:

This species differs from all the hitherto known species of the genus Paranoplocephala in the arrangement of the testes in the nature segments. Its hitherto known hosts and zoogeographical distribution are also very specific.

19. Paranoplocephala octodensis (Babero et Cattan, 1975) n. comb.
Syn.: Aprostatandrya octodensis Babero et Cattan, 1975.
Original host: Octodon degus, Chile.
Holotype: deposited in the Helminthological Collection of the U.S. National Museum, No. 73439.

Comments:

This species is very close to the species P. gundii. Fundamentally it differs from it in the distribution of the testes (always only between the ventral excretory canals). Also the host and zoogeographical distribution of P. octodensis are specific.

20. Paranoplocephala petauristae (Sawada et Kugi, 1979) Schmidt, 1986.
Syn.: Aprostatandrya (A.) petauristae Sawada et Kugi, 1979.
Original host: Petaurista leucogenys (Sciuridae), Japan.
Holotype: deposited in the Biological Laboratory, Nara University, Japan.

Comments:

This large species is very closely related to P. neotomae with the distribution of testes, both have large cirrus sac overlapping strongly the ventral excretory canal, and parasites of Sciuridae.

21. Paranoplocephala gracilis Tenora et Murai, 1980.
Original host: Microtus agrestis, Europe.
Holotype: deposited in the Hungarian Natural History Museum.

Comments:

This species is very close to the species P. primordialis and P. arctica. Fundamentally is differs from both of them in that the cirrus sac is not so long and in the metric relation of vagina cirrus sac. Also the zoogeographical distribution and hosts are of some importance for the identification of the species P. gracilis (see GENOV 1984, TENORA, HAUKISALMI and HENTTONEN 1985b, TENORA, MURAI and VAUCHER 1985). For more details see the identification key and the references.

22. Paranoplocephala mascomai Murai, Tenora, et Rocamora, 1980 (Fig. 11).
Original host: Microtus cabrerae.
Holotype: deposited in the Hungarian Natural History Museum, No. 7802 204.

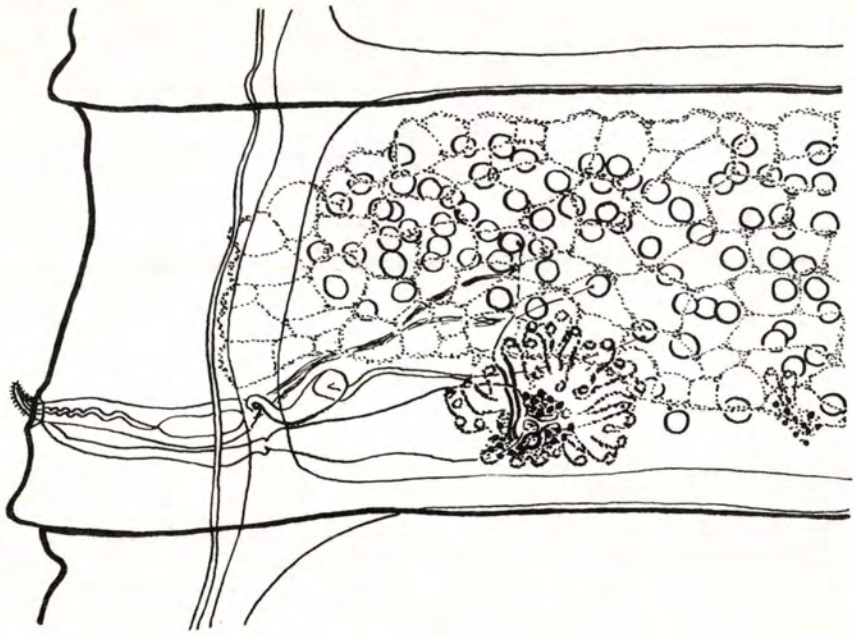
Comments:

In its external morphology and length of the strobila this species rather resembles species of the genus Anoplocephaloides. These characters, in addition combined with metric characters and the distribution of testes in the mature segments, distinguish it expressively from other species of the genus Paranoplocephala (see key for identification). Only new material can clarify the generic status of thus species.

23. Paranoplocephala kalelai (Tenora, Haukisalmi et Henttonen, 1985) n. comb. (Fig. 22).
Syn.: Andrya kalelai Tenora, Haukisalmi et Henttonen, 1985.
Original host: Clethrionomys rufocanus.
Holotype: deposited in the Zoological Museum, University of Helsinki, No. 205000.

Comments:

After our new detailed study of uterus evolution it is quite certain that this species belongs to the genus Paranoplocephala (for more details see TENORA, MURAI and VAUCHER 1985). It is very close to the species P. primordialis and P. gracilis. From both of these it considerably differs in the ratio length of cirrus sac: length of the vagina (in P. kalelai the vagina is shorter than the length of the cirrus sac). In addition, it differs from the species P. gracilis in a relatively smaller number of testes. In the study of TENORA, HAUKISALMI



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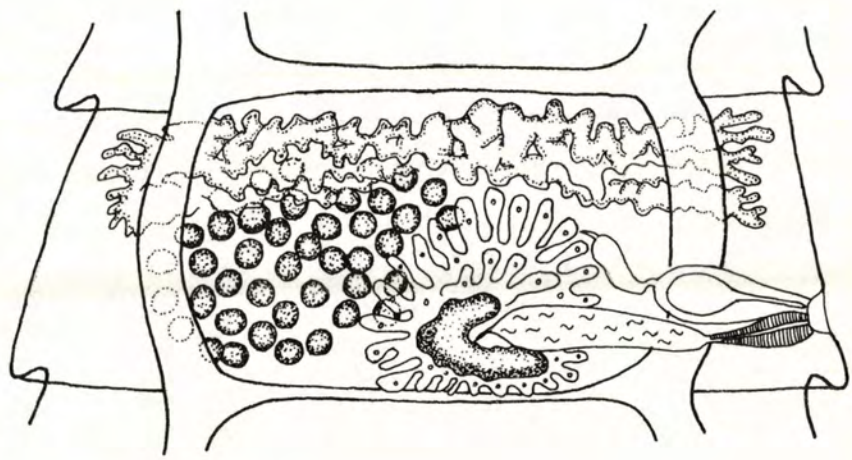

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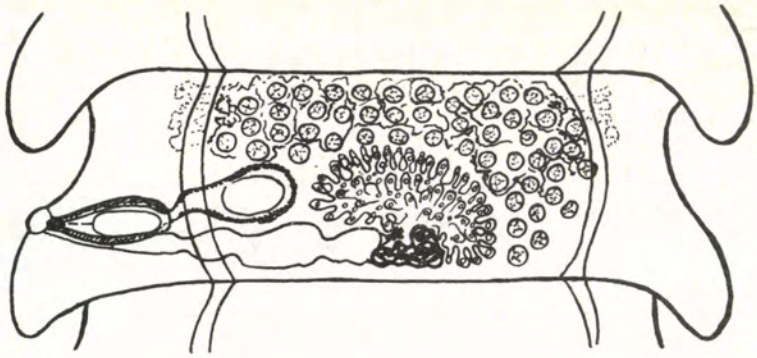
Fig. 1: Diandrya composita Darrah, 1930. Part of mature segment, uterus like network, after Rausch (1980)

Fig. 2: Paranoplocephala omphalodes (Hermann, 1783). Developing uterus, based on the neotype material (orig.)



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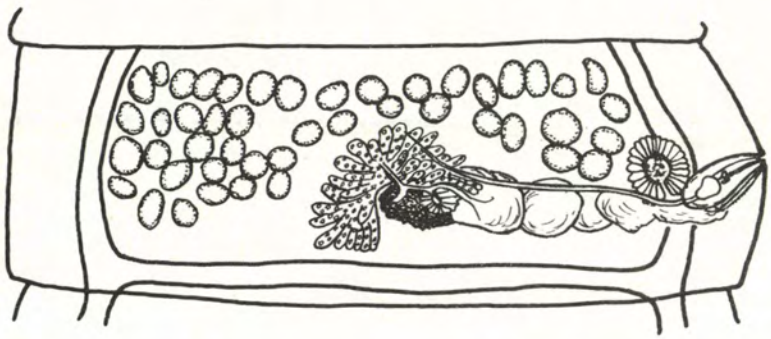

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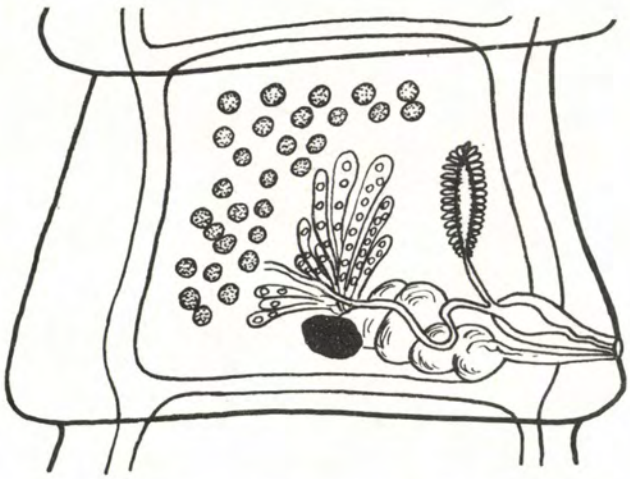

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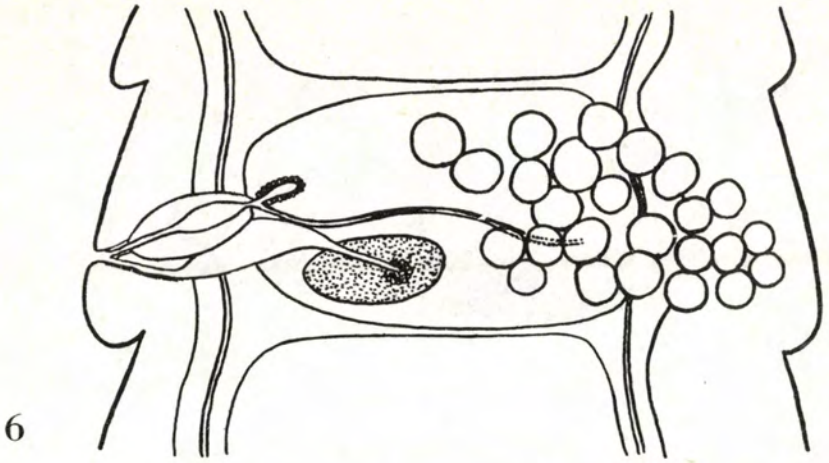
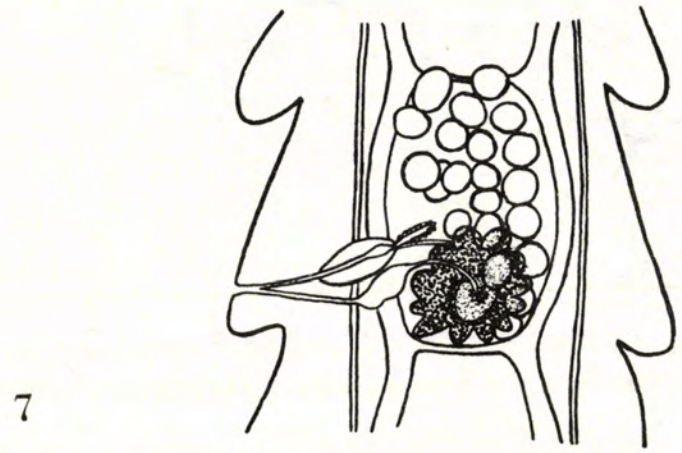
Fig. 3. Andrya cuniculi (Blanchard, 1891). Mature segment, uterus like network, after Tenora, Murai, Valero et Cutillas (1981–1982)

Fig. 4. Andrya cuniculi (Blanchard, 1891). Mature segment, after Stiles (1896)

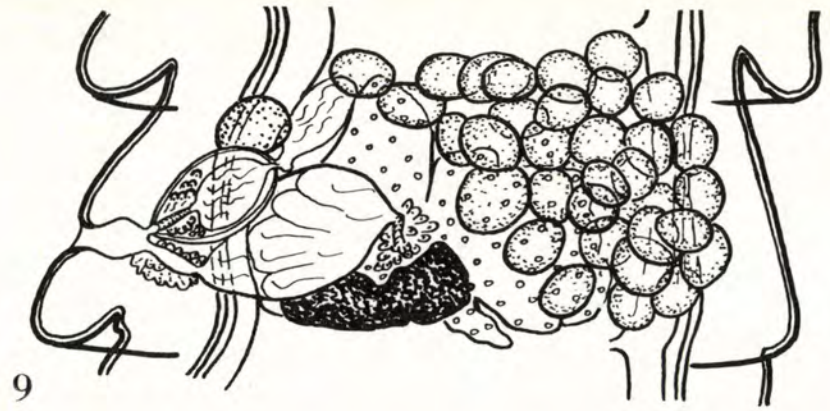
Fig. 5. Andrya rhopalocephala (Riehm, 1881). Mature segment, after Baer (1927)





Figs 6–7: Paranoplocephala montana (Kirschenblat, 1941). 6 = mature segment, 7 = premature segment, after Kirschenblat (1941)

Fig. 8: Paranoplocephala blanchardi (Moniez, 1891). Mature segment, after Tenora, Murai and Vaucher (1985)



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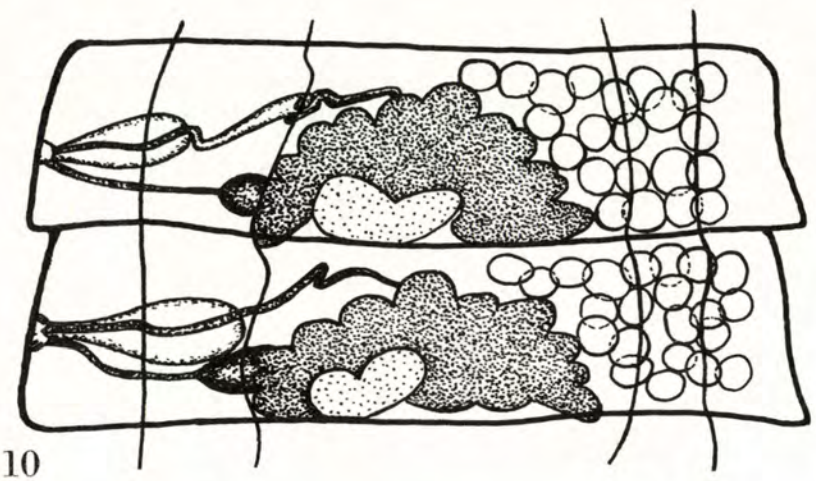

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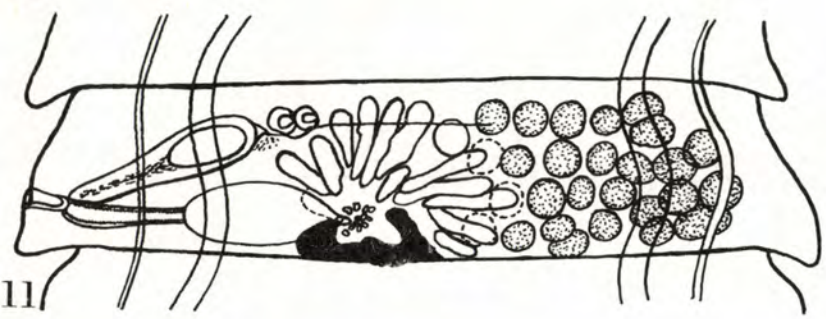

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Fig. 9: Paranoplocephala janickii Tenora, Murai et Vaucher 1985. Mature segment, after Tenora, Murai and Vaucher (1985)

Fig. 10: Paranoplocephala bairdi (Schad, 1953). Mature segments, after Schad (1953)

Fig. 11: Paranoplocephala mascomai Murai, Tenora and Rocamora (1980) Mature segment, after Murai, Tenora and Rocamora (1980)

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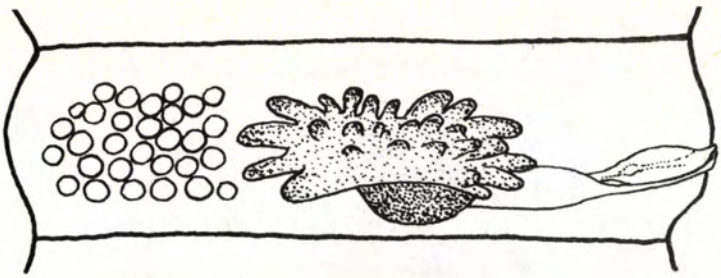

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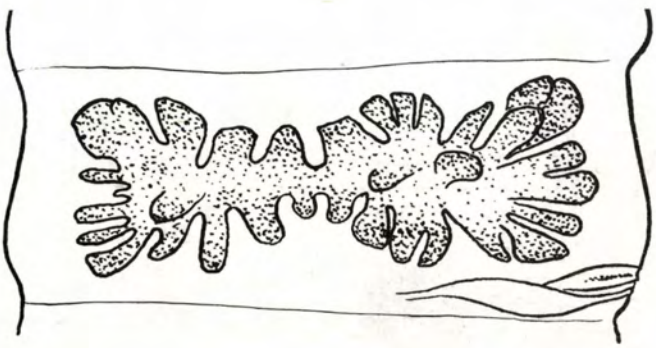

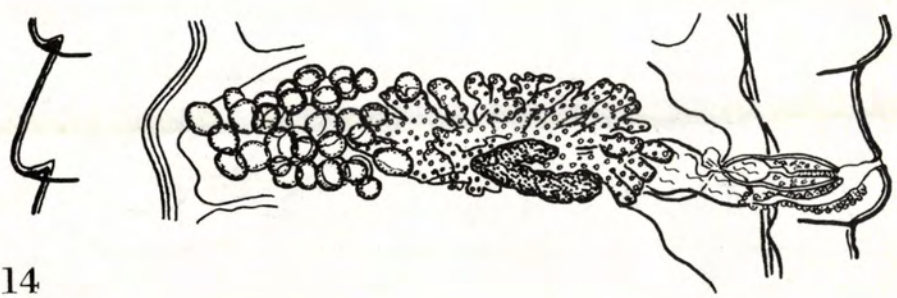

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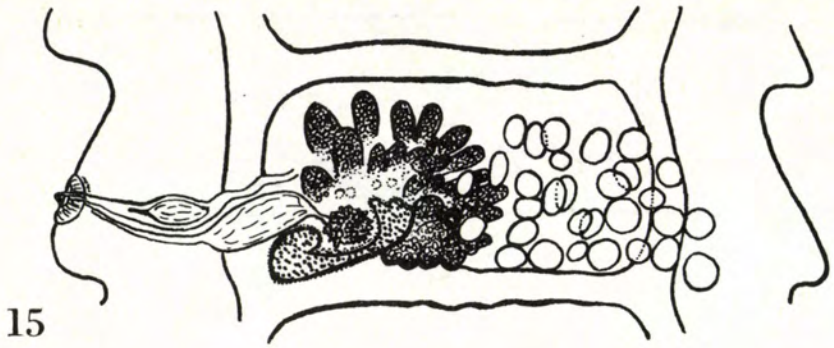
Fig. 12: Paranoplocephala omphalodes (Hermann, 1783). Mature segment, after Stieda (1862)
Fig. 13: Paranoplocephala omphalodes (Hermann, 1783). Gravid segment, after Stieda (1862)
Fig. 14: Paranoplocephala omphalodes (Hermann, 1783). Mature segment, after Tenora, Murai and Vaucher (1985)



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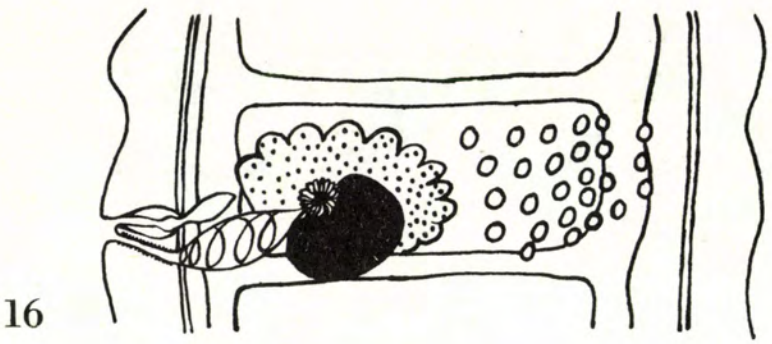

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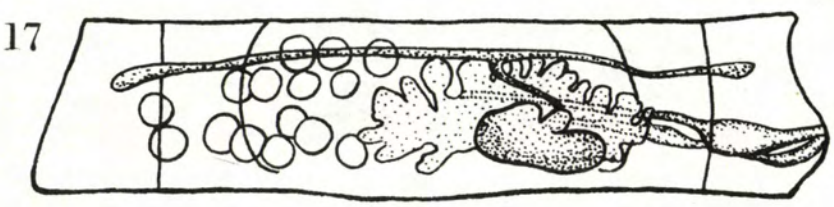

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Fig. 15: Paranoplocephala microti (Hansen, 1947). Mature segment, after Hansen (1947)
Fig. 16: Paranoplocephala caucasica (Kirschenblat, 1938). Mature segment, after Kirschenblat (1938)
Fig. 17: Paranoplocephala kirbyi (Voge, 1948). Mature segment, after Voge (1948)

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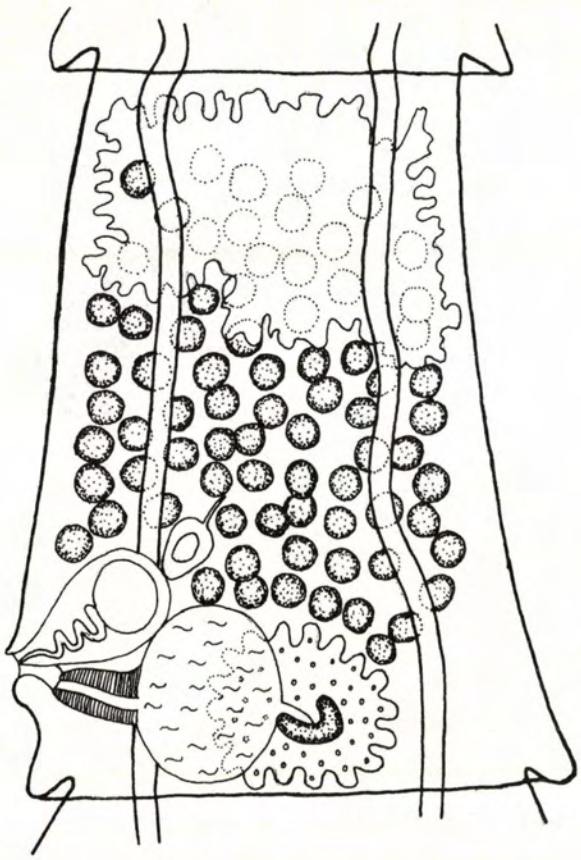

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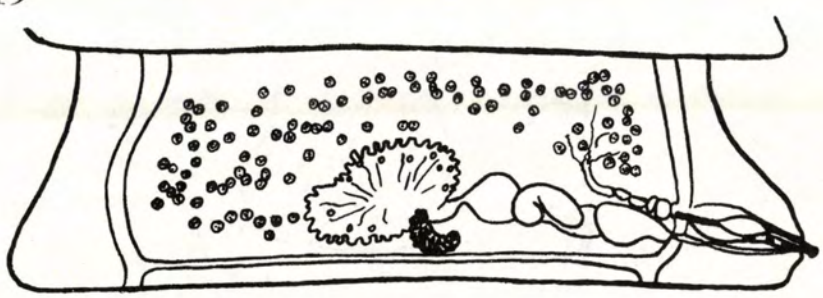
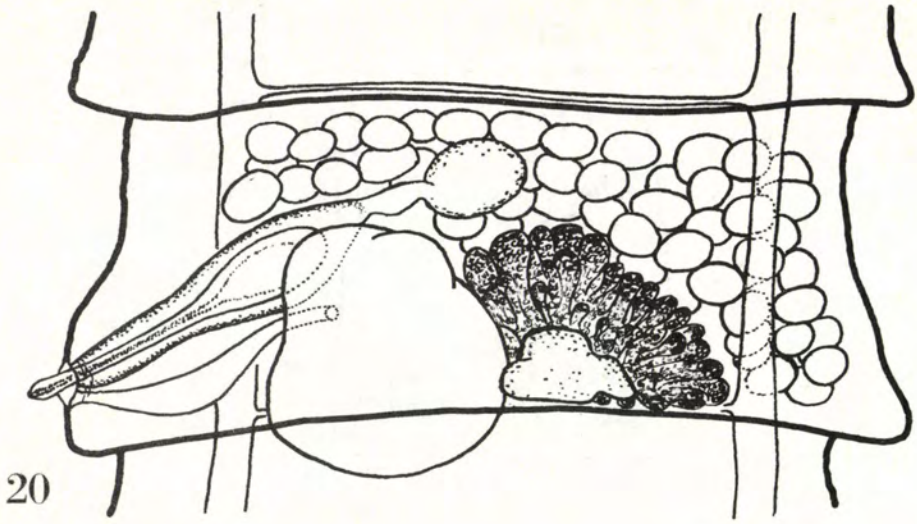


Fig. 18. Paranoplocephala gundii (Joyeux, 1923). Mature segment, based on the material of the Paris Museum (orig.)

Fig. 19: Paranoplocephala octodensis (Babero et Cattan, 1975). Mature segment, after Babero and Cattan (1975)



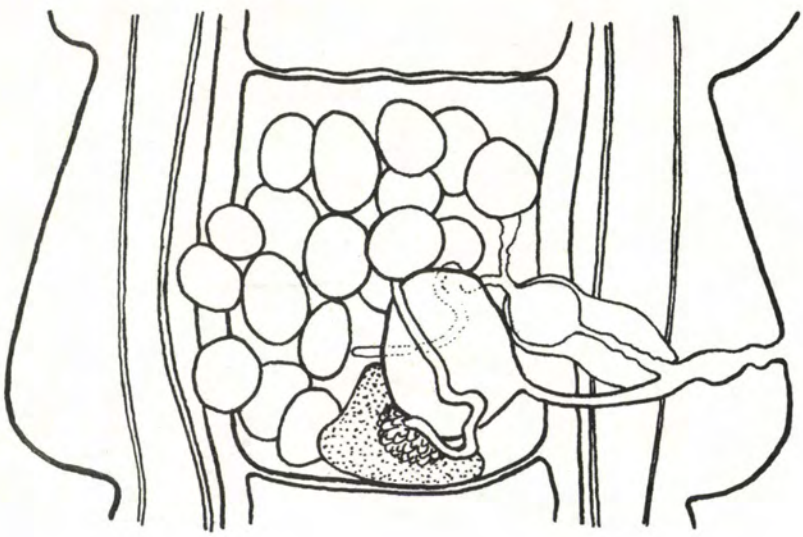
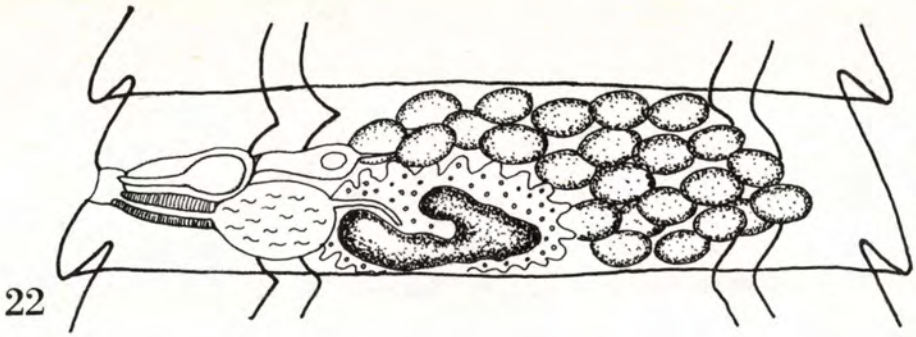


Fig. 20: Paranoplocephala arctica (Rausch, 1952). Mature segment, after Rausch (1952)
Fig. 21: Paranoplocephala primordialis (Douthitt, 1915). Mature segment, after Douthitt (1915)



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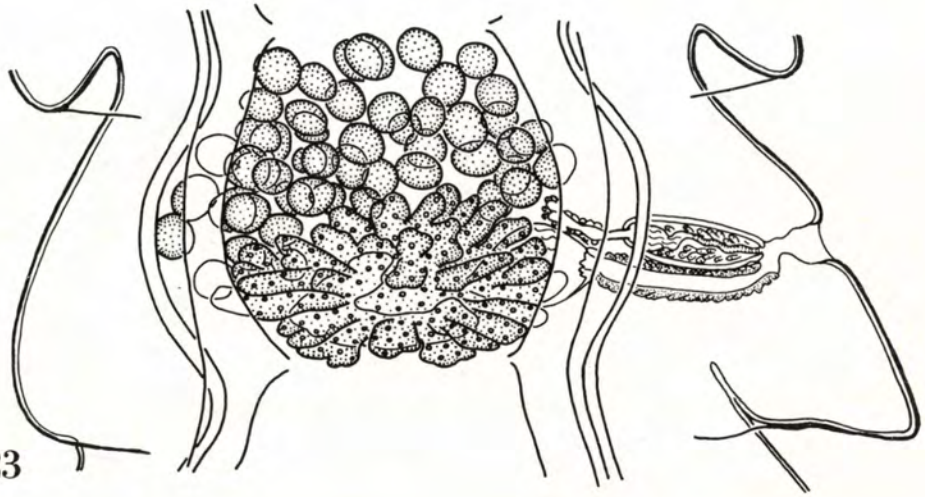

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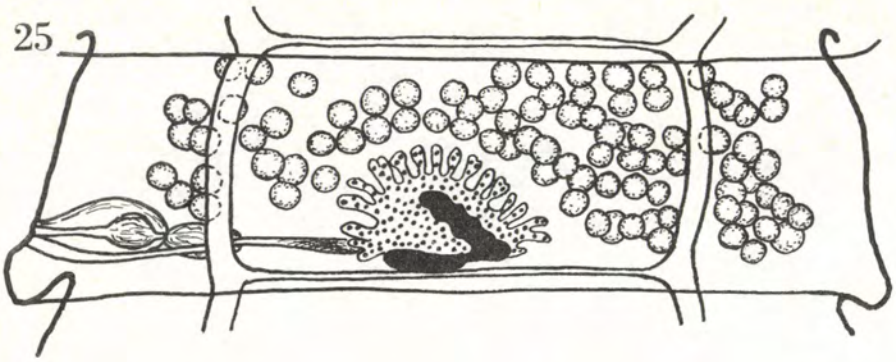
Fig. 22: Paranoplocephala kalelai (Tenora, Haukisalmi et Henttonen, 1985). Mature segment, based on the type material (orig.)

Fig. 23: Paranoplocephala gracilis Tenora et Murai, 1980. Mature segment, after Tenora, Murai and Vaucher (1985)

Fig. 24: Paranoplocephala dasymidis (Hunkeler, 1972). Mature segment, after Hunkeler (1972)



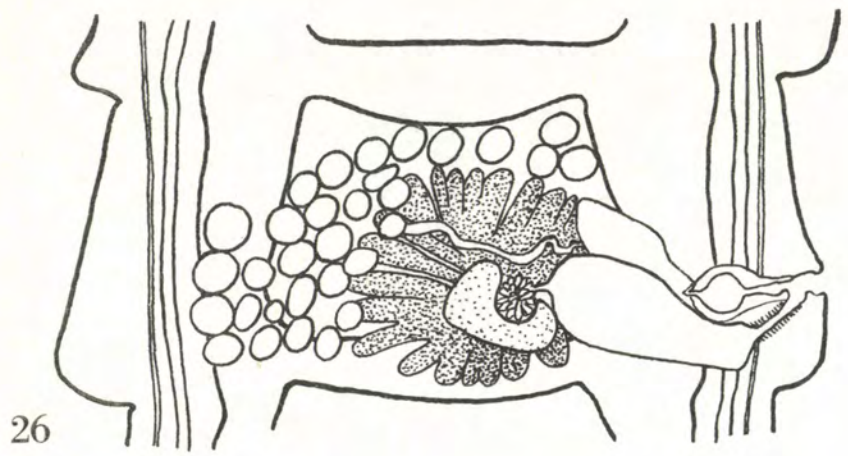
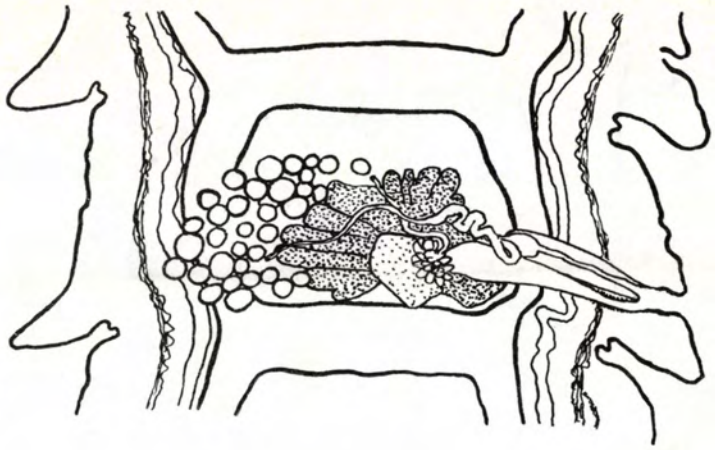


Fig. 25: Paranoplocephala sciuri (Rausch, 1947). Mature segment, after Rausch (1947)
Fig. 26: Paranoplocephala macrocephala (Douthitt, 1915). Mature segment, after Douthitt (1915)
Fig. 27: Paranoplocephala communis (Douthitt, 1915). Mature segment, after Douthitt (1915)



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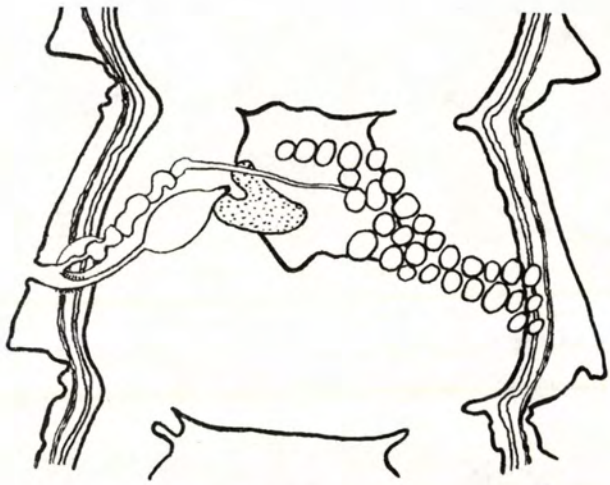

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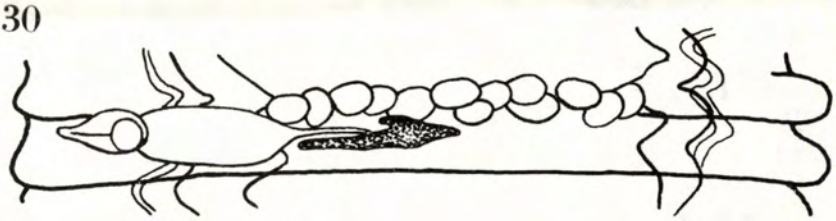

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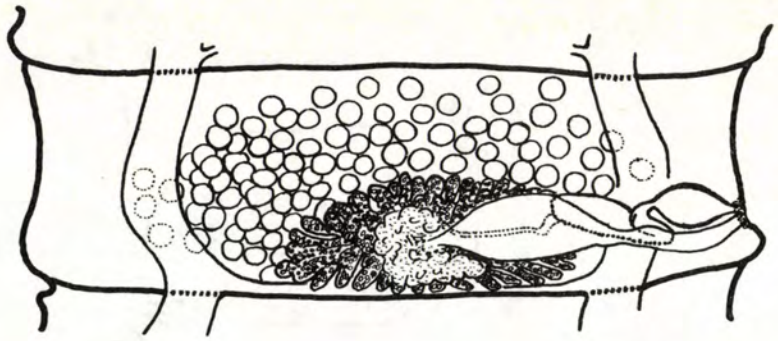
Figs 28–29: Paranoplocephala translucida (Douthitt, 1915). Mature segments, after Douthitt (1915)

Fig. 30: Paranoplocephala sp. After Tenora, Haukisalmi and Henttonen (1985)



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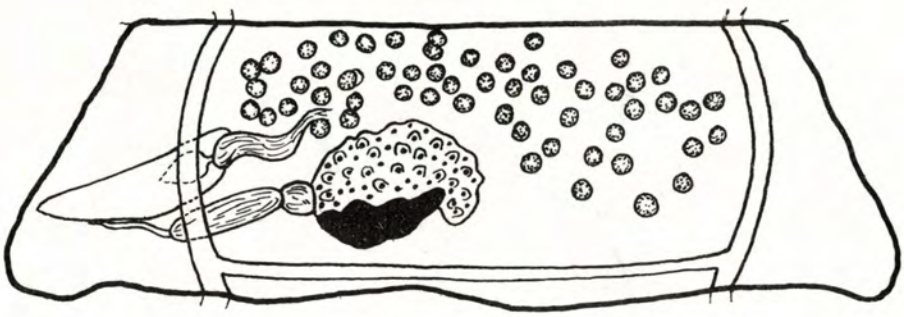

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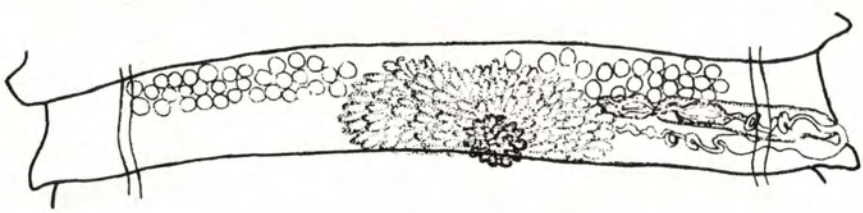

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Fig. 31: Paranoplocephala ondatræ (Rausch, 1948). Mature segment, after Rausch (1948)
Fig. 32: Paranoplocephala neotomae (Voge, 1946). Mature segment, after Voge (1946)
Fig. 33: Paranoplocephala petauristae (Sawada et Kugi, 1979).
Mature segment, after Sawada and Kugi (1979)

and HENTTONEN (1985), on page 411 the size of the scolex of the species P. kalelai is incorrect - instead of 0.53-1.16 it should read 0.5-0.7 in diameter.

24. Paranoplocephala sp. (Tenora, Haukisalmi and Henttonen, 1985) n. comb.
Syn.: ? Anoplocephaloides sp. Tenora, Haukisalmi and Henttonen, 1985.
Original host: Clethrionomys rufocanus, Finland.
Material deposited in the Zoological Museum, University of Helsinki.

Comments:

Allocation of this species to a genus is very difficult. Fig. 12 in the study of TENORA, HAUKISALMI and HENTTONEN (1985) shows the network-like uterus in the gravid segments. The external morphology of this species remotely resembles the species P. campestris and individuals which had been incorrectly identified in the study of TENORA and MURAI (1980) as P. blanchardi (for more details, see the study of TENORA, MURAI and VAUCHER, 1985). The internal morphology of this species shows that it is probably a new species of the genus Paranocephala.

25. Paranoplocephala janickii Tenora, Murai et Vaucher, 1985.
Original host: Microtus arvalis.
Holotype: deposited in the Hungarian Natural History Museum, Budapest, No. 6722.

Comments:

This species has a very short vagina and belongs to species related to P. blanchardi. From this species it fundamentally differs in the distribution of the testes which are both in the poral and aporal part of the segments. It cannot be excluded that this species had previously been incorrectly identified as A. macrocephala (compare ERHARDOVÁ 1956, ZARNOWSKI, 1955-1956, Fig. 2, c).

Criteria for identification of the valid species in the genus Paranoplocephala

The opinions of authors on criteria for the identification of bona species in the genus Paranoplocephala are not identical. We have dealt with this problem in detail in our study of 1986 (see TENORA, MURAI and VAUCHER, 1986). In addition, it must be said that especially in earlier descriptions data are often missing which, at the present time, are important (e.g. exact number of testes, length of the cirrus sac and length of the vagina, sometimes even the character of the opening of the reproductive organs, etc.). It was also found that the so-called representative characters do not, in fact, exist (e.g. the prostatic gland) and that it was merely mistaken for other already known organs (e.g. the vesicula seminalis externa, compare in RAUSCH 1976, TENORA, MURAI and VAUCHER, 1984).

The complexity of this situation is also some species have been found in the original hosts only once, in many species we do not know the extent of the variability not only of their organs, but also the variability of the morphology of the segments of the strobila. Only in individual cases is the rate of development of the uterus and/or development of the uterus as such known, hardly no facts are known about the number of mature segments or total number of segments. The greatest disadvantage is probably the fact that virtually no intermediate hosts of tapeworms of the genus Paranoplocephala are known, so that there are hardly any experimental studies which could explain the developmental cycles (see SMIRNOVA and KONTRIMAVICHUS, 1977).

On the basis of the authors' own experiences, according to available descriptions of the individual species and by investigating many of these species, the present authors classified the tapeworms of the genus Paranoplocephala into several groups (see Table 1). The following comments to this table are added:

The species whose description distinctly differs from all the other tapeworms of the genus Paranoplocephala, seems to be P. montana. Well differentiated are also tapeworm species

Table 1

Review of the division of Paranoplocephala Lühe, 1910

I. TESTES POSITION DIFFERENT IN MATURE AND PREMATURE SEGMENTS

1. P. MONTANA[+]

II. TESTES IN SAME POSITION IN MATURE AND PREMATURE SEGMENTS

II. 1. Vagina shorter than 1/2 of the cirrus sac or 1/2 of the cirrus sac

II. 1. a.	II. 1. b.
Testes aporally in mature segments	Testes aporally and porally in mature segments
1. *P. blanchardi*[x]	1. *P. janickii*[xx]
	2. *P. petauristae*[++]

II. 2. Vagina longer than 1/2 of the cirrus sac

II. 2. a.	II. 2. b.
Testes predominantly in aporal half in mature segments	Testes in aporal and poral half of mature segments
II. 2. a. A.	II. 2. b. A.
Seminal receptacle oval or spherical	Seminal receptacle oval or spherical
1. *P. bairdi*[+]	1. *P. primordialis*[+]
	2. *P. gundii*[+]
	3. *P. arctica*[+]
	4. *P. octodensis*[++]
	5. *P. gracilis*[xx]
	6. *P. kalelai*[+]
II. 2. a. B.	II. 2. b. B.
Seminal receptacle elongated or bottle-shaped	Seminal receptacle elongated or bottle-shaped
II. 2. a. B. 1.	II. 2. b. B. 1.
Testes across or beyond aporal ventral excretory canal	Testes across or beyond ventral excretory canals
1. *P. omphalodes*[x]	1. *P. macrocephala*[+]
2. *P. caucasica*[+]	2. *P. communis*[+] - sp. inquirenda
3. *P. microti*[+]	3. *P. translucida*[+] ? syn. of P. macrocephala
4. *P. kirbyi*[xx]	4. *P. ondatrae*[+]
5. *P. mascomai*[xx]	5. *P. bialowiezensis*[+] - nomen nudum
6. *Paranoplocephala* spp.	6. *P. dasymidis*[+]
II. 2. a. B. 2.	II. 2. b. B. 2.
Testes not across, not beyond ventral excretory canal	Testes not across, not beyond ventral excretory canal
1. *P. campestris*[+++] - sp. inquirenda	1. *P. neotomae*[+]
2. *Paranoplocephala* spp.	2. *Paranoplocephala* spp.

[+] First described in the genus Andrya

[++] First described in the genus Aprostatandrya

[+++] First described in the genus Anoplocephala

[x] First described in the genus Taenia

[xx] First described in the genus Paranoplocephala

which have a vagina that is shorter by as much as 1/2 of the cirrus sac, or maximum 1/2 of the cirrus sac: P. blanchardi, P. janickii and P. petauristae.

Tapeworms which have a vagina longer than 1/2 of the cirrus sac form the most numerous group. In this group the important differentiating criterion is the distribution of the testes: (1) the testes distributed both in the aporal and poral part of the segments, or (2) the testes are either exclusively in the aporal part of the segments or predominantly in the aporal part of the segments. Using this differentiating criterion along with knowledge of the character of the seminal receptacle, we have obtained several groups with species that are closely related.

Using comments given previously it seems that in the group where the oldest known described species is P. omphalodes, another bona species is P. mascomai, conditionally also P. caucasica. At the same time a synonym of the species P. caucasica seems to be P. microti and P. kirbyi. A species inquirenda is P. campestris.

P. arctica differs from P. primordialis in the group where it is the oldest described species. It is very hard to distinguish the species P. gracilis and P. kalelai from P. primordialis. These two species differ from each other evidently in the ratio length of vagina: length of cirrus sac.

Very numerous is the group where the oldest described species is P. macrocephala. Its synonym seems to be perhaps P. translucida whereas P. bialowiezensis is a nomen nudum. The species P. communis appears to be well distinguishable, P. ondatrae seems to be a bona species as well.

P. bairdi and P. neotomae also belong to the group of species which can be easily identified.

From this survey it is evident that there are still some other, yet undescribed, species of the Paranoplocephala.

Criteria, according to which - in the author's opinion - the hitherto described species of the genus Paranoplocephala can be distinguished, have been included into an identification key. The process of finding further criteria is a completely open matter.

ORIENTATION KEY TO THE SPECIES OF THE GENUS PARANOPLOCEPHALA LÜHE, 1910

1. Testes positioned in premature and mature segments differently, scolex about 0.400 mm, parasites of mountain - Caucasus - rodents in USSR (Figs 6 and 7) ..... Paranoplocephala montana (Kirschenblat, 1941)
- Tapeworms with other morphological, metrical and ecological marks 2
2. Vagina shorter than 1/2 of the cirrus sac, or 1/2 of the cirrus sac 3
- Vagina longer than 1/2 of the cirrus sac 5
3. Testes in aporal half of the segments (Fig. 8) ..... Paranoplocephala blanchardi (Moniez, 1890)*
- Testes in poral and aporal part of segments anteriorly to female gonads 4
4. Cirrus sac only slightly overlapping ventral excretory canal. Parasites of Microtus arvalis (Fig. 9) ..... Paranoplocephala janickii Tenora, Murai et Vaucher, 1985
- Cirrus sac considerably overlapping ventral excretory canal. Parasites of Petaurista leucogenys (Sciuridae) (Fig. 33) ..... Paranoplocephala petauristae (Sawada et Kugi, 1979)
5. Testes mostly in aporal half of segments 6
- Testes in aporal and poral half of segments 11
6. Seminal receptacle oval or spherical (Fig. 10) ..... Paranoplocephala bairdi (Schad, 1953)

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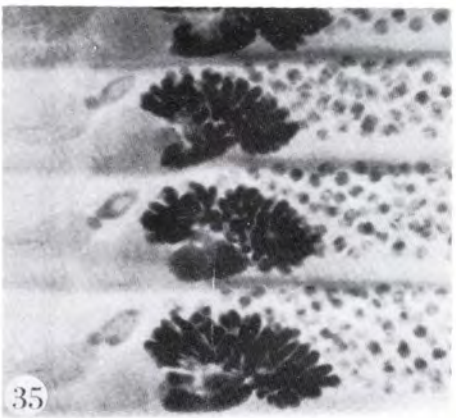
*Species studied personally

7. Testes not across or not beyond aporal ventral excretory canal ..... Paranoplocephala spp.*
- Testes across or beyond aporal ventral excretory canal 8
8. Small cestodes, 14-21 mm long, testes aporal beyond ventral excretory canal (Fig. 11) ..... Paranoplocephala mascomai Murai, Tenora et Rocamora, 1980*
- Cestodes of medium size, 60 mm and more in length, testes operlapping aporal ventral excretory canal, not beyond this canal..... 9
9. Vagina shorter than cirrus sac 10
- Vagina the same length or nearly the same length as cirrus sac ..... Paranoplocephala spp.*
10. Testes about 35-51 in number, genital opening irregularly alternating or alternating in sets, scolex more as 0.7 in diameter (Figs 12-14 and 40-45) ..... Paranoplocephala omphalodes (Hermann, 1783)*
- Testes 24-35 in number, genital opening irregularly alternating or unilateral; group of species, very near to P. omphalodes .....
.....(Fig. 16) Paranoplocephala caucasica (Kirschenblat, 1938)
.....(Fig. 15) Paranoplocephala microti (Hansen, 1947)
.....(Fig. 17) Paranoplocephala kirbyi (Voge, 1948)
11. Seminal receptacle spherical or oval 12
- Seminal receptacle elongated or bottle-shaped 17
12. Testes more than 90 in number 13
- Testes 25-60 in number 14
13. Testes beyond ventral excretory canals, parasites of Ctenodactylus gundii in Africa (Fig. 18) ..... Paranoplocephala gundii (Joyeux, 1923)*
- Testes only between ventral excretory canals, parasites of Octodon degus in South America (Fig. 19) ..... Paranoplocephala octodensis (Babero et Cattan, 1975)
14. Cirrus sac remarkable long, across 1/4 of segmental width. Genital opening irregularly alternating, testes number 40-50, scolex relatively small 0.215-0.500 mm, parasites of Arvicolidae (Fig. 20)..... Paranoplocephala arctica (Rausch, 1952)
- Cirrus sac smaller, of another length ratio 15
15. Vagina the same length or longer as cirrus sac. Genital opening unilateral, exceptionally alternating in long sets, testes 30-55 in number, scolex diameter 0.43-0.68 mm (Fig. 23) ..... Paranoplocephala gracilis Tenora et Murai, 1980*
- Vagina shorter as cirrus sac 16
16. Genital opening irregularly alternating. Testes 22-35 in number, scolex about 0.53-0.77 mm in diameter, cirrus sac longer than vagina (Fig. 22) ..... Paranoplocephala kalelai (Tenora, Haukisalmi et Henttonen, 1985)*
- Genital opening unilateral, testes 30-40 in number, scolex about 0.70 mm, parasites of Sciuridae (Fig. 21) .....Paranoplocephala primordialis (Douthitt, 1915)
17. Testes across or beyond ventral excretory canals 18
- Testes not across or not beyond excretory canals 22
18. Ovar dividing testes into two groups, testes 120-130 in number, parasites of Dasymys and Mylomys in Africa (Fig. 24) ..... Paranoplocephala dasymidis (Hunkeler, 1972)

Figs 34-39: Andrya rhopalocephala (Riehm, 1881)
(34-35= mature segments; 36= postmature segment with developing uterus; 37= coexistence of testes with uterus; 38-39= reticular uterus in gravid segments).

Figs 40-45: Paranoplocephala omphalodes (Hermann, 1783)
(40= mature segments; 41= uterus in postmature segments; 42-45= uterus development in the pregravid and gravid segments - Photos orig., based on Hungarian material from Lepus europaeus /34-39/ and from Microtus arvalis /40-45/).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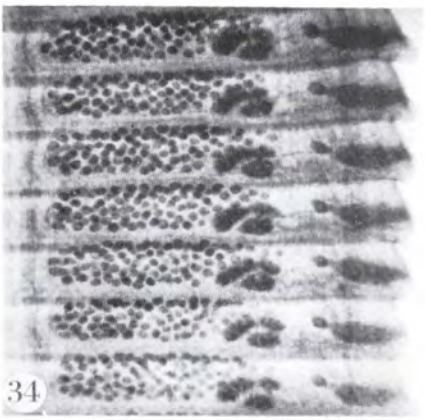
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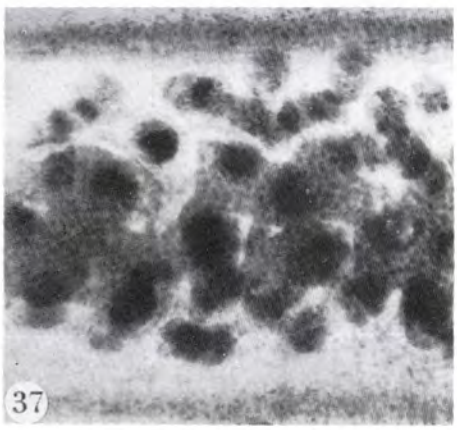
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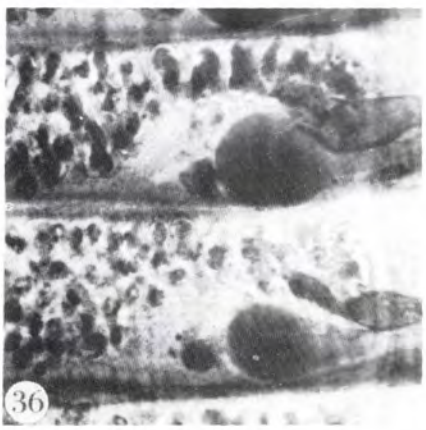
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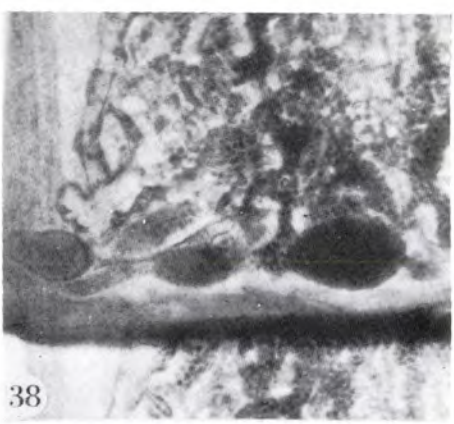
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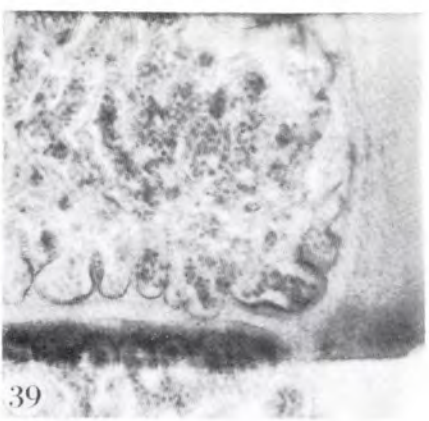
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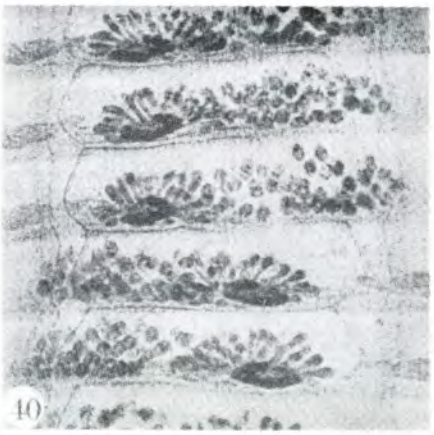
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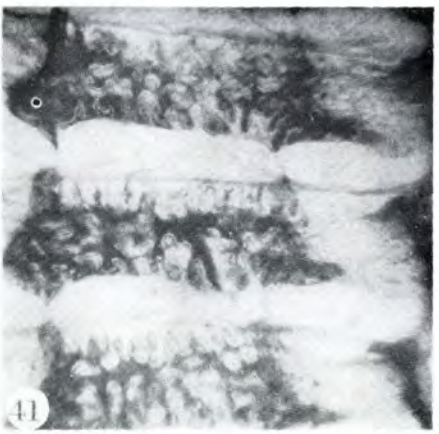
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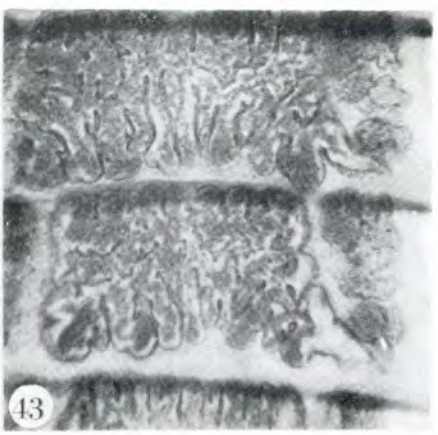
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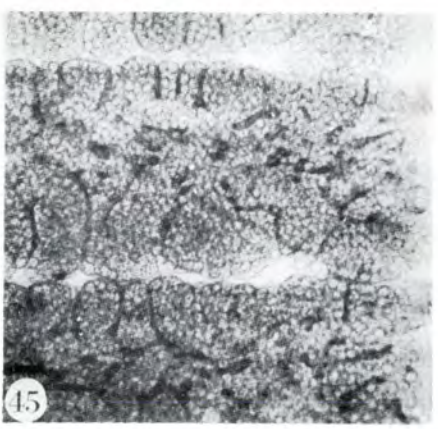
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- Testes not divided into groups 19
19. Testes 100-110 in number, strictly beyond ventral excretory canals, parasites of Glaucomys sabrinus in North America (Fig. 25) .... Paranoplocephala sciuri (Rausch, 1947)
- Testes less than 100, exceptionally across ventral excretory canals 20
20. Vagina longer than cirrus sac, scolex 0.560 mm, testes aporal across ventral excretory canal (Fig. 27) ..... Paranoplocephala communis (Douthitt, 1915)
- Vagina shorter than cirrus sac, scolex more than 0.560 mm 21
21. Testes 43-57 in number, not beyond poral margin of ovary, aporal across ventral excretory canal (Fig. 26) .... Paranoplocephala macrocephala (Douthitt, 1915) (Figs 28-29) syn.: Andrya translucida Douthitt, 1915
- Testes 75-95 in number, testes beyond poral margin of ovary (Fig. 31) .... Paranoplocephala ondatrae (Rausch, 1958)*
22. Cirrus sac strictly beyond ventral excretory canal, parasites of Neotoma fuscipes in North America (Fig. 32) ..... Paranoplocephala neotomae (Voge, 1946)
- Cirrus sac very short, not beyond, not across or over ventral excretory canal (Fig. 30) ..... Paranoplocephala sp. (Tenora, Haukisalmi et Henttonen, 1985)*; syn.: ? Anoplocephaloides sp. Tenora, Haukisalmi et Henttonen, 1985

Note:

In the key to the species we did not include the species Paranoplocephala otomyos Colins, 1972 because it might be a representative of the genus Anoplocephaloides (see RAUSCH, 1976) or a new genus.

It is the same in the case of the species P. acanthocirrosa Baer, 1924 which is now provisionally arranged in the genus Anoplocephaloides (see RAUSCH, 1976; TENORA, MURAI and VAUCHER, 1984). In the future it will be necessary to explain the correct generic position of the Paranoplocephala sp. Sec, Rim et Yoon, 1968.

TENORA, F. — MURAI, É. — VAUCHER, C.: Az Andrya Railliet, 1893 és Paranoplocephala Lühe, 1910 nemekről (Cestoda, Monieziinae)

A dolgozat valamennyi 1985-ig leirt Andrya és Paranoplocephala faj rendszertani helyzetét tisztázza és kulcsot ad a két nem fajainak meghatározásához. A szerzők elkészítették az Andrya és Paranoplocephala nemek új, "javított" leírását és az Anoplocephalidae család Monieziinae alcsaládjába tartozó genuszok határozókulcsát. A tárgyalt fajokról az eredeti leírásokban szereplő, vagy a szerzők által saját vizsgálataik alapján készített ábrákat mellékeltek.

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