Mathevolepis alpina sp. n. (Cestoda: Hymenolepididae) from an alpine shrew: the first record of the genus in Europe

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Abstract: Mathevolepis alpina sp. n. is described from an alpine shrew, Sorex alpinus, from the Carpathian Region of the Slovak Republic. The new species differs from other species of the genus by the morphology of the male copulatory apparatus, especially the cirrus, which is characterised by asymmetrical parabasal swelling. The new species represents the first record of cestodes of the genus Mathevolepis in Europe.

Keywords: Cyclophyllidea, taxonomy, Sorex alpinus, Slovak Republic, High Tatras, Palaearctic Region, distribution

The genus Mathevolepis Spassky, 1948 was erected by Spassky (1948) for M. petrotschenkoi Spassky, 1948, a parasite of shrews (Soricidae) in Siberia. According to Spassky (1948), the genus was characterised by a very short strobila composed of only two proglottides, with the last proglottides released from the strobila before becoming fully gravid, unarmed scolex with a rudimentary restellum and a sacciform uterus.

Significant contribution to the morphology of the type-species has been made by Gulyaev and Karpenko (1998), who redescribed M. petrotschenkoi and selected the neotype on the basis of a new material collected from the common shrew Sorex araneus L. in the north-eastern Altai mountains in Siberia. Live tapeworms were collected from freshly-dead shrews, allowing Gulyaev and Karpenko (1998) to precisely describe the morphological characteristics of the species and to reveal that hyperapolyssis is not a generic character of Mathevolepis as Spassky (1948) assumed.

Gulyaev and Karpenko (1998) also observed that the full development of eggs in M. petrotschenkoi was completed inside the gravid uterus and that only proglottides with invasive eggs detached from the strobila. Moreover, Gulyaev and Karpenko (1998) noticed that M. petrotschenkoi could have up to four proglottides that were morphologically clearly distinct from each other, each corresponding to a part in a series of proglottides at the same stage of development as in other unarmed hymenolepidid tapeworms of the related genera Ditetolepis Spassky, 1954, Cucurbilepis Sadovskaya, 1965 and Ecri-nolepis Spassky et Karpenko, 1983, which parasitize shrews (Spassky 1954, Sadovskaya 1965, Spassky and Karpenko 1983, Gulyaev 1991). Gulyaev and Karpenko (1998) considered the reduction in the number of proglottides to four in the strobila of M. petrotschenkoi to represent oligomerization. For this reason, they amended the generic diagnosis of Mathevolepis to include also species with more than four proglottides. They also transferred Cucurbilepis skrjabini Sadovskaya, 1965 and Hymenolepis macyi Locker et Rausch, 1952 to Mathevolepis and excluded two other species, namely Mathevolepis tri-varia Karpenko, 1990 and M. morosovi Karpenko, 1994, from the genus and later placed them in the new genus Brachyolepis Karpenko et Gulyaev, 1999 (Karpenko and Gulyaev 1999).

Since then, another two new species of Mathevolepis, M. junlanae Melnikova, Lykova et Gulyaev, 2004 from Russian Far East and M. ketenchievi Irzhavsky, Gulyaev et Lykova, 2005 from Central Caucasus, were described. Lykova et al. (2006) redescribed Mathevolepis larbi Karpenko, 1982 from Yakutia and assumed that it is not the synonym of Cucurbilepis sorextscherskii Morozov, 1957 as Gulyaev (1991) proposed. Consequently, Math-evolepis currently includes six species, all specific parasites of shrews. These are M. petrotschenkoi, M. skrjabini (Sadovskaya, 1965), M. macyi (Locker et Rausch, 1952), M. larbi, M. junlanae and M. ketenchievi.

Re-examination of cestodes of shrews collected by J. Mituch (Mituch 1968), currently deposited in the Eastern Slovak Museum in Košice, revealed that specimens designated as Insectivorolepis (= Soricinii) globosa (Baer, 1931) from Sorex alpinus Schinz did not morphologically correspond to the diagnosis of this species. Moreover, S. globosa was originally described by Baer (1931) from...
a shrew of the genus _Neomys_ Kaup. The results of the examination of these specimens supported their allocation into the genus _Mathevolepis_ as a new species. The aim of the present study is to describe this new species and to review the geographical distribution of all species of the genus.

**MATERIALS AND METHODS**

Unstained tapeworms from Mituch’s collections were fixed in formaldehyde and stored in one vial labelled as _Insectivororolepis globosa_ from the shrew _Sorex alpinus_ collected in 1958 from the High Tatras in the Slovak Republic. Four specimens were removed from vial and washed in tap water. Three of them were stained with Ehrlich’s haematoxylin or iron acetocarmine, were removed from vial and washed in tap water. Three of them were stained with Ehrlich’s haematoxylin or iron acetocarmine, differentiated in 70% ethanol with hydrochloric acid, then dehydrated in an ascending ethanol series, cleared in clove oil and mounted in Canada balsam. One specimen was mounted in Berlese’s medium to facilitate examination of the copulatory apparatus.

Measurements are presented in micrometres (µm) unless otherwise stated. The range of metrical data is given, with the mean and number of specimens measured in parentheses. Type specimens of the present species are deposited in the Natural History Museum, Geneva (MNHG), in the collection of the Laboratory of Parasitology of the Institute of Ecology of Nature Research Centre, Lithuania (EKOI) and in the Helminthological Collection, Institute of Parasitology, Biology Centre, Academy of Sciences of the Czech Republic, České Budějovice (IPCAS).

**RESULTS**

**Mathevolepis alpina** sp. n.  

*Fig. 1*

**Description** (based on four specimens). Body very small, flattened. Total length of entire pre gravid specimens 1.5–1.9 mm (1.6 mm, n = 3) and maximum width 205–248 (230, n = 3), consist of 10–12 proglottides (Fig. 1A). Strobilization serial. Strobila with very rapid protandrous development. Three clear series of proglottides each containing 3–4 proglottides at same stage of development observed in each strobila. First series represented by proglottides with underdeveloped male gonads, second series by mature hermaphroditic proglottides and third series by pre gravid proglottides with developing uterus.

Scolex oval, relatively large, 176–204 long and 201–259 wide (187 × 235, n = 3) (Fig. 1B). Suckers oval, 147–174 × 90–122 (161 × 107, n = 12), with well-marked muscular walls. Glandular sac-like rostellum, unarumed, 60–67 long and 26–33 wide (64 × 29, n = 3). Rostellar sac absent. Neck very short, 134–163 (147, n = 3) wide. Proglottides acraspedote. Juvenile proglottides much wider than long, 14–50 long and 112–168 wide (25 × 140, n = 12), mature proglottides slightly wider than long or almost as long as wide, 73–154 × 137–211 (106 × 172, n = 11), pre gravid proglottides longer than wide, 212–284 × 165–248 (243 × 205, n = 11).

Two pairs of osmoregulatory canals, divide proglottides into three almost equal parts; transverse anastomoses not observed. Ventral osmoregulatory canals with diameter 3–5 (4, n = 6), dorsal osmoregulatory canals with diameter 1–2 (2, n = 6). Lateral fields of proglottides 44–67 (54, n = 12) wide. Genital pore dextral, opens anteriorly to middle of lateral proglottis margin. Genital atrium cylindrical, 14–24 deep (20, n = 9), surrounded by intensely stained cells (Fig. 1C). Genital ducts pass dorsal to osmoregulatory canals.

Testes three, oval, 27–44 × 28–44 (37 × 36, n = 15), disposed in a right-angled triangle in median field of proglottis, where two antiporal testes lie one above another, more or less overlapping female gonads (Fig. 1C). Cirrus-sac elongated, bow-shaped, thin-walled, 143–244 × 13–18 (178 × 16, n = 10), crosses antiporal osmoregulatory canals (Fig. 1C,E). Partly-evaginated cirrus almost conical, with small asymmetrical parabasal swelling marked only in lateral view of cirrus (Fig. 1D). Evaginated part of cirrus 36–87 in length and 9–14 (10, n = 4) in width, invaginated part of cirrus 124–176 in length; total length of cirrus 160–263 (194, n = 4). Cirrus covered with needle-shaped spines of different size. Length of spines at base 2.5–3.9 (3.0, n = 15), at middle part 4.4–6.3 (5.3, n = 30) (Fig. 1D,E), in distal part their size decreases to 0.8–1.0 (0.9, n = 10). External seminal vesicle elongate, 35–53 × 9–16 (46 × 12, n = 8), usually bent along dorsal side of cirrus-sac, reaching middle line (Fig. 1C). Internal vas deferens forms few coils inside antiporal part of cirrus-sac. Internal seminal vesicle indistinguishable.

Ovary trilobed, 50–63 × 20–33 (56 × 26, n = 10), in centre of median field, ventral to testes; lobes oval, 23–31 × 16–27 (26 × 21, n = 9). Vitellarium compact, rounded, 23–29 × 16–20 (26 × 18, n = 10), posterior to ovary (Fig. 1C). Seminal receptacle elongates alongside midline. Vagina tubular, thin-walled, 85–104 × 7–11 (92 × 9, n = 8), runs parallel with and ventral to cirrus-sac and opens ventrally to genital atrium. Vagina with sphincter, 8–10 × 4–5 (9 × 5, n = 8) in middle part, sphincter lies at a distance of 26–47 (36, n = 8) from vaginal aperture (Fig. 1C,E). Uterus in pre gravid proglottides sac-like, 154–200 × 65–94 (168 × 76, n = 10); occupying almost entire median field, not crossing osmoregulatory canals (Fig. 1A). Fully-developed uterus not observed. Immature eggs numerous (up to 64–83), 7–10 (9, n = 20) in diameter.

**Type host:** _Sorex alpinus_ Schinz (Soriciformes: Soricidae).  
**Site:** Intestine.  
**Type locality:** High Tatras, Western Carpathian Region, Slovak Republic.  
**Type specimens:** Holotype: complete worm MHNG INVE 78871, Slovak Republic, 1958. Paratypes: complete worms EKOI HELMI 444 and IPCAS C-624.

**Etymology:** The species name refers to the name of the definitive host.
Fig. 1. Mathevolepis alpina sp. n. A – total view of mature specimen (holotype); B – scolex; C – mature hermaphroditic proglottis; D – cirrus; E – genital ducts.
The pattern of strobilation and strobilar morphology of Mathevolepis alpina correspond well to the generic diagnosis of Mathevolepis as amended by Gulyaev and Karpenko (1998). All known species of the genus are specific to shrews of the genus *Sorex* (Löcker and Rausch 1952, Spassky 1954, Sadovskaya 1965, Karpenko 1982, but differs in the possession of a longer cirrus—*M. alpina*.

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<th>Table 1. Hosts and distribution of species of the genus Mathevolepis in the Holarctic Region.</th>
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<td>Species</td>
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<td>Mathevolepis petrotschenkoi</td>
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<td>Mathevolepis magy (Locke et Rausch, 1952) Gulyaev et Karpenko, 1998 Syn.: Hymenolepis magy Locke et Rausch, 1952; Soricina magy (Locke et Rausch, 1952) Zarnowski, 1956</td>
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<td>Mathevolepis skrjabini (Sadovskyaya, 1965) Gulyaev et Karpenko, 1998 Syn.: Cucurbitispis skrjabini Sadovskyaya, 1965; Cucurbi- leptis trifolius Karpenko, 1983; Soricina japonica Sawada et Koyasu, 1991; Siniterlepis diglobovary sensu Eltyshev, 1975 nec Sadovskyaya, 1965</td>
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<td>Mathevolepis larbi Karpenko, 1982 Syn.: M. lircus Karpenko, 1982 according Lykova et al. (2006)</td>
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<td>Mathevolepis junlanae Melnikova, Lykova et Gulyaev, 2004</td>
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<td>Mathevolepis ketenchievi Izhavavoki, Gulyaev et Lykova, 2005</td>
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<td>Mathevolepis alpina sp. n.</td>
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**DISCUSSION**


Two species of Mathevolepis possess a markedly different number of proglottides in the strobila from that of *M. alpina*. These are the type-species *M. petrotschenkoi* (the number of proglottides 2–4) and *M. skrjabini* (up to 45 proglottides). The remaining four species have a number of proglottides closer to that of *M. alpina*. Mathevolepis ketenchievi has 12–15 proglottides, *M. larbi* 12–18 proglottides, *M. magy* 12–18 proglottides and *M. junlanae* 9–12 proglottides. One of the most reliable differentiating characters of the new species is the structure of the male copulatory apparatus. The cirrus of *M. alpina* (160–263 μm in length) is unique in having a small asymmetrical swelling on the parabasal part of the cirrus, which is well noticeable on the partly-evaginated cirrus (Fig. 1D).

Mathevolepis ketenchievi, described from two species of *Sorex* in the Central Caucasus, corresponds closely to *M. alpina*, but differs in the possession of a longer cirrus-sac (320–360 μm long) curved in the form of the letter “M” and a cirrus (350–400 μm long) with a symmetrical basal swelling. The number of eggs in the uterus of *M. ketenchievi* is greater (140–160) than that of *M. alpina*.

Mathevolepis larbi, described from shrews in Eastern Siberia, has a cirrus-sac 170–210 μm long and the sac does not cross the antiporal osmoregulator canals, and a cirrus is 170–200 μm long, without swellings. Moreover, the vaginal sphincter of *M. larbi* is situated in the entry of the copulatory part of the vagina in the genital atrium and the number of eggs in its uterus is about 150 (Lykova et al. 2006).

Mathevolepis junlanae described from *S. caecutiens* in Primorskiy Krai is characterised by a short straight cirrus-sac (100–150 μm long), which crosses the middle line but does not reach antiporal osmoregulator canals, a cirrus (up to 92 μm long and 14–15 μm wide) is with symmetrical parabasal swelling, a vaginal sphincter is situated near the female orifice and the number of eggs in the uterus is about 140–160.

Mathevolepis magy, a common parasite of shrews in North America, has a cirrus-sac up to 140 μm long, cirrus is without swelling, being armed with numerous hair-shaped, very slender spines, and eggs are 30–40 μm in diameter (Davis and Voge 1957).

According to all available data (see Table 1), the species of the genus Mathevolepis are unevenly distributed throughout the Holarctic Region. Most species have been found in the eastern part of the Palearctic Region: four species in Siberia and one species in Caucasus, whereas one species was found in the Nearctic Region (North America). Some records of Mathevolepis spp. (Nieland al. 2006).

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