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RARE AND ENDEMIC MILLIPEDES (DIPLOPODA) OF THE ABALIGET CAVE

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Description of the cave

The Abaliget Cave is situated in southern Hungary in the Mecsek Mts, about 20 km NW of the town Pécs, embedded in Middle Triassic limestone. It has a permanent stream along its main pathway which is connected to the surface by several vertical shafts. Stalaktites and stalagmites are not uncommon, although not so beautifully developed as in other Central European caves.

The cave is known since 1768, and was first described by Kölesi (1819). The next detailed description was given by Schmidl (1863), based on his own investigation in autumn 1862. The total length of the cave system, according to the latest exploration and mapping in 1977, is 991 meters. About 500 m has been prepared and opened to the public in 1957. The most impressive part of the cave is the "Nagy-terem" (Big Hall) at the end, situating about 18 m higher than the entrance and accessible by an iron staircase of 78 steps.

The fauna of the Abaliget Cave was first studied by Bokor (1887-1928) in the early 1920s, then summarised by Gebhardt in 1934 and in 1941-1942. Dudich and Méhely have also collected invertebrates in the cave. All the millipede findings were seen, identified and published by Verhoeff (1928), then kept a correspondence with Gebhardt. Altogether 190 animal species could be listed from the cave, of which only one snail (*Lartetia hungarica* Soós, 1927), two blind shrimps (*Niphargus molnari* Méhely, 1927 and *N. gebhardti* [Schellerberg, 1934]), one woodlouse (*Protelsonia hungarica* Méhely, 1924), and three species of millipedes can be considered as eu- or hemitroglobionts.

The millipede fauna

There are altogether eight species of millipedes (Table 1.) which were enumerated from the cave (Gebhardt 1934). Two of them (*Polydesmus collaris* C. L. Koch, 1847 and *Polyzonium germanicum* Brandt, 1837) are common in forest litter all around Southwest Hungary, they could most probably be driven into the cave by chance.

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The species *Trachysphaera noduligera* (Verhoeff, 1906) was first mentioned as *Gervaisia costata* (Waga, 1858) from the cave (Verhoeff 1928), but later corrected by himself as *G. noduligera* (Gebhardt 1934). The generic name *Gervaisia* Waga was preoccupied as noted by Strasser (1966) who proposed *Trachysphaera* Heller as a replacement name. The species is recorded from forest litter in the Mecsek Mts, southwest Hungary, although rather rare (Korsós 1994).

Two more species from the cave were mentioned by Gebhardt in 1934 (as *Craspedosoma transsilvanicum* [Verhoeff, 1897] and *Heteroporatia mehelyi* Verhoeff, 1897), but they have uncertain status in taxonomy. The first one belongs in the *Craspedosoma rawlinsii* Leach, 1814 complex, which is under revision by Hauser (1999). *Heteroporatia mehelyi* could be updated as *Mastigona mehelyi*, however, it is hard to distinguish from *Mastigona bosniensis* (Verhoeff, 1897). Anyhow, both species occur outside the cave and are not particularly adapted to the special environment. Together with the former ones, these five millipede species can only be considered as tychotroglobiont elements (according to Dudich's classification, 1932).

Species	Order	Ref.	Cave element
Trachysphaera noduligera	Glomerida	Verhoeff 1928, Gebhardt 1934	tychotroglobiont
Polyzonium germanicum	Polyzoniida	Gebhardt 1934	tychotroglobiont
Craspedosoma transsilvanicum	Chordeumatida	Gebhardt 1934	tychotroglobiont
Hungarosoma bokori	Chordeumatida	Verhoeff 1928	hemitroglobiont
Haasea hungarica	Chordeumatida	Verhoeff 1928	hemitroglobiont
Mastigona mehelyi	Chordeumatida	Gebhardt 1934	tychotroglobiont
Brachydesmus troglobius	Polydesmida	Verhoeff 1928	eutroglobiont
Polydesmus collaris	Polydesmida	Daday 1889, Gebhardt 1934	tychotroglobiont

Three millipede species are known from the Abaliget Cave which can be considered as eu- or hemitroglobiont, and at the same time are rare or endemic faunal elements in the cave. They are small (up to 12 mm long) and white, depigmented, have a few ocelli (chordeumatids) or are completely blind (polydesmid).

Hungarosoma bokori Verhoeff, 1928

Order: Chordeumatida
Family: Anthroleucosomatidae

Material examined:
One juvenile, 12 September 1991, Nagy-terem, leg. Z. Korsós & H. J. Read

The species was described from the Abaliget Cave by Verhoeff (1928) based on a single female specimen. According to the original description, it was about 5 mm long, white, except the 11 black ocelli (4,3,2,1,1), had 28 trunk segments, and a pair of long macrosetae on each diplosomite. The nearest relative in the family (Brachychaeteumidae at that time) is the Japanese genus *Macrochaeteuma*. The new species was named after Bokor, keen explorer of the Abaliget Cave, who found the type specimen on 24 August, 1924. It was allocated in a new genus, *Hungarosoma*. The family (presently called Anthroleucosomatidae, see Hoffman 1979) has had no other member in the Carpathian Basin, until Ceuca (1967) discovered two females of another new species, *Hungarosoma inexpectata* in the Botanical Garden of Cluj in 1964.

The rare and thought to be endemic species was found 6 year later in more female specimens by Gebhardt (1934). Loksa (1961), interestingly, adds Kovácsi Hill as a second locality for the species. This locality is situated at the northwestern corner of Lake Balaton in the Keszthelyi Mts, and represents a cool basalt corridor with many unexpected soil zoological elements. From all these collectings, unfortunately, no specimens were preserved in the Hungarian Natural History Museum.

In 1991 a short visit to the cave gained a single specimen found under wood debris in the most remote part, the "Big Hall". Although it is a juvenile, its characters fit well to the description by Verhoeff, i. e. depigmented body, long macrosetae, shape of segment. Its totally white body is ornamented only by three distinctly black ocelli on each side of the head. It has 21 body segments (+head and anal ring), length ca. 5 mm.

Haasea hungarica (Verhoeff, 1928)

Order: Chordeumatida
Family: Haaseidae

Material examined:
Two females, 14 August 1999, Nagy-terem, leg. Z. & P. Korsós

It was described as a new species of *Orobainosoma* (senior syn.: *Haasea*, see Hoffman 1979) from the collecting by Bokor in March, 1922. First it was thought to be a real cave endemism, but later found in forest litter in the Kőszegi Mts, W Hungary (Szalay 1942), on Kovácsi Hill (Loksa 1961), and in the Dráva Region (Korsós 1998) as well.

The two specimens collected recently have the following details: (1) adult female with 28 body segments (+head and anal ring), ca. 8 mm long, strong black triangle eye field on

both sides of the head; (2) damaged subadult female with at least 22 body rings, somewhat smaller in size, only 3 (2+1) ocelli in two rows on both sides. The adult has a pale light brown colouration, whereas the subadult is totally depigmented.

Brachydesmus troglobius Daday, 1889

Order: Polydesmida
Family: Polydesmidae

Material examined:
Three specimens, October 1923, leg. E. Bokor, Inv. No. 1720/1928, det. Verhoeff, revid Loksa 240/1953: (1) subadult female with 18 segments(+head), ca. 8 mm long; (2) female with 12+7 segments + head; (3) body end with 10 segments

Five specimens, 12 August 1924, leg. E. Dudich, Inv. No. 1721/1928, det. Verhoeff, revid. Loksa 234/1953: (1) female 18 body segments +head and anal ring, ca. 11 mm long; (2) female 18 b.s.+h+a, ca. 12 mm; (3) female 10+8 b.s +h+a, ca. 10 mm; (4) female 9+9 b.s.+h+a, ca. 10 mm; (5) juv. 5+4+7 b.s.+h+a, ca. 7 mm

Fragments of 9 specimens, 3 males, 5 females, 1 juv., altogether 21 fragments, 21 April 1922, leg. E. Bokor, Inv. No. 1722/1928, det. Verhoeff, revid. Loksa 245/1953

Seven specimens, 12 September 1991, Nagy-terem, leg. Z. Korsós & H. J. Read: (1) 19 b.s.+h+a, 9 mm; (2) 18 b.s.+h+a, 10 mm; (3) subadult 17 b.s.+h+a; (4) four juveniles: 15, 14, 13, 12 b.s.+h+a

The species was described from the cave by Daday (1889) in his monograph on Hungarian myriapods. Attems (1911) and Verhoeff (1928) gave good gonopod drawings of the males. Gebhardt (1934, 1941-1942, 1959) considered it as endemic for the cave, however, it is quite widespread in the carstic system of former Yugoslavia (Mrsic 1988, 1994, Curcic & Makarov 1998). Despite this, *Brachydesmus troglobius* is the only eutroglobiont element of the Abaliget Cave.

The material studied consisted of altogether 24 specimens: intact bodies or fragments of 3 males, 15 females, and 6 juveniles. Adults have 19 body rings + head and anal segment, with a total length of 8-12 mm. They uniformly whitish, depigmented. The postembryonic development was described by Curcic & Makarov (1998).

Discussion

Five of the eight species recorded altogether in the Abaliget Cave were only found occasionally more than 50 years ago. *Trachysphaera noduligera* was first collected by Bokor in 1922, then by Gebhardt in 1930 (Gebhardt 1934). *Polyzonium germanicum* was found by Gebhardt only once thought in several specimens in 1930. The first specimens of *Polydesmus collaris* were collected by Pável as mentioned by Daday (1889), then the species was recollected Bokor, Dudich and Gebhardt as well in the 1920s (Gebhardt 1934). The two species of chordeumatids (*Mastigona mehelyi* and *Craspedosoma transsilvanicum*) may loose their importance if their taxonomic status will be clarified. They were only found in the cave by Gebhardt in 1930. *M. mehelyi* was originally described by Verhoeff (1897) from the Buda Hills near Budapest, and later only repeated by Gere (1962) from Hársbokor-hegy, Buda Hills.

The three remaining species were all registered by Gebhardt as troglobionts and true endemisms for the Abaliget Cave. However, two of them (*Hungarosoma bokori*, *Haasea hungarica*) were later found by Loksa (1961) also in forest litter at the Kovácsi Hill. This locality is situated in the volcanic region northeast of Keszthely at the lake Balaton. It is a special biotope made of basalt rocks containing many microcavernicolous habitats, and covered by dense forest with a exceptional cool microclimate.

The eighth species, *Brachydesmus troglobius* is the only one which is, although not endemic any more to the Abaliget Cave, but occurs only in real cave environment and hence can be considered as an eutroglobiont species. Its rather compact distribution in the North Balkan, especially in the Dinaric Karst, may well be extended to the Mecsek Mts as well. It is interesting, nevertheless, that this species was not (yet?) found in other caves in Mecsek (Gebhardt 1933).

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Summary

The millipede fauna of the Abaliget Cave consists of altogether eight diplopod species: *Trachysphaera noduligera, Polyzonium germanicum, Craspedosoma transsilvanicum, Hungarosoma bokori, Haasea hungarica, Mastigona mehelyi, Brachydesmus troglobius, Polydesmus collaris*. Five of these are tychotroglobiont, i. e. occur in the cave only by chance, and three of them (*Hungarosoma bokori, Haasea hungarica, Brachydesmus troglobius*) are characteristic elements for the cave. The only species which can be considered as a real cave endemism is *Brachydesmus troglobius*, which also occurs throughout the caves of former Yugoslavia. Its presence and survival in the Abaliget Cave has been proved by recent collectings as well.