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The enchytraeid fauna (Annelida: Oligochaeta) of the Sas-hegy Nature Conservation Area, Hungary

G. BOROS[1]

Abstract. The aims of the present study, which was part of our comprehensive investigation of rock grasslands of Hungary, were to explore the enchytraeid fauna of Sas-hegy Nature Conservation Area, and to get knowledge on some ecological characteristics of this family. Ten enchytraeid species of five genera were found during the investigations; one of them, *Achaeta antefolliculata* proved to be new to science. The fact that the species *Fridericia maculatiformis* and *Fridericia tubulosa* proved to be dominant in the opened rock grasslands of Hungary might lead to a conclusion that they are the most characteristics species of these kind of habitats. The investigations of rock grasslands of Sas-hegy and other Hungarian hills, e.g. Szent György Hill, Nagy Szénás Hill and Villányi Mountains, show that the enchytraeid fauna of these localities are affected by the actual status of microhabitats (organic matter content, soil moisture, plant covering).

INTRODUCTION

There are certainly no many capitals worldwide which would have such a precious and vivid nature conservation area rich in endemic elements like Sas-hegy (Sas Hill) in the centre of Budapest, Hungary. It is a small dolomite hill of late Triassic origin with narrow ridges and steep slopes, situated on the right side of river Danube (Fig. 1). It extents to approximately 30 hectares with maximal height of 254 m above sea level. Due to its relic flora and special fauna, it has been protected since 1958, and now is part of the Duna-Ipoly National Park

Concerning the earlier publications on the fauna and flora of Sas Hill, Loksa (1977) provided a good view. As for the invertebrate fauna, Balogh (1935), Bleicher *et al.* (1999), and Samu & Szinetár (2000) published valuable data. However, comprehensive investigations on the enchytraeid worms (Annelida: Oligochaeta) have not been carried out so far. Moreover, there is only one publication deling with enchytraeids living on rock grasslands: Schmidegg (1938) studied the corresponding fauna living in elevations of 2000-3000 metres in the Austrian Alps.

Rock grasslands build due to their location and shallow soils a special habitat that is rich in organic matter content, but can easily desiccate. Since enchytraeids prefer soils with high organic matter content on arid places, too, we have planned to study the enchytraeid fauna of the Sas-hegy Nature Conservation Area, and to get knowledge on some ecological characteristics of this family. This study is part of our comprehensive investigation of rock grasslands of Hungary.

MATERIALS AND METHODS

The present investigations were carried out in the period between autumn 2003 and spring 2005. Soil samples were taken continually when the worms were in active life period that is in spring and autumn. Preliminary monitoring ascertained that our worms get at inactive condition in the dry seasons, in summer and winter.

Three different plant associations were chosen for sampling:

1. *Seslerietum sadlerianae* on the Northern side of the hill.
2. Open rock grassland *Seseli leucospermo–Festucetum pallentis.*
3. Closed rock grassland *Festuco pallenti–Brometum pannonic;* both latter situated on the south-west slopes.

[1]*Gergely Boros*, ELTE Állatrendszertani és Ökológiai Tanszék (Department of Systematic Zoology and Ecology of the Eötvös Loránd University), H-1117 Budapest, Pázmány Péter sétány 1/C, Hungary. E-mail: henlea@citromail.hu

Figure 1. Location of the Sas-hegy Nature Conservation Area in District XI, Budapest

Both qualitative and quantitative samples were collected; the latter were taken by using a convertible iron cylinder of 5,05 cm diameter (A = 20 cm^2). The samples were taken from 0 to 8 cm depth, and later divided into an upper (0–3 cm) and a lower (3–8 cm) section. Animals were extracted with the O'Connor wet funnel method (O'Connor, 1962). For microscopic investigations, the living worms were put on glass slides in a few drops of water and covered with cover slips. The pressure of the cover slip is necessary to immobilize the worms and to flatten the body, in order to make the internal organs visible. The large or too agile animals were narcotized with sparkling mineral water.

Drawings and photographs of the most important organs were taken by Zeiss Axioskop 2 microscope, using DIC (Differental Interference Contrast) illumination and an Olympus Colour View digital camera with DP-Soft software. The animals were anaesthetized in 30 % ethanol and preserved in 70 % ethanol containing one percentage of formaldehyde. The specimens of the species *Achaeta antefolliculata* were also anaesthetized in 30 % ethanol, but subsequently they were stained with a mixture of borax-carmine and bromphenol-blue, and mounted in euparal.

Since enchytraeids are terricolous animals, their presence and abundance might not be independent from certain soil parameters. Therefore, pH, organic matter content, $CaCO_3$ content were also measured to compare the three associations sampled

RESULTS

During the investigation the following ten enchytraeid species belonging to five genera were observed:

Achaeta antefolliculata Dózsa-Farkas & Boros, 2005
Achaeta pannonica Graefe, 1989
Buccholzia appendiculata (Buccholz, 1862)
Enchytraeus bulbosus Nielsen & Christensen, 1963
Enchytraeus variatus Bougenec & Gianni, 1987
Fridericia conculcata Dózsa-Farkas, 1986
Fridericia eiseni Dózsa-Farkas, 2005
Fridericia maculatiformis Dózsa-Farkas, 1972
Fridericia tubulosa Dózsa-Farkas, 1972
Henlea ventriculosa (Udekem, 1854)

One of them, *Achaeta antefolliculata* proved to be new to science (Dózsa-Farkas & Boros, 2005). It is worth to mention that the species *Fridericia maculateformis* and *Fridericia tubulosa* have also been found in other rock grasslands in Hungary, namely in Szent György Hill, Nagy Szénás Hill, Villányi Mountains, etc. (unpublished data). Their dominance suggests that they are the most characteristic species of the open rock grasslands in Hungary (Fig. 2).

The individuals of the species found had eggs at all times, which shows that their reproduction was continuous throughout their active life period. *Buchholzia appendiculata* proved to be the only exception. Sexually mature individuals of this species were not found at all. This fact coincides with the observations of Christensen *et al.* (2002) who found that this enchytraeid propagates either by fragmentation or some individuals of the population become mature but only for a short period of time.

The abundance of the animals though greatly varied, but it was relatively low, apart from the

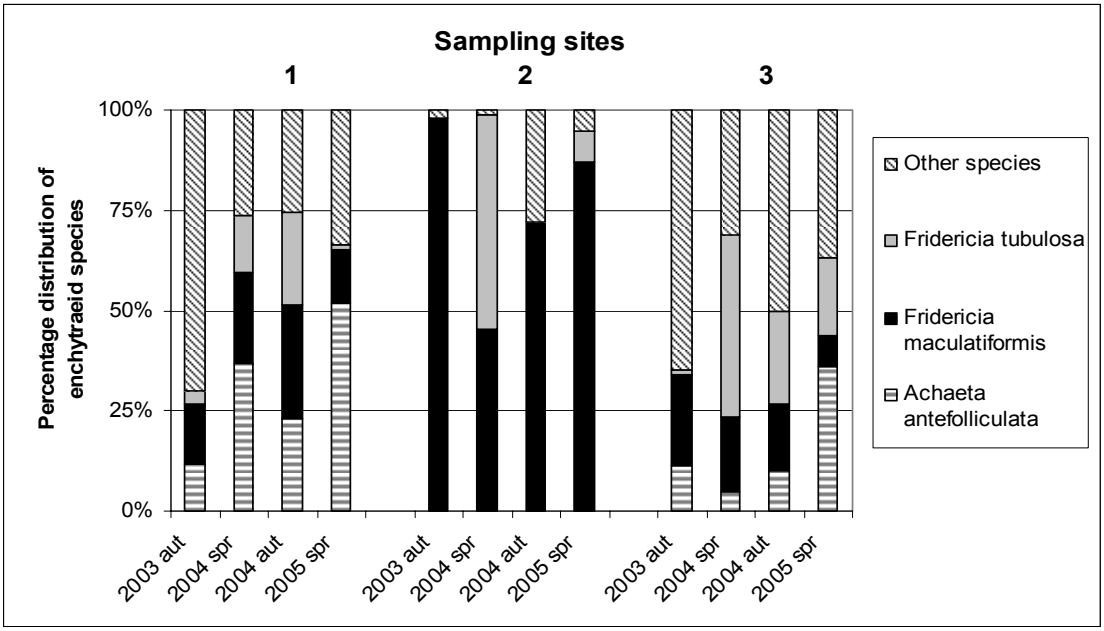

Figure 2. Distribution of enchytraeids in the three plant associations. 1 = *Seslerietum sadlerianae*, 2 = *Seseli leucospermo–Festucetum pallentis,* open rock grassland, 3 = *Festuco pallent– Brometum pannonici,* close rock grassland

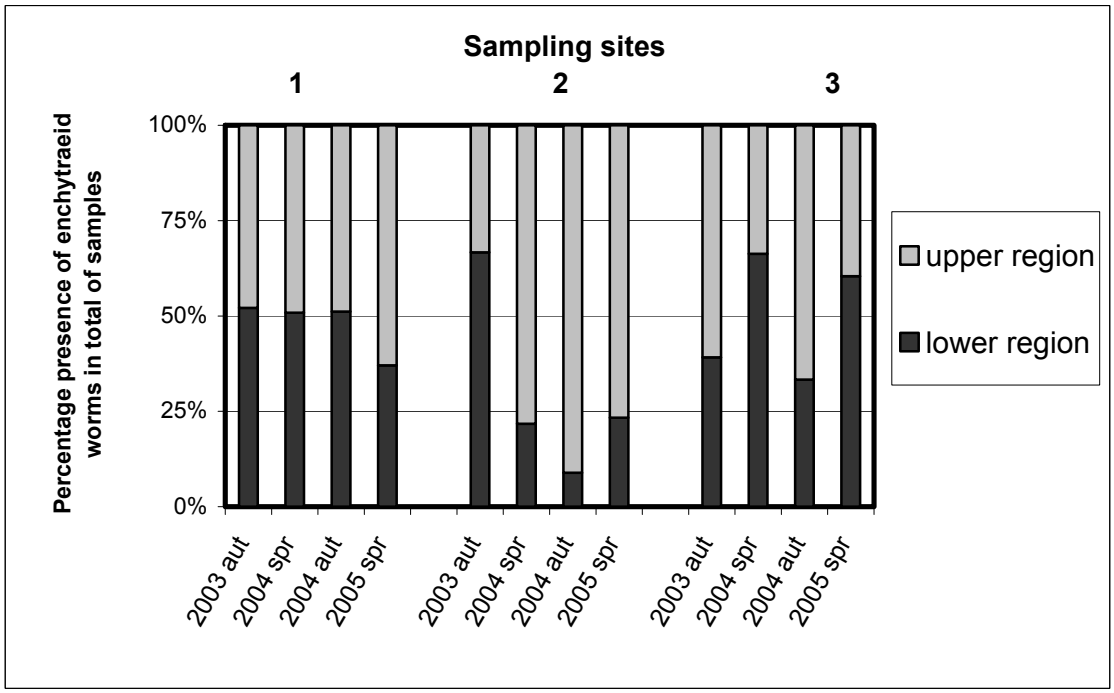

Figure 3. Vertical distributions of enchytraeids in the three plant associations. 1 = *Seslerietum sadlerianae*, 2 = *Seseli leucospermo–Festucetum pallentis,* open rock grassland, 3 = *Festuco pallenti– Brometum pannonici,* close rock grassland

closed rock grassland *(Festuco pallenti–Brometum pannonici)* in springs of the two consecutive years (Table 1). On the basis of these two outstanding values we may suppose that the dense plant cover keeps the soil moisture more efficiently and make possible for more enchytraeids to survive dry periods.

Table1. Abundance of enchytraeids (individual/m^2) in the three investigated associations. 1 = *Seslerietum sadlerianae*, 2 = *Seseli leucospermo–Festucetum pallentis,* open rock grassland, 3 = *Festuco pallenti–Brometum pannonici,* close rock grassland. Significant values signed with * (Mann-Whitney, p.= 0.05).

	1. association	2. association	3. association
Autumn, 2003	4100	6450	6000
Spring, 2004	2950	4600	22250*
Autumn, 2004	2150	2250	2050
Spring, 2005	5800	4250	12250*

As mentioned above, each sample was separated to an upper and a lower section, so that the vertical distribution of the animals could also be estimated. Seasonal period in their activity could be observed only in the closed grassland; most of the animals preferred the upper region in autumn and the lower one in springtime (Fig. 3).

Soil parameters are shown in Table 2. As for pH, there were no differences among the three investigated associations. The pH values varied around 7. However, this divergence is not considerable for enchytraeids and the similar domain is typical of most of their habitats. The organic matter content was high in *Seslerietum sadlerianae* and *Festuco pallenti–Brometum pannonici,* while it was much lower in *Seseli leucospermo–Festucetum pallentis*. In the open rock grassland the close of the vegetation was not complete, so the erosion prevents the humus from accumulating.

Diversity was higher in soil with high organic matter content, and the representatives of the genus *Achaeta* were found only at these places. The data of $CaCO_3$ content were not of use. They were extremely high; these values cannot be justified by the dolomite base rock. One might be able to give hypothetical explanations for this, though the problem can only be answered with the help of geological researches.

Table 2. Soil parameters of the three investigated association. 1 = *Seslerietum sadlerianae*, 2 = *Seseli leucospermo–Festucetum pallentis,* open rock grassland, 3 = *Festuco pallenti–Brometum pannonici*, close rock grassland.

	pH (H_2O/KCl)	Organic matter content (%)	$CaCO_3$ content (%)
1. association	7.2 ± 0.1 / 7.0 ± 0.1	11.5 ± 0.4	41.2 ± 13.4
2. association	7.3 ± 0.1 / 7.0 ± 0.2	5.6 ± 1.3	67,2 ± 4.1
3. association	7,3 ± 0.2 / 7.1 ± 0.1	14,7 ± 0.8	39,8 ± 2.5

It seems that the investigation of rock grasslands of Sas Hill (and other Hungarian hills and mountains, e.g. Szent György Hill, Nagy Szénás Hill and Villányi Mountains) prove that the enchytraeid fauna of these places are affected by the actual status of microhabitats (organic matter content, soil moisture, plant cover). Schmidegg (1938) came to similar conclusion, the enchytraeid fauna of rock grasslands strongly depends on the plant cover.

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