

## Soil inhabiting testaceans (Protozoa: Rhizopoda) from the Hungarian Central Mountains

By

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**Abstract.** Testate amoebae were collected from 26 sites in the Hungarian Central Mountains. 41 species were detected, 5 of them are new for the Hungarian fauna.

Hungarian Central Mountains provide a series of different soils, covering several kinds of parent rocks. This region is mostly part of National Nature Reserve, therefore these soils are nearly free from human influence. Consequently, amount of testacean species is expected to be higher than that of cultivated areas, including some new, rare taxa as well. Former investigations concerning soil testate amoebae were carried out by BICZÓK (1955, 1956), VARGA (1935, 1959, 1961, etc.) and JEKKEK (1969). Their papers comprised remarkable results on taxonomic and ecological significance of protozoans - included testaceans - collected mainly from cultivated or disturbed lands.

This qualitative, preliminary study is a contribution to our knowledge about the inland soil testacean fauna.

### Materials and methods

Sampling sites were located at five different areas throughout the Hungarian Central Mountains: Börzsöny Mountains, Visegrádi-M., Budai-M., Vértes-M. and Bakony-M. (Fig. 1). Sampling took place in 30 — 60 year old forests, settled on brown forest soil, comprising more or less thick litter layer. Collection has been restricted to the AoF and AoH horizons, which are considered to be the richest in species (after LOUSIER, 1974). Table 1 shows the quality of the study area. Samples were composed of considerable amount fragmented litter mixed with amorphous organic material. All of them - about 500 g wet weight each - were dried out at room temperature for some days. After flotation of the sifted material shells were systematically identified under microscope.

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Table 1. Characteristics of the sampling sites

	Sampling site	Altitude	Parent rock	Forest type	Ao thickness	Date of sampling
1.	Börzsöny Mountains Csömöle Valley /1	200 m	andesite	mixed oak ( <i>Quercetum petraea</i> <i>Carpinetum</i> )	2-3 cm	09. 10. 1994
2.	Csömöle Valley /2	200 m		beech	3-4 cm	09. 24. 1994
3.	Csömöle Valley /3	200 m		mixed beech- larch - spruce	5-7 cm	
4.	Csömöle Valley /4	200 m		mixed beech - oak	1-2 cm	12. 29. 1994
5.	valley of Fekete Stream	620 m		beech	1 cm	04. 08. 1995
6.	Hosszú-bérc Hill	600 m		mixed beech- larch - spruce		
7.	below Nagy Hideg Hill	720 m		mixed beech - oak		
8.	Cseh-vár Hill	540 m		beech		
9.	Hosszú-bérc Hill /1	600 m		mixed beech - larch - spruce	6-8 cm	
10.	Hosszú-bérc Hill /2	620 m				
11.	Hosszú-bérc Hill /3	640 m				
12.	Hosszú-bérc Hill /4	640 m				
13.	Hosszú-bérc Hill /5	660 m				
14.	1 km East from Foltán-kereszt	680 m		mixed beech - larch - spruce, (temporarily wet soil)		
15.	1.5 km North from Foltán-kereszt	700 m		spruce	2-3 cm	
16.	below Cseh-vár Hill	480 m		beech	3-4 cm	
17.	Visegrádi Mountains Apátkúti Valley /1	280 m		mixed oak	1 cm	09. 17. 1994
18.	Apátkúti Valley /2	300 m			2 cm	
19.	Budai Mountains Remete Valley /1	270 m	limestone		2 cm	
20.	Remete Valley /2	320 m			0.5-1 cm	08. 28. 1994
21.	Remete Hill /1	400 m			1 cm	
22.	Remete Hill /2	410 m				
23.	Remete Hill /3	360 m				
24.	Vértés Mountains Vinyabükki Valley	300 m			1 cm	03. 11. 1994
25.	Bakony Mountains Koloska Valley	250 m			2 cm	11. 04. 1993
26.	Farkasgyepő	320 m		beech	1-2 cm	09. 27. 1994

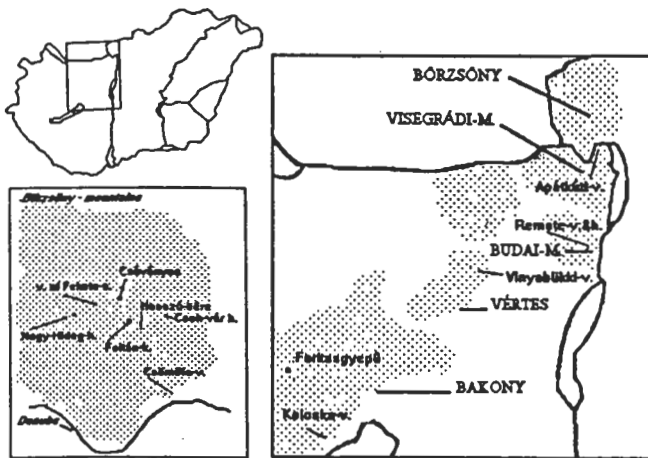


Fig. 1. Location of the sampling sites

## Results

Altogether 41 taxa were determined (Tables 2 and 3). Five of them are new for Hungarian fauna, these are as follows:

*Centropyxis plagiostoma* BONNET & THOMAS, 1955

*Plagiopyxis intermedia* BONNET, 1959

*Plagiopyxis oblonga* BONNET & THOMAS, 1960

*Nebela bigibbosa* PENARD, 1890 (Fig. 2 a, b).

*Nebela retorta* WAILES, 1912

Most species - 25 - were determined from the Fekete Valley (Börzsöny Mountains). Poorest site was below Cseh-vár Hill (Börzsöny Mountains) comprising only 7 species.

Some 'dubious' *Euglypha* specimens are referred to as *E. "ciliata"* in the species list. *Diffflugia* sp. indicates about 60  $\mu$  long, round shaped, slightly pyriform specimens, belonging to so far unknown species.

Table 2. List of species in the Börzsöny Mountains

\*F = valley of Fekete Creek, H = Hosszú-bérc Hill, N = below Nagy-Hideg Hill, C = Cseh-vár Hill, E = East of Foltán-kereszt, k = North of Foltán-kereszt, b = below Cseh-vár Hill

	BÖRZSÓNY																
	Csömöle Valley				F*	H*	N*	C*	Hosszú-Bérc Hill					E*	K*	B*	
	1	2	3	4					1	2	3	4	5				
<i>Arcella arenaria</i> Greeff					+			+	+	+	+				+	+	-
<i>Centropyxis aerophila</i> Deflandre			+	+	+	+	+								+		
<i>Centropyxis aerophila</i> <i>sphagnicola</i> Deflandre			+		+		+	+	+	+	+	+	+	+	+	+	+
<i>Centropyxis constricta</i> Ehrenberg				+													
<i>Centropyxis orbicularis</i> Deflandre	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Centropyxis plagiotoma</i> Bonnet & Thomas			+	+			+			+		+	+	+		+	
<i>Cyclopyxis arcelloides</i> (Penard) Deflandre				+													
<i>Cyclopyxis eurystoma</i> Deflandre	+					+	+	+	+		+						
<i>Cyclopyxis kahli</i> Deflandre	+	+			+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Trigonopyxis arcuata</i> (Leidy) Penard																	
<i>Pontigulatia bryophila</i> Penard						+											
<i>Diffugia bryophila</i> (Penard) Jung				+											+		
<i>Diffugia lucida</i> Penard						+		+									
<i>Diffugia oblonga oblonga</i> Ehrenberg															+		
<i>Diffugia</i> sp.				+		+									+		
<i>Plagiopyxis declivis</i> Thomas	+	+			+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Plagiopyxis intermedia</i> Bonnet	+	+				+		+			+						
<i>Plagiopyxis oblonga</i> Bonnet & Thomas			+			+		+								+	
<i>Geopyxella sylvicola</i> Bonnet & Thomas						+									+	+	
<i>Helospora rosea</i> Penard	+		+	+	+										+		
<i>Helospora sylvatica</i> Penard		+				+	+	+		+	+	+	+				
<i>Nehela bigibbosa</i> Penard						+	+										
<i>Nehela collaris</i> (Ehrenberg) Leidy					+	+	+	+		+	+						
<i>Nehela lageniformis</i> Penard						+	+				+	+	+			+	
<i>Nehela ratorata</i> Wailles						+											
<i>Awerintzevia cyclostoma</i> Penard			+			+											
<i>Quadrulella symmetrica</i> Wallich						+											
<i>Diffugiella oviformis</i> (Pen.) Bonnet & Thomas						+				+							
<i>Phryganella acropodia</i> Hopkinson		+	+	+	+		+		+	+	+	+	+			+	-
<i>Assulina muscorum</i> Greeff							+	+	+				+	+		+	+
<i>Corythion dubium</i> Taranek	+															+	
<i>Euglypha</i> "ciliata"							+		+	+	+	+	+		+	+	
<i>Euglypha cristata</i> Leidy						+											
<i>Euglypha laevis</i> (Ehrenberg) Percy			+						+	+				+	+	+	
<i>Euglypha rotunda</i> Wailles			+			+		+	+	+						+	+
<i>Euglypha tuberculata</i> Dujardin				+													
<i>Tracheuglypha denata</i> Moniez					+		+	+	+	+	+	+	+	+	+	+	+
<i>Trinema complanatum</i> Penard							+		+	+					+	+	+
<i>Trinema encheleya</i> (Ehrenberg) Leidy	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Trinema lineare</i> Penard			+														
<i>Trinema penardi</i> Thomas & Chardez																	

Table 3. List of species in different mountains

\*Vis = Visegrádi Mountains, V = Vértes Mountains, Bak = Bakony Mountains, Apv = Apátkúti Valley, Remv = Remete Valley, Remh = Remete Hill, V = Vinyabükki Valley, K = Koloska Valley, F = Farkasgyepű

	Vis*		Budai Mountains						V*		Bak*	
	Apv*		Remv*		Remh*		V*		K*		F*	
	1	2	1	2	1	2	3					
<i>Arcella arenaria</i> Greeff	+	+		+			+					
<i>Centropyxis aerophila</i> Deflandre	+		+	+	+			+	+			
<i>Centropyxis sphagnicola</i> Deflandre	+	+		+				+	+	+	+	+
<i>Centropyxis constricta</i> Ehrenberg												
<i>Centropyxis orbicularis</i> Deflandre			+	+	+	+	+	+	+			+
<i>Centropyxis plagiostoma</i> Bonnet & Thomas				+	+	+	+	+	+	+		
<i>Cyclopyxis arcelloides</i> (Penard) Deflandre												
<i>Cyclopyxis eurystoma</i> Deflandre	+							+		+	+	
<i>Cyclopyxis kahli</i> Deflandre	+	+	+	+	+	+	+	+	+	+	+	+
<i>Trigonopyxis arcula</i> (Leidy) Penard	+	+										+
<i>Pontigulata bryophila</i> Penard												
<i>Diffugia bryophila</i> (Penard) Junn												
<i>Diffugia lucida</i> Penard			+									+
<i>Diffugia oblonga oblonga</i> Ehrenberg												
<i>Diffugia</i> sp.												
<i>Plagiopyxis dealvis</i> Thomas	+		+	+	+	+		+	+	+	+	+
<i>Plagiopyxis intermedia</i> Bonnet	+		+	+	+	+		+	+	+	+	+
<i>Plagiopyxis oblonga</i> Bonnet & Thomas	+	+	+									
<i>Geopyxella sylvicola</i> Bonnet & Thomas	+	+	+		+	+		+	+		+	
<i>Heleopera rosea</i> Penard			+									
<i>Heleopera sylvatica</i> Penard				+	+	+	+			+	+	
<i>Nebela bigibbosa</i> Penard												
<i>Nebela collaris</i> (Ehrenberg) Leidy												+
<i>Nebela lageniformis</i> Penard												+
<i>Nebela retorta</i> Walters												
<i>Awerintzewia cyclostoma</i> Penard												
<i>Quadrulella symmetrica</i> Wallich												
<i>Diffugiella oviformis</i> (Pen.) Bonnet & Thomas			+									
<i>Phryganella acropodia</i> Hopkinson	+	+		+					+	+		
<i>Assulina muscorum</i> Greeff												
<i>Corythion dubium</i> Taraneck									+			
<i>Euglypha</i> "ciliata"	+	+		+	+	+	+					+
<i>Euglypha cristata</i> Leidy			+									
<i>Euglypha laevis</i> (Ehrenberg) Perty	+			+								+
<i>Euglypha rotunda</i> Walters			+									
<i>Euglypha tuberculata</i> Dujardin	+											+
<i>Tracheuglypha dentata</i> Moussiez	+	+		+	+							+
<i>Trinema complanatum</i> Penard			+						+			+
<i>Trinema enchelys</i> (Ehrenberg) Leidy	+	+		+							+	+
<i>Trinema lineare</i> Penard	+			+				+				
<i>Trinema penardi</i> Thomas & Chardez						+	+					

## Discussion

Most of the recorded species are considered to be soil inhabitants (BONNET & THOMAS, 1960). Some of them, however, are rather typical for acrophilous mosses (BONNET and THOMAS, 1960), nevertheless, they occurred in some of my soil samples. There is no clear correlation between the species richness and the nature of sampling sites, namely geographical location, altitude, parent rock, forest type and A<sub>0</sub>-thickness.

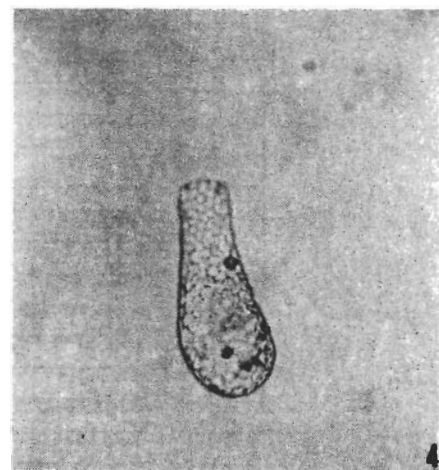
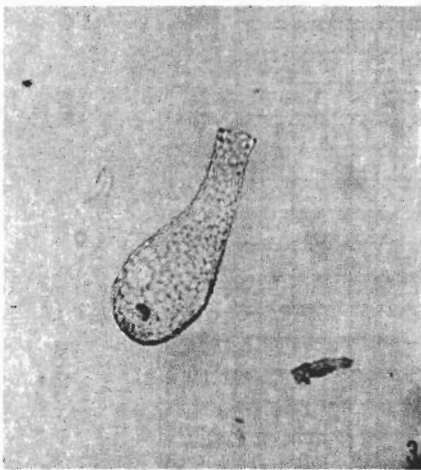
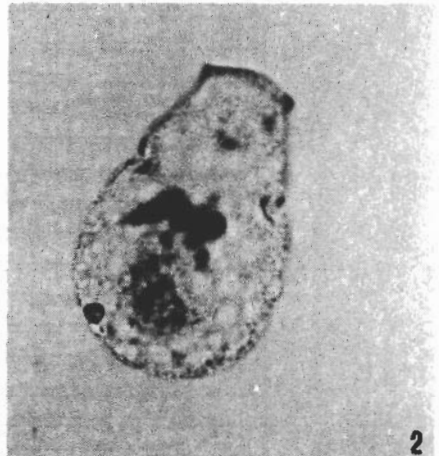
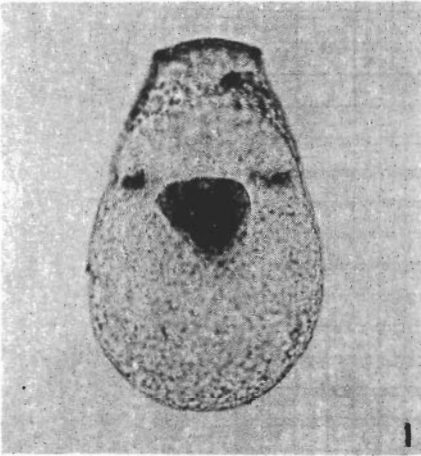


Fig. 2. *Nebela bigibbosa* PENARD; 3—4: *Nebela retorta* WAILLES

Species richness corresponds well with that of found by VARGA (1959) in the Bükk Mountains (another part of the Central Mountains), suggesting that total number of testacean species within one community reaches a maximum at about 25 species in Hungary. There are no other works prepared on the subject to compare with, since other authors dealt with mosses, or cultivated and disturbed lands (BICZÓK, 1955, 1956; JEKKEK, 1969; VARGA, 1935, 1961). Number of species at each site seems to be a bit lower, than that recorded by several authors in other countries (GOLEMANSKY and TODOROV, 1990; MEISTERFELD and HEISTERBAUM, 1986; WANNER, 1991 etc.). This fact needs some explanation. One of them could be that decomposition of litter layer in Hungarian forests is quite quick in most areas, in other words the process is completed within one year. Contribution of great lumbricids with rapid consumption may be decisive. Lack of thick, steadily decomposing litter and Ao layers prevents origin of richer testacean community. Yet the investigated soils show a similar species spectrum to those observed in foreign countries.

*Centropyxis plagiostoma* is known as an indicator of calcareous soils - just like *Geopyxella sylvicola* - (BONNET & THOMAS, 1960), nevertheless their presence was not restricted to the alkaline habitats (concluding from the nature of the parent rock, since chemical analysis was not carried out this time and humus type was not exactly registered (see Tab. 1 and 2).

The two *Plagiopyxis* species found newly in the home fauna are considered to be frequent and eurytop by literature (BONNET & THOMAS, 1960). Their late registration shows the little attention payed to the inland soil testaceans during the last three decades.

*Nebela bigibbosa* was also detected for the first time in Hungary. This species is entitled to be stenotherm, preferring cold biotopes and its geographical distribution is concentrated to the Northern Holarctic (JUNG, 1940). Accordingly, specimens of this taxon were found only above 600 m altitude above sea level in Hungary (Börzsöny Mountains) comprising a fairly cold and wet climate in our country. This species was found mainly among mixed beech—larch—spruce litter, suggesting that it requires a rather constant environment guaranteed by the slowly decomposing pine-needles.

*Nebela retorta* was represented with only five specimens. They were found in the wet soil of the valley of the Fekete Creek.

Occurrence of further terrestrial species is still to be expected at any National Nature Reserve sites. Reduction of these areas as well as unreasonable deforestation can endanger the existence of rare soil testaceans.

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