MACROINVERTEBRATES IN THE SOUTH-EASTERN LITHUANIAN SPRINGS WITH THE NOTE ON THE BLACKFLY (DIPTERA: SIMULIIDAE) SPECIES NEW FOR LITHUANIAN FAUNA

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Introduction

Studies on benthic macroinvertebrates in rivers of Lithuania were discussed in different publications (Kazlauskas, 1963; Gasiūnas, 1978; Višinskienė, 2005, 2010; Bernotienė & Višinskienė, 2007, 2012; Ruginis, 2007; Pliūraitė & Kesminas, 2010; Bernotienė & Bartkevičienė, 2011). However, information on benthic macroinvertebrates in springs is still lacking in Lithuania.

Springs can be characterised by physical and chemical stability, isolated habitat areas and low species diversity (Giller & Malmqvist, 1998), whereas some have unique, rare or endemic fauna (Di Sabatino *et al*., 2003). The aim of this study was to find out the composition of benthic macroinvertebrate taxa occurring in the selected South-Eastern Lithuanian springs and to review their ecological patterns.

Material and methods

Investigations of benthic macroinvertebrates were carried out in selected nine springs of South-Eastern Lithuania, in 2012 (Table 1). Multihabitat kick-sampling method with standard dip net (25×25 cm opening net bag with a mesh size of 0.5 mm) was used for macroinvertebrate sampling supplementing by 5 minutes of hand-picking from submerged stones, wooden debris, foliage (Arbačiauskas, 2009). Springs differed in their physico-chemical parameters. Some hydrochemical parameters (Table 2) were measured in the field using multiparameter water quality sonde 6600 V2-4. Microhabitat preference and feeding types of macroinvertebrate taxa were based on ASTERICS assessment software (AQEM, 2004). The taxonomy of macroinvertebrates follows Fauna Europaea Database (http://www.faunaeur.org).

Table 1. Location and the date of investigation of studied springs.

No	Spring name	District / Town	Coordinates	Date
1.	Inkūnai	Anykščiai distr.	55°39'14"N, 25°10'55"E	28 05 2012
2.	Kavarskas	Anykščiai distr.	55°25'54"N, 24°55'44"E	28 05 2012
3.	Antončikas	Varėna distr.	54°01'38"N, 24°17'54"E	14 05 2012
4.	Skroblus source	Varėna distr.	54°00'02"N, 24°17'55"E	14 05 2012
5.	Ūlos Akis	Varėna distr.	54°08'30"N, 24°26'23"E	14 05 2012
6.	Jeruzalė	Vilnius t.	54°44'12"N, 25°17'18"E	10 07 2012
7.	Spalvoti Šaltiniai	Vilnius t.	54°43'24"N, 25°18'54"E	10 07 2012
8.	Pūčkoriai 1	Vilnius t.	54°41'16"N, 25°22'10"E	12 07 2012
9.	Pūčkoriai 2	Vilnius t.	54°41'05"N, 25°22'07"E	12 07 2012

Table 2. Parameters of investigated springs (water temperature (T, C°), conductivity (C, µS cm-1), oxygen saturation (OS, %), dissolved oxygen (DO, mg/l), pH, oxidation/reduction potential (ORP, mV), total dissolved solids (TDS, g/l), approximate depth (Depth, cm), surrounding area (Area, w – woodland, sdt – single deciduous trees, m – meadow), dominant substratum (DSubst.) and additional substratum (ASubst., gra – gravel, peb – pebble, san – sand, sil – silt, ord – organic debris)). Numbers correspond to spring's name presented in Table 1.

No	T	C	OS	DO	pH	ORP	TDS	Depth	Area	DSubst.	ASubst.
1.	7.0	0.39	91.5	11.1	8.6	96.2	0.25	5-10	w	gra, ord	ord, san
2.	8.6	0.76	87.7	10.2	8.3	97.1	0.51	5-15	w	gra, ord	san, ord
3.	8.4	0.27	58.6	6.9	8.0	-55.0	0.17	5-15	w	gra, san	ord
4.	7.5	0.32	73.6	8.8	8.1	52.7	0.21	5-10	w	gra, peb	ord
5.	8.8	0.22	5.1	0.6	8.0	-123.1	0.15	5-20	sdt	san, ord	sil
6.	7.7	0.76	81.0	9.7	7.5	90.1	0.49	10-30	m	sand, silt	peb, ord
7.	9.1	1.10	72.5	8.3	7.3	83.6	0.71	5-15	w	gra, peb	san, ord
8.	8.9	0.55	57.3	6.6	8.1	83.3	0.36	5-15	sdt	gra, peb	san, peb
9.	12.3	0.55	93.6	10.0	8.0	88.0	0.36	5-15	w	gra, peb	peb, san

Results

Sixty benthic macroinvertebrate taxa were found in nine springs, 52 of them belonged to Insecta (Table 3). Invertebrate composition varied from 11 (Kavarskas spring) to 22 (Ūlos Akis spring) taxa in a spring. Non-insect groups were represented by Turbellaria, Gastropoda, Bivalvia, Oligochaeta, Hydrachnidia, and Isopoda. The most frequent insects were *Nemurella pictetii* Klap., *Amphinemura* sp. (Plecoptera), *Elodes* sp. (Coleoptera), *Plectrocnemia conspersa* Curt. (Trichoptera) and *Dixa* sp., *Oxycera* sp., *Cricotopus* sp. (Diptera) (Table 3).

Table 3. Macroinvertebrate taxa found in springs. Numbers correspond to name of the spring presented in Table 1.

Taxa list	1.	2.	3.	4.	5.	6.	7.	8.	9.
Mollusca									
Galba truncatula (O.F.Müller, 1774)							+		
Pisidium sp.							+		
Pisidium casertanum (Poli, 1791)						+			
Crustacea									
Asellus aquaticus (Linnaeus, 1758)				+	+				
Oligochaeta *Gen. sp.*	+	+	+	+	+			+	+
Hydrachnidia *Gen. sp.*		+			+	+	+		
Turbellaria									
Polycelis sp.					+				
Planaria sp.	+							+	+
Plecoptera									
Nemurella pictetii (Klapálek, 1900)	+	+		+	+	+	+	+	+
Nemoura sp.					+	+			
Amphinemura sp.	+	+	+	+		+			+
Leuctra sp.	+		+					+	+
Ephemeroptera									
Baetis rhodani (*gamellus* form) (Pictet, 1843)	+		+						+
Baetis rhodani (Pictet, 1843)									+

Baetidae *Gen. sp*.				+					
Trichoptera									
Rhyacophila fasciata Hagen, 1859	+		+					+	+
Plectrocnemia conspersa (Curtis, 1834)		+	+		+	+	+		
Neureclipsis bimaculata (Linnaeus, 1758)									+
Sericostoma sp.						+			+
Sericostoma personatum (Kirby&Spence, 1826)	+	+							+
Limnephilidae *Gen. sp*., juv.			+	+		+			
Limnephilus lunatus Curtis, 1834							+		
Chaetopteryx villosa (Fabricius, 1798)	+					+	+	+	
Halesus radiatus (Curtis, 1834)						+			
Potamophylax nigricornis (Pictet, 1834)		+							+
Coleoptera									
Elodes sp. Lv.	+	+	+	+	+	+			
Helophorus aquaticus (Linnaeus, 1758) Ad.					+				
Hydraena sp. Ad.					+				+
Limnebius sp. Ad.					+				
Agabus sp. Lv.					+				+
Ilybius sp. Lv.	+				+	+			
Ilybius sp. Ad.		+	+			+			
Helochares sp. Ad.					+				
Heteroptera									
Velia sp.					+	+			
Diptera									
Dicranota sp.				+					+
Limoniidae *Gen. sp*.	+		+						
Tipulidae *Gen. sp*.			+	+					
Athericidae *Gen. sp*.		+			+				
Empididae *Gen. sp*.			+	+					+
Thaumalea sp.	+		+						
Dixa sp.		+	+	+		+			+
Oxycera sp.	+	+	+	+				+	+
Ptychoptera sp.						+			
Simulium brevidens (Rubtsov, 1956)	+		+						
*Tonnoiriella s*p.			+	+			+		
Pericoma sp.	+		+						
Chironomus sp.		+							
Cricotopus sp.		+		+	+	+	+	+	
Diamesa sp.								+	
Eukiefferiella sp.	+								
Macropelopia sp.							+		
Micropsectra sp.					+				
Orthocladius sp.		+				+		+	
Polypedilum sp.	+			+					
Procladius sp.	+				+		+		+
Prodiamesa sp.				+	+			+	
Psectrocladius sp.			+		+		+		
Tanypus sp.				+					
Tanytarsus sp.			+		+				
Thienemanniella sp.			+	+					
No of taxa	19	15	21	18	22	18	12	11	19

New for Lithuanian fauna blackfly species – *Simulium brevidens* Rubtsov (Diptera: Simuliidae) was found in two springs located in Vilnius city – Spalvoti Šaltiniai and Pūčkoriai 2 in July (Tables 1, 3). Larvae and pupae of this blackfly species were abundantly found (54 specimens were collected) attached to small stones, pebble. This blackfly species is usually found in highland streams in Central Europe. It is known from

Poland, Austria, Bosnia, the Czech Republic and some other European countries (Adler & Crosskey, 2008).

Majority of registered macroinvertebrate taxa preferred phytal (27%), pelal (22%) and lithal (20%) microhabitats (Fig. 1a). Majority of registered macroinvertebrate taxa were gatherers/collectors (29%) and predators (27%). The proportion of grazer and scrapers (18%) was slightly less (Fig. 1b).

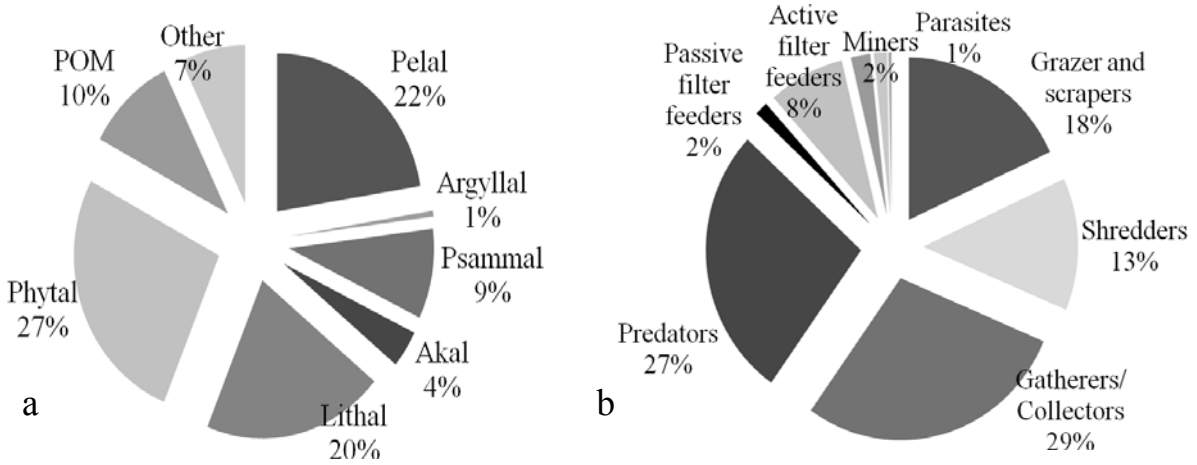

Figure 1. Microhabitat preference (a) and feeding types (b) of macroinvertebrates registered in springs

Discussion

The diversity of macroinvertebrates in springs is strictly dependent on the presence of different microhabitats and local environmental conditions (Bottazzi *et al*., 2011). Substratum type is found to be the main discriminatory factor with regard to the fauna density while faunal composition was related to the geographical position of springs (Dumnicka *et al*., 2007). According to this investigation, the least species diversity was found in springs with dominant gravel, pebble or sand microhabitats, but with less organic debris (11 taxa were found in Kavarskas spring and 12 taxa – in Skroblus source). And vice versa, species diversity was the highest, where organic debris was dominant – 21 taxa were found in Pūčkoriai 2 spring and 12 taxa – in Ūlos akis spring.

According to the River Continuum Concept, shredders and collectors feeding groups are predicted to dominate in low-order streams (Giller & Malmqvist, 1998). Our results suggest, that majority of registered macroinvertebrate taxa depends to gatherers/collectors and predators feeding groups.

The investigation has showed that unique macroinvertebrate fauna can live in springs. Two new Dipteran taxa, typical for highland streams of Central Europe, were found in springs: *Thaumalea* sp. larvae (Bernotienė & Višinskienė, 2012) and *Simulium brevidens* larvae. Two caddis fly species – *Rhyacophila fasciata* and *Potamophylax nigricornis* – found in springs are also characteristic for small rivers (Višinskienė, 2005).

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Makrobestuburiai Pietryčių Lietuvos šaltiniuose bei Lietuvos faunos papildymas nauja upinių mašalų (Diptera:Simuliidae) rūšimi

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Santrauka

Ištyrus devynių pasirinktų Pietryčių Lietuvos šaltinių bentoso makrobestuburius, nustatyta jų taksonominė sudėtis, įvertintos fizikocheminės gyvenimo sąlygos, šaltiniuose aptikti makrobestubriai sugrupuoti pagal mitybos pobūdį. Pirmą kartą Lietuvoje (Vilniuje) buvo aptiktos *Simulium brevidens* Rubtsov, 1956 upinių mašalų (Diptera: Simuliidae) lervos.

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