THE SHARE OF CADDISFLIES (TRICHOPTERA) IN BENTHIC MACROINVERTEBRATE ASSEMBLAGES OF DIFFERENT LITHUANIAN RIVERS

GIEDRĖ VIŠINSKIENĖ

Gamtos tyrimų centras, Akademijos g. 2, LT–08412, Vilnius. E-mail: giedre@ekoi.lt

Abstract. The composition, abundance and community structure of benthic macroinvertebrates were investigated in 33 Lithuanian rivers. In order to evaluate caddisfly importance (the share of caddisfly taxa and individuals) in the assemblages of benthic macroinvertebrates, five environmental parameters (river size, discharge, temperature regime, bottom structure, current velocity) were selected. Caddisfly larvae were dominants among benthic macroinvertebrates by number of taxa and biomass in medium-sized and medium discharge, cold-water rivers, on stony bottom, and dominants by abundance in medium-sized, medium discharge rivers and stony bottom.

Key words: caddisflies, macroinvertebrates, environmental parameters, rivers

Introduction

The invertebrates are the most diverse animals in the rivers (Giller & Malmqvist, 1998). Caddisfly is one of the most important benthic components in freshwater ecosystems. Larvae of caddisflies often take the second place after larvae of Diptera in zoobenthos of rivers according to species and ecological diversity (Solem & Gullefors, 1996, Lods–Crozet *et al.,* 2001), and they are sensitive to environmental changes, thus they are often used to assess ecological status of the water bodies (Kiss *et al*., 2002; Czachorowski & Buczyński, 2004; Kownacki & Soszka, 2004; Schmidt–Kloiber *et al.,* 2006). Caddisfly are frequently investigated together with other benthic invertebrates (Buczyński *et al.,* 2003; Pliūraitė, 2006; Ruginis, 2007). Dominance of particular macroinvertebrate groups may differ in different rivers or in sections of the same river (Jović *et al.,* 2006; Ruginis, 2007).

Information about caddisfly distribution in Lithuanian rivers, the share of larvae in benthic invertebrate assemblages and other ecological characteristics in rivers habitats is incomplete by now. All this information is important in assessing biological diversity and ecological status in Lithuania or particular regions of the country, in different water bodies. The aim of the present study was to evaluate caddisfly significance (the share of caddisfly taxa and individuals) in the assemblages of benthic macroinvertebrates under different environmental conditions in Lithuanian rivers.

Material and Methods

The studies of caddisflies and other benthic macroinvertebrates were performed in 33 Lithuanian rivers (Būka, Dysna, Dubysa, Elmė, Grabuosta, Graisupis, Grūda, Juodupis, Lėvuo, Merkys, Musė, Mūša, Mūšia, Nemunas, Nemunėlis, Riešė, Sasna, Siesartis, Skroblus, Sudervė, Susiena, Šelmenta, Širvinta, Šventoji, Šventoji (Baltic Sea), Ūla, Varius, Venta, Verkė, Vilnia, Virinta, Vyžuona, Žeimena) in 2003, 2004, 2006–2008.

The biomass of macroinvertebrates was measured in 15 study sites in 2004. All together, 69 sites with varying environmental parameters river were investigated (Fig. 1).

The samples of benthic macroinvertebrates were collected in accordance with uniform methodology (Arbačiauskas, 2009), by standard kick-sampling method in particular habitat or taking samples during the period of 10 minutes from all possible habitats using hydrobiological dip net at each study site. Specimens were identified to the lowest taxon, the individuals were counted and weighed, and their abundance and biomass were recalculated per square meter. Because of different number of samples in the rivers, the abundance of taxa and individuals of benthic invertebrates were averaged into one sample per square meter. Dominant (D), rare and frequent (F) species were estimated. The dominance of species in community was calculated according to the formula, $D_i = (n/N)*100\%$, where: n – abundance of species i, N – abundance of all species in the community (Durska, 2001). The species were classified to 4 domination groups: eudominants – >15%, dominants – 5,1-15%, subdominants 1,1-5%, and accessories – <1%. Relative share (%) of caddisfly and other invertebrate animals in the benthic assemblages were estimated according to number of taxa and abundance of individuals.

Fig. 1. Localities of investigated rivers in Lithuania.

The analysis of variance (one-way ANOVA) was used to assess the influence of environmental factors on the number of caddisfly taxa and abundance. Five main environmental parameters were measured in each river site: river size, discharge, water temperature regime, bottom structure, and current velocity (Table 1). The river size was classified according to the river catchment area; the river temperature regime – according to the water temperature in July (Noble & Cowx, 2002). The river discharge was classified according to annual means (Gailiušis *et al*., 2001) as well as the current velocity. Bottom structure was classified according to the dominant component of the particle size. Different number of rivers, included in the calculations, depended to separate categories of environmental factors.

Table 1. Categories of environmental factors.

Environmental factor	Categories of the environmental factor			Number of studied rivers
River size (catchment area)	1	Small	10–100 km^2	10
	2	Medium	100–1000 km^2	14
	3	Large	1000–10000 km^2	8
	4	Very large	>10000 km^2	1
River discharge	1	Low	0.1–1 m^3/s	13
	2	Medium	1–10 m^3/s	12
	3	High	10–100 m^3/s	7
	4	Very high	> 100 m^3/s	1
Temperature regime	1	Cold-water	< 18°C in July	14
	2	Warm-water	> 18°C in July	19
Bottom substrate	1	Stones	> 6 cm	4
	2	Pebble	2–6 cm	10
	3	Gravel	0.2–2 cm	3
	4	Sand	0.06–0.2 cm	3
Current velocity	1	Slow	< 0.2 m/s	4
	2	Medium	0.2–0.5 m/s	10
	3	Strong	0.5–1.0 m/s	5

Results

During the studies, 462 lowest taxa of benthic invertebrates were identified: Mollusca (22 taxa), Turbellaria (3), Oligochaeta (1), Hirudinea (10), Arachnida (1), Crustacea (6), Insecta (419). Insects were the dominant group of macroinvertebrates in the investigated rivers: Diptera (129 taxa), Trichoptera (107), Coleoptera (71), Ephemeroptera (48 taxa), Plecoptera (23), Odonata (21), Heteroptera (13), Lepidoptera (3), Megaloptera (2), Neuroptera (2) (Fig. 2). The most frequent taxa were *Oligochaeta* spp. and *Hydracarina* spp., they were registered respectively in 93.9% and 87.9% of river sites. Larvae of water beetle *Oulimnius* sp. and *Tipulidae* spp. were found in 84.8% sites, *Erpobdella octoculata* L., *Hydropsyche pellucidula* Curt. and *Baetis rhodani* Pict. in 81.8%. Frequancy (F) of other benthic invertebrates was 78.8% and even less. The eudominant group in the benthic communities was *Chironominae* spp. – 26.6% of all individuals in the rivers. The dominant insects were *Calopteryx splendens* Harr. (6.1%), *Baetis rhodani* Pict. (5.6%); the subdominants were *Aphelocheirus aestivalis* Fabr. *Centroptilum luteolum* Müll. (4.7% each) and *Cloeon dipterum* L. (4.2%).

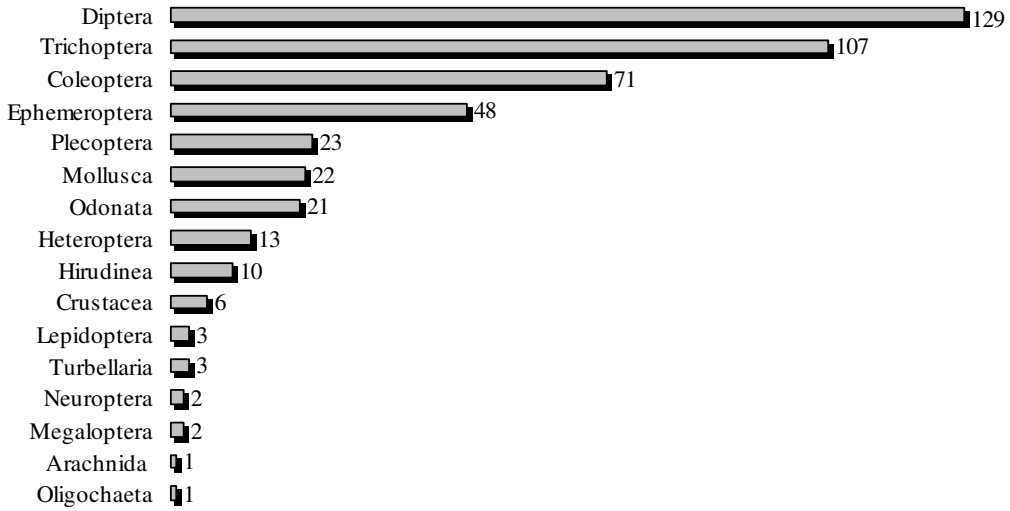

Fig. 2. Number of the lowest taxa of benthic invertebrate groups in the investigated rivers.

The most frequent caddisfly species were *Hydropsyche pellucidula* Curt. (found in 81.8% of all rivers), *Lepidostoma hirtum* F. (F = 63.6%), *Polycentropus flavomaculatus* Pict. and *Hydropsyche angustipennis* Curt. (F = 60.6%), *Brachycentrus subnubilus* Curt. (F = 57.6%) and *Ithytrichia lamellaris* Eaton (F = 54.5%). The eudominant and dominant caddisfly taxa were *Micrasema setiferum* Pict. – 19.5%, *Hydropsyche pellucidula* Curt. – 14.6%, *Hydropsyche spp*. – 10.1%, *Brachycentrus maculatus* Four. – 9.3%, *B. subnubilus* Curt. – 9.2% of all individuals.

Number of invertebrate taxa varied from 20 (in Verkė, a small, warm-water river) to 163 (in Virinta, a medium-sized, cold-water river) during all study period. The average of benthic invertebrates was 29.8 ± 1.75 taxa m^{-2} and 3113.2 ± 463.1 ind. m^{-2} per one sample detected.

Different hydrobiont groups constituted different parts of taxonomic diversity in benthic macroinvertebrate assemblages. Insects were the most abundant assemblage, comprising 81.7±0.97% of all taxa (hereinafter, average±SE). The share of insects varied from 65.7% (in the Nemunas River, locality Gerdašiai) to 95.1% (Merkys River). Among them, caddisflies accounted for 20.8±1.1%. The other benthic invertebrates (molluscs, water mites, crustaceans, leaches and other worms) constituted 18.3±0.97% on average (Fig. 3A). A similar tendency was observed in the abundance of individuals. The insects were the most abundant assemblage with 79.4%±2.5% of all individuals per sample. The share of insects varied from 32.4% (in the Žeimena River) to 99.8% (Merkys River) of individuals in the benthic assemblages. The average abundance of caddisfly larvae in river benthos accounted for 20.2±2.7% of all benthic macroinvertebrates. Other insects constituted 59.2±3.0%, and other macroinvertebrates 20.6%±2.5% of the total abundance of individuals (Fig. 3B).

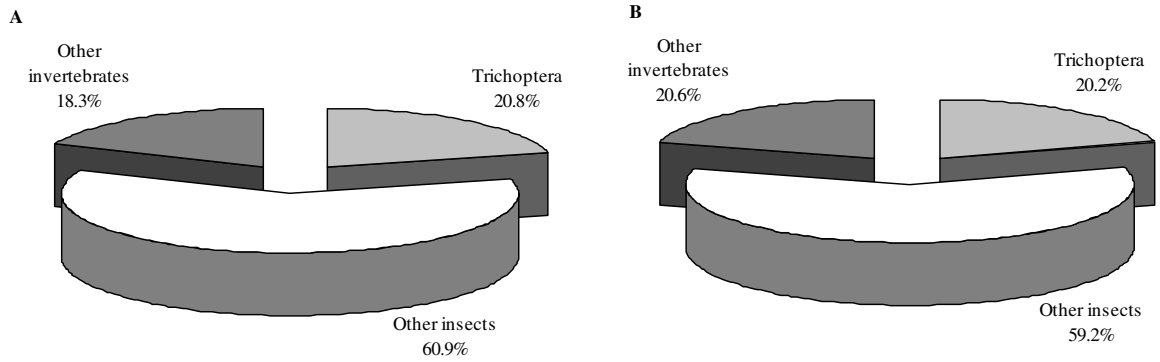

Fig. 3. The share of caddisfly, other insects and other invertebrate taxa (A) and individuals (B) in the benthic assemblages in the rivers.

Benthic groups dominating in separate study sites differed, though in most cases they were representatives of insects. The smallest share of caddisfly taxa and individuals in benthic macroinvertebrate communities was in the Nemunas River at Gerdašiai (0,6% and 2,9% by the number of taxa and abundance of individuals, respectively), and the largest share in the Grūda (79.6% and 43.7%, respectively).

The main part of benthic taxa in the Nemunas River (Gerdašiai locality) was represented by the other invertebrates (not insects) – they formed 34.3%, and the main part of individuals was represented by dipterans – 35.0% in benthic community. Other benthic invertebrates (molluscs, water mites, crustaceans, leeches, oligochaets) varied from 4.9% (in the Merkys River) to 34.3% (the Būka River) of all taxa and from 0.2% (the Merkys River) to 67.6% (the Žeimena River) of individuals in the rivers and formed 18.3% ± 0.97% of taxa and 20.6% ± 2.5% part of individuals in benthic assemblages of the investigated rivers (Fig. 3 A, B).

Dominance of Trichoptera and other groups of macroinvertebrates depended on different environmental parameters. River discharge and bottom structure had a significant impact on the number of caddisfly taxa ($F=12.97$, $p<0.001$ and $F=8.82$, $p=<0.001$, respectively) and abundance of individuals ($F=3.56$, $p=0.03$ and $F=7.97$, $p=<0.001$). River size and current velocity significantly influenced the number of caddisfly taxa ($F=11.36$, $p<0.001$ and $F=4.20$, $p=0.03$, respectively) but did not affect the abundance. Our study did not confirm the data of other authors about the effect of temperature on the distribution of caddisflies: the temperature regime did not have any significant impact on the number of caddisfly taxa or abundance. The relevance was clarification what share caddisfly taxa and individuals make in the assemblages of benthic macroinvertebrates under different environmental conditions (river size, discharge, bottom substrate, current velocity, and temperature regime).

River size. Trichoptera was the dominant group only in medium-sized rivers (21.0% of all taxa) according to the number of taxa (Fig. 4 A). In small rivers the number of caddisfly taxa was lower than that of dipteran taxa. In the large rivers, they were the second dominant group after other insects (except Diptera, Ephemeroptera, Plecoptera, and Coleoptera). In the very large rivers, the number of caddisfly taxa was exceeded by all invertebrate groups, except Coleoptera (Fig. 4 A). The abundance of caddisfly larvae in different rivers ranged from 3.4% (in very large river) to 33.3% (in medium-sized rivers) of all benthic macroinvertebrates (Fig. 4 B). The caddisfly larvae were the dominant benthic invertebrate group in medium-sized rivers only. In other categories of

river size, the dominant groups according to specimen abundance were mayflies and stoneflies (small and large rivers) or larvae of Diptera (very large river). The least share of caddisfly taxa and individuals in benthic invertebrate assemblages was estimated in a very large river (Nemunas) (Fig. 4 A, B).

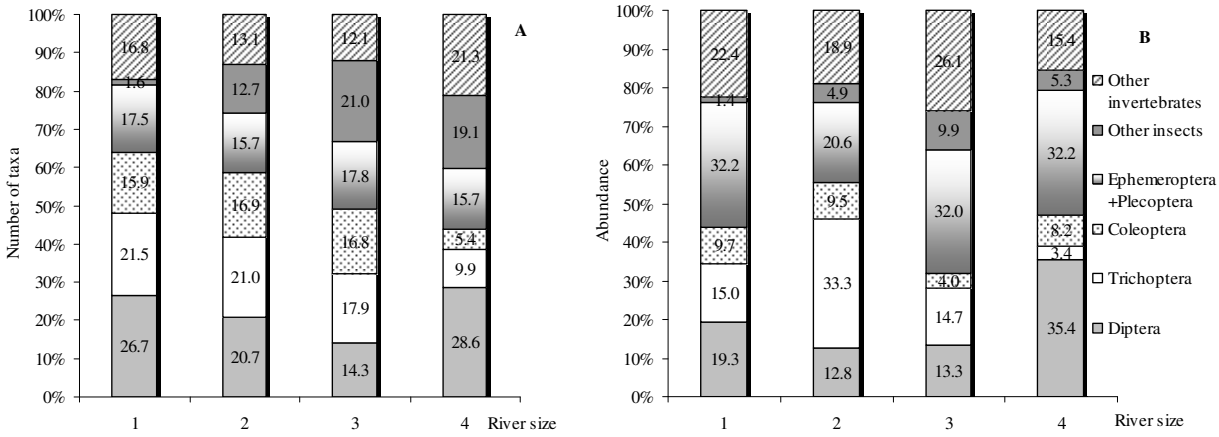

Fig. 4. The shares of benthic macroinvertebrate groups according to the number of taxa (A) and the abundance of individuals (B) in different-sized rivers: 1 – small, 2 – medium, 3 – large, 4 – very large.

River discharge. The number of caddisfly taxa and abundance of their larvae ranged respectively from 9.9% and 3.4% (in very high discharge river) to 21.3% and 40.3% (in medium discharge rivers) of all benthic macroinvertebrates. Trichoptera was the dominant group in medium discharge rivers according to the number of taxa and abundance of individuals in the benthic communities (Fig. 5 A, B).

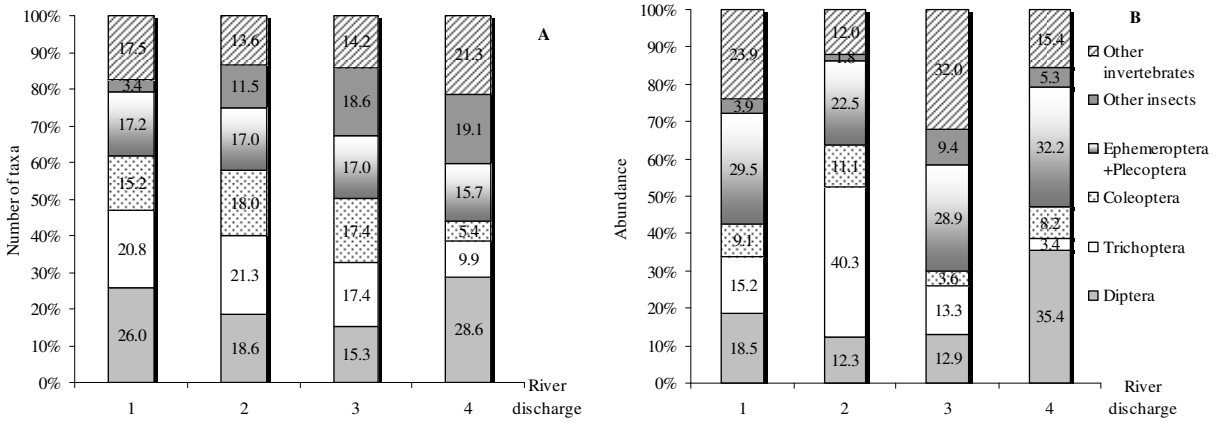

Fig. 5. The shares of benthic macroinvertebrate groups according to the number of taxa (A) and the abundance of individuals (B) in different discharge rivers: 1 – low, 2 – medium, 3 – high, 4 – very high.

In low and very high discharge rivers, Diptera species were dominants by number of their taxa, amounting 26.0% and 28.6% respectively. In high discharge rivers other insects were dominant, they composed 18.6% of all invertebrate taxa (Fig. 5 A). According to the abundance of individuals, caddisflies dominated in medium discharge rivers only, creating 40.3% share. Mayflies and stoneflies were dominants in low discharge rivers, the other invertebrates dominated in high discharge rivers and dipteran insects in very high discharge rivers, forming respectively 29.5%, 32.0% and 35.4%

shares (Fig. 5. B). Mayflies and stoneflies, which were dominants in low discharge rivers, were the second dominant group in the other discharge categories, according to the abundance of individuals.

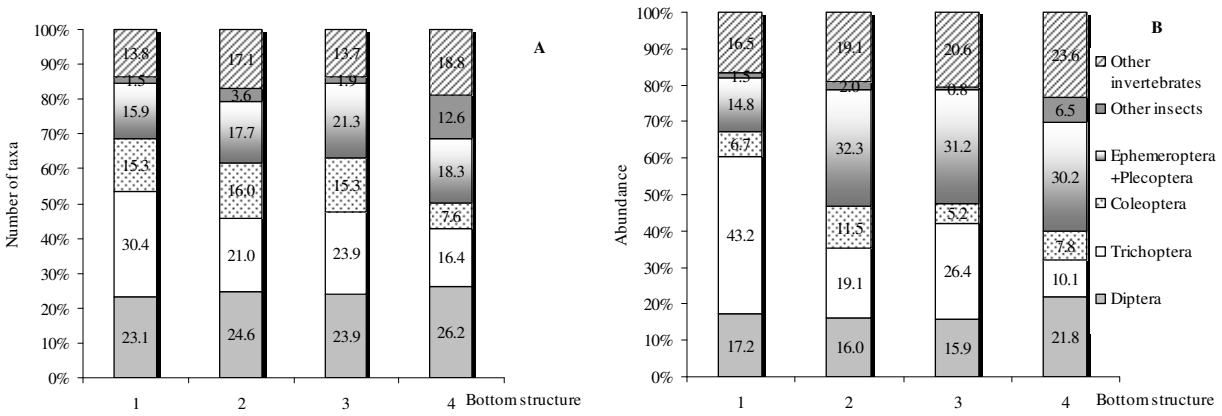

Fig. 6. The shares of benthic macroinvertebrate groups according to the number of taxa (A) and the abundance of individuals (B) in the rivers of different bottom structure: 1 – stones, 2 – pebble, 3 – gravel, 4 – sand.

Bottom substrate. Number of caddisfly taxa and abundance were distributed differently in particular riverine bottom structure. Caddisflies, according to the number of taxa, were dominant benthic invertebrates on the stony and gravel bottom (Fig. 6 A). Diptera and Trichoptera had equal shares (23.9%) on the gravel bottom. Number of caddisfly taxa was exceeded by dipteran insects on pebble and sandy river bottom and by other insects and other invertebrates on sandy bottom. According to the abundance of individuals, caddisflies were dominant group on stony river bottom (Fig. 6 B).

Ephemeroptera and Plecoptera abundance exceeded Trichoptera group in the other categories of river bottom structure. Diptera and other invertebrates exceeded abundance of caddisfly larvae in sandy bottom as well.

Current velocity. Caddisfly taxa richness ranged from 15.9% to 24.5% of benthic macroinvertebrates in different current velocity of the rivers, but in any place had not been a dominant group (Fig. 7 A). In all current categories, larger than caddisfly portion of taxa was represented by dipteran insects, and in slow current mayflies and stoneflies and other invertebrates animals were more diverse as well. The abundance of caddisfly larvae ranged from 9.5% to 32.1% of benthic macroinvertebrates in different current velocity of the rivers, but Trichoptera was not a dominant group in any velocity class (Fig. 7 B).

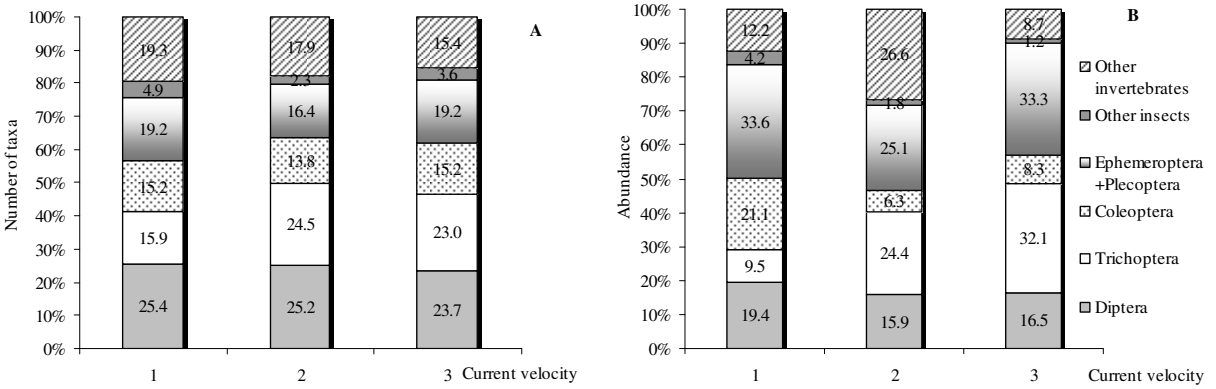

Fig. 7. The shares of benthic macroinvertebrate groups according to the number of taxa (A) and the abundance of individuals (B) in the rivers with different current velocity: 1 – slow, 2 – medium. 3 – strong.

Temperature regime. In the rivers of different thermal regime, caddisfly taxa dominated in cold-water rivers only. The abundance of caddisfly larvae was not dominant neither in warm-water, nor in cold-water rivers (Fig. 8 A, B). The number of caddisfly taxa (16.13%) in warm-water rivers was exceeded by dipteran species (21.0%), which were the second after caddisflies in cold-water rivers, and by other invertebrates (17.0%). In cold-water rivers, the abundance of caddisfly larvae was exceeded by Ephemeroptera and Plecoptera, forming 31.0% of benthos. In warm-water rivers, their abundance was exceeded by mayflies and stoneflies, other invertebrates, and dipteran species (Fig. 8 B).

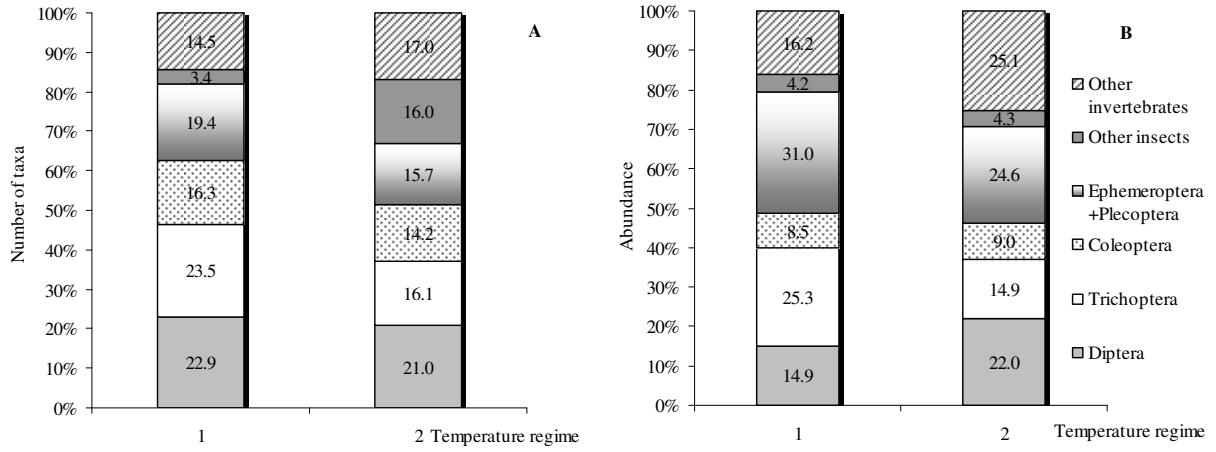

Fig. 8. The shares of benthic macroinvertebrate groups according to the number of taxa (A) and the abundance of individuals (B) in different temperature regime: 1 – cold-water, 2 – warm-water.

In all categories of current velocity, mayflies and stoneflies had a larger share than caddisfly larvae did. In medium and slow current rivers, other invertebrates exceeded them as well. In the rivers of slow current, abundance of caddisfly individuals was exceeded by Diptera and Coleoptera (Fig. 8 B).

The mentioned categories of rivers with the greatest significance of caddisflies in macroinvertebrate assemblages according to the number of taxa and abundance of individuals were also distinguished by the dominance of larvae biomass (Fig. 9). In

medium-size and medium discharge rivers, the biomass of caddisflies ranged from 0,59 (the Širvinta River) to 5.9 g m^{-2} (the Virinta River) and formed 41.8% share of macroinvertebrate biomass. The caddisfly biomass in cold-water rivers ranged from 0.64 (the Merkys River) to 5.95 g m^{-2} (the Skroblus River), constituing 46.5% share. The highest caddisfly biomass was in the rivers with stony bottom structure, ranging from 4.02 (the Grūda River) to 5.73 g m^{-2} (the Mūšia River) and forming 56.7% of biomass of all macroinvertebrates (Fig. 9).

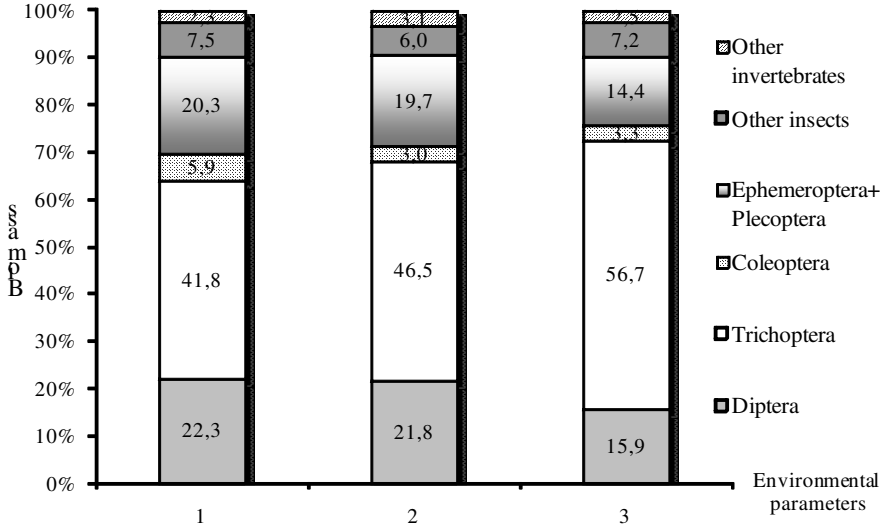

Fig. 9. The shares of benthic macroinvertebrate groups according to their biomass in medium-sized and medium discharge rivers – 1, cold–water rivers – 2, stony bottom – 3.

Discussion

More than 460 lowest taxa of benthic invertebrates were identified during our studies in 33 different Lithuanian rivers. In spite of different literature on abundance and dominance of benthic macroinvertebrates in Lithuanian rivers (Pliūraitė, 2006, 2007; Ruginis, 2007), the share of caddisflies in invertebrate assemblages under different environmental conditions have not been investigated. For this reason, the most important task was to find out what conditions of Lithuanian rivers are the most significant for dominance of caddisfly diversity and abundance in macroinvertebrate assemblages.

Dominance of macroinvertebrate groups can be different in the same river (Jović *et al.,* 2006; Ruginis, 2007). Trichoptera species richness and assemblage composition in Danish streams primarily show a strong association with stream order, width and slope. Maximum richness was found at the largest (5^{th} order) stream sites (Wiberg-Larsen *et al.,* 2000). According to our researches, caddisflies constituted the largest part of macroinvertebrates according to the number of taxa in small size (21.5%) and medium-discharge (21.3%), and, according to the abundance of individuals, in medium size (33.3%) and medium-discharge (40.3%) rivers. Biomass of caddisflies also dominated in medium-sized and medium discharge (41.8%) rivers. Environmental factors, influencing different distribution of invertebrate groups in the rivers are often not known. It was observed that in the river site (Ribnica River, Serbia) where caddisflies were dominant group (85% of all taxa), substrate of stones was prevailing (Jović *et al.,* 2006). In the other river sites dominated Ephemeroptera (57.24%) (at this site Trichoptera accounted

for 23.03%) or Diptera species (39.73%) (the second dominants were Ephemeroptera in this site, 24.66%). According to benthic macroinvertebrate abundance, different groups dominated in the same river (Babrungas River, Lithuania): Mollusca (67.1%), Diptera (61.9% or 47.8%), and Trichoptera (34.4%) (Ruginis, 2007). In the river sites where caddisflies were dominant, stony bottom substratum, strongest current velocity (0.6–1 m/s) and lowest depth (0.2–0.3 m) were recorded.

Caddisflies often take the second place after Diptera in zoobenthos of rivers according to species and ecological diversity (Solem & Gullefors, 1996, Lods–Crozet *et al.,* 2001). Diptera accounted for 43.9% of all taxa are dominants in the macroinvertebrate communities of glacial stream (Lods–Crozet *et al.,* 2001). In the rivers we investigated it was identified more than 100 taxa of Diptera and Trichoptera only. Other groups of macroinvertebrates constituded no more than 71 taxa of registered fauna. Dominance of Trichoptera, Diptera and other benthic groups differ under different environmental parameters. Diptera insects are dominant group of macroinvertebrates in small (12 rivers investigated) and medium-sized rivers (17 rivers investigated) of Lithuania (Virbickas & Pliūraitė, 2002; Pliūraitė & Kesminas, 2004). Diptera constitute 33.7% of taxa richness, whereas caddisflies constitute 19.4% according to number of taxa in the medium-sized rivers (Pliūraitė & Kesminas, 2004). Diptera species compose 34.2% and Trichoptera – 17.1% of all species in small Lithuanian rivers (Virbickas & Pliūraitė, 2002). In the categories of river size, caddisflies dominate in medium discharge rivers only, according to the number of taxa (21.3%) and abundance of individuals (40.3%) in the benthic assemblages. Other dominant groups according to the abundance are mayflies and stoneflies (in small and large rivers, more than 30%) or larvae of Diptera (in very large river, 35.4%). Besides, Diptera dominate in low and very high discharge rivers according to the number of taxa, and other insects dominate in high discharge rivers. Mayflies and stoneflies dominate in low discharge rivers according to the abundance, other invertebrates dominate in high discharge rivers, and Diptera larvae dominate in very high discharge rivers.

Influence of water temperature for distribution of caddisfly larvae (especially for particular species) may be different. Reduction of diversity and abundance of macroinvertebrates was recorded after harsh winter with low temperatures (Hoffsten, 2003). The distribution of caddisflies in the mountain streams is mostly affected by water temperature, and, secondly – by the amount of food (Reiso & Brittain, 2000a). Abundance of caddisfly *Hydropsyche pellucidula* larvae in medium-sized Lithuanian rivers is mostly influenced by water temperature and season (Pliūraitė, 2006). Our studies demonstrate that caddisflies constitute the greatest part of macroinvertebrates according to the number of taxa and abundance of individuals in the cold-water rivers only (23.5% and 25.3% shares respectively).

The data of earlier investigations demonstrated that the highest abundance and biomass of caddisflies and mayflies is in Lithuanian rivers with stony bottom (Pliūraitė, 2006). Stony substratum contains the highest diversity of macrozoobenthic species, and caddisflies have the highest diversity in the invertebrate communities of the Vilnia River (Pliūraitė, 2007). Our studies also demonstrate dominance of caddisfly larvae in the rivers with stony bottom structure according to taxonomic richness (30.4%), abundance of individuals (43.2%), and biomass (56.7%). Conversely, it was found that the lowest caddisfly abundance and biomass is in the rivers with sandy bottom (Derka *et al.,* 2001).

The examination of caddisflies in different current velocity established the highest

caddisfly abundance and dominance index in the strongest current, but the lowest species diversity (Komzák, 2001). Our research data demonstrate that caddisflies constitute the greatest part of macroinvertebrates, according to the number of taxa, in the rivers of medium current velocity (24.5%) and, according to the abundance of individuals, in strong current velocity (32.1%) at study site. Different significance of current velocity could be more important for particular caddisfly species. Widespread in Norway caddisfly *Rhyacophila nubila* dominated only in strong current river sections, and *Plectrocnemia conspersa*, conversely, dominated in the rivers of slow current or in stagnant water bodies (Reiso & Brittain, 2000).

In conclusion, our results have revealed that caddisflies were accounted for the largest part in taxonomic diversity of benthic invertebrate assemblages in medium-size, medium discharge, cold-water rivers on the stony bottom (21–30%), and the largest part of caddisflies according to their abundance was in medium-sized, medium-discharge Lithuanian rivers on the stony bottom (33–43%). Dominance of larvae biomass was distinguished in the mentioned river categories also (42–57%).

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Apsiuvų (Trichoptera) dalis skirtingų Lietuvos upių bentoso makrobestuburių gyvūnų bendrijose

G. VIŠINSKIENĖ

Santrauka

Apsiuvų lervų ir kitų bentoso makrobestuburių gyvūnų tyrimai buvo vykdyti 2003, 2004, 2006–2008 metais 33-jose Lietuvos upėse. Vertinant apsiuvų svarbą (apsiuvų taksonų ir individų dalį) dugno bestuburių struktūroje, buvo pasirinkti penki aplinkos parametrai (upės dydis, upės debitas, terminis režimas, grunto struktūra, srovės greitis).

Skirtinga dugno makrobestuburių struktūra yra upėse, besiskiriančiose įvairiais aplinkos parametrais. Apsiuvos, pagal taksonų skaičių, yra dominantinė bentoso makrobestuburių dalis vidutinio dydžio ir vidutinio debito šaltavandenėse upėse ant akmenuoto grunto, o pagal gausumą - vidutinio dydžio, vidutinio debito upėse ant akmenuoto grunto. Minėtų upių kategorijose, kur pagal taksonų ir gausumo indėlį apsiuvų vaidmuo makrobestuburių bendrijose didžiausias, lervų biomasė taip pat dominuoja.

Rezultatai leido nustatyti, kad apsiuvų lervos, būdamos vienu svarbiausiu upių bentoso makrobestuburių komponentu, didžiausią dalį šios bendrijos sandaroje sudaro vidutinio dydžio ir vidutinio debito šaltavandenėse upėse ant akmenuoto grunto.

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