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Mayflies (Ephemeroptera) of the Wołosatka stream and its main tributaries (The Bieszczady National Park, souteastern Poland)

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Abstract — 38 mayfly species were found to occur in the investigated streams, among them some rare species being observed (*Rhithrogena gorganica*, *R. wolosatkae*, *Ecdyonurus* cf. *subalpinus*). In all the distinguished habitats species from the Baetidae family dominated. The habitat preferences of larvae of some larger species are discussed.

Key words: mountain streams, mayflies, communities, habitat preferences.

1. Introduction

The mayflies (Ephemeroptera) are one of the poorer investigated groups of animals in the Bieszczady Mountains. Faunal data on particular species of mayfly from this area may be found in the publications of Sowa (1962, 1971), Kłonowska (1987), and Kłonowska et al. (1987). Investigations were also carried out in the Bieszczady on the effect of water temperature upon the larvae of mayflies and stoneflies (Kamler 1965). So far, the most comprehensive data on mayflies in the Bieszczady Mts may be found in the papers of Sowa (1975a, 1975b), on these insects in the Polish part of the Carpathian Mountains. From an enormous number of stations assigned in the catchment basins of the main Carpathian tributaries of the Vistula the author established 40 in that of the River San of which, 7 were located in the Wołosatka and Wołosaty streams. The material collected by Sowa concerned the whole length of the Wołosatka-Wołosaty stream, beginning from the spring areas. However, for technical reasons, these places have been visited only 3 or 4 times over several years.

The aim of the present paper was to investigate more accurately the mayfies and their communities in the Wołosatka stream in its main tributaries.

2. Study area

The highest montana belts of the High Bieszczady Mts (i.e. the Tarnica and Halicz belts) run east to west and are separated from each other by the deep valleys of two streams i.e. the Wołosatka, below Ustrzyki Górne called the Wołosaty, and its tributary the Terebowiec. Date concerning these streams may be found in the paper of D u m n i c k a and K u k u ł a (1990). 21 stations were marked out for sampling, 8 of which were on the Wołosatka, 6 on the Terebowiec, 3 each on the Zakopaniec and Polaniec streams, and 1 on the Wołosaty (fig. 1, Tables I, II).

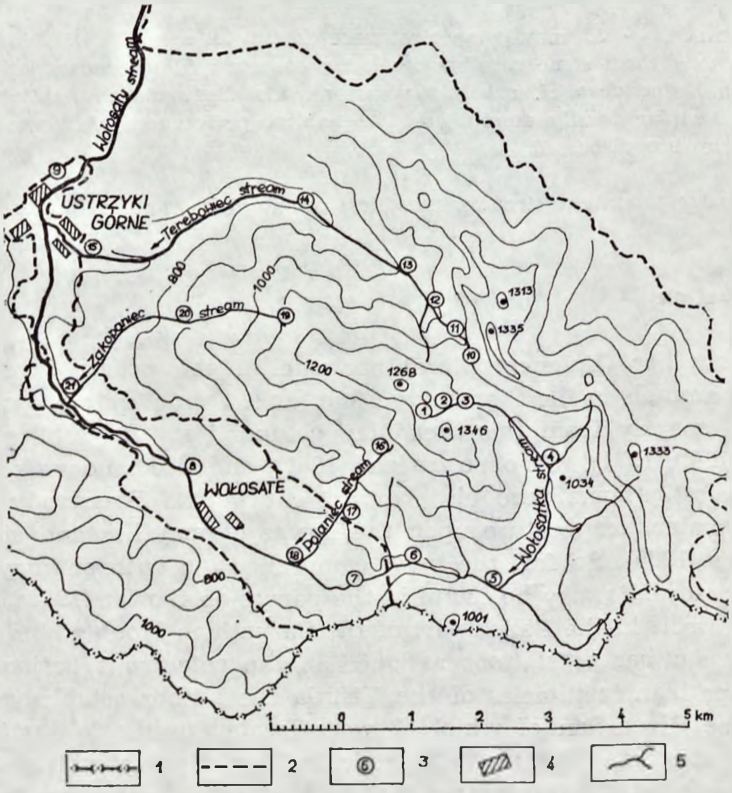

Fig. 1. Map of the investigated area. 1 — state boundary; 2 — boundary of the Bieszczady National Park; 3 — stations; 4 — buildings; 5 — streams

Table I. Basic hydrographical and hydrological data of stations on the Wołosatka stream

Number of station	Altitude m	Distance from sources km	Gradient ‰	Width min. m	Width max. m	Depth min. m	Depth max. m	Current velocity (max.) m s^{-1}
1	1175	0.05	100	0.2	0.7	0.05	0.1	0.5
2	1080	0.4	160	0.2	0.8	0.05	0.1	0.5
3	1005	1.0	130	0.6	2.0	0.1	0.4	1.5
4	900	2.1	30	1.0	4.0	0.2	0.6	1.3
5	825	4.1	21	2.5	6.0	0.3	0.8	1.5
6	775	6.0	19	1.5	6.0	0.3	0.8	1.5
7	750	7.0	12	5.0	9.0	0.2	0.7	1.2
8	725	10.3	9	5.0	9.0	0.3	0.9	1.3
9	650	17.8	8	8.0	18.0	0.2	1.0	1.2

Table II. Basic hydrographical and hydrological data of stations on the Terebowiec stream

Number of station	Altitude m	Distance from sources km	Gradient ‰	Width min. m	Width max. m	Depth min. m	Depth max. m	Current velocity (max.) m s^{-1}
10	1125	0.1	175	0.2	0.5	0.05	0.1	0.5
11	1050	0.3	160	0.4	0.6	0.05	0.2	0.7
12	950	0.9	100	1.0	3.0	0.1	0.3	1.5
13	900	1.7	85	1.5	4.0	0.1	0.3	1.5
14	790	3.8	24	2.5	6.0	0.2	0.5	1.5
15	675	7.9	11	3.0	7.0	0.2	0.8	1.2

3. Material and methods

The subject of investigation were in the first place the larval stages of mayflies. These were caught using a bottom scraper (Dumnicka, Kukuła 1990). Usually from each station, 10 quantitative samples and a single qualitative one were taken. Altogether 800 samples were collected, among which about 50 thousand larvae and winged forms were found. From these 46 231 were determined as to species. The sampling

consisted in scraping the animals into a net together with the substratum (stones, gravel) from the area traced by the frame of the scraper. Then after removing the stones picked up with the animals, the samples were placed in containers, described, and preserved in 4% formalin. The adult mayflies were caught with an entomological net directly at the stations and also when passing to the next ones. These catches were qualitative. Each of the quantitative samples taken with the scaper from Stations 5—7 was also estimated with regard to the composition of the substratum, determining stones 3—8 cm in diameter as small, 9—15 cm as medium, and over 15 cm as large. On the basis of the data on water current velocity and composition of the substratum 6 types of habitat were distinguished (Dumnicka, Kukuła 1990). By analysis of variations (at the significance level $\alpha = 0.05$) the significance of differences between mean densities of particular mayfly species from various types of habitat were studied. A 10 m long section for upper sections of streams and up to 50 m for lower ones were treated as stations. The water current velocity was determined similarly as described by Dumnicka and Kukuła (1990). Estimation of the distribution of mayflies along the course of the Wołosatka and Terebowiec streams was carried out on the basis of analysis of the species composition and the dominance structure of larvae. In describing the latter it was assumed that dominant species are those whose percentage share was 5 or more per cent or the total number of larvae collected at a given station, while subdominants are species with a 2 to 4.9 percentage share.

The sampling dates at particular stations were:

Stations 1, 2, 3, 4 — 8, 22 May, 3 July, and 7 Sept. 1987.

Stations 5, 6, 7 — 13, 20 June, 4, 18 July, 7 Aug., 3, 17 Sept., 11 Oct., and 8 Nov. 1985; 10 Apr., 2, 23 May, and 16 June 1986.

Stations 8, 9 — 16 May, 20 June, 18 July, 3 Sept., and 11 Oct. 1985.

Stations 10, 11, 12, 14, 15 — 8, 22 May, 3 July, and 7 Sept. 1987.

Stations 13 — 10 Jan., 21 Mar., 10 Apr., 23 May, 16 June, 4 July, 8 Aug., 3 Sept., 3 Oct., and 21 Nov. 1986.

Stations 16, 17, 18, 19, 20, 21 — 7 May, 30 Aug., and 16 Sept. 1988.

4. Results

4.1. Distribution of mayflies along stream courses

In analysing the species composition and dominance structure of mayfly larvae in the Wołosatka and Terebowiec streams several of

Table III. Percentage share of mayfly species at the stations in the Wołosatka stream

Taxon	Station								
	1	2	3	4	5	6	7	8	9
Ecdyonurus gr. helveticus	82.0	40.0	5.0	6.0					
Rhithrogena iridina	3.0	15.0	31.0	59.6	26.0	20.6	7.2	5.8	4.1
Baetis alpinus	9.0	10.0	23.8	20.8	56.6	48.7	37.6	40.7	16.5
Baetis rhodani	6.0	15.0	17.3	2.0	2.8	9.0	19.0	11.6	13.6
Rhithrogena gorganica		20.0	22.3	0.8	0.1	0.02		20.7	6.5
Baetis mutlicus			0.3	3.6	7.3	8.7	22.4	0.1	
Rhithrogena wolosatkae			0.3	0.4	1.2	1.4	0.6		
Rhithrogena carpatoalpina				4.8					
Rhithrogena puytoraci and R. carpatoalpina									
Rhithrogena puytoraci					0.7	1.8	1.7	3.8	11.6
Baetis melanonyx				1.6	2.7	3.3	1.3	2.3	1.1
Ephemerella ignita				0.4	0.2	2.0	5.8	5.8	7.4
Baetis scambus					0.03	0.1	0.5	2.5	8.4
Habroleptoides confusa					0.2	1.0	0.8	1.6	2.8
Ecdyonurus venosus					1.1	2.2	1.6	1.6	8.4
Ecdyonurus carpathicus					0.2	0.2	0.3		
Epeorus sylvicola					0.7	0.3	0.4	0.3	0.6
Ecdyonurus submontanus					0.1	0.1	0.01	0.4	0.5
Ecdyonurus starmachi					0.03	0.2	0.1	0.2	1.2
Electrogena lateralis					0.03	0.2	0.2	1.1	1.0
Ephemerella mucronata					0.01	0.1	0.2	0.5	0.8
Caenis beskidensis						0.01	0.01	0.2	4.6
Caenis rivulorum						0.02	0.2	0.1	2.2
Ephemerella major							0.01	0.05	0.2
Habrophlebia lauta							0.03	0.3	1.6
Electrogena quadrilineata								0.3	0.1
Rhithrogena semicolorata								0.1	1.7
Caenis macrura								0.1	0.1
Caenis pseudorivulorum									2.1
Ecdyonurus torrentis									1.2
Baetis fuscatus									0.3
Baetis lutheri									0.3
Rhithrogena savoiensis									0.2
Acentrella sinaica									0.2
Ephemera danica									0.2
Siphlonurus lacustris									0.2
Ecdyonurus dispar									0.1
Centroptilum. luteolum									0.1
Ephemera lineata									0.1
Total number of species	4	5	7	10	19	21	22	24	33
Number of community	1			2a			2b		3

Table IV. Percentage share of mayfly species at the stations in the Terebowiec stream

Taxon	Station					
	10	11	12	13	14	15
E. gr. helveticus	44.0	20.5	6.5	2.1		
R. iridina	38.0	48.0	33.1	33.9	15.6	1.6
— gorganica	12.0	8.2	8.5	0.6		
B. alpinus	2.0	22.3	43.9	50.5	37.3	4.9
— muticus	4.0	1.0	3.6	5.5	28.5	21.7
R. wolosatkae			0.1	2.8	2.4	
B. melanonyx			0.8	1.0	1.0	2.1
— rhodani			3.5	1.1	1.0	23.5
R. carpatoalpina				1.4		
R. puytoraci and carpatoalpina					8.1	
— puytoraci						1.6
E. venosus				0.2	1.7	4.3
E. sylvicola				0.7	1.0	4.9
E. lateralis				0.2	0.1	0.3
E. carpathicus					2.4	
— starmachi					0.3	4.9
H. confusa					0.7	11.9
C. beskidensis						8.0
E. ignita						6.1
E. submontanus						1.8
B. scambus						1.5
E. major						0.6
E. torrentis						0.3
Total number of species	5	5	8	12	14	17
Number of community	1			2a		2b

their communities may be distinguished. Three communities with two subcommunities in the second one (Table III) may be distinguished in the Wołosatka in the section from the source down to Ustrzyki Górne. The first community settles the spring section of the stream (Zone I), characterized by a steep gradient (up to 160‰) and by a low temperature of the water in summer and small fluctuations of temperature during the year. The dominants were larvae of *Ecdyonurus helveticus* group, mainly *E. subalpinus*, whose share decreased at successing stations and *Rhithrogena gorganica* and *R. iridina*, *Baetis alpinus*, and *B. rhodani* whose larvae were more and more numerous (Table III). *Rhithrogena gorganica* has the best conditions for development in this section of the stream. The second community settles the zone (Zone II) covering a section of the Wołosatka stream about 9 km long. Here there is a

Table V. Percentage share of mayfly species at stations in the Polaniec and Zakopaniec streams

Taxon	Polaniec			Zakopaniec		
	Stations					
	16	17	18	19	20	21
E. gr. helveticus	7.2			80.0	3.0	
R. iridina	36.4	24.1	10.9	10 0	31.9	17.6
— gorganica	20.0	3.5	1.8		7.6	
B. alpinus	36.4	53.4	23.7	10.0	47.0	32.9
— muticus		10.3	18.2		3.0	7.1
R. wolosatkae		5.2	1.8		4.5	1.2
B. rhodani		3.5	3.6		3.0	10.5
E. venosus			7.3			7.1
E. ignita			21.8			7.1
R. puytoraci and carpatoalpina						5.9
E. sylvicola			3 6			5.9
H. confusa			7.3			4.7
Total number of species	4	6	10	3	7	10
Number of community	1		2a	1		2a

gradual decrease in the gradient and a widening of the stream bed. At the same time shading of the stream decreases. The distinctly differing number of species at the first and last stations of this zone but with a similar dominance structure was the basis for dividing it into two subzones with somewhat different communities of mayfly larvae (Table III). In the upper part of Zone II (community 2a) was Station 4. Here dominated *R. iridina* and *B. alpinus*, while *E. subalpinus* was still comparatively numerous. As subdominant larvae there also occurred here *Rhithrogena carpatoalpina* and *B. muticus*. The communities from Stations 5—7, situated close to each other, and from the Station 8 were assigned to Zone IIb. The number of species along this zone increased from 19 to 24. Dominant were *B. alpinus* and also *R. iridina*, *B. rhodani*, and *B. muticus*. At the lower stations of this zone one of the dominants was *E. ignita*. However, there are no larvae of *Ecdyonurus subalpinus*, connected with the spring zone, while *Rhithrogena gorganica* was represented by single specimens (Table III). Station 9 was reckoned as belonging to the separate Zone III. The community of this zone consisted of 33 mayfly species, of which in the total number of specimens caught, 7 had a share of more than 5%. As before, *B. alpinus* dominated, although it was already proportionally less numerous. Other dominants were *B. muticus*, *B. rhodani*, *E. ignita*, *B. scambus*, *E. venosus*, and

Rhithrogena from the *semicolorata* group, probably for the most part *R. puytoraci* (Table III).

The species composition and dominance structure of mayflies in the Terebowiec stream (Table IV) showed great similarity to those of the upper section of the Wołosatka. Zone I is the spring section of the stream on which Stations 10—12 are situated. In this group of stations from 5 (Station 10) to 8 (Station 12) species were found. The dominants were *E. subalpinus*, *R. iridina*, *R. gorganica*, and *B. alpinus*. Stations 13 and 14 represent the Zone IIa. *B. alpinus* and *R. iridina* continued to dominate. The place of dominance hitherto held by larvae of *Ecdyonurus* from the *helveticus* group and *R. gorganica* was taken by *B. muticus* and *Rhithrogena* from the *semicolorata group*, i.e. at the higher situated Station 13 R. *carpatoalpina*, at Station 14 *R. carpatoalpina* and *R. puytoraci*. The community at the lowest situated Station 15 is in Zone IIb. 17 species of mayfly were observed here among which dominated *B. muticus*, *B. rhodani*, *H. confusa*, *C. beskidensis*, and *E. ignita*. *B. alpinus* and *R. iridina* here began to disappear.

The species composition and dominance structure of mayflies in the Polaniec and Zakopianiec streams were similar (Table V). The stream sections containing Stations 16, 17, and 19 and 21 constitute Zone I. Here dominated *E. subalpinus*, *R. iridina*, *B. alpinus*, *R. gorganica*, *R. wolosatkae*, and *B. muticus*. The species composition and dominance structure of mayflies at Stations 18 and 21 approximated to those observed in community 2a in the Wołosatka and Terebowiec streams.

4.2. Numbers of mayflies in different types of habitat

Six types of habitat were found in the Wołosatka stream. The substratum of Stations 5—7 in this stream was composed of more or less broken up rock material in zones with varying current velocity. Because of the great similarity of habitat conditions at these stations the material collected here was analysed together (Table IV). In all the distinguished types of habitat species from the Baetidae family dominated, constituting at least 50% of all larvae caught in a given type of habitat. In four out of six types of habitat, the most numerous were the larvae of *B. alpinus*. In samples taken from that part of the stream with a bottom of medium and small stones in a medium or slow current (habitat IV) larvae of *B. rhodani* dominated, while in habitat VI with a finer stone substratum in a medium or slow current the most numerous were larvae of *R. iridina*. In comparing the dominance structure in habitats, a similarity may be seen between those with a very swift and swift water current. In all these habitats the larvae of *B. alpinus* and *R. iridina* clearly dominated. In those from

lenitic parts of the stream, the dominance structure was different, also *E. ignita* and *E. venosus* being here comparatively numerous.

4.3. Habitat preferences of larvae of some mayfly species

B. alpinus in the Wolosatka stream occurred most numerously in a very swift current on various types of substratum, though most frequently on large and very large stones, where their density amounted on the average to 941.7 larvae per 1 m². The differences between average densities of larvae of this species in particular habitats were statistically significant (Table VI). The *B. melanonyx* larvae occurred at Stations 5—7 concomitantly with those of allied *B. alpinus* species. In the material collected in the Wołosatka stream, larvae of this species were found in habitats with a substratum composed of small stones and gravel. The greatest density of *B. melanonyx* larvae was found in habitat V, where on average 257.3 larvae fell to 1 m², though the differences between means were statistically non-significant. At Stations 5—7 *B. rhodani* larvae were found in greatest numbers in places with a slower water current (habitats II and IV). In this species a tendency can be seen towards avoidance of gravelly-sandy places (habitats V and VI). The differences between means were significant (Table VI). *B. muticus* like *B. rhodani*, is a species that is not very demanding as to the type of flow it settles. In the Wołosatka most larvae of this species were found among medium and small stones in a medium current (habitat IV) but in the remaining types of habitat the number of larvae of this species was similar and the differences between means were non-significant. Larvae of *R. iridina* were found in various types of habitat, their numbers ranging from 172.5 to 451.1 specimens per 1 m². The most larvae of this type were observed in habitats with very swift water currents with various types of substratum. Lenitic places were not too numerously settled by *R. iridina*. No significant differences were found between the mean density of this species in different types of habitat (Table VI). Two jointly analysed species, *B. carpatoalpina* and *R. puytoraci*, were together less numerous than *R. iridina*. Just as in the case of the below discussed *R. wolosatkae* species the differences between mean densities were caused by the activity of accidental factors. The new, recently described, species of *R. wolosatkae* has not yet been investigated in respect of habitat requirements. In analysing the collected material it may be seen that larvae of this species were observed on a stony bottom of various stones sizes, but the greatest density of specimens was found in very swift or swift current on a considerably broken down substratum (Table VI). *E. venosus* was the most numerous representative of the

Table VI. Density of settlement (number of larvae per 1 m²) and predomination of mayfly larvae (%) in various types of habitat in the Wołosatka stream and significance of differences between mean values (F). + — below 0.1%; * — statistically significant differences

Taxon	habitat						F
	I	II	III	IV	V	VI	
B. alpinus	941.7	782.6	647.7	172.5	694.0	247.7	3.84*
	28.9	22.5	21.7	11.8	21.1	15.5	
B. rhodani	74.4	493.1	234.1	365.0	89.3	70.0	3.91*
	2.3	14.2	7.8	25.1	2.7	4.4	
B. muticus	193.9	173.9	209.5	245.0	172.2	112.3	2.14
	5.9	5.0	7.0	16.8	5.2	7.0	
B. melanonyx	105.3	28.7	67.6	0	257.3	84.3	1.76
	3.2	0.8	2.3		7.8	5.3	
B. scambus	4.3	7.4	1.9	0	7.4	2.3	
	0.1	0.2	0.1		0.2	0.1	
Baetis young nymphs	1124.0	1476.4	797.7	195.0	1049.5	304.5	2.00
	34.5	42.5	26.7	13.4	31.9	19.0	
Baetidae total	2443.6	2962.1	1958.5	977.5	2269.7	821.1	
	74.9	85.2	65.6	67.1	68.9	51.3	
E. ignita	36.3	66.0	54.1	23.3	78.5	35.0	1.21
	1.1	1.9	1.8	1.6	2.4	2.2	
E. mucronata	0.4	0	6.5	2.5	0.9	0	
	+		0.2	0.2	+		
E. major	0.1	0	0	0	0	0	
	+						
Ephemerella young nymphs	3.7	12.0	6.0	0	1.8	7.5	1.41
	0.1	0.3	0.2		+	0.5	
Ephemerellidae total	40.5	78.0	66.6	25.8	81.2	42.5	
	1.2	2.2	2.2	1.8	2.5	2.7	
H. confusa	5.6	28.7	13.0	17.5	4.2	13.9	4.16*
	0.2	0.8	0.4	1.2	0.1	0.9	
H. lauta	0	0	0.6	0	0	0	
			+				
Leptophlebiidae total	5.6	28.7	13.6	17.5	4.2	13.9	
	0.2	0.8	0.5	1.2	0.1	0.9	
C. beskidensis	0	0	0	0	0	1.9	
						0.1	
C. rivulorum	0.6	0	1.8	0	2.9	2.3	
	+		0.1		0.1	0.1	

Caenis young nymphs	0 +	0	1.1 +	0	1.7 +	0	
Caenidae total	0.6 +	0	2.9 0.1	0	4.6 0.1	4.2 0.2	
R. inidina	316.7 9.7	167.0 4.8	451.1 15.1	172.5 11.8	443.2 13.5	370.8 23.2	5.49*
R. puytoraci and carpatoalpina	23.9 0.7	16.2 0.5	24.8 0.8	27.5 1.9	21.3 0.6	31.4 2.0	0.26
R. wolosatkae	15.4 0.5	13.9 0.4	23.0 0.8	12.5 0.9	39.6 1.2	21.5 1.3	0.95
R. gorganica	1.4 +	0.9 +	1.2 +	0	2.7 0.1	0	
Rhithrogena young nymphs	333.0 10.2	137.4 3.9	388.2 13.0	130.0 8.9	365.8 11.1	203.8 12.7	2.35*
Rhithrogena total	690.4 21.2	335.4 9.6	888.3 29.7	342.5 23.5	872.6 26.5	627.5 39.2	
E. venosus	23.4 0.7	33.0 0.9	17.7 0.6	37.5 2.6	23.6 0.7	43.1 2.7	1.79
E. submontanus	2.3 0.1	0	3.5 0.1	0	1.9 0.1	0	
E. stammachi	1.4 +	6.1 0.2	0.6 +	0	2.7 0.1	3.1 0.2	
E. carpathicus	2.4 0.1	1.7 +	3.6 0.1	2.5 0.2	1.0 +	0.8 +	
Ecdyonurus young nymphs	38.1 1.2	26.0 0.7	24.7 0.8	50.0 3.4	19.2 0.6	37.2 2.3	
Ecdyonurus total	67.6 2.1	66.8 1.9	50.1 1.7	90.0 6.2	48.4 1.5	84.2 5.3	
Ep. sylvicola	10.6 0.3	2.6 0.1	6.4 0.2	2.5 0.2	1.0 +	1.5 0.1	3.03*
El. lateralis	0.9 +	3.4 0.1	2.4 0.1	0	6.1 0.2	4.6 0.3	
Heptageniidae total	769.5 23.6	408.2 11.7	947.2 31.7	435.0 29.9	928.1 28.2	717.8 44.9	
EPHEMEROPTERA total	3259.8	3477.0	2988.8	1455.8	3287.8	1599.5	

genus *Ecdyonurus* at Stations 5—7 (Table III). *E. venosus* larvae were fairly numerous in habitats of slow current and gravel bottom (habitat VI) averaging 43.1 specimens per 1 m^2 but no significant differences in the density of larvae of this species were observed (Table VI). The *E. sylvicola* species, constituting 0.5% of all mayfly larvae collected at Stations 5—7, most frequently settled stream zones of very swift and swift current. The demanding, as far as current velocity is concerned, larvae of this species distinctly avoided fine stone and gravel bottoms (the differences between habitats being significant) (Table VI). The Ephemerellidae family had three representatives at Stations 5—7 but only the material concerning *E. ignita* permits an analysis to be carried out. In the Wołosatka this species was found in various types of habitat. On the average 78.5 larvae fell to 1 m^2 of the fine stone and gravel bottom in a very swift current, in the remaining habitats being less numerous. In the Wołosatka most *H. confusa* specimens were caught in lenitic habitats with various types of substratum. A considerable part of the larvae came from places with a swift current. The differences between mean values here were significant (Table VI).

5. Discussion

The majority of mayfly species found in the Bieszczady National Park commonly occur in various other Carpathian streams. However, there are some rare species among them. These are *Rhithrogena gorganica*, *R. wolosatkae* and the species *Ecdyonurus* cf. *subalpinus* and *Ecdyonurus* sp.. *R. gorganica*, endemic to the Eastern Carpathians, apart from the Bieszczady mountains has not been recorded elsewhere in Poland. The centre of settlement of this species in the Czarnohora (Mikulski 1936, Sowa 1975a). Localities of *R. wolosatkae* are still scarcer and the Wołosatka abd Terebowiec streams are the only places in Europe where this species has been found (Kłonowska 1987). Similarly scarce may prove to be species of *Ecdyonurus* from the *helveticus* group from the spring sections of streams. Larvae of the species assigned to the *helveticus* group were mainly found in the material collected in the spring sections of the Wołosatka, Terebowiec, Polaniec, and Zakopaniec streams and also at some lower stations. The most numerous belonged to *E. subalpinus* whose lower limit of occurrence is about alt. 800 m. This species was observed by Sowa in the upper course of the Wołosatka stream (Sowa 1975a). When determining larvae of this species a great number of specimens were found that differed from the description of *E. subalpinus* (Landa 1969). The differences were mostly visible in the shape of the lateral

margins of the pronotum. Three types of margin of the pronotum were observed. These were typical for *E. subalpinus* larvae, i.e. sharpened and curved inwards or similar but slightly less curved and sharpened (*E.* cf. *subalpinus*), or also wider, rounded at the end fairly strongly curved (*Ecdyonurus* sp.). It was also possible to observe a fairly great variability in shape and coloration of thighs of larvae although on the basis of these features it was difficult to divide them into separate groups. The above-mentioned observations together with distinct vertical differentiation in the distribution of particular types of larva indicate the necessity of further, more precise analysis of the problem. It seems that in the examined material, apart from those of *E. subalpinus*, there were larvae belonging to two other not yet described allied species which cannot be determined precisely according to the existing keys.

The distribution of communities of mayfly larvae suggested in the present work is similar to that of the earlier one elaborated by Sowa (1975a, 1980) for the Carpathian streams, whose springs are at altitudes of at least 700 m. The differences result from the smaller material from the Wołosatka stream at that author's disposal and, for example, that in his opinion the community of Zone I of the Wołosatka stream consisted only of *E. subalpinus* larvae.

The habitat preferences of the larvae of some analysed mayfly species observed in the Wołosatka stream differ only slightly from the data in the literature. *B. alpinus* is a species connected mainly with mountain waters (Landa 1969, Müller-Liebenau 1969, Sowa 1975a) where larvae live in a rapid current, clinging to the surface of stones. In the Wołosatka *B. alpinus* occurred most numerously in the very swift current on various types of substratum, though most frequently on large and very large stones. *B. rhodani* larvae occur in the whole stream profile in the current at the bank, among stones and plants — as long as there is a constant flow of water in these places (Landa 1969, Müller-Liebenau 1969). At Stations 5—7, however, the larvae of this species avoided zones with a turbulent flow and also gravelly-sandy places. *B. muticus*, similarly as *B. rhodani*, is a species not very exacting as regards the type of settled flow. The larvae of *B. muticus* may be seen in various types of waters (Landa 1969, Müller-Liebenau 1969) where they also settle habitats with a greater number of macrophytes. This is confirmed by data from the Wołosatka, where the species settled various zones of the stream, indicating no distinct habitat preference. Outstandingly reophilus is the species *R. iridina*, whose larvae settled the current zones of the stream in great numbers, whereas the substratum type played a smaller role. In the Olszowy stream in the Gorce Mountains (Sowa 1975a). *R. iridina* was encountered in similar habitats. The most

numerous representative of the genus *Ecdyonurus*, *E. venosus*, at the stations on the Wołosatka and its tributaries, settled all the distinguished types of habitat, without showing a special preference for any one of them. Głowaciński (1968) includes *E. venosus* with reophilous species, associated with a stony bottom (the Skawinka stream). In the Olszowy and Koninka streams in the Gorce mountains this species was most frequently found in lotic zones (Sowa 1975a). In the Wołosatka the species *E. sylvicola* distinctly avoided lenitic zones and a bottom with small stones and gravel. Probably the tendency to choose larger stones usually to be found in a rapid current results from the manner of respiration of *E. sylvicola larvae*. For proper gas conversion this species requires sufficiently high pressure, which is most easily attainable on large stones in a strong current. This tendency in *Epeorus* larvae was observed by Clements (1987). The larvae of *E. ignita* occurred in the Wołosatka in various types of habitat. The species was earlier found in streams and rivers, often of very different nature (Landa 1969, Sowa 1975a, Jop 1981). The larvae of *H. confusa* live under stones (Landa 1969) where they find the detritus silt that constitutes their food base. Most specimens of *H. confusa* were caught in the Wołosatka in lenitic habitats, though a great many of them also came from places with a swift current. One may suppose that their body structure permits their easy translocation in crevices between stones so that the larvae of *H. confusa* may also be temporarily found in a strong current when changing the feeding place.

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6. Polish summary

Jętki (Ephemeroptera) potoku Wołosatka i jego głównych dopływów (Bieszczadzki Park Narodowy, południowo-wschodnia Polska)

W badanych potokach (ryc. 1) na wybranych stanowiskach (tabele I, II) stwierdzono występowanie 38 gatunków jętek. W Wołosatce na odcinku od źródeł do Ustrzyk Górnych wyróżniono 3 zgrupowania larw jętek z dwoma podgrupami w zgrupowaniu 2 (tabela III). Skład gatunkowy i struktura dominacji jętek w potoku Terebowiec wykazywały duże podobieństwo do górnego odcinka Wołosatki (tabela IV), podobnie jak Polańca i Zakopańca (tabela V). Na stanowiskach 5—7 wyróżniono 6 typów siedlisk. We wszystkich typach siedlisk dominowały gatunki z rodziny Baetidae. W czterech typach siedlisk najliczniejsze były larwy *B. alpinus* (tabela VI).

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