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The distribution and ecology of *Hydropsyche bulgaromanorum* and *Hydropsyche contubernalis* (*Trichoptera*: *Hydropsychidae*) in Poland and Belarus

Stanisław Czachorowski and Edyta Serafin

With 3 figures and 3 tables

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Little has been known so far about distribution and habitat requirements of *H. bulgaromanorum* Malicky, 1977 and *H. contubernalis* McLachlan, 1865 in Poland and Belarus. The paper presents the current state of knowledge about both species on the basis of material collected in 1984-2003 in both countries by using standard methods for catching larvae and adults. New sites of both species confirmed their wide and compact European distribution. *H. contubernalis* larvae are associated with the middle reaches of large and small rivers while *H. bulgaromanorum* larvae favour lower reaches of large rivers. The relationship between water quality class (Polish classification) and the occurrence of both species in Poland is also discussed; habitual analysis show that *H. bulgaromanorum* larvae are tolerant to water pollution. This, therefore, can not be the main limiting factor for the distribution of the species; their small number of records in the past most probably result from the poor state of research of riverine habitats in Poland.

1 Introduction

Caddisflies of the family Hydropsychidae are one of the most abundant and common species in European freshwaters, especially in medium-sized lowland and upland rivers and large lowland rivers. This is the reason why they are treated as potential indicators of water pollution. The family is quite numerous – in Poland 18 species have been found so far, with 16 of the genus *Hydropsyche* (Czachorowski 2002; Szczęsny 2002; Serafin 2003). At the same time this genus seems to be one of the most controversial ones with respect to knowledge, identification and distribution in Europe. The determination of Hydropsychidae is still based mainly on males and larvae but even within the descriptions one can find some vague points, e.g. in distinguishing between subspecies in adults or separating new species within the existing ones. The most important diagnostic features of larval stages have been described relatively recently; the same refers to many species, e.g. *Hydropsyche bulgaromanorum*, *H. dinarica*

Marinkovic, 1979, *H. incognita* Pitsch, 1993 or *H. tobiasi* Malicky, 1977. Consequently the revisions of recently described species have changed the distribution of the whole genus. For instance many specimens identified as *H. guttata* Pictet, 1834 or *H. ornatula* McLachlan, 1878 in the past turned out to be *H. bulgaromanorum* (Ciubuc 1993). That is why the European distribution of these species, *H. bulgaromanorum* among others, can be confusing. Taking into consideration the determination of adult females in recent years some descriptions or keys have been published but they are still in the phase of testing and improvement. Besides our lack of knowledge of recent geographical distribution problems of the genus *Hydropsyche* also the older records are fragmentary. This refers especially to the situation in Poland and Eastern Europe. According to Pitsch (1993) this above mentioned part of Europe is still an unsurveyed area. Generally both species dealt in this paper are regarded as widely distributed in whole Europe but these are the recent researches that have provided the major part of data about their distribution in Europe (Chvojka & Novak 2001, Malicky 1984, Pitsch 1993).

The subspecies of *H. contubernalis* were also described only relatively recently. While observing the high variation of coloration patterns on larval frontoclypei in rivers of south-eastern Poland a question arises – is it a matter of subspecies or intraspecific variability? Insufficient knowledge of its geographical distribution makes it difficult to decide whether there are real subspecies, two different taxa (which must be described) or just polymorphism. That is why this problem needs to be investigated further, with distribution pattern taken into account in the first place.

Ecological characteristics of the larval distribution in case of *H. contubernalis* and *H. bulgaromanorum* are one of the poorest known within the family Hydropsychidae in Poland and Belarus as well but their sensitivity to water pollution has remained even less known.

The main purpose of this paper is to present the results of studies on the distribution of *H. bulgaromanorum* and *H. contubernalis* in Poland and Belarus in order to complete the view of their geographical distribution, longitudinal distribution and larval microhabitat preferences with some remarks on their sensitivity to water pollution.

2 Material and methods

The material was collected during hydrobiological and entomological studies 1984-2003 by the Department of Ecology and Environmental Protection at Warmia and Mazury University in Olsztyn and the Department of Zoology at Maria Curie-Sklodowska University in Lublin. The studies were done in cooperation with the University of Agriculture in Lublin in Poland, the University

of Szczecin in Poland and the Institute of Zoology in National Academy of Sciences in Minsk in Belarus.

The specimens of *H. bulgaromanorum* were collected 1999-2003, of *H. contubernalis* 1984-2003. The larvae and pupae were caught with a hydrobiological scoop and handpicked directly from submerged plants, stones, branches etc. Imagines were collected with an entomological net on the riverbanks and by light traps. Then, all stages were preserved in ethanol. The material encompassing both species is in the authors' collections at the University of Warmia and Mazury in Olsztyn and the University of Agriculture in Lublin.

Saprobity classes of the new localities presented in this paper are in accordance with the Polish system consisting of four categories as follows: I class – clean waters, II – moderately polluted, III – highly polluted and IV - excessively polluted ("non" in the tables). Faecal coliform counts and concentrations of chlorophyll a are the most important criteria for classification (Brodowska & al. 2003) (Tab. 1, Tab. 2). The lack of such information means that no data are available which is common for short water courses. It must be pointed out, that the Polish system of water quality differs from the systems used in Germany and some other Central European countries.

3 Results

H. bulgaromanorum and *H. contubernalis* in Poland

14 new localities of *H. bulgaromanorum* were recorded in Poland in 1999-2003 (Fig. 1). The collected material encompasses 225 specimens – 167 larvae, 55 pupae and 3 imagines. The detailed data are given in table 1. 21 new localities of *H. contubernalis* from Poland were found in 1984-2003 (Fig. 2). The material examined consist of 580 specimens – 352 larvae, 4 pupae and 224 imagines. The detailed data are given in table 2.

H. bulgaromanorum and *H. contubernalis* in Belarus

Two localities of *H. bulgaromanorum* are known so far with one larva found in each of them. Now 15 new localities of *H. contubernalis* are added. The total number of 1084 specimens – 393 larvae and 691 adults – was collected in 1997-2002. One locality was considered doubtful but recently has been confirmed (see discussion). The data on both species are given in table 3 and in figure 3.

Fig. 1: Localities of *H. bulgaromanorum* in Poland. 1 = new localities, 2 = localities given in literature

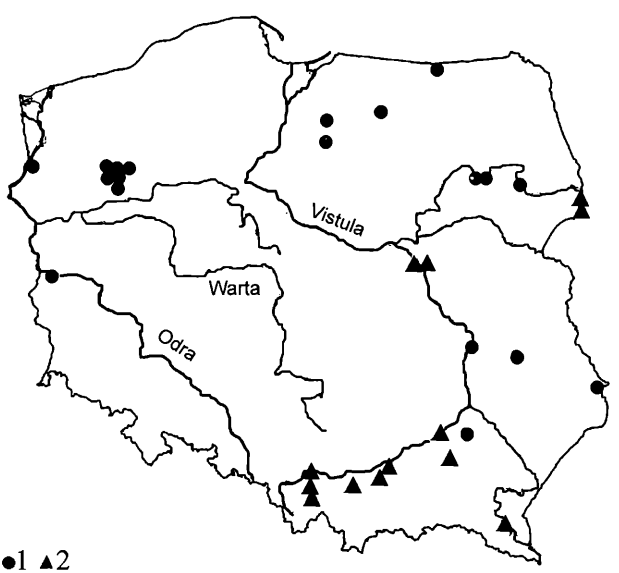

Fig. 2: Localities of *H. contubernalis* in Poland. 1 = new localities, 2 = localities given in literature

Tab. 1: New localities of *Hydropsyche bulgaromanorum* in Poland: km = the distance of a given locality from the river source (after Czarnecka & al. 1978), L = larvae, P = pupae I = imagines, CC = saprobity class (after Božek & al. 2001). * = geographical areas according to Kondracki (2000)

Locality and UTM code	Habitat	km	Date	L	P	I	CC	Habitat characteristic
River Dolna Odra Valley*								
Nowe Czarnowo near Gryfino (VU69)	canal of River Odra	718	05-11-1996	24				Fed by water from the power station and backwater from the River Odra Wschodnia; artificial substrate, well-oxygenated waters
			04-12-1996	10				
Lublin Upland*								
Mięćmierz near Kazimierz Dolny (EB68)	River Vistula	362	05-08-1999	3	1		non	Wide river, bottom of large stones, no vegetation, shallow water
Kazimierz Dolny (EB68)	River Vistula	364	30-06-2003	18			non	
River Biebrza Basin*								
between Wizna (ED99) and Krzewo (ED88)	River Narew	214	08-07-2003	1			III	Wide, meandering river, bottom of sand and clay with no vegetation
Wizna (ED99)	River Narew	202	03-07- 2002	1			III	
Rivers Warta and Odra Proglacial Stream Valley*								
Krosno Odrzańskie (WT06)	River Odra	514	25-07-2003	2	27		non	Wide regulated river, bottom of large stones, no vegetation, shallow water
Sandomierska Basin*								
Sandomierz (EB51)	River Vistula	268	01-08-2002	31	17		non	Wide regulated river, bottom of large stones, no vegetation, shallow water
			03-10-2002	3	6			
Toruńsko-Eberswaldzka Proglacial Stream Valley*								
Gozdowice (VU54),	River Odra	645	03-09-1999	2			non	No data
Górzyca (WV18)	River Odra	605	03-09-1999	8			non	
Wołyń Polesie*								
Dubienka (GB05)	old arm of River Bug		12-06-2003	1			non	Abundant vegetation, bottom of sand, shallow water
Świerże (FB97)	River Bug	322	20-06-2003	3	2		non	Wide natural river, bottom of large stones, no vegetation, shallow water
Wołyń Upland*								
Gródek (GB03)	River Bug	231	04-04-2002	1			non	Wide river, bottom of large stones, no vegetation, shallow water
			04-08-2003	23	2			
			02-09-2003	22		3		
Kryłów (KS91)	River Bug	219	04-04-2002	7			non	
Ślipcze (KS82)	River Bug	226	16-08-2001	7			non	
Sum of specimens				167	55	3		Total: 225

Tab. 2: New localities of *Hydropsyche contubernalis* in Poland: km = the distance of locality on a river from its source (after Czarnecka & al. 1978), L = larvae, P = pupae I = imagines, CC = saprobity class (after Božek & al. 2001). * = eographical areas according to Kondracki (2000)

Locality	habitat	km	date	L	P	I	CC	Habitat characteristic
River Dolna Odra Valley*								
Nowe Czarnowo near Gryfino (VU69)	canal of River Odra	718	03-04-1996	5				Fed by water from the power station and backwater from the River Odra Wschodnia. Artificial substrate, foil covered with periphyton; welloxygenated
			29-06-1996	13				
			26-07-1996	11				
			30-09-1996	31				
			05-11-1996	32				
			04-12-1996	17				
Iława Lake District*								
The Iława Lake District Landscape Park, Siemiany (DE05)			26-08-2000			2		Light trap set at the lake near the forest
Lublin Upland*								
Mięćmierz (EB68)	River Vistula	362	26-04-2000	1			non	Wide regulated river, bottom of large stones, no vegetation, shallow water
Kazimierz Dolny (EB68)	River Vistula	364	30-06-2003	4	2			
Lublin (FB17)	River Bystrzyca	44	20-05-2001	6		51	non	Medium-sized river, bottom of medium-sized stones covered with mosses, submerged branches, *Potamogeton* spp., *Elodea canadensis*, abundant riparian vegetation
			10-06-2001			3		
			07-08-2001			38		
			08-09-2001	6				
			19-09-2001	10		1		
			07-10-2001	5				
			02-06-2003	2	2			
	xerothermic scarp		08-08-2003			2		Light trap situated on the loess slope
Masurian Lake District*								
Ruś (DE64)	River Łyna	41	20-07-1998	4				Bottom of stones
Olsztyn (DE66)	River Łyna	43	05-05-1990	6				Urban area, fast-flowing current, bottom of stones covered with vegetation.
			02-07-1992	5				
			15/25-08-93	2				
			25-05-1995	2				
			10-05-1996	10				
			23-10-1996	46				
			25/28-08-97	16				
			07-11-1997	20				
			23-09-1999	1				
			18-10-1999	2				
Middle River Odra Basin*								
Połęcko (VT96)	River Odra	530	02-09-1999	1			non	Bottom of stones
Północnomazowiecka Lowland								
Drozdowo (ED78)	River Narew	226	12-08-1985			48		Light trap
			08-08-1985			46		
Krzewo (ED88)	River Narew	224	03-07-1993	9			III	Bottom covered with emerged branches
Rakowo (ED88)	River Narew	224	22-10-1984	1			III	Hollow with grass
			16-08-1985			1		
Sandomierska Basin*								
Nowa Dęba (EA58)			18-08-1998			18		Light trap in a artillery range
Sępopolska Plain*								
Wyskok (EF31) near Lake Oświn			2-09-1996			2		Light trap

Locality	habitat	km	date	L	P	I	CC	Habitat characteristic
South Pomeranian Lake District*								
The River Drawa National Park (WU68, WU58, WU59, WU67)	River Drawa	115-160	24-06-1998	12		5		Bottom of stones, fast-flowing current, *Potamogeton* spp.
			27-06-1998	1				
The River Drawa National Park (WU68, WU79, WU69, WU67)	River Płociczna		25-06-1998	10				Bottom of stones, fast-flowing current
			26-06-1998	9		5		
The River Drawa National Park (WU58)	River Korytnica		27-06-1998	1				Bottom of stones and gravel, shallow water
Glusko (WU67)	River Drawa	160	27-07-1988	1				Bottom with emerged tree branches
St. Osieczno (WU67)	River Drawa	160	28-07-1988	1				Bottom covered with *Fontinalis antypyretica*
River Górna Narew Basin*								
The River Narew National Park, Bokiny (FD27)	River Narew	113	9-07-2002			2		Light trap by the river
			12-07-2002	1				Net found on a *Potamogeton natans* stem
Wolyń Upland*								
Gródek (GB03)	River Bug	231	12-06-2003	10			non	Bottom of large stones, no vegetation, shallow water
			4-08-2003	37				
	gravel pit (near River Bug)		4-08-2003	1				Small gravel pit overgrown by *Chara foetida*
Sum of specimens				352	4	224		Total: 580

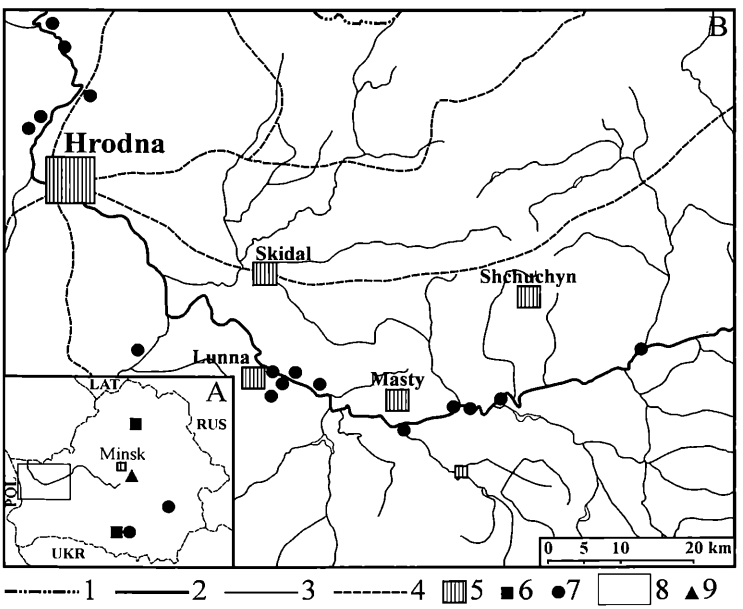

Fig. 3: Localities of *H. bulgaromanorum* and *H. contubernalis* in Belarus, River Nieman basin. 1 = boundries of Belarus, 2 = the River Neman, 3 = other rivers, 4 = main roads, 5 = towns, 6 = new localities of *H. bulgaromanorum,* 7 = new localities of *H. contubernalis,* 8 = Niemen basin enlarged in B, 9 = the only one locality from literature (Czachorowski & Prishchepchik 1998)

Tab. 3: New localities of *Hydropsyche contubernalis* and *H. bulgaromanorum* in Belarus: L = larvae, P = pupae I = imagines

Locality	Habitat	Date	L	P	I	Habitat characteristic
Hydropsyche bulgaromanorum						
Berezyna National Park	River Berezyna	23-04-2002	1			No data
Prypyat National Park	River Stviga	15-09-2002	1			
Sum of specimens			2			Total: 2
Hydropsyche contubernalis						
Bala Solnaja	River Neman	12-06-1998	10			Bottom of stones, fast current
		28-09-1998	8			
		17-07-1997	14			
		13-09-1997	30			
Dubno	River Neman	5-07-1998			1	No data
Jablonowo	River Neman	1-07-1998	3			River-bank caving, with *Salix* spp.
Kopiejnoje*	River Świslocz	10-07-1999			14	Light trap
		7-07-1998			120	
		7-06-1999			4	
Lukawica	River Neman	14-05-1997	1			*Potamogeton* spp, *Butomus umbellatus* and *Glyceria* spp.
		17-07-1997			1	
Lunna (four separate dots on the fig. 3)	River Neman	14-07-1997	55		13	Hard or clayey bottom, with *Salix* spp., *Glyceria* spp. on the banks. Light traps for adults
		1-26-07-1998	2		522	
		17-08-2000	14			
Masty	River Zalewianka	16-09-1997	2			*Glyceria maxima* on banks
Orlja	River Neman	15-07-1997	50			Bottom of stones, fast current
Polnica	Unnamed creek	13-09-1997	40			Bottom of stones, slowly current
Prawe Mosty	River Neman	16-07-1997	41			Bottom of stones, *Sagittaria sagittifolia*, water depth – 0.5 m
		16-09-1997	7			
		25-07-1998	18			
		29-09-1998	2			
Prypyat National Park	River Stviga	15-09-2002	60			No data
Suchaja Dol	River Świslocz	14-07-1997	4			Bottom of sand, *Sagittaria sagittifolia*, *Potamogeton pectinatus*
		15-09-1997	1			
		23-07-1998	1			
Zaborje	River Neman	16-07-1997	20			Bottom of sand, on the trunk
Zareczanka	River Zareczanka	12-06-1998	1		5	Bottom of sand and gravel
		28-09-1998	2			
Zaryca	River Neman	12-04-1998	1			*Potamogeton pectinatus*, lot of sediments
		27-07-1998	2		11	
Zoton	River Dniepr	28-06-2000	4			No data
Sum of specimens			393		691	Total: 1084

4 Discussion

4.1 Distribution and larval habitats of *Hydropsyche bulgaromanorum* in Poland and Belarus

In Europe *H. bulgaromanorum* is regarded as a species of large rivers (Chvojka & Novak 2001, Edington & Hildrew 1995, Pitsch 1993, Wallace 1991). It is widespread in Europe and Siberia: Austria, Hungary, Romania, Bulgaria, Italy, France, Serbia, Slovenia, Germany, Finnland, Russia (Malicky 1984), Belgium

(Stroot 1985) and Lithuania (Cibaite 2003). In England the occurrence of this species is controversial – on one hand it is believed that this species is extinct from Britain (Edington & Hildrew 1995, Wallace 1991) but on the other hand it is regarded as present (Malicky 1984). The state of knowledge on this species and its status in the countries mentioned differ slightly due to the level of trichopterological studies and the presence of suitable habitats.

In Poland only two records of *H. bulgaromanorum* were known until the 1980s (Fig. 1 – black triangles) – the Białowieża Primeval Forest (Mohammad & al. 1987) and the Carpathians area – two males from Antonii Waga's collection (Szczęsny 1980, 1986). In both cases the data referred to imaginal stages only. With 14 new localities (Fig. 1 – black dots) it makes 16 localities found so far. New records refer to larval or pupal stages and that is why some conclusions about larval preferences can be deduced. *H. bulgaromanorum* as a large river species is most likely associated with the lower reaches of lowland rivers, e.g. the Rivers Bug, Odra or Vistula in Poland. In most cases the larvae and pupae were not found in river rapids but in lentic habitats without vegetation and with shallow, warmer water and stony substratum. The presence of this species in the Polish part of the River Bug proves that it must be also present on the territory of the Ukraine, where data about this species are lacking. The same refers to *H. contubernalis* and it can be concluded that both discussed species need to be included in the Ukrainian checklist.

The status of *H. bulgaromanorum* as a red list species in Poland is unquestionable. It is included with "LC" (least concerned) category (Szczęsny 2002). The abundance of this species is probably limited by its particular kind of habitat described above but within such habitats it seems to be not very rare. In Germany this species is also present in the red lists, category "R" (Neu 2001). Other comparisons are impossible due to the lack of red lists of neighbouring countries.

In Belarus the first findings are restricted to the national parks (Fig. 3) with the same types of habitats like in Poland. Given the fact that this country is still in the phase of intensive caddisfly research and that the suitable habitats for *H. bulgaromanorum* are also present further records might be expected in the future.

4.2 The distribution and larval habitats of *Hydropsyche contubernalis* in Poland and Belarus

H. contubernalis is a more common species in Europe than the previous one. It is regarded as a species of large rivers (Edington & Hildrew 1995; Wallace 1991). Its distribution is similar to the distribution of H. bulgaromanorum (except for

Italy) with the northern boundary of the range reaching Scandinavia: Denmark, Sweden and Norway (Solem & Gullefors 1996).

The following records have been published so far (Fig. 2, black triangles): the Białowieża Primeval Forest (Mohammad & al., 1987), the River Vistula in Sulejów (Pitsch pers. comm.), the River Vistula in Warszawa (Kownacki 1999), the same river – one male from Waga's collection (Szczęsny, 1980), the River Raba (Szczęsny 1975), the lower and middle courses of the Rivers Soła, Raba and Wisłoka in the North Carpathians (Szczęsny 1986), and the River San outside the Bieszczady Mountains (Szczęsny 2000). Here 21 new sites are given from whole Poland (Fig. 2 – black dots). Contrasting with *H. bulgaromanorum*, *H. contubernalis* is clearly associated with upper courses of smaller lowland and upland (mountain) rivers. The habitats of this species are very different , but it seems that larvae of *H. contubernalis* are rather associated with aquatic plants, either submerged or floating (e.g. *Potamogeton* ssp. or *Fontinalis* ssp.) than *H. bulgaromanorum* larvae. Whereas the larvae of *H. bulgaromanorum* were strictly associated with stones, particularly large ones, the larvae of *H. contubernalis* colonize stones, plants or submerged parts of trees as well.

In Belarus *H. contubernalis* was found for the first time in 1997 in Kopiejnoje (38 adult specimens caught in a light trap), but the identification was doubtful (Czachorowski & Prischchepchik 1998). Since this find, the occurrence of this species has been confirmed. 15 new sites given in this paper are almost limited to the basin of the River Nieman in the north-western part of the country. This can be a starting point for future investigations. On the basis of the number of the localities it can be concluded that other records will show the species as being widely distributed in Belarus. Larval habitats in Belarus were also varied: the bottom of rivers was of stone, clay or gravel with considerable variation in vegetation.

4.3 Longitudinal distribution of *H. bulgaromanorum* and *H. contubernalis* in Poland

The problem of longitudinal distribution of Hydropsychidae in rivers seems to be still unsolved definitely. Based on the general knowledge of the longitudinal distribution if Hydropsychidae it can be concluded that in Poland it will be as follows: upper stretches of rivers (epipotamal) are inhabited by *Hydropsyche saxonica* and *H. incognita*, middle reaches (mesopotamal) by *H. contubernalis*, *H. angustipennis* and *H. pellucidula* and lower reaches (metapotamal) by *H. bulgaromanorum*. Information on the distribution of the species discussed presented by Edington and Hildrew (1995) and Pitsch (1993) correspond with this model. According to Pitsch (1993) *H. bulgaromanorum* is found between 500-800 km from the river's source in contrary to *H. contubernalis* which occurs

between 20-800 km. Our data show that *H. bulgaromanorum* is found between 200-700 km from the source of large rivers, while *H. contubernalis* can also be found in rhitral stretches of large or medium-sized rivers with a longitudinal distribution covering 40-700 km of a river. Nevertheless, the numbers are quite similar but at the same time the whole lengths of rivers in a particular country must be taken into consideration when marking out the border values. In south-eastern Poland *H. contubernalis* co-occurs almost always with *H. angustipennis* and sometimes *H. pellucidula*. In these large lowland rivers the adults of *H. angustipennis* emerge earlier than *H. contubernalis*. In Britain *H. contubernalis* co-occurs in the lower reaches of large rivers with *H. pellucidula* and *H. siltalai*. In Polish large rivers *H. bulgaromanorum* was the only Hydropsychidae species, in most cases co-occuring with *H. contubernalis* larvae sporadically.

4.4 Water pollution tolerance of *H. bulgaromanorum* and *H. contubernalis* in Poland

The tolerance to water pollution of the genus *Hydropsyche* is not very clear and ambiguous. Key factors limiting the occurrence of *Hydropsychidae* are chemical factors, oxygen level and velocity (Stuijfzand & al. 1999); others are less decisive.

In Poland caddisflies are regarded as organisms quite sensitive to pollution; they are in most cases associated with very clean and clean waters (Kownacki & al. 2002). At the same time genus *Hydropsyche* is known to be characteristic of mesosaprobity (Czachorowski, 1988). Additionally, the number of larval Hydropsychidae can increase with organic matter in slightly polluted areas (Szczęsny 1975). Comparing both species, *H. bulgaromanorum* is less resistant to water pollution (Saprobity Index = 2.2) than *H. contubernalis* (Saprobity Index = 2.8) (Moog 1995 after Waringer & Graf 1997). According to results obtained (Tab. 1) larvae of *H. bulgaromanorum* were found in waters of saprobity class III and beyond only. The detailed analyses of water's quality of 6 chosen sites where *H. bulgaromanorum* was found – one on the River Odra, two on the River Vistula and three on the River Bug – confirm that *H. bulgaromanorum* must be tolerant to water pollution. The waters of the River Vistula in Sandomierz have quality class IV due to high concentrations of salt and faecal Coliform counts. The pollution of the River Vistula in Mięćmierz is mainly due to class IV concentrations of chlorophyll a and high degrees of mineralization (Janiszewska 2002). The waters of the River Bug are also class IV, typical of very high chlorophyll a concentration while total phosphorus, faecal Coliform counts and total nitrogen are less important (Bańkowska-Królikowska & al. 2002). In addition, the site in Sandomierz is influenced by pollutions

from a sewage pipe. Even though the population size, the density and the number of nets on stone substratum testified the good population which was clearly not sensitive to water pollution. The same was true for River Odra in Krosno Odrzańskie, despite water quality class IV, high concentrations of chlorophyll a and sodium and high electrolytic conductivity (Wojewódzki Inspektorat 2002); the population of *H. bulgaromanorum* at this site was extremely large. Thermal conditions are not a limiting factor as well – the waters of a canal of the River Odra in Nowe Czarnowo, where *H. bulgaromanorum* larvae were found in high numbers, were relatively warm because they were fed by waters from a power station. Very symptomatic and worth for further studies is the fact that this species forms vast congeneric populations under such conditions.

H. contubernalis is regarded as an alpha-mesosaprobic species (Hellawell 1986). The obtained results (Tab. 2) and localities given in the literature (Fig. 2) showed that this species inhabits the whole range of water quality – from class I in mountain areas to class IV – but it is more numerous in the cleanest streams and rivers in contrary to highly polluted large rivers where it is rare and in small numbers. In Finland, together with *H. angustipennis, H. pellucidula*, *H. saxonica* and *H. siltalai* it is regarded as the most tolerant one among to waters polluted by paper pulp mills (Vuori 1992). Quite interesting observations were made among the macrofauna of the River Rhine (Van Urk 1993); the decrease in concentrations of insecticides was coupled with the reappearance of this particular species. It was also found that in the River Rhine this species is highly resistant to the lack of oxygen which couples with water pollution (Becker 1987).

It can be concluded that in case of *H. bulgaromanorum*, water pollution, either organic or inorganic, is not the limiting factor for the Polish populations. It seems that suitable habitats (large rivers) are much more important and the next records are also expected within these habitats. In Poland, *H. contubernalis* is less resistant to water pollution because it is associated with upper reaches of rivers that have generally weaker pollution impact on aquatic insects. The higher number of potential habitats, either in Poland or in Belarus, makes it likely to make new records in the future.

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Address of the author: Prof. Dr. hab. Stanisław Czachorowski, Department of Ecology and Environmental Protection, University of Warmia and Mazury, Plac Łódzki 3, 10-727, Olsztyn, Poland, e-mail: stanislaw.czachorowski@uwm.edu.pl.

Mgr Edyta Serafin, Department of Zoology, University of Agriculture, Akademicka 13, 20-033 Lublin, Poland, e-mail: eserafinek@wp.pl

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