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The water quality state of the Szalajka Stream, Bükk Mts., Hungary

Ottó KISS, László VILIMI and István FEHÉR

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Abstract. The water quality of the Szalajka Stream, in a nature reserve, is characterised, using water data (water temperature, pH, content of nitrate ions, chemical oxygen demand and specific conductivity) obtained over three years (1996-99), and the saprobity indices of the bioindicator Trichoptera. With respect to these chemical and biological characteristics, the water of the Szalajka Stream is of first class quality.

Introduction.

The Szalajka Valley, of Tectonic origin runs NW to SE on the western slope of the Bükk Mts. and overlooks the village of Szilvásvárad. The spring waters of this deep valley are discharged into the Szalajka Stream. Upper Szalajka Spring yields the largest volume of water, with a maximum output of 12000 l/sec and a minimum output of 1600 l/sec. (Fig. 1.)

The bottom of the valley below the spring is covered with a relatively thick tuffaceous limestone layer, where the spring has grooved its way and formed nice veil-like water falls.

The spring itself is one of the outlets of water courses under the surface of the Bükk plateau of limestone at a place where the limestone stratum and the aquifer clay shale, come into contact. The catchment area is 8-10 km^2. Precipitation is immediately absorbed in the crevices and dolinas of the limestone plateau, increasing the water volume of the spring after an lapse of one or two days.

The Szikla Spring rises from the steep layers of Campilian limestone. Its catchment area is east of the spring, and is approximately 4-6 km^2. After prolonged droughts it dries out completely.

The Szökevény Springs near the Szikla spring are the important water supply of the valley (HERNÁDI 1992, ZILÁK 1960).

Methods

In 1958, when hydrogeological investigations of the valley were carried out to supply the Sheet-iron Works in

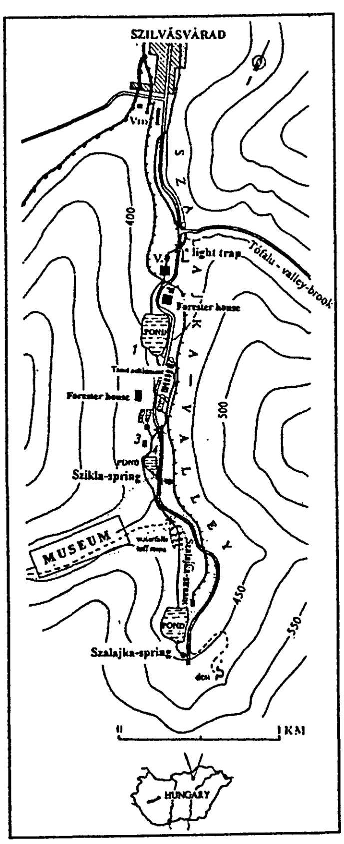

Fig.1: Map of Szalajka stream, North Hungary

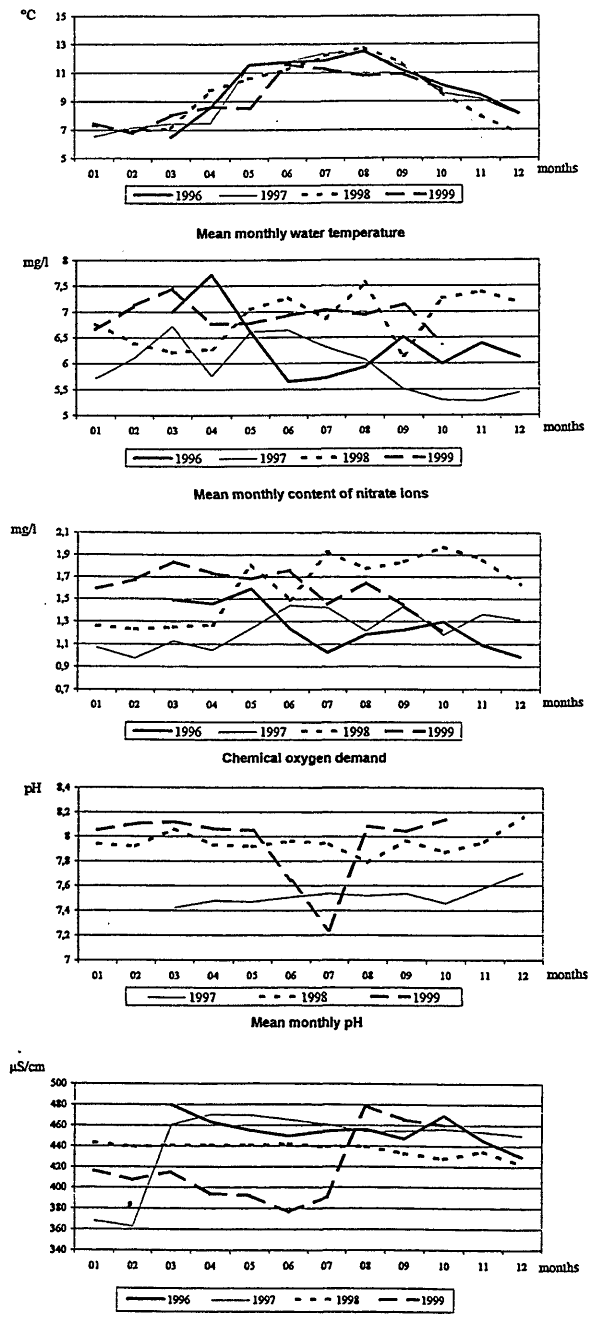

Fig.2: Chemical analysis of Szalajka stream

Borsodnádasd with water and replenish the water of the ponds on the trout farms of the forestry, water levels were also recorded by VITUKI (Scientific Research Institute for Water Management. SZABÓ & al (1969-70, 1971), KISS (1977, 1997), KISS & SCHMERA (1996) published hydroecological studies of the Szalajka Stream.
At present, regular measurements of the water temperature, pH, nitrate ions, chemical oxygen demand and specific conductivity of the stream are taken by the North Hungarian Regional Water Company Ltd. These data are in compliance with the qualification specifications (MSZT 1999, MKOSZ 1989).

Results and Discussion

Chemical analysis
As indicated by the water temperature range, the water of the stream is not frozen in winter, it is only along the bedside where a layer of ice is formed, so the essential conditions for the benthic assemblages are provided. Water pH ranged from 7.3-7.6, 7.4-7.7, 7.8-8.1, and 7.2-8.1 in 1996, 1997, 1998 and 1999, respectively.
The content of nitrate ions ranged between 5.7 and 7.0 mg/l in July and March, in 1996, 5.3 and 6.7 mg/l in 1997, 6.1 and 7.3 mg/l in 1998, and 6.4-7.4 mg/l in 1999.
The chemical oxygen demand (titrated with potassium permanganate) values ranged from 0.98-1.59 mg/l in 1996, 0.97-1.44 mg/l in 1997, 1.23-1.86 mg/l in 1998, and 1.20-1.76 in 1999.
Specific conductivity ranges were between 430 and 480 µS/cm in 1996, 368 and 470 µS/cm in 1998 and 391 and 479 µS/cm in 1999 (Fig. 2.).
These data show that the water in the Szalajka Stream is of high quality. Since the water can be used either as drinking or industrial water or used on continuously operated trout farms, and also because the stream itself is a tourist attraction, nature conservation and environmental protection along with landscape manegement are indispensable. The Szalajka valley is one of the most important protected areas of the Bükk National Park which will help the long term survival of this habitat of benthic communities and its refugium character (KISS 1982-83, 1991, SCHMERA 1999).

Trichoptera as indicators of water quality
50 species of Trichoptera were collected along the Szalajka Stream (Table 1), by light-trapping, netting and collecting larvae, which is about 65 % of the total number of species found in the Bükk Mts., so this number is likely to increase in future investigations.
Caddisfly species are applicable as indicators of water quality. Most of them accumulate in a certain zone, which does not exclude their occurrence in other zones, i.e. in other quality classes.
The total sum of the indicator frequency values of all five quality classes is 10. 18 of 49 species with high values (4 or over 4) and 15 with lower (1-3) occurred in oligosaprobic waters.
The proportional distribution of the occurrence of caddisfly species (in 127 cases) expressed as percentage is the following: 33.7 % of the species are oligosaprobic, e.g.: *Hydropsyche fulvipes, Tinodes sp., Chaetopteryx fusca* (in the Upper Szalajka Stream), *Ceraclea alboguttata, and Odontocerum albicorne.*
36.3% of the species are beta-mesosaprobic, e.g.: *Rhyacophila obliterata, Hydropsyche angustipennis, Neureclipsis bimaculata, Polycentropus flavomaculatus, Anabolia furcata, Limnephilus decipiens and Mystacides nigra.*
10.3% of the species are alpha-mesosaprobic, e.g.: *Glyphotaelius pellucidus, Leptocerus tineiformis, Halesus digitatus, and Limnephilus rhombicus.*
19.4% of the species are xenosaprobic: *Rhyacophila pubescens, Synagapetus mosely, Plectrocnemia brevis, Ecclisopteryx madida, Crunoecia irrorata, Beraea maurus and Potamophylax nigricornis.*
0,3% of the species have preference for polisaprobic waters (Fig. 3.).

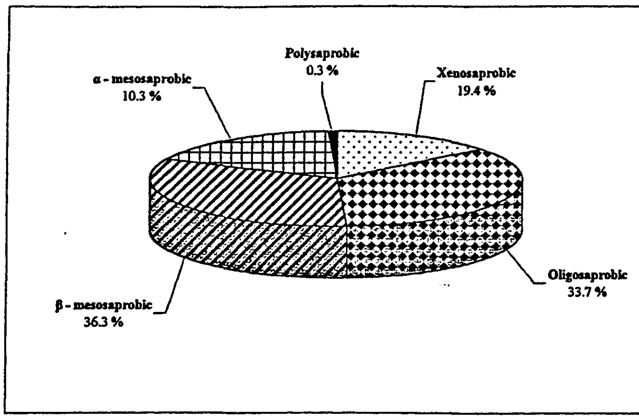

Fig.3: Distribution of trichopteran species of Szalajka stream in accordance with their saprobic values

The saprobity indices (SI) are between 0-0.9 for 9 species (18%), e.g.: *Crunoecia irrorata* (0.2), *Synagapetus mosely* (0.3), and *Rhyacophila pubescens* (0.3). The SI are between 1-1.7 for 14 species 29%), e.g.: Sericostoma personatum (1), *Hydropsyche fulvipes* (1.1), *Oligotricha striata* (1.1) and *Odontocerum albicorne* (1.2). The saprobity indices are between 1.8 and 2.5 for 11 species (22%), e.g.: *Limnephilus rhombicus* (2), *Limnephilus* stigma (2), *Mystacides nigra* (2.1) and *Anabolia furcata* (2.1). Because of the scarcity of data, the saprobity indices are not given for 15 species (31%) (MOOG 1995), (Fig. 4., Table 1.).

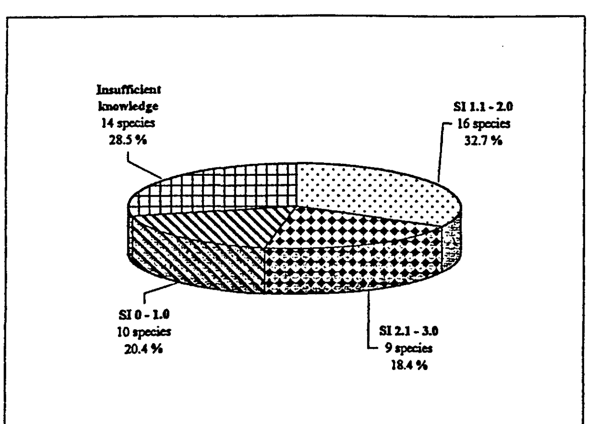

Fig.4: Distribution of trichopteran species of Szalajka stream in accordance with their saprobic indices

The dominant species from the light-trap captures were *Hydropsyche instabilis* (1509 specimens), *Halesus digitatus* (843), *Limnephilus lunatus* (364), *Odontocerum albicorne* (320), and *Rhyacophila obliterata* (286). *Rhyacophila* *pubescens, Rhyacophila nubila, Allotrichia pallicornis, Ernodes articularis, Plectrocnemia brevis, and Oligotricha striata* can be considered colouring elements.

Conclusion

The water temperature values show that the water of the stream is not frozen in winter, so the essential conditions for the benthic assemblages are provided. During the years the following changes were observed: the pH of the water range between 7.2 and 8.1, the content of nitrate ions between 5.7 mg/l and 7.0 mg/l, the chemical oxygen demand between 0.98 mg/l and 1.86 mg/l, and the conductivity between 368 µS/cm and 479 µS/cm.

The relatively constant chemical values also make this stream a favourable place for the caddisflies. We collected 50 caddisfly species in the area. These species represent 65% of the caddisfly fauna of the Bükk Mts.. The main quality classes of their saprobien classification range from xenosaprobic to ß-mesosaprobic, and the SI values range between 0.2 and 2.5.

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References

HERNÁDI, B. (1992) A Szalajka-és Szikla-forrás vízhozam adatai. In: Lénárt L., A Bükk karsztja, vizei, barlangjai. Tud. Konferencia. Miskolci Egyetem. 221-234.

KISS, O. (1977) On the Trichoptera fauna of the Bükk mountains, N. Hungary. Proc. of the 2nd Int. Symp. on Trichoptera, Junk, The Hague, 89-101

KISS, O. (1997) Trichoptera ökológiai vizsgálatok jellegzetes Bükk hegységi forrás-és patakvizekben (Szalajka-, Disznóskút-Sebesvíz). Doctoral és PhD thesis, KLTE, Debrecen. 1-232.

KISS, O. (1982-83) A study of the Trichoptera of the Szalajka Valley near Szilvásvárad as indicated by light trap material. Fol. Hist.-nat. Mus Matr. 8., 97-106.

KISS O. (1991) Trichoptera from a light trap in the Bükk Mountains, North Hungary, Proc. of the 6th Int. Symp. on Trichoptera. Adam Mickiewicz University Press, Poznan, 234-236

KISS, O., SCHMERA, D. (1996) Die Köcherfliegen der Quellregionen des nord-ungarishen Bükk Gebirges. Crunoecia, 5, 67-70.

MOOG, O. (ed.) (1995) Fauna Aquatica Austriaca. Bundesministerium für Land-und Forstwirtschaft, Wien. 1-200.

MKOSZ. (1989) Ivóvízminősítés fizikai és kémiai vizsgálat alapján. *MSZ.* 450/1-1989.

MSZT. (1999) ICS szerinti jegyzék, Szabványjegyzék. 141-149.

SCHMERA, D. (1999) Előtanulmány az Északi-középhegység patakjainak tegzes (Trichoptera) lárvaegyütteseiről. Hidrológiai Közlöny *79. évf.* 6, 337-338.

SZABÓ, J. & al. (1969-70). Hidroökológiai vizsgálatok a Bükk és a Zempléni hegység vizeiben. I. Acta Biologica Debrecina, 7-8.

SZABÓ, J. & al. (1971) Hidroökológiai vizsgálatok a Bükk és a Zempléni hegység vizeiben II. Acta Biologica Debrecina, 9, 187-195.

ZILÁK, Gy.L. (1960) A szilvásváradi Szalajka-völgy hidrológiai és hidrogeológiai vizsgálata. Hidrológiai Közlöny, 1, 58-64.

Addresses of authors:

O.K., I.F.: Károly Eszterházy College of Education, Department of Zoology, H - 3300 Eger, Leányka u. 6, Hungary. E-mail: kissotto@gemini.ektf.hu. - veovilimi@ervrt.hu.

L.V.: North Hungarian Regional Waterworks Ltd, Kazincbarcika. E-mail: fetyu@freemail.hu

Table 1: Classification of the trichopteran species of the Szalajka stream into saprobic categories described by Moog (1995). + occurrence, - insufficient knowledge, x xenosaprobic, o oligosaprobic, ß beta-mesosaprobic, α alpha-mesosaprobic, p polysaprobic, G indicator weight, SI saprobic index.

	Species captured in a light trap	X	O	ß	α	p	G	SI
	RHYACOPHILIDAE							
1.	*Rhyacophila fasciata (H., 1859)*	2	4	4	+	-	2	1.2
2.	*Rhyacophila pubescens (P., 1834)*	7	3	-	-	-	4	0.3
3.	*Rhyacophila obliterata (McL., 1863)*	-	4	6	-	-	3	1.6
4.	*Rhyacophila polonica (McL., 1879)*	4	6	+	-	-	3	0.6
5.	*Rhyacophila tristis (P., 1834)*	2	3	4	1	-	1	1.4
	GLOSOSOMATIDAE							
6.	*Synagapetus moselyi U., 1938*	7	3	-	-	-	4	0.3
	HIDROPTILIDAE							
7.	*Allotrichia pallicornis (E., 1873)*	-	-	-	-	-	-	-
	HYDROPSYCHIDAE							
8.	*Hydropsyche angustipennis (C., 1834)*	-	1	5	4	-	2	2.3
9.	*Hydropsyche fulvipes (C., 1834)*	1	7	2	-	-	3	1.1
10.	*Hydropsyche instabilis (C., 1834)*	1	4	5	+	-	2	1.4
11.	*Hydropsyche sp.*	-	-	+	+	-	-	-

	POLYCENTROPODIDAE							
12.	*Neureclipsis bimaculata (L., 1758)*	-	1	7	2	-	3	2.1
13.	*Plectrocnemia brevis McL.,1871*	6	4	-	-	-	3	0.4
14.	*Plectrocnemia conspersa (C.,1834)*	1	3	4	2	-	1	1.7
15.	*Polycentropus flavomaculatus (F., 1834)*	-	2	6	2	-	3	2
	PSYCHOMYIDAE							
16.	*Lype reducta (H., 1868)*	-	+	+	+	-	-	-
17.	*Tinodes sp.*	-	7	3	-	-	4	1.3
	PHRYGANEIDAE							
18.	*Oligotricha striata (L., 1758)*	2	5	3	-	-	2	1.1
19.	*Phryganea grandis (L.,1758)*	-	-	-	-	-	-	-
	LIMNEPHILIDAE							
20.	*Anabolia furcata (B.,1857)*	-	1	7	2	-	3	2.1
21.	*Chaetopteryx fusca (B., 1857)*	1	7	2	-	-	3	1.1
22.	*Ecclisopteryx madida (McL., 1867)*	4	4	2	-	-	2	0.8
23.	*Glyphotaelius pellucidus (R., 1783)*	-	2	4	4	-	2	2.2
24.	*Halesus digitatus (S., 1781)*	-	5	4	1	-	2	1.6
25.	*Halesus tessellatus (R., 1842)*	-	5	5	-	-	3	1.5
26.	*Limnephilus affinis (C., 1834)*	-	-	-	-	-	-	-
27.	*Limnephilus auricula (C., 1834)*	-	-	-	-	-	-	-
28.	*Limnephilus decipiens (K., 1848)*	-	+	7	3	-	4	2.3
29.	*Limnephilus extricatus McL., 1865*	+	2	5	2	1	1	2.2
30.	*Limnephilus falvicornis (F., 1787)*	-	-	-	-	-	-	-
31.	*Limnephilus griseus (L., 1758)*	-	-	-	-	-	-	-
32.	*Limnephilus ignavus McL., 1865*	-	+	+	+	-	-	-
33.	*Limnephilus lunatus (C., 1834)*	-	+	+	+	-	-	-
34.	*Limnephilus rhombicus (L., 1758)*	-	2	6	2	-	3	2
35.	*Limnephilus stigma (C., 1834)*	-	2	6	2	-	3	2
36.	*Limnephilus vittatus (F., 1798)*	-	-	-	-	-	-	-
37.	*Micropterna lateralis (S., 1834)*	-	-	-	-	-	-	-
38.	*Potamophylax nigricornis (P., 1834)*	5	5	-	-	-	3	0.5
39.	*Stenophylax permistus McL., 1895*	-	-	-	-	-	-	-
	GOERIDAE							
40.	*Silo pallipes (F., 1781)*	1	4	5	-	-	2	1.4
	LEPIDOSTOMATIDAE							
41.	*Crunoecia irrorata (C., 1834)*	8	2	-	-	-	4	0.2
	LEPTOCERIDAE							
42.	*Ceraclea alboguttata (H., 1860)*	-	1	7	2	-	3	2.1
43.	*Leptocerus tineiformis (C., 1834)*	-	-	5	5	-	3	2.5
44.	*Mystacides nigra (L., 1758)*	-	1	7	2	-	3	2.1
45.	*Oecetis notata (R., 1842)*	-	+	+	+	-	-	-
	SERICOSTOMATIDAE							
46.	*Sericostoma personatum (K. et S., 1826)*	3	4	3	-	-	2	1
	BERAEIDAE							
47.	*Beraea maurus (C., 1834)*	7	3	-	-	-	4	0.3
48.	*Ernodes articularis (P., 1834)*	5	5	-	-	-	3	0.5
49.	*Odontocerum albicorne (S., 1763)*	1	6	3	-	-	3	1.2