

Ephemeroptera and Plecoptera (Insecta) from the Bulgarian Part of the Struma River

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Abstract: The composition and the species diversity of Ephemeroptera and Plecoptera orders in Struma - the biggest river in Southwest Bulgaria - are discussed in a contemporary aspect (1999-2000) and retrospectively for 2 periods - until 1975 and 1980-1984. In the past the Struma River was subjected to impact with suspended substances of industrial origin, which strongly suppressed the development of the zoobenthos. After removing the impact (1974-1975), the new ecological situation in the river allowed to be enriched considerably the mayfly and stonefly fauna in qualitative and quantitative aspects. In the period 1999-2000 totally 20 mayfly (3 new species for the fauna of the Struma River) and 4 stonefly taxa (2 new genera) were established. Their distribution along the river is discussed in terms of the contemporary saprobiological state of the river.

Key words: Ephemeroptera, Plecoptera, ecological state, Struma River, Southwest Bulgaria

Introduction

Initially the research on the macrozoobenthos of the Struma River bounded above all with the pollution influence. KOVACHEV, UZUNOV (1977) treated the river pollution from the biological point of view and stressed on the extremely unfavourable reflection of organic and inert pollution on the benthic macrozoocoenoses. Later on KOVACHEV *et al.* (1979) and UZUNOV, KOVACHEV (1987) reported the considerable self-purifying potential of the river and the good results after elimination of the pollutants. ISLAM *et al.* (1986) have made more profound research of the species composition and macrozoobenthos distribution in the Struma River and reported 42 established taxa of Ephemeroptera and 11 of Plecoptera order totally.

The published faunistic data are not coordinated and related to several groups of invertebrates. NATCHEV (1982, 1983) gave data on the mayfly and stonefly composition at two stations (above and below the infusion of the Blagoevgradska Bistritsa River).

Presenting new data on the aquatic invertebrate fauna of the Kresna Gorge, UZUNOV, VARADINOVA (2001) reported 30 taxa of Ephemeroptera and 6 taxa of Plecoptera, found at two stations in the gorge.

The modern taxonomic working on the *Caenis* genus during the last decade made possible the exact determination of its species.

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The aim of the present work is to make an analysis of the contemporary taxonomical status of Ephemeroptera and Plecoptera orders regarding the saprobiological situation in the Struma River.

Study Area

Struma is the biggest river in Southwest Bulgaria, which is of considerable importance for the industry and especially for the agriculture of that region. It is an example of the successful elimination of inert pollution to which the river was subjected for years. The river was heavily polluted by suspended materials of industrial origin (coal, cement powder, etc.). At sites immediately below the sources of the pollutants (polysaprobry and/or alpha-mesosaprobry- below Pernik, Razhdavitsa, Nevestino, Blagoevgrad, 1980-1984, ISLAM *et al.* 1986), the mean number of species present in the macrozoobenthos was less than 15% of that at upstream sites (beta-mesosaprobry). Two hundred and ten kilometers downstream the mean number of species was still only half that at the upstream sites, despite the fact that the level of the suspended materials had fallen more than 95%. The Lobosh Dam, built in the 1974-1975 period, effectively precipitated the suspended materials and eliminated this impact in the whole Bulgarian stretch downstream. The saprobity of the river after this period is improving gradually, as in 1999-2000 the poorest situation (alpha-mesosaprobry) was only below Pernik and Blagoevgrad. All the rest sections are in the range of stable beta-mesosaprobry (SOUFI *et al.* 2001).

Materials and Methods

A part of the investigation data from the project of the Ministry of Environment and Waters, related with a methodology for run-off limit rates and ecological balance in running waters, is used in the present work. The material summarizes 41 samples, collected during 7 expeditions in August, September and October 1999 and in June, July, August and September 2000 at 7 regular stations downstream (Fig. 1).

The common methods and procedures for macrozoobenthos samples collection used in the present study, are collated with ISO 7828/1985 (E) and ISO 9391/1993 (E), as a priority to the quantitative method ISO 8265/1988 (towards unit of bottom area) was given.

Results and Discussion

In the present period of research, 20 taxa of species and genus category from Ephemeroptera order were found in the benthic fauna of Struma (Appendix 1).

The genus *Baetis* is presented with the greatest number of species (7) and was found at all stations. Most numerous among the baetids are *Baetis fuscatus*, *B. lutheri* MUELLER-LIEBENAU and *B. rhodani* (PICTET), as well as *Ephemerella ignita*. The typical summer species *Oligoneuriella rhenana* (IMHOFF) occurs in the samples very often.

The mayflies *Heptagenia longicauda* (STEPHENS) and *Torleya major* (KLAPALEK) and *Caenis pseudorivulorum* KEFFERMÜLLER are new to the hydrofauna of the river and are reported for the first time. The last one is presented on five of the investigated sites usually with rich populations.

In the 1999-2000 period, four taxa of species and genus level from Plecoptera

order have been found in the river (Appendix 1).

Stoneflies are established only at three of the observed stations, as *Leuctra* sp. occurs in most of the samples with more specimens. *Taeniopteryx* sp. is found only at station 2. The other two taxa occur in single numbers. The genera *Taeniopteryx* and *Perlodes* are new to the hydrofauna of the Struma River and are reported for the first time in this paper.

By comparison between the number of the established Ephemeroptera and Plecoptera taxa during the first two periods it may be concluded (Table 1) that the prognostic increasing of the species number parallel with the expected stabilizing of β -mesosaprobic state of the bigger part of the river is apparent (KOVACHEV *et al.* 1979), which is confirmed by ISLAM (1985) as well.

Enrichment of the fauna is realized through inclusion of new species into the familiar mayfly composition. Despite the irregular distribution of the taxa downstream, some of them are found at all sites (*Ephemerella ignita* (PODA)), and others (*Baetis vernus* CURTIS; *B. fuscatus* LINNE; *Caenis* gr. *macrura*) - at nearly all stations. The above-mentioned species show high frequencies of occurrence.

In the past periods, Plecoptera order was presented with 11 taxa, belonging to nine genera, but with a few specimens. Most of the taxa occur at two or three sites. *Isoperla* gr. *grammatica* is an exception - it is established at five stations downstream (ISLAM *et al.* 1986).

The smaller number of established mayfly and stonefly taxa during the last study of the river is due, on one hand, to the reduced number of station downstream - 7 (in comparison - during the 1980-1984 period 17 sites are observed), and some of them are really polluted (alpha-mesosaprobly), on the other hand, to the sampling only within the summer and autumn seasons (without spring observations).

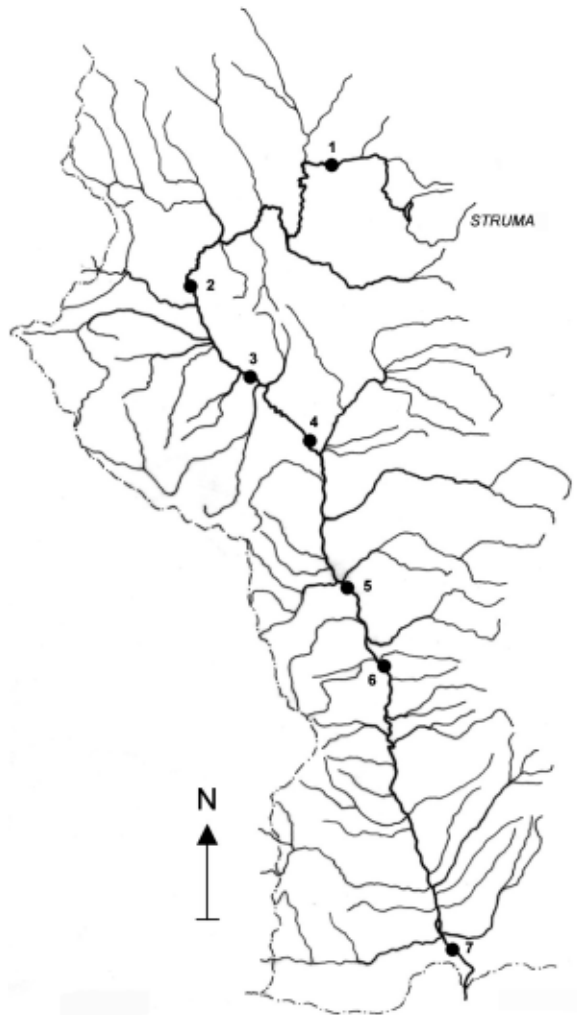


Fig.1. Location of stations along the Struma river: 1- below Pernik; 2- above Razhdavitsa; 3- below Nevestino; 4- at Boboshevo; 5- below Blagoevgrad; 6- at Krupnik; 7- at Marino pole.

Table 1. Number of taxa of species and genus categories from Ephemeroptera and Plecoptera orders, presented in Struma (ISLAM *et al.* 1986 and our data).

Number of taxa Order	Known from earlier studies and literature	Found in the 1980-1984 period	Found in 1999-2000
Ephemeroptera	26	45 (20 of them new)	20 (3 of them new)
Plecoptera	6	10 (5 of them new)	4 (2 new genera)

This is of importance especially for the representatives of Plecoptera order, which inhabit mainly the upper course of the rivers.

Ephemeroptera and Plecoptera are groups, which are very sensitive towards pollution and they are successfully used as bioindicators. The water quality worsening in some river sections (below Pernik and below Blagoevgrad) influences the species richness of both orders towards its decreasing. For instance, only the eurybiont species of *Baetis* genus, which are tolerant to alpha-mesosaprobity, are found below Pernik and *Caenis macrura*, *C. pseudovivulorum* and *Ephemerella ignita* - below Blagoevgrad. The established upstream Blagoevgrad species from the genera *Ecdyonurus*, *Ephemerella*, *Epeorus*, *Heptagenia*, *Potamanthus* u *Oligoneuriella*, were not found at that site. The Plecoptera order is presented with 4 genera at Razhdavitsa, at Nevestino and Boboshevo - only with a genus (*Leuctra*), most probably caused by the influence of Kyustendil town.

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Appendix I. List of the established mayfly and stonefly taxa in the Struma River (in alphabetical order)

Ephemeroptera

- Baetis alpinus* (Pictet, 1845)
- **B. buceratus* Eaton, 1870
- **B. fuscatus* (Linne, 1761)
- B. gemellus* Eaton, 1885
- **B. lutheri* Mueller-Liebenau, 1967
- B. melanonyx* (Pictet, 1845)
- **B. muticus* (Linne, 1758)
- B. pavidus* Grandi, 1949
- **B. rhodani* (Pictet, 1845)
- **B. scambus* Eaton, 1870
- B. tracheatus* Keffermüller & Machel, 1967
- B. tricolor* Tschernova, 1928
- **B. vernus* Curtis, 1834
- B. sp.*
- Caenis luctuosa* (Burmeister, 1839)
- **C. macrura* Stephens, 1838
- C. sp. gr. macrura*
- **C. pseudorivulorum* Keffermüller, 1960
- C. robusta* Eaton, 1884
- **C. sp.*
- **Centroptilum luteolum* (Müller, 1776)
- Centroptilum sp.*
- Cloeon dipterum* (Linne, 1761)
- Ecdyonurus dispar* (Curtis, 1834)
- **E. insignis* (Eaton, 1870)
- E. picteti* (Meyer.-Dür, 1864)
- E. venosus* (Fabricius, 1775)
- **E. sp. gr. venosus*
- **Ecdyonurus sp.*
- Epeorus sylvicola* (Pictet, 1865)
- **Ephemerella danica* Müller, 1764
- **Ephemerella ignita* (Poda, 1761)
- E. maculocaudata* Ikonomov, 1961
- E. mesoleuca* (Brauer, 1857)
- E. mucronata* (Bengtsson, 1909)
- E. notata* Eaton, 1887
- Habroleptoides confusa* (Hagen, 1864)
- Heptagenia coeruleans* Rostock, 1877
- H. flava* Rostock, 1878
- H. fuscogrisea* (Retzius, 1783)
- **H. longicauda* (Stephens, 1836)

H. sulphurea (MÜLLER, 1776)

Heptagenia sp.

**Oligoneuriella rhenana* (IMHOFF, 1852)

Paraleptophlebia submarginara (STEPHENS, 1835)

**Potamanthus luteus* (LINNE, 1767)

Procloeon pennulatum (EATON, 1870)

Rhithrogena loyolaea NAVAS, 1922

R. sp. gr. *semicolorata*

Rhithrogena sp.

**Torleya major* (KLAPALEK, 1905)

Plecoptera

Amphinemoura sp.

Capnia sp.

Dinocras cephalotes (CURTIS, 1827)

Isoperla cf. *difformis* (KLAPALEK, 1909)

I. cf. *grammatica* (PODA, 1761)

**Leuctra* sp.

Nemoura sp.

Nemourella sp.

**Perla burmeisteriana* CLASSEN, 1936

P. gr. *burmeisteriana*

P. gr. *marginata*

**Perlodes* sp.

Protonemura sp.

**Taeniopteryx* sp.

* Taxa established in 1999-2000

Еphemeroptera и Plecoptera (Insecta) от българската част на река Струма

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(Резюме)

Дискутират се съставът и видовото разнообразие на разредите Ephemeroptera и Plecoptera в р. Струма през 1999-2000 и в ретроспективен аспект - до 1975 г. и през периода 1980-1984 г. В миналото развитието на зообентоса в Струма е било силно повлияно от индустриално химическо замърсяване. След неговото отстраняване (1974-1975 г.), новата екологична ситуация в реката довежда до значимо обогатяване на едnodневките и перлите в качествено и количествено отношение. Общо 20 таксона едnodневки (от които 3 нови вида за фауната на р. Струма) и 4 таксона перли (от които 2 нови рода) са установени през периода 1999-2000 г. Тяхното разпространение по протежението на реката се дискутира във връзка със съвременното ѝ сапробиологично състояние.