

A check list of the mayfly fauna (Insecta; Ephemeroptera) of the Republic of North Macedonia with a short literature review

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Abstract

This paper summarizes published records contributing to our knowledge regarding the Ephemeroptera fauna from the territory of the Republic of North Macedonia. Based on this comprehensive review the recent mayflies' fauna of North Macedonia consists of 80 species that belongs to 20 subgenera, 28 genera and 15 families. As the presence of two of those species (*Palingenia longicauda* (Olivier, 1791) and *Neophemera maxima* (Joly, 1870)) is doubtful, we could assume that the more accurate number of species is 78. A further increase in the number of recorded species could be expected, as some taxa (*Ecdyonurus* and *Rhithrogena*, for example) are insufficiently studied at the moment

Key words: Ephemeroptera, review of literature, nomenclature, taxonomy.

Introduction

The earliest known reference of the ephemeropteran fauna from the territory of North Macedonia dates back from 100 years ago and is attributed to Ulmer (1920), who mentioned the first mayfly record, the adult form of *Neophemera maxima* (Joly, 1870). Šamal (1935) studying the mayfly larvae stated 12 more species, including description of one new species, so by the end of 1940's a total of 14 mayfly species were known (Ikonomov, 1951). The most significant breakthrough considering mayflies' taxonomy and diversity from the region came with Ikonomov (1951; 1953; 1954a,b,c; 1958; 1960; 1961a,b,c; 1962a,b,c,d; 1963a,b; 1964; 1970). During his extensive research Ikonomov noted a total of 55 species and 4 subspecies (Ikonomov 1960). From that number 9 species (*Baetis* (*Baetis*) *meridionalis* Ikonomov, 1954, *B.* (*B.*) *vardarensis* Ikonomov, 1962, *B.* (*B.*) *kozufensis* Ikonomov, 1962, *Centroptilum pirinense* Ikonomov 1962, *Electrogena mazedonica* (Ikonomov, 1954), *Choroterpes* (*Euthraululus*) *balcanica* (Ikonomov 1961), *Paraleptophlebia lacustris* Ikonomov, 1962, *Ephemerella maculocaudata* (Ikonomov, 1961), and *Caenis strugaensis* Ikonomov, 1961) were previously

unknown, thus being described for the first time by Ikonomov (Ikonomov 1954b,c; 1961a,b,c; 1962c,d; 1963a). The complete check list of species recorded by Ikonomov, with the valid (updated) taxonomy (based on Bauernfeind and Soldan 2012), is presented in **Table 1**.

By the end of 1970's the mayfly fauna is enriched by 5 species (*Ecdyonurus* (*Helvetoraeticus*) *zelleri* (Eaton, 1885), *E.* (*Ecdyonurus*) *aurantiacus* (Burmeister, 1839), *E.* (*E.*) *dispar* (Curtis, 1834), *Baetis* (*Baetis*) *lutheri* Müller-Liebenau, 1967, *Siphonurus* (*Siphonurus*) *armatus* (Eaton, 1870)) (Puthz 1980). More than 20 years later, 6 more species (*Paraleptophlebia ruffoi* Biancheri, 1956, *Baetis* (*B.*) *melanonyx* (Pictet, 1843), *Ecdyonurus* (*H.*) *picteti* (Meyer-Dür, 1864), *Rhithrogena savoiensis* Alba-Tercedor & Sowa, 1987, *Rh.* gr. *hybrida* Eaton, 1885, *Rh.* *braaschi* Jacob, 1974) were added to the mayfly fauna of North Macedonia (Tanasijević 1981; Vidinova 1998; Memeti et al. 1999). Most recently, Jacob (2003) note the first record of *Baetis* (*Labiobaetis*) *balcanicus* Müller-Liebenau & Soldan, 1981, Bauernfeind and Soldan (2012) enriched with another three species (*Metreletus balcanicus* (Ulmer, 1920), *Paraleptophlebia cincta* (Retzius, 1783), *P. wernerii* Ulmer, 1920) and Slavevska-Stamenković et al.

Table 1. List of Ephemeropteran species described and reported by Ikonomov (1959), and corrected valid names according Bauernfeind and Soldan (2012).

Old name	Valid name
<i>Ameletus inopinatus</i>	<i>Ameletus inopinatus</i> Eaton, 1887
<i>Siphonurus aestivalis</i>	<i>Siphonurus (Siphonurus) aestivalis</i> (Eaton, 1903)
<i>Pseudocloeon hyalopterum</i>	<i>Baetis (Acentrella) hyalopterum</i> (Bogoescu, 1951)
<i>Baetis carpatica</i>	<i>Baetis (Baetis) alpinus</i> (Pictet, 1843)
<i>Baetis venustulus</i>	<i>Baetis (B.) fuscatus</i> (Linnaeus, 1761)
<i>Baetis bioculatus</i>	<i>Baetis (B.) fuscatus</i> (Linnaeus, 1761)
<i>Baetis meridionalis</i>	<i>Baetis (B.) meridionalis</i> Ikonomov, 1954
<i>Baetis vardarensis</i> n. sp.	<i>Baetis (B.) vardarensis</i> Ikonomov, 1962
<i>Baetis kozufensis</i> n. sp.	<i>Baetis (B.) kozufensis</i> Ikonomov, 1962
<i>Baetis tenax</i>	<i>Baetis (B.) vernus</i> Curtis, 1834
<i>Baetis vernus</i>	<i>Baetis (B.) vernus</i> Curtis, 1834
<i>Baetis tricolor</i>	<i>Baetis (Labiobaetis) tricolor</i> Tshernova, 1928
<i>Pseudocentropitillum</i> sp. <i>strugaensis</i>	<i>Baetis (Nigrobaetis) digitatus</i> Bengtsson, 1912
<i>Baetis pumilus</i>	<i>Baetis (N.) muticus</i> (Linnaeus, 1758)
<i>Baetis niger</i>	<i>Baetis (N.) niger</i> (Linnaeus, 1761)
<i>Baetis rhodani</i>	<i>Baetis (Rhodobaetis) rhodani</i> (Pictet, 1843)
<i>Centroptilum luteolum</i>	<i>Centroptilum luteolum</i> (Müller, 1776)
<i>Centroptilym pirinense</i> n. sp.	<i>Centroptilum pirinense</i> Ikonomov 1962
<i>Cloeon dipterum</i>	<i>Cloeon (Cloeon) dipterum</i> (Linnaeus, 1761)
<i>Cloeon praetextum</i>	<i>Cloeon (Similicloeon) praetextum</i> Bengtsson, 1914
<i>Centroptiloides ambigua</i>	<i>Cloeon (S.) simile</i> Eaton, 1870
<i>Procleon lychnidensis</i>	<i>Procleon (Procleon) bifidum</i> (Bengtsson, 1912)
<i>Isonychia ignota</i>	<i>Isonychia (Isonychia) ignota</i> (Walker, 1853)
<i>Oligoneuriella poecile</i>	<i>Oligoneuriella pallida</i> (Hagen, 1855)
<i>Oligoneuriella rhenana</i>	<i>Oligoneuriella rhenana</i> (Imhoff, 1852)
<i>Ecdyonurus insignis</i>	<i>Ecdyonurus (Ecdyonurus) insignis</i> (Eaton, 1870)
* <i>Ecdyonurus flumminum</i>	<i>Ecdyonurus (E.) submontanus</i> Landa, 1969
<i>Ecdyonurus venosus</i>	<i>Ecdyonurus (E.) venosus</i> (Fabricius, 1775)
<i>Ecdyonurus epeorides</i>	<i>Ecdyonurus (Helvetoraeticus) epeorides</i> Demoulin, 1955
<i>Heptagenia trimaculata</i>	<i>Electrogena affinis</i> (Eaton, 1887)
<i>Heptagenia macedonican.</i> sp.	<i>Electrogena mazedonica</i> (Ikonomov, 1954)
<i>Heptagenia coerulans</i>	<i>Heptagenia (Dacnogenia) coerulans</i> Rostock, 1878
<i>Heptagenia flavipes</i>	<i>Heptagenia (Heptagenia) longicauda</i> (Stephens, 1836)
<i>Epeorus assimilis</i>	<i>Epeorus (Epeorus) assimilis</i> Eaton, 1885
<i>Iron yougoslavicus</i>	<i>Epeorus (Ironopsis) yougoslavicus</i> (Šamal, 1935)
<i>Rhithrogena aurantiaca</i>	<i>Rhithrogena diaphana</i> species group.

<i>Rhithrogena semicolorata</i>	<i>Rhithrogena semicolorata</i> (Curtis, 1834)
<i>Euthraulus balcanicus</i>	<i>Choroterpes (Euthraulus) balcanica</i> (Ikonomov, 1961)
<i>Habroleptoides robusta</i>	<i>Habroleptoides confusa</i> Sartori & Jacob, 1986
<i>Habroleptoides modesta</i>	<i>Habroleptoides confusa</i> Sartori & Jacob, 1986
<i>Habrophlebia konjarensis</i>	<i>Habrophlebia fusca</i> (Curtis, 1834)
<i>Habrophlebia lauta</i>	<i>Habrophlebia lauta</i> Eaton, 1884
<i>Paraleptophlebia lacustris</i> n. sp.	**<i>Paraleptophlebia lacustris</i> Ikonomov, 1962
<i>Paraleptophlebia submarginata</i>	<i>Paraleptophlebia submarginata</i> (Stephens, 1836)
<i>Ephemera lineata</i>	<i>Ephemera (Ephemera) lineata</i> Eaton, 1870
<i>Ephemera hellenica</i>	<i>Ephemera (E.) hellenica</i> Demoulin, 1955
<i>Palingenia longicauda</i>	<i>Palingenia longicauda</i> (Olivier, 1791)
<i>Polymitarcis virgo</i>	<i>Ephoron virgo</i> (Olivier, 1791)
<i>Potamanthus luteus</i>	<i>Potamanthus luteus</i> (Linnaeus, 1767)
<i>Ephemerella ignita</i>	<i>Ephemerella ignita</i> (Poda, 1761)
<i>Ephemerella maculocaudata</i>	<i>Ephemerella maculocaudata</i> (Ikonomov, 1961)
<i>Chitonophora</i> sp. <i>nympha unicolorata</i>	<i>Ephemerella mucronata</i> (Bengtsson, 1909)
<i>Ephemerella notata</i>	<i>Ephemerella notata</i> Eaton, 1887
<i>Ephemerella spinosa</i> n. sp.	<i>Serratella ikonomovi</i> (Puthz, 1971)
<i>Torleya major</i>	<i>Torleya major</i> (Klapalek, 1905)
<i>Caenis macrura</i>	<i>Caenis macrura</i> Stephens, 1835
<i>Orelanthus macedonicus</i>	<i>Caenis horaria</i> (Linnaeus, 1758)
<i>Caenis lycnidensis</i>	<i>Caenis strugaensis</i> Ikonomov, 1961
<i>Prosopistoma foliaceum</i>	<i>Prosopistoma pennigerum</i> (Müller, 1785)

Legend: *According to illustrations provided by Ikonomov (1959), the *Ecdyonurus flumminum* resembles most the *Ecdyonurus (E.) submontanus* description; **According to Bauernfeind and Soldan (2012) *Paraleptophlebia lacustris* is omitted from species list, amplifying on misidentification (listed as synonym of *Paraleptophlebia cincta* (Retzuis, 1783)). In Fauna Europaea taxa list this species exist as species so far known from 2 countries (Belfiore and Thomas, 2013, <https://fauna-eu.org>).

(2016) confirmed the presence of *Caenis pseudorivulorum* Keffermüller, 1960. The full relevant taxa records are listed in **Table 2**, where summarizes all available literature sources.

The newest relevant publications include the report of *M. balcanicus* (larva and imago) (Rimcheska and Vidinova 2018) and partial contribution with Ephemeroptera records concerning some streams from Ohrid Lake watershed is given in Trajanovski et al. (2019).

Presolska (2014) explained why the misidentification (Table 2) of the *Epeorus sylvicola* records from some Balkan countries occur, as pointing out on the proposed synonym, *E. sylvicolus* (Pictet) for two differ-

ent species (*E. assimilis* Eaton, 1885 and *E. sylvicolus* (Pictet, 1865)) proposed by Puthz (1973), and as later stated by Thomas et al. (2000) this proposed synonym mentioned by numerous European specialist is not valid. Furthermore, Presolska (2014) also revised the material from her institutional collection and confirmed that these materials belong to *E. assimilis* species. In addition to this finding also all collections of the recent larval materials from different sites from territory of North Macedonia refer to *E. assimilis* (Rimcheska, Vidinova, unpublished data). Thereafter, all the mentions (Puthz 1980; Memeti et al. 1999) of *E. sylvicola* for the territory of North Macedonia are not valid as well

Table 2. Check list of the established mayfly species from the fauna of North Macedonia with the relevant literature sources.

Recorded species	Author, publication, year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Family Ameletidae	McCafferty, 1991																													
Genus <i>Ameletus</i>	Eaton, 1885																													
<i>Ameletus inopinatus</i>	Eaton, 1887									X																				
Genus <i>Metreletus</i>	Demoulin, 1951																													
<i>Metreletus balcanicus</i>	(Ulmer, 1920)																													
Genus <i>Siphonurus</i>	Eaton, 1868																													
Subgenus <i>Siphonurus</i>	Eaton, 1868																													
<i>Siphonurus (Siphonurus) aestivalis</i>	(Eaton, 1903)									X																				
<i>Siphonurus (S.) croaticus</i>	Ulmer, 1920										X																			
<i>Siphonurus (S.) armatus</i>	(Eaton, 1870)																													
Family Baetidae	Leach, 1815																													
Genus <i>Baetis</i>	Leach, 1815																													
Subgenus <i>Acentrella</i>	Bengtsson, 1912																													
<i>Acentrella (Baetis) hyalopterum</i>	(Bogoescu, 1951)																													
Subgenus <i>Baetis</i>	Leach, 1815																													
<i>Baetis alpinus</i>	species-group																													
<i>Baetis (Baetis) alpinus</i>	(Pictet, 1843)																													
<i>Baetis (B.) melanonyx</i>	(Pictet, 1843)																													
<i>Baetis fuscatus</i>	species-group																													
<i>Baetis (B.) fuscatus</i>	(Linnaeus, 1761)																													
<i>Baetis lutheri</i>	species-group																													
<i>Baetis (B.) lutheri</i>	Müller-Liebenau, 1967																													
<i>Baetis (B.) meridionalis</i>	Ikonomov, 1954																													
<i>Baetis (B.) vardarensis</i>	Ikonomov, 1962																													
<i>Baetis vernus</i>	species-group																													

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