

The mayflies of Greece (Insecta: Ephemeroptera) – A provisional check-list

ERNST BAUERNFEIND

Naturhistorisches Museum Wien, I. Zoologische Abteilung, Burgring 7, A – 1014 Wien, Austria
vogelsammlung@nhm-wien.ac.at.

Abstract

A provisional check-list for Greece is established based on mayfly material collected by H. Malicky between 1975 and 1999 and incorporating all previously published records.

A hitherto undescribed species, *Rhithrogena lisettae* sp.n., is included in the check-list (for the description see this volume p. 109-112). For *Ecdyonurus androsianus* stat. nov., and *Ecdyonurus vitoshensis* stat. nov., originally described as subspecies of *E. aurantiacus* and *E. carpaticus* respectively, specific rank is proposed. *Ephemera hellenica* syn. nov. is considered to represent a junior synonym of *E. lineata*. *Serratella spinosa* (Ikononov, 1961) sensu Jacob (1993) is not available (primary homonymy), and the replacement name *Ephemerella ikononovi* Puthz, 1971 has to be used for this taxon irrespective of the generic combination preferred.

The present study increases the number of species known from Greece to 70, which may, as a very rough estimate, comprise about 60-70% of the mayfly fauna expected for the area. Although still insufficiently known, distribution patterns suggest a considerable number of species to represent taxa endemic to the Balkans, whereas only a minor percentage may be considered of euro-siberian distribution (compare Puthz 1980). These findings further stress the importance of the Mediterranean as a possible glacial refuge for freshwater benthic organisms, as proposed earlier by Zwick (1981) for stoneflies (Plecoptera). More systematic collections on a larger scale are urgently needed to clarify the taxonomic position of several taxa and to enable future faunistic research.

Keywords: check-list, Ephemeroptera, Greece, mayflies.

Introduction

Relatively little is known about the mayfly fauna of Greece and no major collections have been published so far. Since Puthz (1980) provided a first list enumerating 31 species another 15 taxa have been described from the area, almost all of them based on material collected by Professor Dr. Hans Malicky (Lunz). Scattered throughout various taxonomic papers, records for an additional 15 species have been published between 1981 and 1994.

Professor Malicky most kindly donated to the author a sample from his extensive collections (dating from 1975 – 1999), which was used for drawing up the provisional check-list presented below. The material contained about 250 specimens (mostly from light trap catches), representing 39 taxa from 71 sampling sites (mainland Greece) as well as from 12 stations on islands Kriti (Crete), Evvia (Euboea), Lesbos (Lesbos), Samothraki, Seriphos and Skiathos. Data concerning the identified species are detailed in the appendix (sampling localities, gazetteer), for geographic provinces and numbers of sampling stations see Fig. 1.



Fig. 1 - Geographic provinces and numbers of sampling stations (in brackets).

Material and Methods

[Abbreviations. m: male imago, f: female imago, SI: subimago, L: larva. Numbers in brackets: field numbers / sampling localities (H. Malicky), see appendix]

Baetis alpinus (26) m, (79) 2m, 2f, (439) 2L, (TC 2) m. *Baetis fuscatus* (303) m, (423) 3mSI, (430) 2mSI. *Baetis meridionalis* (316) 2L, (702) 2m, (703)m. *Baetis melanonyx* (433) 2L. *Baetis muticus* (27, 423) m, f. *Baetis cf. navasi* (K 105) m, mSI, fSI. *Baetis rhodani* (310) 2L, fSI, (418) 3mSI, (439) m, (546) 2m, 3L, (702) m, (703) m, (Str 8) L. *Centroptilum luteolum* (414) m, mSI, (421) fSI, (702) mSI, fSI. *Cloeon dipterum* (KK 1) m. *Oligoneuriella rhenana* (28) 3f, (422) 2m, 7f, (439) 2L, (446) m, f, (KA 7) L. *Epeorus cf. assimilis* (27) f, (306) m, (307) f, (308) 2L, (309) 2m, 2f, (TC 1) f. *Epeorus yougoslavicus* (TC 1) m, 2f. *Rhithrogena bulgarica* (410) m, (411) m, (413) m, f, (702) m. *Rhithrogena semicolorata* (18) m, (309) 2m. *Rhithrogena lisettae* sp.n. (705) 3m, (707) m, f, (TC 2) m, f. *Ecdyonurus aurantiacus* (403) m, (512) m, (513) m. *Ecdyonurus epeorides* (419) mSI, f, (424) m, fSI. *Ecdyonurus graecus* (505) m. *Ecdyonurus insignis* (422) 2m, f, (432) 2m, 2f, (446) m. *Ecdyonurus krueperi* (1) m, mSI, f, fSI, L, (6) mSI, f, fSI, L, (301) m, f, (403)m, (433) m, f, L, (508) mSI, fSI. *Ecdyonurus moreae* (401) m, f, (406) m, f, (601) m, (702) m, f, (703) m, f. *Ecdyonurus vitoshensis* (309) m, ? (421) f, (440) m, L, (541) m, f, (546) f, (549) m. *Electrogena malickyi* (K 104) fSI, (K 105) mSI, f, fSI. *Electrogena cf. mazedonica* (411) m. *Electrogena hellenica* (27) mSI. *Choroterpes ? balcanica* (446) m, f. *Habroleptoides filipovicae* (10) 5m fSI, (403) m. (702) f. *Habroleptoides confusa* (26) m, mSI, f, fSI. *Habroleptoides malickyi* (71) m. *Habrophlebia eldae* (7) m,mSI, (10) 2m, 3fSI, (67) m, (402) 2mSI, fSI, (423) 3m, 5mSI, fSI. *Ephemera danica* (421) f, (423) m, f. *E. cf. parnassiana* (444) f. *Ephemera lineata* (315) f, fSI, (402) mSI, (422) mSI, fSI, (423) m, (427) f, (705) m, f, (TC 1) f, (TC 3) f, (E 82) L, (E 84) L. *Ephemerella ignita* (28) f, (403) fSI, (406) f, (421) fSI, (423) m, f, (601) mSI, f, fSI, (702) mSI, f, (TC 1) m, mSI. *Ephemerella ikonomovi* (702) f, (703) f. *Ephemerella major* (406) m, f. *Caenis macrura* (3) m, f, (28) m, f, (123) m, f, (211) m, f, (234) m, f, (406) m, (423) m, f, (446) m, f, (601) m, f, (Ser 22) m, f, (Ski 2) m, (Str 5) L, (Str 7) m, (Str 8) L. *Caenis pseudorivulorum* (420) m, f.

A few specimens (subimagines / females) from localities 5, 36, 417, 418, 435, 445, 451, 500, 516, 525, 535 (not listed in the gazetteer) could not be

identified on the species level and are therefore omitted from the list of material.

The check-list

All species recorded so far from Greece are listed in Table 1. Systematic arrangement is corresponding to Puthz (1980), nomenclature follows the guidelines adopted by Bauernfeind and Moog (2001), spelling of localities is according to The Times Atlas (1972). Type localities are quoted in a broad sense equivalent to geographical provinces. Sources for previous records (usually only the first record) are cited in full and species found in the present sample are marked by dots. For details and localities see appendix.

Remarks on selected taxa

Baetidae

Baetis digitatus has been recorded only once for Greece by Belfiore (1990). In his remarks on the material (nymphs) Belfiore pointed out some differences compared with the characters described in the revision by Müller-Liebenau (1969) and the specimens in question may eventually represent a hitherto undescribed species.

Baetis navasi is so far known only from Portugal. A single male imago (accompanied by two subimaginal specimens) from Prases, Kriti (Crete), agrees well with the description by Müller-Liebenau (1974), differing slightly from typical *B. muticus* (specimens from Austria and Greece). Considering the difficulties in separating the nearly allied and very similar representatives of the *B. muticus*-group in the Mediterranean (and in the absence of nymphs) identification remains altogether doubtful. Under these circumstances the taxon was provisionally identified sub *Baetis cf. navasi*, and entered on the check-list mainly to focus the interest of future research on specimens resembling the well known *B. muticus*.

Baetis meridionalis was hitherto only known from Ikonomov's descriptions (1954: larva, 1962: imago) and a provisional record for Albania (Puthz 1980, with a photograph of male genitalia / microslide). The material used for the check-list includes male imagines and last instar larvae that agree well with both descriptions. A more detailed analysis will be published elsewhere. Generic (or subgeneric) classification in the family remains widely controversial, for the check-list a more conservative approach has been used (see the discussion in Bauernfeind and Moog 2001).

Table 1 - The check-list in the present sample ●.

1. <i>Siphonurus lacustris</i> (EATON, 1870)	Puthz 1980: 345 (?)	
2. <i>Isonychia ignota</i> (WALKER, 1853)	Puthz 1980: 345	
3. <i>Baetis alpinus</i> (PICTET, 1843-1845)	Puthz 1980: 345	●
4. <i>Baetis balcanicus</i> MÜLLER-LIEBENAU & SOLDÁN, 1981	loc.cit.: 291	
5. <i>Baetis digitatus</i> BENGTSOON, 1912	Belfiore 1990: 266	
6. <i>Baetis fuscatus</i> (LINNAEUS, 1761)	Puthz 1980: 345 (t. Navás)	●
7. <i>Baetis lutheri</i> MÜLLER-LIEBENAU, 1967	Belfiore 1990: 266	
8. <i>Baetis melanonyx</i> (PICTET, 1843-1845)	new record	●
9. <i>Baetis meridionalis</i> IKONOMOV, 1954	new record	●
10. <i>Baetis muticus</i> (LINNAEUS, 1758)	Malicky 1994: 137	●
11. <i>Baetis cf. navasi</i> MÜLLER-LIEBENAU, 1974	new record	●
12. <i>Baetis rhodani</i> (PICTET, 1843-1845)	Puthz 1980: 345	●
13. <i>Baetis vernus</i> CURTIS, 1834	Malicky 1994: 137	
14. <i>Centroptilum luteolum</i> (MÜLLER, 1776)	Puthz 1980: 345	●
15. <i>Pseudocentroptilum fascicaudale</i> SOWA, 1985	loc.typ. (Rhodos)	
16. <i>Pseudocentroptilum motasi</i> BOGOESCU, 1947	Keffermüller & Sowa 1984	
17. <i>Cloeon dipterum</i> (LINNAEUS, 1761)	Puthz 1980: 345 [inkl. <i>C. rufulum</i> (MÜLLER) t. Russev]	●
18. <i>Cloeon simile</i> EATON, 1870	Puthz 1980: 345 (t. Russev)	
19. <i>Oligoneuriella rhenana</i> (IMHOFF, 1852)	Hoffmann 1994: 90	●
20. <i>Epeorus cf. assimilis</i> (EATON, 1871)	Puthz 1980: 346 sub <i>E. sylvicola</i> auct., nec PICTET	●
21. <i>Epeorus yougoslavicus</i> (SAMAL, 1935)	Puthz 1980: 345	●
22. <i>Iron znojkoii insularis</i> BRAASCH, 1983	loc.typ. (Samos)	
23. <i>Rhithrogena braaschi</i> JACOB, 1974	Belfiore 1986: 192, Kazanci & Braasch (1988:132)	
24. <i>Rhithrogena bulgarica</i> BRAASCH, SOLDÁN & SOWA, 1985	new record [Puthz 1980: 346 sub <i>Rh. diaphana</i> auct. nec NAVÁS, pro parte]	●
25. <i>Rhithrogena lisettae</i> sp.n.	new species loc.typ. (Taiyetos)	
26. <i>Rhithrogena semicolorata</i> (CURTIS, 1834)	Puthz 1980: 346	●
27. <i>Ecdyonurus androsianus</i> BRAASCH, 1983 stat.nov.	loc.typ. (Andros) [= <i>E. aurantiacus androsianus</i> BRAASCH]	
28. <i>Ecdyonurus aurantiacus</i> (BURMEISTER, 1839)	Belfiore 1986: 192	●
29. <i>Ecdyonurus dispar</i> (CURTIS, 1834)	Puthz 1980: 345	
30. <i>Ecdyonurus epeorides</i> DEMOULIN, 1955	loc.typ. (Pelion O.) [= <i>E. picteti</i> sensu Puthz, nec MEYER-DÜR; ?= <i>E. helveticus</i> sensu Ulmer cit. in Puthz 1980: 345]	●
31. <i>Ecdyonurus graecus</i> BRAASCH, 1984	loc.typ. (Ipiros)	●
32. <i>Ecdyonurus insignis</i> (EATON, 1870)	Puthz 1980: 345 (?)	●
33. <i>Ecdyonurus krueperi</i> (STEIN, 1863)	loc.typ. (Akarnania)	●
34. <i>Ecdyonurus macani</i> THOMAS & SOWA, 1970	Belfiore 1986: 193	
35. <i>Ecdyonurus moreae</i> BELFIORE & BRAASCH, in Belfiore (1986)	loc.typ. (Peloponnisos) [?= <i>E. forcipula</i> sensu auct., nec PICTET, zit. in Puthz 1980: 345]	●
36. <i>Ecdyonurus vitoshensis</i> JACOB & BRAASCH, 1984; stat.nov.	new record [?= <i>E. zelleri</i> sensu Puthz 1980: 345]	●
37. <i>Electrogena affinis</i> (EATON, 1883)	Belfiore <i>et al.</i> 1999: 248 [?= <i>E. trimaculata</i> (IKONOMOV, 1963)]	
38. <i>Electrogena aspoeki</i> (BRAASCH, 1984)	loc.typ. (Chios)	
39. <i>Electrogena hellenica</i> ZURWERRA & TOMKA, 1986	loc.typ. (Ipiros)	●
40. <i>Electrogena malickyi</i> (BRAASCH, 1983)	loc.typ. (Crete), Gaino & Sowa 1985: 130	●
41. <i>Electrogena cf. mazedonica</i> (IKONOMOV, 1954)	new record	●

42. <i>Choroterpes (Eu.) assimilis</i> GAINO & SOWA, 1985	loc.typ. (Lesbos)	
43. <i>Choroterpes (Eu.) ? balcanica</i> IKONOMOV, 1961	new record	•
44. <i>Choroterpes (Ch.) lesbosensis</i> GAINO & SOWA, 1985	loc.typ. (Lesbos)	
45. <i>Choroterpes (Ch.) picteti</i> (EATON, 1871)	Puthz 1980: 346	
46. <i>Habroleptoides confusa</i> SARTORI & JACOB (1986)	Puthz 1980: 346 [sub <i>H. modesta</i> auct., nec HAGEN]	•
47. <i>Habroleptoides filipovicuae</i> GAINO & SOWA, 1985	new record	•
48. <i>Habroleptoides malickyi</i> GAINO & SOWA, 1983	loc.typ. (Euboea)	•
49. <i>Habrophlebia eldae</i> JACOB & SARTORI, 1984	new record	•
50. <i>Habrophlebia fusca</i> (CURTIS, 1834)	Puthz 1980: 136, Malicky 1994: 137	
51. <i>Habrophlebia lauta</i> EATON, 1884	Puthz 1980: 346	
52. <i>Paraleptophlebia submarginata</i> (STEPHENS, 1835)	Puthz 1980: 346 (t. Russev)	
53. <i>Potamanthus luteus</i> (LINNÉ, 1767)	Hoffmann 1994: 90	
54. <i>Ephemera danica</i> MÜLLER, 1764	new record	•
55. <i>Ephemera glaucops</i> PICTET, 1843-1845	Puthz 1980: 346 (t. Navás)	
56. <i>Ephemera lineata</i> EATON, 1870	Malicky 1994: 137 [= Puthz 1980: 346 sub <i>E. hellenica</i> DEMOULIN syn.nov.]	•
57. <i>Ephemera cf. parnassiana</i> DEMOULIN, 1958	loc.typ. (Parnassos)	•
58. <i>Ephemera vulgata</i> LINNAEUS, 1758	Puthz 1980: 346 (t. Navás)	
59. <i>Ephemerella (S.) ignita</i> (PODA, 1761)	Puthz 1980: 346	•
60. <i>Ephemerella (E.) ikonomovi</i> PUTHZ, 1971	Studemann <i>et al.</i> 1989: 123	•
61. <i>Ephemerella (T.) major</i> (KLAPÁLEK, 1905)	new record	•
62. <i>Ephemerella (E.) mesoleuca</i> (BRAUER, 1857)	Soldán 1982: 48	
63. <i>Ephemerella (E.) notata</i> EATON, 1887	Puthz 1980: 346 (t. Russev)	
64. <i>Caenis macrura helenica</i> MALZACHER, 1986	loc.typ. (Euboea)	•
65. <i>Caenis macrura minoica</i> MALZACHER, 1986	loc.typ. (Crete)	•
66. <i>Caenis pseudorivulorum belfiorei</i> MALZACHER, 1986	loc.typ. (Kalamas)	•
67. <i>Caenis pusilla</i> NAVÁS, 1913	Malzacher 1986: 28	
68. <i>Caenis robusta</i> EATON, 1884	Puthz 1980: 346	
69. <i>Caenis strugaensis</i> IKONOMOV, 1961	Malzacher 1986: 10	
70. <i>Prosopistoma pennigerum</i> (MÜLLER, 1785)	Hoffmann 1994: 89 [sub <i>P. foliaceum</i> FOURCROY]	

Heptageniidae

Epeorus assimilis has recently been reinstated by Thomas *et al.* (2000, 2001) for populations north of the Pyrenees. Specimens from the material resembling this species (as well as *E. sylvicola* PICTET, 1865) have been listed provisionally sub *E. cf. assimilis* until the status of *E. sylvicola* and related taxa as well as the variation of characters in the genus are better understood.

The discriminating characters described by Braasch (1983) for *Ecdyonurus aurantiacus androsianus* (imagines and last instar larvae) have been compared with material of *Ecdyonurus aurantiacus* from Austria and mainland Greece. Considering current opinions within the genus the differences may well warrant recognition on the species level. Accordingly *Ecdyonurus androsianus* stat. nov. is proposed for the taxon described by Braasch (l.c.), known so far only from the island of Andros.

The characters described by Jacob and Braasch (1984) and Hefti *et al.* (1989, 1991) for imagines and last instar larvae of *Ecdyonurus carpathicus vitoshensis* may well warrant recognition on the species level. Based on specimens from Greece identified with this taxon specific rank for *Ecdyonurus vitoshensis* stat. nov. is proposed.

The insufficiently known taxon *Electrogena trimaculata* (IKONOMOV, 1963), described only in the male submaginal stage, may represent a junior synonym of *E. affinis*, as suggested earlier by Sowa (1974).

Electrogena mazedonica represents another rather poorly known taxon (compare Sowa 1974), described only in the larval and (male) subimaginal stage. A single specimen agreeing with the description and drawing by Ikonomov (1963) has been provisionally assigned to this species.

Leptophlebiidae

A male and female imago of *Choroterpes* (collected at Kalendini, Ipiros) could not be

assigned with certainty to any of the hitherto described species of that genus. The specimens may belong to *Ch. balcanica*, known so far only in the larval stage. In the check-list the specimens in question have provisionally been listed sub *Choroterpes* cf. *balcanica*; a drawing of the male genitalia was provided earlier (Bauernfeind, 1998).

Ephemeridae

Ephemera hellenica was described from a single female specimen from Zagora, Mt. Pelion (Pilion). A comparison of the description and drawings by Demoulin (1955) with material of *E. lineata* from Greece, France and Austria shows (despite a certain degree of variation, compare Pongrácz, 1923) no perceptible differences. In the check-list *Ephemera hellenica* DEMOULIN, 1955 (syn. nov.) is therefore considered to represent a junior synonym of *Ephemera lineata* EATON, 1870.

Ephemera parnassiana strongly resembles *E. danica* (as pointed out already by Demoulin 1958), and may well prove synonymous in the future. In the absence of sufficient material at present, a single specimen that agrees perfectly with the description and drawings by Demoulin (1958) has been provisionally listed under *Ephemera* cf. *parnassiana*. The taxon however remains doubtful and fresh material from the type locality (Polydrosos, Parnassos) should be investigated.

Ephemerellidae

Jacob (1993) reinstated *E. spinosa* IKONOMOV, 1961 because of a new generic combination (transfer to *Serratella*). This opinion can not be maintained: *Ephemerella spinosa* IKONOMOV, 1961 represents a primary homonym of *Ephemerella spinosa* MAYO, 1951 [= *Caudatella hystrix* (TRAVER, 1934)] and is therefore permanently invalid (ICZN 2000, Article 57.2.). The only available name for “*Ephemerella spinosa* Ikononov, 1961” is the replacement name *Ephemerella ikononovi* PUTHZ, 1971, irrespective of the generic placement. Generic (or subgeneric) classification in the family remains controversial, for the check-list a more conservative approach has been used (compare Studemann and Landolt 1997; Bauernfeind and Moog, 2001).

Acknowledgements

I am greatly indebted to Univ. Prof. Dr. Hans Malicky (Lunz) for the kind donation of the material from Greece. My sincere thanks are due to our staff, who helped considerably in preparing the manuscript: Hans-

Martin Berg, Mag. Marianne Ullmann (library, EDV), Kriemhild Repp, Alice Schumacher (maps, photographs). Friedrich Stich (Ferlach) generously provided life photographs of mayflies and Prof. Dr. M. D. Larsen (Baden) gave his friendly advice in linguistic matters. Dr. Carlo Belfiore and Dr. Arne Haybach kindly drew my attention on some previously overlooked faunistic records. The author gratefully acknowledges the valuable support by the Museum of Natural History Vienna and the Austrian Ministry for Education, Science and Cultural Affairs (bm:bwk), who sponsored his attendance at the International Conference in Perugia.

References

- Bauernfeind E., 1998. Taxonomie und Verbreitung von *Choroterpes* Eaton in der Palaearktis (Insecta: Ephemeroptera: Leptophlebiidae). *Stapfia* 55:629-640.
- Bauernfeind E., Moog O., 2001. Comments on the systematics and nomenclature of selected Austrian mayflies (Insecta: Ephemeroptera). *Lauterbornia* 40:79-91.
- Belfiore C., 1986. Contribution to the Knowledge of the Heptageniidae of Greece, with a Description of *Ecdyonurus moreae* sp.n. (Ephemeroptera). *Aquat. Insects* 8(4):191-195.
- Belfiore C., 1990. Efemerotteri delle isole dell'Egeo (Ephemeroptera). *Fragm. Entomol.* 22(2):265-270.
- Bengtsson S., 1912. Neue Ephemeriden aus Schweden. *Entomol. Tidskr.* 33:107-117.
- Bogoescu C.D., 1947. Un genre nouveau d'Ephéméroptère trouvé en Roumanie. *Bull. Sect. Biol. Acad. Sci. Rouman.* 29(9):602-606.
- Braasch D., 1983a. Zwei neue Heptageniidae von den griechischen Inseln. *Reichenbachia* 21(11):69-74.
- Braasch D., 1983b. *Ecdyonurus aurantiacus androsianus* n.subsp. von der griechischen Insel Andros (Ephemeroptera, Heptageniidae). *Reichenbachia* 21(18):117-120.
- Braasch D., 1984a. *Ecdyonurus aspoecki* n. sp. von der griechischen Insel Chios (Heptageniidae, Ephemeroptera). *Reichenbachia* 22(25):193-194.
- Braasch D., 1984b. *Ecdyonurus graecus* n.sp. aus Griechenland (Ephemeroptera, Heptageniidae). *Entomol. Nachr. Ber.* 28:11-12.
- Braasch D., Soldán T., Sowa R., 1985. *Rhithrogena bulgarica* n.sp. und zwei für die Fauna Bulgariens neue Eintagsfliegenarten (Ephemeroptera, Heptageniidae). *Faun. Abh. (Dresd.)* 12(12):125-127.
- Brauer F., 1857. Ephemerida. In: Brauer F, Löw F., (eds). *Neuroptera austriaca*. Wien: Verl. Gerold. pp. 72.
- Burmeister H. I., 1839. Ephemerina. *Handbuch der Entomologie* Bd. II, Abt. II. Berlin: G. Reimer. pp. 788-804, 1015.
- Curtis J., 1834. Descriptions of some nondescript British species of mayflies of anglers. *Lond. Edinb. Philos. Mag.* 3(14):120-125.

- Demoulin G., 1955. Mission E. Janssen et R. Tollet en Grèce. Bull. Ann. Soc. R. Belge. Entomol. 91:38-44.
- Demoulin G., 1958. Ephemeroptera. Mission E. Janssens en Grèce, 1957. 3e note. Bull. Ann. Soc. R. Belge Entomol. 94:226-228.
- Eaton A. E., 1870. On some new British species of Ephemeridae. Trans. Entomol. Soc. Lond. 18:1-8.
- Eaton A. E., 1871. A Monograph of the Ephemeridae. Trans. Entomol. Soc. Lond. 1870 (1):1-164.
- Eaton A. E., 1884. A revisional monograph of recent Ephemeridae or Mayflies. Part 2. Trans. Linn. Soc. Lond. 2(3):78-152.
- Eaton A. E., 1887. A revisional monograph of recent Ephemeridae or Mayflies. Part 5. Trans. Linn. Soc. Lond. 2(3):281-319.
- Gaino E., Sowa R., 1983. *Habroleptoides malickyi* n. sp. de la Grece (Ephemeroptera, Leptophlebiide). Boll. Soc. Entomol. Ital. 115(8-10):130-134.
- Gaino E., Sowa R., 1985. Nouvelles especes de Lephophlebiidae de Grece et de Yougoslavie (Eph.). Boll. Soc. Entomol. Ital. 117(1-3):8-17.
- Hefti D., Tomka I., Zurwerra A., 1989. Revision of morphological and biochemical characters of the European species of the *Ecdyonurus helveticus* – group (Ephemeroptera, Heptageniidae). Mitt. Schweiz. Entomol. Ges. 62:329-344.
- Hefti D., Tomka I., Zurwerra A., 1991. Revision of the European species belonging to the *Ecdyonurus helveticus* – group (Ephemeroptera: Heptageniidae). In: Alba-Tercedor J., Sanchez-Ortega A. (eds). Proc. VIth Int. Conf. Ephem., Granada:63-72.
- Hoffmann A., 1994. Zur Fauna der Fließgewässer Nordwest-Griechenlands. Verh. Westd. Entomologen Tag 1993: 87-93 [Löbbecke-Museum, Düsseldorf].
- ICZN, 1999. International Code of Zoological Nomenclature. 4th edition, London: Intern. Trust on Zool. Nomencl. pp.306.
- Ikonomov P., 1954a. Über eine neue Larve der Gattung *Baetis* (Ephem.) aus Mazedonien [Maked., German summary]. Fragm. Balc. Mus. Mazedonici Sci. Nat. 1:95-105.
- Ikonomov P., 1954b. Über eine neue *Heptagenia* (Ephem.) aus Mazedonien [Maked., German summary]. Fragm. Balc. Mus. Mazedonici Sci. Nat. 1: 57-68.
- Ikonomov P., 1961a. *Euthraulus balcanicus* sp. n. (Leptophlebiidae) [Maked., German summary]. Fragm. Balc. Mus. Mazedonici Sci. Nat. 4(1):1-10.
- Ikonomov P., 1961b. *Caenis strugaensis* sp.n. = *lychnidensis* Ikon. [Maked., German summary]. Fragm. Balc. Mus. Mazedonici Sci. Nat. 4(2):11-19.
- Ikonomov P., 1961c. Eintagsfliegen (Ephemeroptera) Macedoniens, Fam. Ephemerellidae [Maked., German summary]. Acta Mus. Macedonici Sci. Nat. VIII(3):53-74.
- Ikonomov P., 1962. Baetidae (Ephemeroptera) na Makedonija. Facult. Sci. Nat. Univ. Skopje, Annales Biologici I: 83-140.
- Ikonomov P., 1963. Eintagsfliegen (Ephemeroptera) Macedoniens Genus *Heptagenia* (Ecdyonuridae) [Maked., German summary]. God. Zb. Biol. Prir.-Mat. Fac. Univ. Kiril Metod Skopje 14:155-165.
- Imhoff L., 1852. *Oligoneuriella rhenana*. Ber. Verhandl. naturf. Ges. Basel X:177-180.
- Jacob U., 1974. *Rhithrogena braaschi* n.sp., eine neue Heptageniidae aus Bulgarien (Insecta, Ephemeroptera). Entomol. Nachr. Ber. 18:167-173.
- Jakob U., 1993. Zur Systematik und Verbreitung der europäischen Ephemerellidae (Ephem.). Verh. Westd. Entomologen Tag 1992:101-110. [Löbbecke-Museum, Düsseldorf]
- Jacob U., Braasch D., 1984. Neue und statusrevidierte Taxa der *Ecdyonurus helveticus* – Großgruppe. Entomol. Abh. (Dresd.) 48(6):53-61.
- Jacob U., Sartori M., 1984. Die europäischen Arten der Gattung *Habrophlebia* Eaton (Ephemeroptera, Leptophlebiidae). Entomol. Abh. 48(5):45-52.
- Kazanci N., Braasch D., 1988. On some Heptageniidae new for Anatolia (Turkey) (Insecta, Ephemeroptera). Faun. Abh. (Dresd.) 15(2):131-136.
- Keffermüller M., Sowa R., 1984. Survey of Central European species of the genera *Centroptilum* Eaton and *Pseudocentroptilum* Bogoescu (Ephemeroptera, Baetidae). Polsk. Pismo Entomol. 54: 309-340.
- Klapálek F., 1905. Ephemeridarum species quatuor novae. Čas. Čes. Spol. Entomol. 2:75-79.
- Linnaeus C., 1758. Animalia. Systema naturae. Editio decima, reformata. Holmiae: L. Salvii. Tom. I, pp. 823 [Ephemeroptera: 546-547]
- Linnaeus C., 1761. Fauna Svecica. Editio altera, auctior. Stockholmiae: L. Salvii. pp. 578 [Ephemeroptera: 376-378]
- Linné C., 1767. Sytema Naturae, per regna tria Naturae. Editio duodecima, reformata. Holmiae: L. Salvii. Vol. I, Pars 2: 533-1327.
- Malicky H., 1994. Emergence patterns of insects from a permanent stream in the Eu-mediterranean climate region (Trichoptera, Ephemeroptera, Plecoptera). Entomol. Gen. 18:131-144.
- Malzacher P., 1986. Diagnostik, Verbreitung und Biologie der europäischen *Caenis*-Arten (Ephemeroptera: Caenidae). Stuttg. Beitr. Natkd., Ser. A (Biol.) Nr. 387: 1-41.
- Mayo V. K., 1951. New western Ephemeroptera II. Pan-Pac. Entomol. 27:121-125.
- Müller O. F., 1764. Ephemeræ. Fauna Insectorum Friedrichsdaliana: 63 (Nos.554-557).
- Müller O. F., 1776. Ephemeræ. Zool. Dan. Prodrum.:142-143 (Nos. 1640-1651).
- Müller O. F., 1785. Entomostraca seu Insecta Testacea quae in aqui Daniae et Norvegiae reperit, descripsit et iconibus illustravit. Lipsiae et Havniae: F. W. Thiele für J. G. Müller. 1-135.
- Müller-Liebenau I., 1967. Zur Frage der *Baetis „venustulus“*, zugleich Beschreibung der neuen Art *Baetis lutheri* n.sp. (Insecta, Ephemeroptera). Gewässer u. Abwässer 44/45:48-64.

- Müller-Liebenau I., 1969. Revision der europäischen Arten der Gattung *Baetis* Leach, 1815 (Insecta, Ephemeroptera). Gewässer u. Abwässer 48/49, pp.214.
- Müller-Liebenau I., 1974. Baetidae aus Südfrankreich, Spanien und Portugal (Insecta, Ephemeroptera). Gewässer u. Abwässer 53/54:7-42.
- Müller-Liebenau I., 1976. Die Imagines von *Baetis navasi* Müller-Liebenau 1974, aus Portugal (Insecta, Ephemeroptera). Gewässer & Abwässer 60/61:65-69.
- Müller-Liebenau I., Soldán T., 1981. *Baetis balcanicus* sp.n., a new species of the genus *Baetis* from Bulgaria and Greece. Spixiana 4(3):291-295.
- Navás L., 1913. Notas entomológicas 4. Excursiones por los alrededores de Zaragoza. (1). Bol. Soc. Aragon. Cienc. Nat. 12:61-69.
- Pictet F. J., 1843-1845. Histoire Naturelle générale et particulière des Insects Néuroptères. Famille des Ephémérines. Geneva: Kessmann & Cherbuliz. pp.300. XIX + 47pls.
- Pictet F. J., 1865. Synopsis des Néuroptères d' Espagne. Geneve: H. Georg Libr. pp.123.
- Poda N., 1761. Insecta Musaei Graecensis. Graecii: Haeredes Widmanstadii. pp. 18+127 [Ephemeroptera:97-98. pl. I].
- Pongrácz S., 1923. Recésszárnyúak. Neuropteroiden. In: Csiki E., (ed.). Állattani Kutatásai Albániában. Exploraciones zoologicae ab E. Csiki in Albania peractae (A Magyar Tudományos Akadémia Balkán-Kutatásainak Tudományos eredményei Szerkesztik Gróf Teleki Pál és Csiki Ernő). 1:143-166.
- Puthz V., 1971. Namensänderung einer Heptageniidenart (Ephemeroptera). Mitt. Dtsch. Entomol. Ges. 29(4):43.
- Puthz V., 1980. Ergebnisse der Albanien-Expedition 1961 des Deutschen Entomologischen Institutes, Ephemeroptera. Beitr. Entomol. 30(2):343-355.
- Šámal J., 1935. *Iron yougoslavicus*, a new European may-fly species. Vest. Česk. Spol. Zool. 2:87-91.
- Sartori M., Jacob U., 1986. Revision taxonomique du genre *Habroleptoides* Schönemund, 1929 (Ephemeroptera, Leptophlebiidae). II. A propos du statut de *Habroleptoides modesta* (Hagen, 1864). Rev. Suisse Zool. 93(3):683-691.
- Sartori M., Sowa R., 1988. Compléments à la connaissance des espèces du groupe de *Rhithrogena diaphana* Navás, de la péninsule ibérique (Ephemeroptera, Heptageniidae). Mitt. Schweiz. Entomol. Ges. 61:349-360.
- Sowa R., 1974. *Ecdyonurus fasciocolatus* sp.n., espèce voisine d' E. affinis Eaton du midi de la Pologne (Ephemeroptera, Heptageniidae). Bull. Acad. Pol. Sci., Sér. Sci. Biol., II, 22:315-323.
- Sowa R., 1985. *Pseudocentropilum fascicaudale* sp. n. (Ephemeroptera, Baetidae) from Greece. Acta Hydrobiol. Krakow 27(1):75-80.
- Stein J. P. E. F., 1863. Beitrag zur Neuropteren-Fauna Griechenlands (mit Berücksichtigung dalmatinischer Arten). Berl. Entomol. Zschr. 7:411-422.
- Stephens J. F., 1835. Illustrations of British entomology. Mandibulata 6:54-70. pl.29.
- Studemann D., Landolt P., 1997. Eggs of Ephemerellidae (Ephemeroptera). In: Landolt P., Sartori M., (eds). Ephemeroptera & Plecoptera. Biology-Ecology-Systematics. Fribourg: MTL. pp.362-371.
- Studemann D., Landolt P., Tomka I., 1989. Contribution to the study of European Ephemerellidae (Ephemeroptera).II. Description of the winged stages of *Ephemerella ikonovi* Puthz, 1971, and *Serratella albai* Gonzales del Tanagro & Garcia de Jalon, 1983. Mitt. Schweiz. Entomol. Ges. 62:119-127.
- The Times Atlas of the World. 1972. Edinburgh: J. Bartholomew & Son. pp. 272, 123 plates.
- Thomas A., Brulin M., 2001. *Epeorus sylvicolus* et *E. alpicolus*: émendations injustifiées pour *E. sylvicola* et *E. alpicola* [Ephemeroptera, Heptageniidae]. Ephemera 2(1):6.
- Thomas A., Sowa R., 1970. *Ecdyonurus macani* n. sp., espèce européenne voisine d' *Ecdyonurus torrentis* Kimmins (Ephemeroptera, Heptageniidae). Ann. Limnol. 6:75-85.
- Thomas A., Maria V., Brulin M., 2000. Corrections à la Faune des Ephémères d' Europe occidentale: 2. *Epeorus assimilis* Eaton, 1885 est une espèce valide, distincte d' *E. sylvicolus* (Pictet, 1865) [Ephemeroptera, Heptageniidae]. Ephemera 1(2):85-91.
- Traver J. R., 1934. New North American Species of Mayflies (Ephemera). J. Elisha Mitchell Sci. Soc. 50:189-254.
- Walker F., 1853. Catalogue of the species of Neuropterous insects in the collection of the British Museum. Part III, Termites and Ephemeridae. London: BMNH. pp.533-585.
- Zurwerra A., Tomka I., 1986. Drei neue Arten der Gattung *Electrogena* Zurwerra & Tomka, 1985, aus Südeuropa (Ephemeroptera, Heptageniidae). Bull. Soc. Fribg. Sci. Nat. 75:216-230.
- Zwick P., 1981. Das Mittelmeergebiet als glaciales Refugium für Plecoptera. Acta entomol. Jugoslav. 17(1-2):107-111.

Appendix

Sampling localities:

[Localities are grouped according to geographic provinces (bold type). O. (Oros) = mountains, P. (Potamos) = river. Numbers in brackets: field numbers / collecting sites, locality names as provided by Malicky, geographic ordinates see gazetteer. For difficulties concerning local names compare Malicky (1994)]

Ipiros: (1) Igoumenitsa, (3) Archangelos, (6) Krikellos, (7) Loutros, (446) Kalendini, (508) Timfi O., Iliochori, (KA 7) Kalamas.

Panaitolikon: (12) Drimonas, (16) Krikellopotamos, (18) Mikro Chorino, (26) Agios Dimitrios, (27) Platana, (28) Mornos P., Dafni. **Western Thessalia:** (67) Ossa O., Katafigion, (71) Ossa O., Karitsa, (432) Katerini, Mavroneri P., (433) Ossa O., (999) East of Pilion (Pelion O.). **Stereia:** (10) Lake Trikhonis, (301) Elikon O., Agia Triada, (302) Elikon, Ag.Triada, (303) Vardhousia, Mornos P., (306) Vardhousia, Ath.Diakos, (307) Vardhousia, Koniakos, (308, 549) Vardhousia, Koniakos, (309, 546) Vardhousia, Kallion, (310) Vardhousia, Diakopion, (315) Vardhousia, Vlachovouni, Koupaki, (316) Pentalofon, (444) Timfristos, Agia Triada, (601) Ag.Triada. **Pindhos:** (79) Metsovon, (505) N-Katara pass, Milia, (702) Andusa, (703) Milea, (992) Gormos O., W- Oreokastron, Konitsa, (994) W- Peristeri, (995) E-Katara pass. **Makedhonia:** (234) Vernion O., Flamuria, (401, 402) Timfi O., Kipi, (403) Timfi O., Vrisochori, (404) Timfi O., Iliochori, (404) Timfi O., Skamnellion, (410, 411) Smolikas, Samarina, (512, 513) Smolikas, Ag.Paraskevi, (412) Grammos, Pefkofito, (413, 414) Grammos, Pefkos, (418, 419) Vernion, Naoussa, (420) Strimon P. / Lake Volvi, (421) S- Rhodopi, Sminthi, (422, 423) W- Rhodopi, Prasinada, (424) W- Rhodopi, Kriavrasi, (427) W- Rhodopi, Nestos P., Potami, (430) Pieria O., N-Olymbos. **Chalkidiki** (Khalkidhiki): (996) Cholomos O., W-Arnea, (997) Stratoniko O. **Thraki:** (211) Avandos. **Peloponnisos:** (439) R. Erimanthos, Desion, (440) Chelmos O., Saruchla, (541, 705, 707) Taiyetos, Poliana, (TC 1, TC 2, TC 3) Taiyetos [Christensen leg.].

Islands:

Euboea (Èvvia): (E 82) Kutrulo, (E 84) Ano Steni. **Crete (Kriti):** (K 104) Dris, (K 105) S-Prases, (K 992, KK 1) Kastellakia. **Lesbos (Lesvos):** (L 13) Ag. Paraskevi. **Seriphos:** (Ser 22) Koutalas. **Skiathos:** (Ski 2) Kechries cove. **Samothraki:** (Str 5) Katsabas P., Kamariotissa, (Str 7) Agistros P., Akra Agistros, (Str 8) Fonias P.

Gazetteer

[Field numbers for sampling sites (bold print, in brackets), locality names and geographical ordinates as provided by Malicky, elevation above sea level in meters, date of collection.]

(1) Igoumensita 20°19' E / 39°15' N, 10m NN, 19.5.1987 (3) Archangelos 20°19'/37°07', 80m, 20.5.1987 (5) Revmatia 20°43'/39°17', 480m, 21.5.1987 (6) Krikellos 21°13'/38°57', 150m, 22.5.1987 (7) Loutros 21°11'/38°57', 20m,

22.5.1987 (10) Mirtia 21°37'/38°35', 130m, 23.5.1987 (12) between Drimonas and Thermos 21°40'/38°36', 350m, 23.5.1987 (16) Krikellopotamos 21°41'/38°46', 370m, 24.4.1987 (18) Mikro Chorino 21°44'/38°50', 650m, 25.5.1987 (26) Ag. Dimitrios 21°51'/38°39', 720m, 26.5.1987 (27) Platana 21°49'/38°34', 300m, 26.5.1987 (28) Dafni 21°53'/38°28', 60m, 26.5.1987 (36) Mouriata 21°43'/37°14', 340m, 2.6.1987 (67) Katafigion 22°42'/39°50', 1200m, 12.6.1987 (71) between Melivia and Karitsa 22°48'/39°47', 440m, 13.6.1987 (79) Metsovon 21°07'/39°49', 1350m, 14.6.1987 (203) Kapandriti 23°54'/38°13', 300m, 13.5.1989 (211) Avandas 25°54'/40°58', 200m, 29.5.1989 (234) Flamuria 22°00'/40°45', 400m, 9.6.1989 (301) Ag. Triada 22°54'/38°21', 460m, 17.5.1990 (302) Ag. Triada 22°55'/38°22', 250m, 17.5.1990 (303) Kato Musiotitsa 22°13'/38°41', 600m, 18.5.1990 (306) Ath. Diakos 22°10'/38°43', 1000m, 19.5.1990 (307) Kato Musiotitsa 22°11'/38°14', 900m, 19.5.1990 (308) Koniakos 22°11'/38°40', 1000m, 20.5.1990 (309) Kallion 22°11'/38°34', 400m, 20.5.1990 (310) Diakopion 22°07'/38°35', 400m, 20.5.1990 (315) Koupaki 22°01'/38°30', 260m, 21.5.1990 (316) Pentalofon 21°12'/38°29', 0m, 22.5.1990 (401) Kipi 20°48'/39°51', 700m, 10.7.1991 (402) Kipi 20°47'/39°52', 700m, 10.7.1991 (403) Vrisochori 20°54'/39°56', 1200m, 11.7.1991 (404) Iliochori 20°54'/30°57', 1100m, 11.7.1991 (406) Skamnellion 20°53'/39°55', 1000m, 11.7.1991 (410) Samarina 21°00'/40°08', 1500m, 12.7.1991 (411) Samarina 21°00'/40°08', 1550m, 12.7.1991 (412) Pefkofito 20°58'/40°18', 1000m, 13.7.1991 (413) between Pefkofito and Pefkos 20°55'/40°18', 1200m, 13.7.1991 (414) between Pefkofito and Pefkos 20°55'/40°18', 1200m, 13.7.1991 (417) Drosopigi 21°24'/40°38', 1750m, 15.7.1991 (418) Naoussa 21°57'/40°40', 1500m, 15.7.1991 (419) Naoussa 21°57'/40°40', 1500m, 15.7.1991 (420) Rendina 23°39'/40°40', 0m, 16.7.1991 (421) Sminthi 24°48'/41°15', 450m, 17.7.1991 (422) Prasinada 24°32'/41°20', 300m, 18.7.1991 (423) Prasinada 24°32'/41°20', 300m, 18.7.1991 (424) Kriavrasi 24°19'/41°30', 1400m, 19.7.1991 (427) Nestos 24°05'/41°23', 300m, 20.7.1991 (430) Pierias O. 22°12'/40°16', 1600m, 26.7.1991 (431) Pierias O. 22°13'/40°16', 1400m, 26.6.1991 (432) Mavroneri 22°25'/40°16', 100m, 27.7.1991 (433) Apataniana P. 22°42'/39°50', 1200m, 28.7.1991 (435) Gardikion 21°57'/38°49', 900m, 30.7.1991 (439) Desion 21°58'/37°55', 650m, 1.8.1991 (440) Saruchla 22°16'/37°58', 1200m, 2.8.1991 (442) Ag. Nikolaos 21°36'/38°54', 350m,

5.8.1991 **(444)** Ag. Triada 21°50'/38°58', 850m,
 7.8.1991 **(445)** Molocha 21°50'/39°08', 1000m,
 8.8.1991 **(446)** Epirus 21°10'/39°12', 150m,
 9.8.1991 **(505)** Milia 21°14'/39°52', 1100m,
 2.10.1991 **(508)** Iliochori 20°54'/39°57', 1100m,
 3.10.1991 **(510)** Samarina 21°00'/40°08', 1550m,
 5.10.1991 **(516)** Vitsi 21°24'/40°38', 1600m,
 7.10.1991 **(525)** Kriavrissi 24°20'/41°30', 1500m,
 10.10.1991 **(535)** Pavliani 22°18'/38°47', 1600m,
 14.10.1991 **(541)** Taiyetos, Poliana 22°22'/36°58',
 1000m, 18.10.1991 **(546)** Kallion 22°11'/38°34',
 400m, 22.10.1991 **(549)** Koniakos 22°11'/38°40',
 1000m, 22.10.1991 **(601)** Ag. Triada
 21°43'/39°50', 500m, 8.6.1992 **(702)** Pindos
 21°12'/39°40', 1200m, 2.8.1993 **(703)** Pindos
 21°18'/39°35', 850m, 3.8.1993 **(705)** Taiyetos,
 Poliana 22°22'/36°58', 1000m, 11.8.1993 **(707)**
 Taiyetos, Poliana 22°22'/36°58', 1000m,
 17.8.1993 **(TC1-3)** Taiyetos, ca. 22°22'./36°58',
 1000m, 22.5.1979 [Georg Christensen leg.] **(E 82)**
 Euboea, Kutrulo 23°54'/38°35', 1000m, 4.8.1993
(E 84) Euböa 23°51'/38°43', 500m, 6.8.1993
(KA) Ipiros, Kalamas near Menira, ca.
 39°50'/21°00', 10.6.1977 **(KK1)** Crete,
 Kastellakia near Rethimnon, ca. 35°23'/24°28',
 19.7.1977 **(K 104)** Crete, Dris 23°43'/35°20',
 450m, 30.4.1990 **(K 105)** Crete, Prases
 23°50'/35°22', 500m, 30.4.1990 **(L 13)** Lesbos,
 Ag. Paraskevi, 26.5.1975, 100m **(Ser 22)**
 Seriphos, Koutalas 24°28'/37°09', 420m,
 13.5.1990 **(Ski 2)** Skiathos, Kechries - cove
 23°26'/39°11', 0m, 5.6.1989 **(Str 5)** Samothraki,
 Katsabas potamos 25°30'/40°30', 0m, 26.5.1989
(Str 7) Samothraki, Agristos potamos
 25°41'/40°28', 10m, 26.5.1989 **(Str 8)**
 Samothraki, Fonias potamos 25°39'/40°29', 10m,
 26.5.1989.