DISTRIBUTION AND ECOLOGY OF THE REPRESENTATIVES OF SOME EPHEMEROPTERAN FAMILIES IN BULGARIA

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The distribution of 23 species belonging to the families Heptageniidae *(Epeorus, Iron, Electrogena, Heptagenia),* Ephemerellidae, Polymitarcyidae, Ephemeridae and Potamanthidae is shown on a map. The data are based on samples gathered in 40 years of research on the hydrobiology and saprobiology of Bulgarian rivers. The established ecological data for each species is discussed.

INTRODUCTION

A survey of the literature and the established species from this order in Bulgaria was made by RUSSEV (1993). To the established 102 species RUSSEV & VIDINOVA (1994a) added other 3.

The investigations which have been carried out during the last 40 years on the hydrobiology and saprobiology of the Bulgarian rivers amassed rich material for the establishment of distribution and ecology of Ephemeroptera species in Bulgaria. The first publications in this sphere were on the family Palingeniidae for the species *Palingenia longicauda* (OLIV.), by RUSSEV (1987) and the families Siphlonuridae, Rallidentidae, Ametropodidae, Oligoneuriidae and Isonychiidae by RUSSEV & VIDINOVA (1994b).

The subject of the present report are the 23 species, established in Bulgaria belonging to the families Heptageniidae (the genera *Epeorus, Iron, Heptagenia, Electrogena),* Ephemerellidae, Polymitarcyidae, Ephemeridae and Potamanthidae.

METHODS

Hydrochemical analyses are made by methods recommended by the Council of Economic Mutual Aid (1977). The saprobiological state of the rivers is determined with the help of the method of saprobic valences of ZELINKA & MARVAN (1961) and ROTHSCHEIN (1962).

RESULTS AND DISCUSSION

HEPTAGENIIDAE

Epeorus sylvicola (PICTET, 1865) is widely spread mainly in the purest xenosaprobic and oligosaprobic mountainous and foothill rivers and streams in the epi-, meta- and hyporhithral (even up to 1900 m above sea level), but it is more rarely met in the midcurrent of the ß-mesosaprobic plane rivers (epipotamal) above 200 m above sea level (Fig. 1, NN 44,45,47-50,52, 71,74,75,84,87,88,95-100, 103-110, 113-115, 121, 133, 140, 142, 144, 148, 156-161, 171, 176-179, 181, 185, 188, 190, 209, 212, 214, 269, 295-298, 300-302, 305, 317, 318, 320-322, 326, 327, 329, 333, 336, 337, 340, 344, 346-352, 354-356, 363-372, 374-378, 383-385, 390, 394-404, 406, 407, 409, 410, 415-418, 420-422, 425, 435, 444, 445, 449-451, 453, 455, 456, 458, 460, 461, 464-466, 477, 499-501, 503, 506, 508, 510, 515, 534, 536, 538, 549, 552). It mainly inhabits the rocky and stony bottom in the middle of streams and rivers at current speeds from 0,32 up to 1,95 m/s and water temperatures usually from 0°C up to 17°C, but we have found nymphs several times at tH_2O from 17,8°C to 23,3°C. Its resistance to changes in hydrochemical surrounding is comparatively high. We have found it with a content of water dissolved oxygen from 7,17 up to 14,0 mg/1 and oxygen saturation from 70,02 up to 150%; oxidability (by $K_2Cr_2O_7$) from 0,24 up to 9,15 mg/lO_2; BOD_5 (biological demand for oxygen) from 1,0 to 17,0 mg/l O_2; CHDO (chemical demand for oxygen) from 1,97 up to 21,89 mg/1 etc. (Table 1). The species has been found at saprobiological index (the integral state of river saprobity with the help of bioindicators from all groups of invertebrates) SR from 51,70 (ß-mesosaprobity) up to 82,24 (xenosaprobity).

The imago of this species has also been found in Rila and the Rhodopes mountains.

SAMAL (1939) raised the question about the group *Epeorus-Iron.* BRAASCH (1980a, b) studied it, using the larva of the Caucasian species in order to differentiate the two genera.

Table 1. Extreme values of some hydrochemical parameters, at which the indicated Ephemeroptera-species are collected.

Species	t°C H_2O	pH	dH°	O_2 mg/l	O_2%	BOD_5 mg/l	CHOD mg/l	Oxid. ($K_2Cr_2O_7$) mg/l	NO_2^{II} mg/l	$NO_3^{I.}$ mg/l	NH_4^+ mg/l	PO_4^{III} mg/l
Epeorus sylvicola	0-23	6.5-8.3	1,26-8,74	7,17-14,0	70,02-150	1,0-4,1	1,97-21,89	0,24-9,15	to 0,52	to 0,56	to 0,31	to 0,13
Iron yougoslavicus	7.3-20.2	7.0-7.5	2,15-3,37	7,40-9,26	64-81,47			1,04-2,60				
Electrogena affinis	13-24	8.2	6,59	10,41-12,8	102,90	3,2	15,80	4,16	to 0,10		to 0,30	
E. lateralis	6.8-28.5	7.1-8.3	2,24-21,60	3,2-16,4	36,20-106	8,2	12,74-23,96	1,6-6,4	to 0,42	to 2,72	to 0,75	to 0,04
E. macedonica	7.2-29.5	7.0-8.5	10,08-15,68	6,2-11,8	72,10-85,22	1,5	3,64	2,22-18,6			to 0,05	
E. quadrilineata	10-24	7.8-8.6	3,93	9,6-11,2	99,38-118,61	0,6	5,97-6,7	0,80	to 0,05	to 2,50		to 0,05
Heptagenia coerulans	18.2-29.2	7.5-8.3	3,52-15,68	7,76-16,4	83,68-122,85	0,17-1,12		2,56-5,3	to 0,42	to 2,72	to 1,20	
H. flava	9-27	7.5-8.4	4,29-17,17	0,81-12,96	8,37-123,92	1,1-4,08	-	0,53-25,8	to 0,70	to 2,72	to 2,90	to 0,40
Ephemerella ignita	6.8-26	7.0-8.1	3,0-17,7	1,21-13,60	12,99-150	0,17-11,0	0,80-21,89	1,52-34,30	to 3,90	to 7,60	to 2,00	to 0,18
E. maculocaudata	18-22	7.5-8.4	11,76-15,68					to 18,6				
E. major	7.8-26	7.2-9.0	2,97-13,44	7,69-12,8	80,94-119,06	1,7	3,18-11,28	0,64-6,43	to 0,09	to 7,00	to 0,13	to 0,18
E. mesoleuca	12.2-26	7.5-8.4	6,73-15,68	3,65-12,95	42,34-95,70	3,06-8,2		1,60-18,6	to 0,02	to 4,10	to 0,04	to 0,21
E. mucronata	0.5-25.5	6.5-8.8	1,40-13,50	6,3-15,47	64,2-160,31	1,0-4,3	1,97-13,93	0,70-10,72	to 0,44	to 5,60	to 1,5	to 0,10
E. notata	9.4-24	6.9-8.0	1,4-10,7	7,79-12,6	82,0-100	0,8-3,4		1,77-9,45	to 1,60	to 2,00	to 0,30	to 0,12
Ephoron virgo	10.8-26.7	7.5-8.2	7,67-13,7	5,55-9,65	68,43-122,75	0,35-5,74		2,41-9,40				
Ephemera danica	5.2-26	6.5-8.5	1,12-14,56	7,3-15,6	47,33-160,31	0,8-2,44	0,80-2,44	1,36-19,5	to 0,07	to 10,4	to 0,23	to 0,21
E. lineata	8.5-19.5	7.6	13,44	5,61-12,96	67-115,82	0,17	2,79-4,35			to 3,20		
Potamanthus luteus	6.3-27.8	7.0-8.5	1,68-46,48	0,25-14,56	2,67-139,59	0,17-25,5	5,12-28,60	0,64-18,8	to 0,24	to 11,8	to 2,90	to 0,48

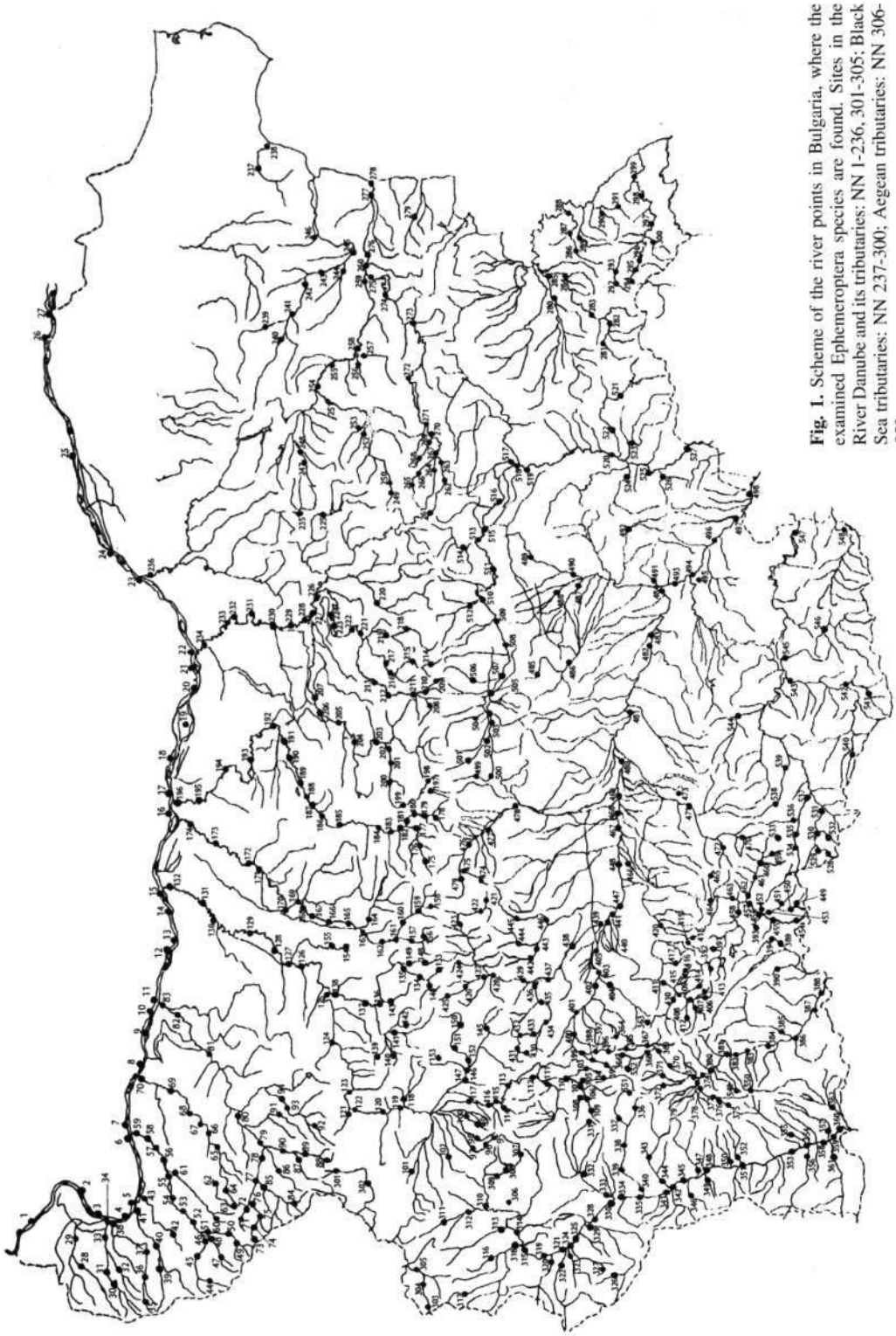

Fig. 1. Scheme of the river points in Bulgaria, where the examined Ephemeroptera species are found. Sites in the River Danube and its tributaries: NN 1-236, 301-305; Black Sea tributaries: NN 237-300; Aegean tributaries: NN 306-552.

Iron yougoslavicus (SAMAL, 1934) is a stenobiont species, which inhabits only the big stones and rocks in the middle of the purest xenosaprobic mountainous and foothill streams and rivers - epi- and metarhithral (Fig. 1, NN 49, 75,96,97,99, 105, 106, 110, 178,209,331,336,337,370, 374, 376, 377, 379, 399, 419, 451, 499), **where the** current speed is at its highest rate. We have found it from 900 up to 1500 m above sea level and water temperatures between 7,3 and 20,2°C. The extreme stenobiontity of the species has been shown as well by the low fluctuations of the oxygen content in the water (7,40 - 9,26 mg/l Ch; oxygen saturation (64,00-81,47%), oxidability (1,04 -2,60 mg/l Ch); dH (2,15-3,37 dH°) and pH (7,0-7,5) (Table 1).

Iron alpicola (EATON, 1871). We have comparatively seldom found this species in the epi- and metarhithral (Fig. 1, NN 354, 399, 419, 499). According to our observations it does not differ extremely from the previous species in ecological point of view.

Heptagenia flava (ROSTOCK, 1877) is an eurybiontic species of a comparatively high ecological plasticity and is widely spread in the epi-, meta- and hypopotamal (Fig. 1, NN 3, 14-17, 20, 24, 26, 27, 30, 34, 59, 62, 65, 67, 69, 70, 82, 83, 113, 122, 125, 129-132, 161, 169, 170, 174, 188, 190, 191, 193-196, 225, 228-234, 236, 238-246, 252, 255, 260, 275-277, 315, 321, 328, 345, 348, 351, 354, 360, 440, 447, 448, 467, 468, 480-482, 484, 488, 489, 493, 494, 496-498, 503, 509-511, 515, 516, 518, 520, 522, 525, 527). Most **often it** can be found under stones and gravel, but it also inhabits the decaying trunks, branches and water sunk higher vegetation. We have found it at water temperatures up to 27 °C, current speeds up to 1,95 m/s; dH° from 4,29 up to 17.17°C; pH from 7,5 up to 8,4. Water purity indexes also vary in wide ranges. Quite surprising is the accidental finding of larva at a high degree of pollution - oxygen content - 0,8l mg/l; oxygen saturation - 8,37%, oxidability - 25,8 mg/l Ch which corresponds to polysaprobity (Table 1). Anyway it does not mean that *H. flava* can resist polysaprobity, because as a rule it does not inhabit rivers with such a high degree of pollution.

Many times we have found male and female imagos along the whole Bulgarian sector of the River Danube.

Heptagenia coerulans (ROSTOCK, 1977) is also met in the potamal rivers, being a typical indicator of ß-mesosaprobity (Fig. 1, NN 16,120, 122, 123, 126-130, 132, 138, 167, 170, 171, 185, 188, 189, 191, 193, 195, 221, 223, 224, 228-233, 272, 273, 277, 278, 330, 334, 342, 351, 353, 360, 361, 386-388, 481, 490, 494, 497, 520). It is a thermophilic lithorheophil species which we have found from May to October at water temperature up to 29,2 °C and current speed up to 1,54 m/s. It was found last in 1982 as some of the lower reaches of the Bulgarian rivers are already polluted. *H. coerulans* hardly resists a longer period of pollution higher than ß-mesosaprobity. Thus for example the lowest values of the oxygen dissolved in the water in which the species was found were 7,76 mg/l and 80% Ch; the highest values of oxidability - 5,30 mg/l - BOD_5-1,12 mg/l Ch, etc. (Table 1).

Heptagenia longicauda (STEPHENS, 1836) as well as *H. flava* inhabits stones, gravel, floating trunks and branches mainly in the potamal of the Bulgarian rivers (Fig. 1, NN 38,195,236, 275, 278, 319, 328, 334, 335, 342, 348, 351, 354, 360, 387, 487, 490,491). It is found much more rarely and like as *H. coerulans,* avoids places of pollution higher than ß-mesosaprobity. Divers male imago and subimago have been found in the Kozhuh mountain (South-western Bulgaria) and announced by BRAASCH & RUSSEV (1986).

Heptagenia sulphurea (MÜLLER, 1776). We have found the larva, subimagos and imagos (male and female) many times alongside the Bulgarian sector of the Danube River and separately in the inner part of the country (Fig. 1, NN 9, 13,82,525).

Heptagenia fuscogrisea (RETZIUS, 1783) is very rarely met in Bulgaria (Fig. 1, N 7).

Electrogena lateralis (CURTIS, 1834) is spread mainly in the hyporhithral of the Bulgarian rivers (Fig. 1, NN 35, 46, 49-51, 97, 100, 106, 114, 115, 120, 124, 129, 132, 134, 138-140, 143,161, 176, 177, 179, 182, 184, 185, 226, 228, 230, 233, 249, 267, 269, 272, 275, 278, 292, 297, 303, 304, 306, 307, 311, 312, 315, 339, 376, 381, 403, 405, 410, 411, 413, 419, 420, 422, 424,-426, 431, 433, 440, 453, 457, 465, 467, 479, 485, 501, 503, 504, 523, 531, 544-546, 548) where it inhabits stones, decaying trunks and branches, especially if their base is muddy. We have found it in a wide range of high water temperature fluctuations (from 6,8 up to 28,5°C) and neutral up to slightly alkaline pH (from 7,1 to 8,3); in soft and hard water (dH from 2,24 up to 21,6°C); content of dissolved oxygen in polluted (Ch from 3,2 and

36,2%) to water rich in oxygen (O_2 from 16,4 mg/l and 106%); oxidability from 1,6 up to 6,4 mg/l O2. These fluctuations in the above stated data show a comparatively high ecological plasticity of this species (Table 1). Diverse male and female imagos of *E. lateralis* have also been found in Bulgaria.

Electrogena macedonica (IKONOMOV, 1954) is more widely spread in the rhithral, but it also inhabits the potamal of some of the Bulgarian Black Sea and some White Sea tributaries. Its regular foundation in most of the Bulgarian Danubian tributaries has excluded our initial concept that this species is submitted only to Mediterranean influence (Fig. 1, NN 31, 82, 177, 180, 213, 214, 218, 272, 278, 281, 283, 284, 286-290, 292, 295-297, 300, 361, 495, 503, 504, 515, 527, 530, 531, 534, 544,545). It has been found even at temperatures up to 29,5 °C. The other ecological indicators do not show at all eurybiontity and resistance to pollution higher than the stable ß-mesosaprobity (Table 1).

Electrogena quadrilineata (LANDA, 1970). It has been proved several times in the hyporhithral and epipotamal of different Bulgarian rivers (Fig. 1, NN 135, 141, 179, 218, 263, 267, 281, 289, 298, 307, 383, 544, 545).

Electrogena affinis (EATON, 1884) inhabits the potamal of the rivers (Fig. 1, NN 70, 82,110,132, 220, 279, 359, 360, 495, 515). The imago of this species has been reported from BRAASCH & RUSSEV (1986).

From the ecological point of view the last two species resemble *E. macedonica* and according to the inhabited substratum - the represented species from *Electogena* genus have similar requirements.

EPHEMERELLIDAE

Ephemerella ignita (PODA, 1761) is the most widely spread and the most eurybiontic of all the species observed. It can be seen in the whole rhithral and potamal of Bulgarian rivers and streams (Fig. 1, NN 28,29,32-34,36-39,41,43, 44,46-62, 64-82, 84-87, 89-94, 96-100, 102, 105-108, 110-111, 113-117, 119-123, 127, 129, 134, 135, 137, 138, 140, 141, 144-152, 154-157, 160-172, 175-182, 184-190, 193, 197-202, 204-211, 213-218, 221-225, 227, 235, 237, 238, 247, 249, 250, 252, 253, 256, 257, 261, 263-267, 271-273, 275-279, 281-283, 285-287, 289, 291-293, 295-298, 302, 305-310, 312-325, 328-330, 332-335, 338-342, 344-363, 367-372, 374, 377, 380, 382, 383, 386, 387, 391-393, 400-403, 405-410, 412-414, 417, 418, 420-423, 425-429, 432, 434, 435, 437-451, 453-465, 467, 468, 470-488, 492-494, 496-505, 508-521, 523-526, 528-531, 533, 534, 537, 538, 540-543, 545-547, 551). It inhabits rocks, stones, gravel, sunk and decaying trunks and branches, sunk higher vegetation as well as mixed with detritus mud. We have met it at current speeds from 0,29 to 1,19 m/s, water temperatures up to 26°C, dH from 3 to 17,7°, pH from 7 to 8,1, content of water dissolved oxygen from 1,21 to 13,60 mg/l and oxygen saturation from 12,99 to 150%, oxidability from 1,52 to 34,3 mg/l O2; BOD5 from 0,17 to 11,00 CHOD from 0,80 to 74,68 mg/l (Table 1).

We have found *E. ignita* in four of the five saprobic zones (xenosaprobic, oligosaprobic, - ß and a - mesosaprobic). That is the reason why this species is considered a bad bioindicator for the determination of the saprobic zones, but it can well be used for the calculation of the accumulation of heavy metals in the body in case of toxic pollution. The imagos of this species (male and female) have repeatedly been found in many places in Bulgaria.

Ephemerella mucronata (BENGTSSON, 1909) is widely spread in the whole of the rhithral (up to 1830 m above sea level), but it prefers hyporhithral and goes into epitomal, inhabiting stones and gravel (Fig. 1, NN 45, 47, 95, 96, 103-107, 109, 110, 112, 115, 120, 149, 156, 157, 159-161, 163, 178-180, 186, 187, 202, 204, 209, 210, 219, 277, 297, 301, 302, 318, 319, 321-323, 330, 340, 342-344, 347-349, 354, 364, 365, 367, 368, 370, 371, 373, 378-381, 384, 391, 395, 396, 398-403, 405, 409, 410, 422, 445, 449-453, 455-458, 460, 461, 465, 472, 499, 500, 504, 507, 529, 531, 533-536, 550). We have found it at current speeds of 0,29 to 0,91 m/s, water temperatures from 0,5 to 25,5°C, dH from 1,40 to 13,50 and pH from 6,5 to 8,8. In spite of the proved eurythermicity of the species, our observations show that it dominates in the river biocoenosis during the colder months of the year and in July and August it is seldom found whereas with *E. ignita* the opposite has been observed. The requirements of the species towards pollution are not so high because of which it can be seen in xeno- and oligosaprobity as well as in ß- and the improved α-mesosaprobity (S_R from 41,48 to 82,64). The oxygen content at which *E. mucronata* has been found varies from 6,3 to 15,47 mg/l O_2 and from 64,2 to 160,31% O_2;

oxidability from 0,70 to 10,72 mg/l O_2; BODs from 1,0 to 4,3 mg/l Ch; CHDO from 1,97 to 13,93 mg/l O2, etc. (Table 1). We have only found imagos of this species in the Rila and Pirin mountains.

Ephemerella notata EATON, 1887 inhabits meta- and hyporhithral, but it goes as well into epi- and metapotamal (Fig. 1, NN 40, 52, 67, 91, 106, 107, 110, 116, 132, 160, 163, 179, 294, 296, 305, 318-321, 328, 352, 357, 381, 403, 440, 441, 467, 469, 483, 499, 500, 503, 504, 510, 515, 520, 542, 547). We have met it up to 1170 m above sea level and current speed from 0,29 to 1,95 m/s; water temperature from 9,4 to 24,0°C. The requirements of this species towards pollution are comparatively high (Table 1).

Ephemerella mesoleuca (BRAUER, 1857) and *E. maculocaudata* IKONOMOV, 1961. The differentiation of the larva of both species is rather difficult. Among the three differences described by SOLDAN (1982), only the dark stripe in the middle or the bottom of the cerci is more distinctly observed. The differences in the triangular swelling at the bottom of the gills as well as those in the third segment of the labial palpus are so non-essential that they can be a considered as being a consequence of variability.

ALBA-TERCEDOR (1990) who found *E. mesoleuca* and *E. maculocaudata* on the Iberian peninsula, differentiates both species only according to the dark stripe in the middle and the bottom of the cerci. As it can be seen from Fig. 1 the distribution of larvae of both species is almost identical - in the potamal of bigger Bulgarian rivers (Fig. 1, *E. mesoleuca* - NN 132, 173, 189-191, 210, 278, 328, 348, 360, 361, 440, 467, 497, 520; *E. maculocaudata* - NN 278, 341, 354, 360, 361, 494, 496-498). From the ecological point of view we do not find any essential difference either (Table 1). For us *E. maculocaudata* IKONOMOV is a synonym of *E. mesoleuca* (BRAUER) confirming the synonymy published by STUDEMANN & TOMKA (1989). That must be proved in relation to the imago as well. Unfortunately we do not have it at our disposal.

Ephemerella major (KLAPALEK, 1905) is spread in the rhithral, but it is more closely related to the hyporhithral and epipotamal (Fig. 1, NN 45, 47, 52, 59, 77, 108, 138, 153, 155, 157, 159-162, 165, 167, 179, 180, 199, 209, 218, 256, 263, 270, 292, 293, 295, 296, 298, 305, 318, 322, 329, 340, 351, 370, 378, 386, 389, 436, 514, 515, 529-531, 534, 536, 539, 547). It inhabits the mud and vegetation covered stones found over abundant detritus. Its requirements towards the conditions of the environment are higher, therefore it is met at lower fluctuations of definite parameters (Table 1).

POLYM1TARCYIDAE

Ephoron virgo (OLIVIER, 1791) is typical for clay ground, mixed with sand, where the frequency of spreading is 12,50%, but it can also be found in the Corophium mud formed over the gravel of the Danube River and more rarely over gravel mixed with sand. It inhabits the hyporhithral and the whole potamal, but it was most widely spread along and across the Bulgarian sector of the Danube. The last time we observed it was on July 7, 1971 at the island of Kutovo (801st river km, Fig. 1, N2). For us it became extinct because of the high pollution. Beside the Danube, *E. virgo* is observed in a number of Bulgarian Danubian and Black Sea tributaries (Fig. 1, NN 1-6, 8, 10-12, 15, 17, 18, 20-23, 25, 26, 82, 113, 130-132, 191, 193, 228, 231, 275, 276, 278, 280, 299, 522). We have found it at depths from 1 to 11,5 m, water temperatures from 10,8 up to 26,7°C, current speeds from 0,27 to 0,78 m/s; pH from 7,5 to 8,2; dH from 7,67 to 13,7°; oxygen content from 5,55 to 9,65 mg/l and oxygen saturation from 68,43 to 122,75%, BOD5 from 0,35 to 5,74 mg/l O_2 and oxidability from 2,41 to 9,40 mg/l O_2 (Table 1). More details about the ecology and especially biology of the species were given by RUSSEV (1968).

EPHEMERIDAE

Ephemera danica MUELLER, 1764 is typical for the psammoreophilous biocoenosis in the upper and middle current of Bulgarian rivers (rhithral, epi- and in some cases metapotamal (Fig. 1, NN 28, 31, 38, 42-45, 47, 49, 50, 52, 60, 61, 63, 71, 73-75, 82, 85,89,92,96,98, 108, 110, 112, 113, 115, 116, 118, 121, 144, 149, 154, 156-163, 176, 178, 179, 182, 185, 190, 191, 198, 199, 202, 205, 209, 210, 212, 218, 228, 248, 262, 263, 268, 289, 292, 293, 295, 296, 300, 302, 305, 308, 311, 313, 317-320, 322, 323, 325, 330, 334, 343-345, 347, 350-352, 356, 363, 367, 368, 370-372, 383, 389-391, 393, 400, 401, 403 404, 406-410, 413, 418, 420, 422, 423, 427, 430-433, 436, 445, 448, 449, 451, 453, 455-461, 463-465, 472, 473, 486, 499, 500, 503, 504, 513, 514, 526-535, 538). It prefers the bottom sediments, mixed with

mud. In such unpolluted places as for example the River Arda (Fig. 1, N 528) we have observed up to 11 larvae per 60 sm^2 (about 54 larva per sq.m). We have met it up to 1010 m above sea level and current speeds from 0,32 up to 1,67 m/s, water temperatures from 5,2°C to 26°C. It belongs to the typical eurybiontic species, inhabiting most of all the oligosaprobic and ß-mesosaprobic zones but it can also be met in xenosaprobic and much rarely in a-mesosaprobic zones. It has been found at saprobiological index S_R from 41,48 to 82,89. Its eurybiontity has been proved by the data concerning the studied hydrochemical parameters - oxygen content from 7,3 to 15,6 mg/1 and oxygen saturation from 47,33 to 160,13%; oxidability from 0,80 to 19,5 mg/1 O_2; CHOD from 0,80 to 16,12 mg/l; dH from 1,12 to 14,56°, etc. Imagos of *E. danica* have repeatedly been found throughout the country.

Ephemera vulgata LINNE, 1758 in contrast to the previous species is rarer and prefers the muddy bottom mixed with sand. We have mainly found the larvae and imagos (male and female) in the hyporhithral and epipotamal, but it goes in the metarhithral of the rivers (Fig. 1, N N 28, 29, 31, 42, 101, 199, 273, 282, 522).

Ephemera lineata EATON, 1870 can be met mainly in the epipotomal, but it often inhabits the hyporhithral of the Bulgarian rivers as well. The scanty hydrochemical data which we have at our disposal show that *E. lineata* prefers purer water. We have found it only in oligosaprobic and ß-mesosaprobic conditions (Table 1). We have comparatively rarely found the larvae and imagos of this species (Fig. 1, NN 34, 38, 80, 157, 182, 185, 209, 270, 274, 293, 295, 296, 298, 423,467,515).

POTAMANTHIDAE

Potamanthus luteus (LINNE, 1767) prefers the epipotamal but it can also be met in the meta- and hypopotamal where there are bigger stones over a muddy base (Fig. 1, NN 6,17-20,22,26,27, 34, 41, 47-50, 53-59, 77-80, 83, 90, 91, 93, 115, 116, 125-129, 136-138, 141, 143, 161-166, 168-174, 177, 183, 185, 186, 188-190, 192, 196, 202-204, 217, 221, 223, 224, 226-231, 233, 251, 252, 254, 255, 258, 259, 271-275, 278, 292, 296, 308, 321, 325, 328, 330, 334, 335, 340, 342, 345, 346, 348, 351, 353, 354, 360, 467, 480-484, 486, 488, 493, 494, 496-500, 503, 504, 509-511, 515-518, 520, 525, 527). We have found it at current speeds between 0,22 and 1,25 m/s, water temperatures between 6,3 and 28,7 °C. Its ecological plasticity is proved by the values of hydrochemical parameters oxygen content from 0,25 to 14,56 mg/1 and oxygen saturation from 2,67 to 139,59%, oxidability from 0,64 to 18,8 mg/1 Ch; BOD_5 from 0,17 to 25,5 mg/l Ch; CHOD from 5,12 to 28,6 mg/l O_2. These data and values of some ions (Table 1) show the high resistance of this species even towards an essential degree of pollution (in some cases even polysaprobity).

In contrast to the abundant larva material which we have at our disposal, we have comparatively rarely found imagos of *P. luteus.*

Table 2. Distribution of the species in different river areas.

Species	rhithral			potamal		
	epi-	meta-	hypo-	epi -	meta -	hypo-
Iron alpicola						
I. yougoslavicus						
Elect rag en a quadrilineata						
Ephemera vulgata						
Electrogena lateralis						
Ephemera lineata						
Ephoron virgo						
Ephemerella maculocaudata						
E. mesoleuca						
Heptagenia sulphurea						
H. coerulans						
H. longicauda						
Electrogena aflinis						
Potamanthus luteus						
Heptagenia flava						
Electrogena macedonica						
Ephemerella notata						
Epeorus syivicola						
Ephemerella mucronata						
E. major						
Ephemera danica						
Ephemerella ignita						

CONCLUSION

From the 23 species we have examined the most often met even in the three zones of the rhithral and those of the potamal, and at the same time the most resistant to different changes in the environment is *Ephemerella ignita.*

Eurybiontic according to their ecological requirements are also *Heptagenia flava, Potamanthus luteus, Epeorus syivicola, Epheme-*

rella mucronata, E. major, Ephemera danica. Whereas the first two species prefer the potamal and resist considerably high pollution which in some instances resembles polysaprobity, the remaining ones inhabit the whole of the rhithral and go into the epipotamal and are slightly more sensitive towards pollution.

Electrogena lateralis is also eurybiontic according to separate ecological factors, but it is found mainly in the hyporhithral.

The most stenobiontic ones are *Iron aplicola* and *I. yougoslavicus,* attached to epi- and metarhithral streches, followed by *Electrogena quadrilineata* and *Ephemera lineata,* inhabiting the hyporhithral and epipotamal *E. quadrilineata* also the metarhithral. *Ephemerella notata* - and *Electrogena macedonica* - the hyporhithral, epi- and metapotamal.

The other nine species are also sensitive to the changes in the environment and especially towards pollution, therefore they are either absent or are seldom met in the structure of the river biocoenosis. Besides, they more or less prefer the potamal, which to a large extent is already polluted. These species are: *Ephoron virgo* (probably died out or missing), *Ephemerella maculocaudata, E. mesoleuca, Heptagenia fuscogrisea, H. sulphurea, H. coerulans* (threatened by extinction), *H. longicauda* and *Electrogena qffinis* (threatened), *Ephemera vulgata* (potentially threatened) (Table 2).

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