

DISTRIBUTION AND ECOLOGY OF THE BAETIDAE IN CATALONIAN RIVERS
(NE - SPAIN)

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Abstract. Samples were taken along the Catalonian rivers since 1978. The basins of the Ter, Serge, Llobregat, Besos, Tordera and Foix rivers were sampled. 225 sampling stations were studied. The total number of Ephemeroptera collected in the Catalonian rivers is the fifty-seven species. The Baetidae with twenty-five species are dominating.

Physico-chemical factors, seasonality, species-association

The Ephemeroptera species of the Catalonia have been studied only partially. The study begun with the investigations of Bertrand and Verrier (1949, 1951a, 1951b, 1954) in the Pyrenees area. This study has not been continued afterwards. Other Iberian areas have been sampled by Müller-Liebenau (1974). And the ecological and biological study of the Ephemeroptera species in central and south Spanish basins were begun for Alba Tecedor (1976) and G. del Tanago (1977).

In this work, the results of prospection in six basins of Catalonia are presented. The data of one basin (Ter) are only preliminary because its study is going on nowadays. Biological, chemical and physical parameters were measured at 225 sampling sites in Catalonian basins (Fig. 1). Six basins were studied: Llobregat, Ter, Besós, Tordera, Foix and Segre rivers (Andorra springs included). Ter and Serge rivers rise in the Pyrenees. Llobregat in the Pre-Pyrenees and Besos, Tordera and Foix in the Pre-Litoral mountains. It must be mentioned that the weather of Tordera basin produces similar conditions to those of pyrenean and pre-pyrenean beginning catchment areas of rivers Segre, Llobregat and Ter.

The hydrological data are presented in Table 1. The physico-chemical data of the different basins are published by Prat et al. (1979, 1982), Llobregat, Besos and Andorra springs, the

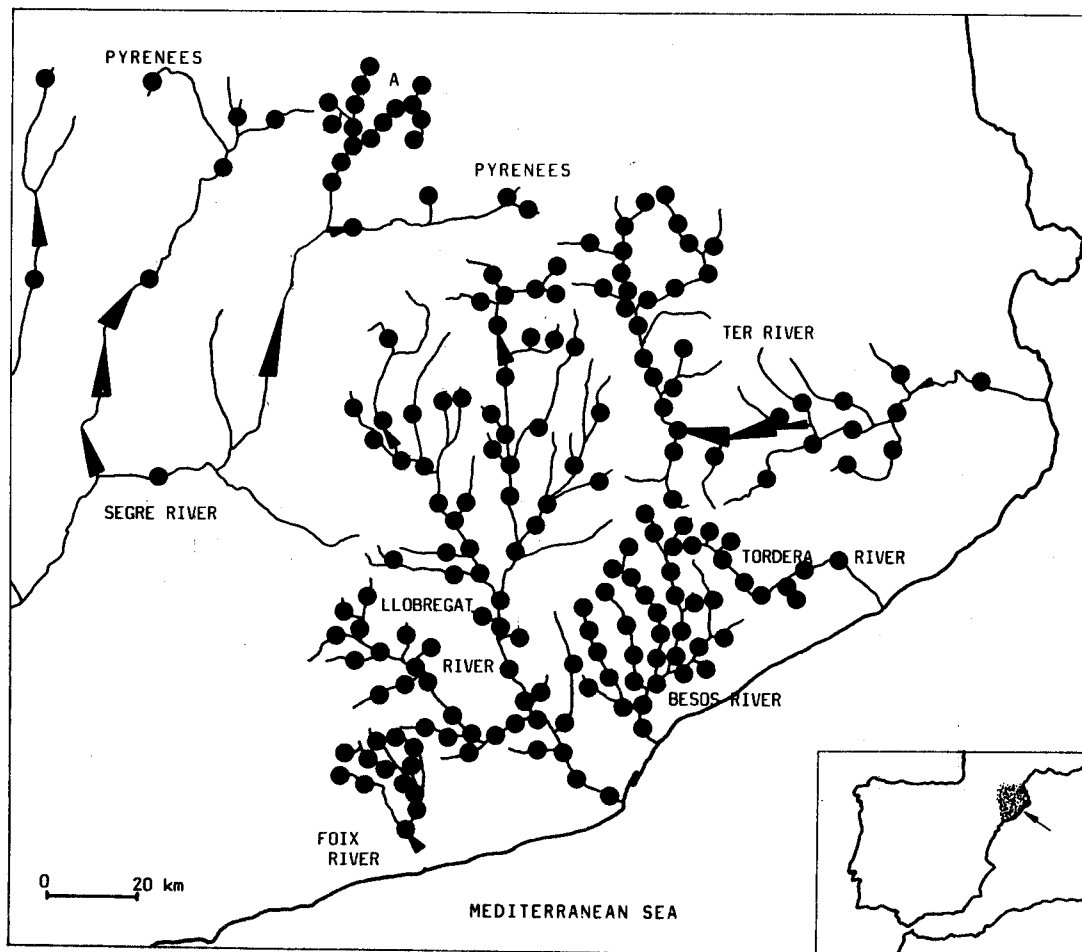


Fig. 1: Distribution of sampling stations in Catalanian river basins. All the sampling stations /50/ in Andorra /A/ are not placed in the map.

other data are in press.

METHODS

Samples were taken every three months for a one-year period for Llobregat, and Besos rivers (1979 - 1980). Samples for Ter river were taken about every 30 days for a one-year period (October 1982 - October 1983). Andorra springs were sampled at spring and summer (1978). The Foix basin were sampled at spring, summer and winter (1982). The Tordera basin were studied, in general, only once, but two sampling stations were studied in different periods since 1978.

In the Llobregat, Besos and Segre rivers the bottom macro-invertebrates were collected only in the lotic areas. In the

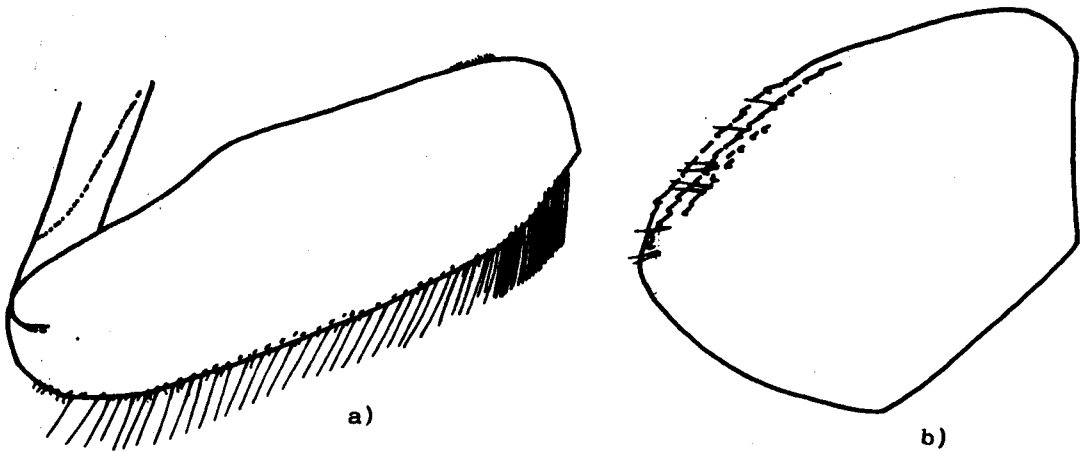


Fig. 2: Baetis vardarensis Ik. /nymphs/. a - row of bristles of the hind femur. b - paraproct.

other basins the macroinvertebrates were sampled in the running and slow water areas. In the Ter river the interstitial fauna was also collected.

MATERIAL IDENTIFICATION

The different species of the Baetidae were identified using mainly the Sowa's (1975, 1980) and Müller-Liebenau's (1970, 1971, 1974) works and studies. The identification of Baetis vardarensis nymphs was really very difficult, because the two more significant characters (paraprocts and bristles distribution along the hind femur) had different descriptions in the Müller-Liebenau's works (1970, 1974). Our material presents the same paraprocts as that described by Müller-Liebenau (1974), but with only two rows of the bristles in the hind femur (Fig. 2).

RESULTS AND DISCUSSION

The stations where we have found the Baetidae are distributed in the total area basins; only in more polluted streams (industrial pollution) we didn't captured Baetidae species.

The altitudinal distribution in the basins is different for each species (Table 2). Baetis alpinus, B. melanonyx, B. gemellus and B. niger have been found at altitudes up to 650 m. Baetis meridionalis, B. fuscatus, B. scambus, B. atrebatinus, Cloeon dipterum, C. inscriptum, C. cognatum, C. praetextum, C. schoenemundi, Centroptilum pennulatum and Procloeon sp. were found at altitudes below 650 m. The other species had a broader altitudinal distribution.

According to our captures all species of the Baetidae have been found as components of bottom fauna on calcareous and silicean areas, the conductivity data are significant in this sense (Table 3). The higher values of this parameter

Table 1. Geographical and hydrological data of the different Catalonian basins.

River	Length (Km)	Size of catch- ment (Km ²)	Highest point of catch. (m)	Annual dis- charge (Hm ³)
Segre	222	22579	2950	3105
Llobregat	156	4940	2531	630
Ter	208	3010	2910	640
Besos	53	1025	1350	78
Tordera	50	894	1712	127
Foix	49	312	700	9

were associated with salt input in the Llobregat river. In this area, we have captured different populations of Baetis lutheri and B. nigrescens, the last species is the most tolerant one.

In general, the different species of Baetis, that we captured, were habitual inhabitants of fast running waters. However, two species have been found in the slow waters (Baetis fuscatus and B. muticus intermedius). The first species is usually associated with Potamogeton and Myriophyllum. The different species of Cloeon, Centroptilum and Procloeon have been found in the slow waters. And the first instars of Cloeon dipterum, Cloeon praetextum and Cloeon cognatum have been found as components of interstitial fauna.

Baetis muticus intermedius, Cloeon cognatum, Cloeon inscriptum, Cloeon praetextum and Centroptilum luteolum are habitual inhabitants of streams that usually dry in summer. In these streams Baetis muticus intermedius has only one annual generation, with the period of emergence from March - April. Baetis rhodani have also been captured in these streams. The period of emergence for this last species is the same that for B. muticus intermedius.

Some areas of streams have running waters all the year round in the Mediterranean basins, while other areas are dry in summer. In the first areas we have been finding in summer high concentrations of the different species, that have a more extensive distribution in winter and spring (B. rhodani, B. nigrescens, ...).

The species we have taken are more or less tolerant to organic pollution (Table 3). Baetis meridionalis, B. fuscatus, Cloeon dipterum, C. inscriptum, C. cognatum and C. praetextum

Table 2. Altitudinal distribution of the Baetidae species in the Catalanian basins.

SPECIES	Serge	Llobregat	Ter	Besos	Tordera	Foix
<i>Baetis alpinus</i> Pict.	850-2080	745-1360	650-1400	1000	680-700	
<i>B. atrebatinus</i> Etn.			280			
<i>B. fuscatus</i> /L./	900-1780	320	100-510			180
<i>B. gemellus</i> Etn.	900-2120					
<i>B. lutheri</i> M. L.		250-440		250-260	350-680	640
<i>B. maurus</i> Kimm.		350-1000				
<i>B. melanonyx</i> /Pict./	1072-1950					
<i>B. meridionalis</i> Ik.	570	80-480	100-210	95-660		300-560
<i>B. muticus</i> L.	1200-1500	535-740	1300	1000		
<i>B. muticus intermedius</i> Alba		326-440		420	100-240	320-560
<i>B. niger</i> L.	1190-1400					
<i>B. nigrescens</i> Nav.	860-2080	220-540		530		180-400
<i>B. pavidus</i> Grandi	1260					
<i>B. rhodani</i> Pict.	860-1547	180-1000	100-1400	135-1000	100-700	220-560
<i>B. scambus</i> Etn.			420-500		100	
<i>B. vardarensis</i> Ik.	700-1640	90-1360				
<i>Cloeon cognatum</i> Stph.		80				
<i>C. dipterum</i> /L./			140-510			
<i>C. inscriptum</i> Bengts.		90-595	80-350	135-660		180-320
<i>C. praetextum</i> Bengts.			140	95		
<i>C. schoenemundi</i> Bengts.			350			
<i>C. simile</i> Etn.			280			
<i>Centroptilum luteolum</i> /MULL./		440-800			100	340
<i>C. pennulatum</i> Etn.		445				
<i>Procloeon</i> sp.			280			

Table 3. Maximum, minimum and arithmetic mean of some parameters for every Baetidae species.

SPECIES	Oxygen (ml/l)	Phosphorus (ug-atm/l)	Nitrite (ug-atm/l)	Conductivity (uS)
<u>Baetis alpinus</u> Pict.	3,02-13,7 6,83	0,00-13,3 2,0	0,00-14,7 2,25	14,9-1190
<u>B. atrebatinus</u> Etn.	8,80 ----	5,7 ----	15,40 -----	370 ---
<u>B. fuscatus</u> (L.)	8,13-11,7 8,10	0,00-25,0 20,0	2,17- 7,23 3,00	295,0- 750
<u>B. gemellus</u> Etn.	5,20- 6,9 5,90	0,22- 8,3 0,5	0,02- 2,02 1,40	19,0- 476
<u>B. lutheri</u> M.-L.	4,60-10,8 6,10	0,00-14,6 5,7	0,00-25,80 3,37	21,1-4980
<u>B. maurus</u> Kimm.	4,00-14,3 7,19	0,01- 6,5 1,05	0,00- 3,38 0,71	285,0-1124
<u>B. melanonyx</u> (Pict.)	4,60- 7,0 6,20	0,00- 2,9 2,5	0,06- 0,30 0,28	21,9-1124
<u>B. meridionalis</u> Ik.	0,00-12,5 6,70	0,00-33,0 11,07	0,00-50,20 9,65	295,0-3201
<u>B. muticus</u> L.	4,23- 7,3 6,70	0,14- 4,1 0,7	0,00- 1,04 0,98	40,0- 560
<u>B. muticus intermedius</u> Alba	6,41-12,1 6,50	0,00- 8,10 0,4	0,00- 3,38 1,09	297,0-1320
<u>B. niger</u> L.	4,54-5,08 5,40	4,06-13,30 2,8	2,05- 3,50 2,7	250,0- 284
<u>B. nigrescens</u> Nav.	3,40-12,5 5,80	0,00-12,50 5,09	0,00- 7,23 1,05	36,4-8820
<u>B. pavidus</u> Grandi	5,80 ----	0,08 ----	0,10 ----	91,8
<u>B. rhodani</u> Pict.	2,90-14,3 6,54	0,00-45,00 4,15	0,00-43,97 4,30	31,3-3901
<u>B. scambus</u> Etn.	9,80-11,6 9,80	0,00- 2,00 3,0	0,60- 0,86 0,70	60,0- 198
<u>B. vardarensis</u> Ik.	0,36- 9,0 6,37	0,00-45,00 6,79	0,00-84,00 4,68	49,6-3300
<u>Cloeon cognatum</u> Stph.	0,00 ----	17,00 -----	18,90 -----	----
<u>C. dipterum</u> (L.)	6,94-12,5 7,50	0,00-24,9 10,0	0,58-43,20 11,60	60,0-1000
<u>C. inscriptum</u> Bengts.	1,60-10,56 5,50	0,00-120,0 21,3	0,00-69,78 10,60	275,0-5572
<u>C. praetextum</u> Bengts.	6,63- 6,94 6,78	16,9-17,1 17,0	1,74- 2,02 1,88	420,0- 992
<u>C. schoenemundi</u> Bengts.	6,90 ----	4,3 ----	0,09 ----	275
<u>C. simile</u> Etn.	8,80 ----	5,7 ---	15,4 ----	370
<u>Centroptilum luteolum</u> (Müll.)	5,30-11,60 6,05	0,25- 5,0 2,01	0,36- 2,58 1,16	424,0-1500
<u>C. pennulatum</u> Etn.	6,02 ----	1,7 ----	1,40 ----	----
<u>Procloeon</u> sp.	8,80 ----	5,7 ----	15,40 ----	370

are the more tolerant species. Baetis meridionalis and Cloeon cognatum have been found in anoxic waters.

In the Catalanian rivers the altitudinal and longitudinal distribution of the different species and different degrees of their tolerance to organic pollution were considered. So that we can establish six faunistic associations:

(I) The association of species with altitudinal distribution up to 800 m (Baetis alpinus, B. melanonyx and B. muticus). This association is present in pyrenean, pre-pyrenean streams and in the springs of Montseny mountains (sources of the Besos and Tordera rivers).

(II) The second association includes the species of the little basins (Baetis rhodani, B. gemellus and B. maurus).

(III) Baetis rhodani and B. vardarensis are the two species distributed in middle stretch of the Catalanian rivers, but only in areas with less pollution.

(IV) In the high pollution areas Baetis meridionalis and B. fuscatus have been found (Llobregat, Ter and Serge rivers).

(V) A special association is established in the rivers with salt input (B. lutheri and B. nigrescens). The presence of B. nigrescens in salt running waters are also constated in the Segura basin by Vidal-Abarca (pers. comm.).

(VI) In the temporary rivers B. rhodani, B. muticus intermedius and Cloeon inscriptum were usually the association present in, however other species that live in pools have been also found in these last streams.

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