

Checklist and historical evolution of the knowledge of Ephemeroptera in the Iberian Peninsula, Balearic and Canary Islands

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Abstract

After a bibliographic revision, a checklist of Ephemeroptera species recorded in the Iberian Peninsula (Portugal and Spain), the Balearic and Canary Islands is presented. A total of 147 species have been recorded in the Iberian Peninsula, 9 species in the Balearic Islands and 7 species in the Canary Islands. The trend in the number of records along the years, the number of species in the different provinces, and topics studied are analysed. Concluding that the knowledge of mayflies in the analyzed areas is still far from being completed.

Keywords: Ephemeroptera, Spain, Portugal, Balearic, Canary Islands.

Research Update on Ephemeroptera & Plecoptera
2003, E. Gaino (Ed.), University of Perugia, Perugia, Italy.

Introduction

There were necessary to update the knowledge of mayflies in the Iberian Peninsula and Balearic Islands, because no one existed since the revision by Alba-Tercedor (1981). Thus, and at the same time that we prepared a complete list of records of mayflies including not only the previous area, but also the Canary Islands (Alba-Tercedor and Jáimez-Cuéllar, *in press*), we considered interesting to present in advance an updated checklist, including the geographical cover of records and analyzing the subjects of publications and the historical trends.

Methods

Bibliographic records have been compiled from an exhaustive bibliographic research. Only those Ephemeroptera citations identified at species level were considered, and only in the case of monospecific genera citations were taken into account.

Results and Discussion

A total of 147 species have been recorded in the Iberian Peninsula, 9 species in the Balearic Islands and 7 species in the Canary Islands (Tables 1, 2). The fauna in the Islands is very poor, with only nine species in the Balearic and seven species in the Canary islands, respectively. Represented mainly by Baetidae and one single species of Caenidae. Within the Iberian Peninsula Baetidae (30%), Heptageniidae (27%) and Leptophlebiidae (14%) are the families with higher number of species (Table 2).

Since the compilation by Alba-Tercedor (1981), where 101 species were known in Iberian Peninsula and Balearic Islands (only 90 of these are now considered as valid species), nowadays, 20 years later, the number of valid known species increased a 63%.

The scientific papers recording Iberian Ephemeroptera species began in the middle of the XIXth century (Rambur, 1842). In the XXth century, scientific production in this field notably increased in the first three decades (Fig. 1), reaching more than 30 papers per decade principally due to the vast amount of the work produced by the Jesuit Longinos Navás, who between 1899 and 1933 published 55 articles with Ephemeropteran records. His review of the Neuropteroid insects (Navás, 1908) gave the first key for the identification of Iberian Ephemeroptera. Moreover his contributions to the

Table 1 - Checklist of mayflies species of the Iberian Peninsula (I.P.), the Balearic (B) and the Canary (C) Islands.

	I.P.	B.	C.
Siphonuridae ULMER 1920			
<i>Siphonurus aestivalis</i> (EATON, 1903)	+		
<i>Siphonurus alternatus</i> (SAY, 1824)	+		
<i>Siphonurus flavidus</i> (PICTET, 1865)	+		
<i>Siphonurus hispanicus</i> DEMOULIN, 1958	+		
<i>Siphonurus irenae</i> ALBA-TERCEDOR, 1990	+		
<i>Siphonurus lacustris</i> (EATON, 1870)	+		
<i>Siphonurus lusoensis</i> PUTHZ, 1977	+		
<i>Siphonurus montanus</i> STUDEMANN, 1992	+		
Baetidae LEACH, 1815			
<i>Acentrella almohades</i> ALBA-TERCEDOR & EL ALAMI, 1999	+		
<i>Acentrella sinaica</i> BOGOESCU, 1931	+		
<i>Alainites muticus</i> (LINNAEUS, 1758)	+	+	
<i>Alainites navasi</i> MÜLLER-LIEBENAU, 1974	+		
<i>Baetis alpinus</i> PICTET, 1843	+		
<i>Baetis beskidensis</i> SOWA, 1972	+		
<i>Baetis buceratus</i> EATON, 1870	+		
<i>Baetis canariensis</i> MÜLLER-LIEBENAU, 1971			+
<i>Baetis catharus</i> THOMAS, 1986	+		
<i>Baetis estrelensis</i> MÜLLER-LIEBENAU, 1974	+		
<i>Baetis fuscatus</i> (LINNAEUS, 1761)	+		
<i>Baetis gadeai</i> THOMAS, 1999	+		
<i>Baetis longinervis</i> NAVÁS, 1917	+		
<i>Baetis lutheri</i> MÜLLER-LIEBENAU, 1967	+		
<i>Baetis maurus</i> KIMMINS, 1938	+		
<i>Baetis melanonyx</i> (PICTET, 1843)	+		
<i>Baetis meridionalis</i> IKONOMOV, 1954	+		
<i>Baetis nexus</i> NAVÁS, 1918	+		
<i>Baetis nigrescens</i> NAVÁS, 1931	+		+
<i>Baetis pavidus</i> GRANDI, 1949	+		
<i>Baetis pseudorhodani</i> MÜLLER-LIEBENAU, 1974			+
<i>Baetis punicus</i> THOMAS, BOUMAIZA & SOLDÁN, 1983	+		
<i>Baetis rhodani</i> (PICTET, 1843)	+	+	+
<i>Baetis scambus</i> EATON, 1870	+		
<i>Baetis vardarensis</i> IKONOMOV, 1962	+		
<i>Baetis vernus</i> CURTIS, 1834	+		
<i>Baetopus tenellus</i> (ALBARDA, 1878)	+		
<i>Centroptilum lituratum</i> (PICTET, 1843-45)	+		
<i>Centroptilum luteolum</i> (MÜLLER, 1976)	+		
<i>Centroptilum obtusum</i> NAVÁS, 1915	+		
<i>Centroptilum sp. A</i> MÜLLER-LIEBENAU, 1974	+		
<i>Cloeon cognatum</i> STEPHENS, 1835	+	+	+
<i>Cloeon dipterum</i> (LINNAEUS, 1761)	+	+	+
<i>Cloeon inscriptum</i> BENGTTSSON, 1914	+	+	
<i>Cloeon praetextum</i> BENGTTSSON, 1914	+	+	
<i>Cloeon schoenemundi</i> BENGTTSSON, 1936	+	+	
<i>Cloeon simile</i> EATON, 1870	+	+	
<i>Nigrobaetis digitatus</i> (BENGTTSSON, 1912)	+		
<i>Nigrobaetis niger</i> (LINNAEUS, 1761)	+		
<i>Procloeon bifidum</i> (BENGTTSSON, 1912)	+		
<i>Procloeon concinnum</i> (EATON, 1883-88)	+		
<i>Procloeon pulchrum</i> (EATON, 1885)	+		
<i>Pseudocentroptilum nanum</i> (BOGOESCU, 1951)	+		
<i>Pseudocentroptilum pennulatum</i> (EATON, 1870)	+		
<i>Pseudocentroptilum sp. B</i> (MÜLLER-LIEBENAU, 1974)	+		
<i>Pseudocloeon atrebatinus</i> (EATON, 1870)	+		
<i>Pseudocloeon neglectus</i> (NAVÁS, 1913)	+		
Oligoneuriidae ULMER, 1914			
<i>Oligoneuriella duerensis</i> GONZÁLEZ DEL TÁNAGO & GARCÍA DE JALÓN, 1983	+		
<i>Oligoneuriella marichuae</i> ALBA-TERCEDOR, 1983	+		
<i>Oligoneuriella rhenana</i> (IMHOFF, 1852)	+		
<i>Oligoneuropsis skhounate</i> DAKKI & GIUDICELLI, 1980	+		
Isonychiidae BURK, 1953			
<i>Isonychia ignota</i> (WALKER, 1853)	+		
Heptageniidae NEEDHAM, 1901			
<i>Epeorus alpicola</i> EATON, 1871	+		
<i>Epeorus sylvicola</i> (PICTET, 1865)	+		
<i>Epeorus torrentium</i> EATON, 1881	+		

	I.P.	B.	C.
<i>Ecdyonurus angelieri</i> THOMAS, 1968	+		
<i>Ecdyonurus aurantiacus</i> (BURMEISTER, 1839)	+		
<i>Ecdyonurus codinai</i> NAVÁS, 1924	+		
<i>Ecdyonurus dispar</i> (CURTIS, 1834)	+		
<i>Ecdyonurus diversus</i> NAVÁS, 1923	+		
<i>Ecdyonurus excelsus</i> NAVÁS, 1927	+		
<i>Ecdyonurus fluminum</i> var. <i>speciosa</i> NAVÁS, 1915	+		
<i>Ecdyonurus forcipula</i> (PICTET, 184345)	+		
<i>Ecdyonurus helveticus</i> (EATON, 1883-88)	+		
<i>Ecdyonurus insignis</i> (EATON, 1870)	+		
<i>Ecdyonurus macani</i> THOMAS & SOWA, 1970	+		
<i>Ecdyonurus torrentis</i> KIMMINS, 1942	+		
<i>Ecdyonurus venosus</i> (FABRICIUS, 1775)	+		
<i>Electrogena lateralis</i> (CURTIS, 1834)	+		
<i>Heptagenia coeruleans</i> ROSTOCK, 1877	+		
<i>Heptagenia longicauda</i> (STEPHENS, 1835)	+		
<i>Heptagenia sulphurea</i> (MÜLLER, 1776)	+		
<i>Rhithrogena adrianae</i> BELFIORE, 1983	+		
<i>Rhithrogena alpestris</i> EATON, 1983	+		
<i>Rhithrogena castellana</i> NAVÁS, 1927	+		
<i>Rhithrogena catalaunica</i> NAVÁS, 1916	+		
<i>Rhithrogena cincta</i> NAVÁS, 1921	+		
<i>Rhithrogena daterrai</i> SOWA, 1984	+		
<i>Rhithrogena diaphana</i> NAVÁS, 1917	+		
<i>Rhithrogena dorieri</i> SOWA, 1971	+		
<i>Rhithrogena ferruginea</i> NAVÁS, 1905	+		
<i>Rhithrogena germanica</i> EATON, 1885	+		
<i>Rhithrogena goeldini</i> SARTORI & SOWA, 1988	+		
<i>Rhithrogena gorrizi</i> NAVÁS, 1913	+		
<i>Rhithrogena iridina</i> (KOLENATI, 1839)	+		
<i>Rhithrogena kimminsi</i> THOMAS, 1970	+		
<i>Rhithrogena loyolaea</i> NAVÁS, 1922	+		
<i>Rhithrogena marcosi</i> ALBA-TERCEDOR & SOWA, 1987	+		
<i>Rhithrogena monserrati</i> ALBA-TERCEDOR & SOWA, 1986	+		
<i>Rhithrogena oscensis</i> NAVÁS, 1927	+		
<i>Rhithrogena semicolorata</i> (CURTIS, 1834)	+		
<i>Rhithrogena soteria</i> NAVÁS, 1917	+		
<i>Rhithrogena thomasi</i> ALBA-TERCEDOR & SOWA, 1986	+		
EphemereIIDae KLAPÁLEK, 1909			
<i>Drunella paradinasi</i> GÓNZÁLEZ DEL TÁNAGO & GARCÍA DE JALÓN, 1983	+		
<i>Eurylophella iberica</i> KEFFERMÜLLER & TERRA, 1978	+		
<i>Serratella albai</i> GONZÁLEZ DEL TÁNAGO & GARCÍA DE JALÓN, 1983	+		
<i>Serratella hispanica</i> (EATON, 1887)	+		
<i>Serratella ignita</i> (PODA, 1761)	+		
<i>Serratella maculocaudata</i> (IKONOMOV, 1961)	+		
<i>Serratella mesoleuca</i> (BRAUER, 1857)	+		
<i>Serratella spinosa</i> (BENGTSSON, 1909)	+		
<i>Serratella spinosa nevadensis</i> (ALBA-TERCEDOR, 1981)	+		
<i>Torleya cf belgica</i> ALBA-TERCEDOR & SÁNCHEZ-ORTEGA, 1982 ¹	+		
<i>Torleya major</i> (KAPLÁLEK, 1905)	+		
Caenidae NEWMAN, 1853			
<i>Brachycercus harrisella</i> CURTIS, 1834	+		
<i>Brachycercus kabyliensis</i> SOLDÁN, 1986	+		
<i>Caenis beskidensis</i> SOWA, 1973	+		
<i>Caenis horaria</i> (LINNAEUS, 1758)	+		
<i>Caenis luctuosa</i> (BURMEISTER, 1839)	+	+	+
<i>Caenis macrura</i> STEPHENS, 1835	+		
<i>Caenis nachoi</i> ALBA-TERCEDOR & ZAMORA-MUÑOZ, 1993	+		
<i>Caenis pusilla</i> NAVÁS, 1913	+		
<i>Caenis pseudorivulorum</i> KEFFERMÜLLER, 1960	+		
<i>Caenis rivulorum</i> EATON, 1884	+		
Prosopistomatidae LAMEÈRE, 1917			
<i>Prosopistoma pennigerum</i> (MÜLLER, 1785)	+		
Leptophlebiidae BANKS, 1900			
<i>Calliarctus humilis</i> EATON, 1881	+		
<i>Choroterpes picteti</i> (EATON, 1871)	+		
<i>Choroterpes prati</i> GAINO & PUIG, 1996	+		

¹ This corresponds to a new species (Alba-Tercedor and Derka, *in press*)

	I.P.	B.	C.
<i>Choroerpes salamannai</i> GAINO & PUIG, 1996	+		
<i>Habroleptoides annae</i> SARTORI, 1986	+		
<i>Habroleptoides berthelemyi</i> THOMAS, 1968	+		
<i>Habroleptoides confusa</i> SARTORI & THOMAS, 1986	+		
<i>Habroleptoides modesta</i> (HAGEN, 1864)	+		
<i>Habroleptoides nervulosa</i> (EATON, 1883-88)	+		
<i>Habroleptoides thomasi</i> SARTORI, 1986	+		
<i>Habroleptoides umbratilis</i> (EATON, 1884)	+		
<i>Habrophlebia antoninoi</i> ALBA-TERCEDOR, 2000	+		
<i>Habrophlebia eldae</i> JACOB & SARTORI, 1984	+		
<i>Habrophlebia fusca</i> (CURTIS, 1834)	+		
<i>Habrophlebia lauta</i> EATON, 1884	+		
<i>Leptophlebia marginata</i> LINNAEUS, 1767	+		
<i>Leptophlebia vespertina</i> (LINNAEUS, 1746)	+		
<i>Paraleptophlebia cincta</i> (RETZIUS, 1783)	+		
<i>Paraleptophlebia submarginata</i> (STEPHENS, 1835)	+		
<i>Thraululus bellus</i> EATON, 1881	+		
Polymitarciidae BANKS, 1900			
<i>Ephoron virgo</i> (OLIVIER, 1791)	+		
Ephemeridae LATREILLE, 1810			
<i>Ephemera danica</i> MÜLLER, 1764	+		
<i>Ephemera glaucops</i> PICTET, 1843	+		
<i>Ephemera lineata</i> EATON, 1870	+		
<i>Ephemera vulgata</i> LINNAEUS, 1758	+		
Potamanthidae ALBARDA, 1888			
<i>Potamanthus luteus</i> (LINNAEUS, 1767)	+		

knowledge of the Canary Islands fauna (Navás, 1932) and the Balearic Islands fauna (Figs. 4-5), providing the first records (Navás, 1914) are specially outstanding.

Table 2 - Number and percentage of species of each family recorded in each zone.

	Iberian Peninsula	Balearic Islands	Canary Islands
Siphonuridae	8 (3%)	-	-
Baetidae	45 (39%)	8 (89%)	6 (86%)
Oligoneuriidae	4 (3%)	-	-
Isonychiidae	1 (1%)	-	-
Heptageniidae	41 (27%)	-	-
Ephemerellidae	11 (7%)	-	-
Caenidae	10 (7%)	1 (11%)	1 (14%)
Prosopistomatidae	1 (1%)	-	-
Leptophlebiidae	20 (14%)	-	-
Polymitarciidae	1 (1%)	-	-
Ephemeridae	4 (3%)	-	-
Potamanthidae	1 (1%)	-	-
TOTAL:	147	9	7

Later on, as result of the Spanish Civil War (1936-1939) and the postwar period a strong decline of the number of publications occurred until the 80's and 90's, during which a great increase in scientific production in Spain occurred (Fig. 1).

As it could be expected, the number of records and described species from the Iberian Peninsula evolved in parallel to the number of published papers along the years (Fig. 2). Nevertheless, ignoring the discontinuity of the data due to the periods without publications, during the 80's and

90's a tendency to continuing lineal growth of the number of species was observed. These results (147 species and 36 genera cited so far, Table 2) and the tendency of records (Fig. 2) let us assume that the Spanish Ephemeroptera fauna is still not completely known and additional researches are needed. The number of species recorded in each province supports this hypothesis (Fig. 3), showing large areas of the Iberian Peninsula with a very small number of species recorded, specially the central and southwestern provinces including: the Guadiana River basin, the region of Extremadura, La Mancha and Southern Portugal, as it was pointed out by Alba-Tercedor *et al.* (1992) for macroinvertebrate communities. In contrast, some "Hot Spots" can be detected relating the number of species (Fig. 3) in the provinces situated close to cities with Universities in which there are active researchers working on Ephemeroptera or on freshwater macroinvertebrate communities: Granada and Jaén (J. Alba-Tercedor), Catalonia (M.A. Puig and the research group of N. Prat) and the high reaches of the Duero Basin (D. García de Jalón and M. González del Tánago).

The aquatic insect fauna of the Balearic Islands had been barely studied (Fig 4). Navás (1914) found two Ephemeroptera species, and 72 years later a new species was recorded (Malzacher, 1986). García-Avilés (1990) carried out a more extensive work, recording 7 other species from the Islands, mainly in Mallorca.

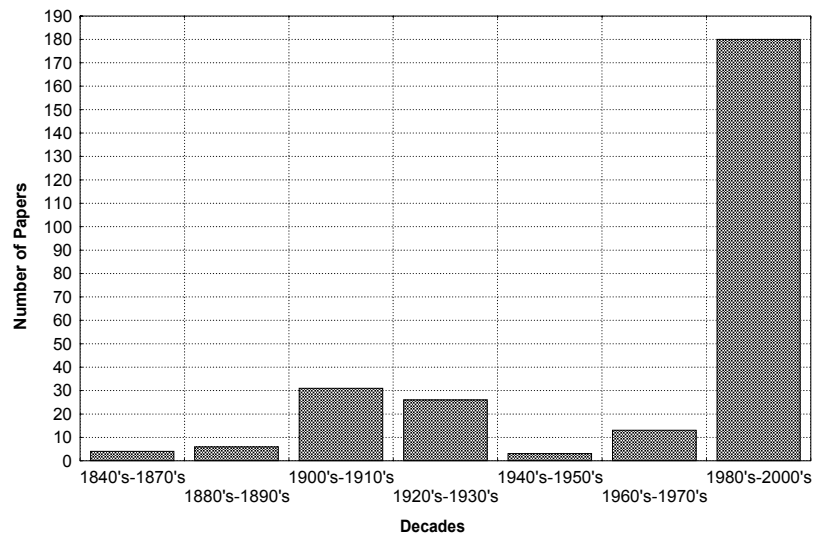


Fig. 1 - Historical evolution of number of mayfly papers published on the Iberian Peninsula, Balearic Islands and Canary Islands.

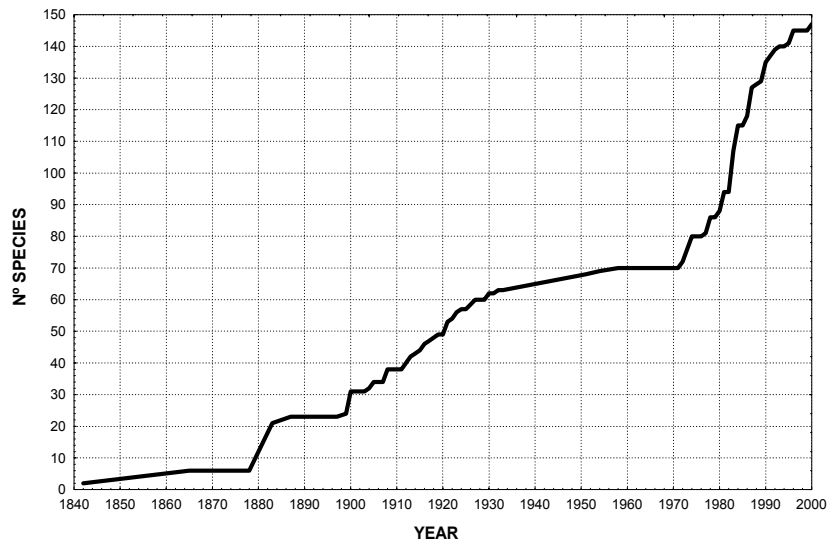


Fig. 2 - Historical evolution of number of mayfly species recorded from the Iberian Peninsula.

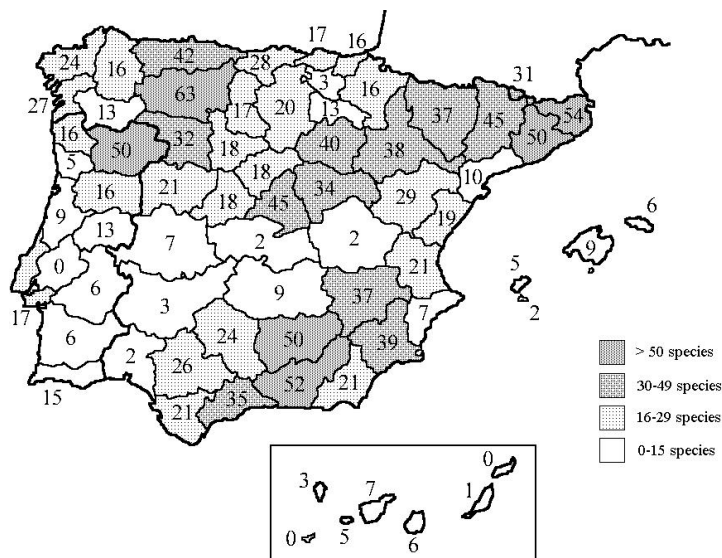


Fig. 3 - Number of species recorded in each province from Portugal and Spain. The Canary Islands are in the bordered area.

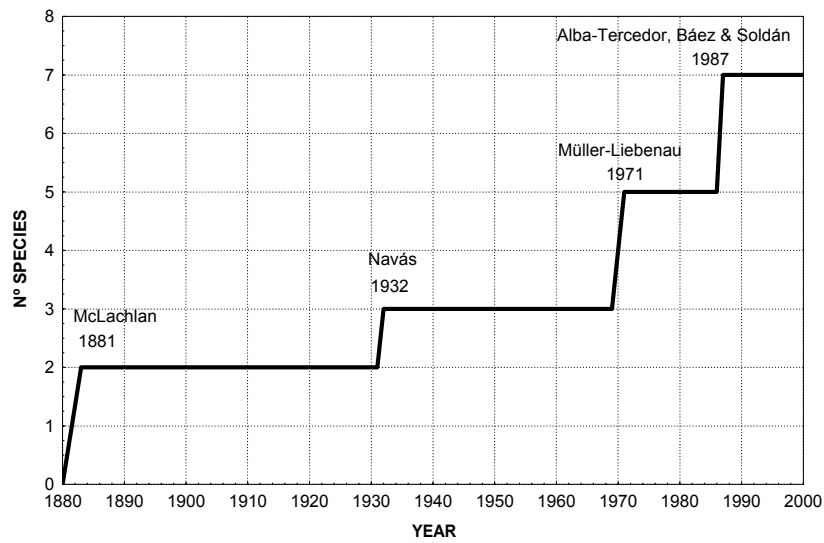


Fig. 4 - Historical evolution of number of mayfly species recorded from the Canary Islands.



Fig. 5 - Historical evolution of number of mayfly species recorded from the Balearic Islands.

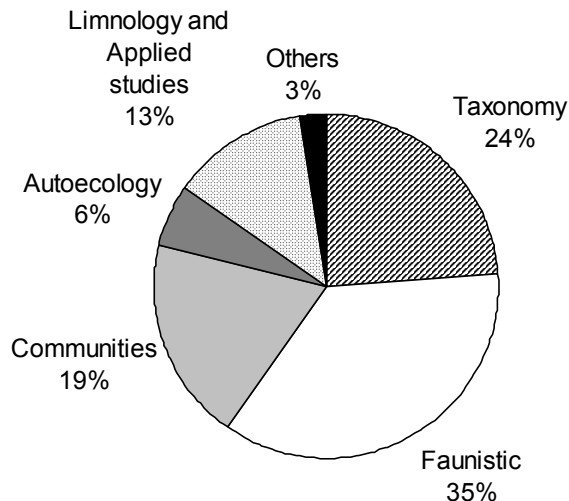


Fig. 6 - Percentage of published mayfly papers according to different topics.

The Canary Islands fauna has been studied since the XIXth century when McLachlan (1881) recorded two species. Afterwards Navás (1932), Müller-Liebenau (1971) and Alba-Tercedor *et al.* (1987) increased progressively the number to three, five and seven species respectively (Fig. 5). These findings represent a high species richness compared with those observed in other Atlantic Islands, probably as a result of the short distance from the continent (Alba-Tercedor *et al.*, 1987).

If we analyze the topics of all the published works in which mayflies appear (Fig. 6), the majority of papers are about faunistic (35%) and taxonomy (24%), followed by some recent studies on aquatic communities (19%), water quality and general limnological studies (13%). However, the

percentage of studies on the species biology is very low at the species level (6%), specially that of the adults, and only some aspects of the biology are studied such as life cycles and flight periods, ignoring important subjects as reproductive biology and habitat selection.

As it can be deduced from these data, the knowledge of mayflies in the analyzed areas is still far from being completed, although during recent years the research has increased notably. Nevertheless, it is necessary to continue with the work that has been produced, particularly in such themes as taxonomy, since it is a fundamental aspect that must precede community knowledge. Moreover, an extensive knowledge of the adult biology is necessary because it can be one of the keys for correct conservation and management of these ecosystems, at present very threaten.

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