

New records of mayflies of the Canary Islands

(Insecta, Ephemeroptera)

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Recently, we have investigated several localities on the Canary Islands of Tenerife, Gomera, La Palma and Fuerteventura respectively. Nymphs of mayflies (*Ephemeroptera*) we found at most of the aquatic biotopes investigated and adults were found at some of them. These findings, together with some data concerning the biology and life cycles of the species found, are listed and discussed in the present paper. The material is in T. SOLDÁN collection.

1. *Cloeon dipterum* (LIN., 1761)

Material examined: Tenerife: Barranco de Igueste, Igueste de San Andrés, 30-VI-1984 (155 nymphs, 4♂♀ subimagos, 2♀♀ imagos); Barranco de Tahodio and Embalse de Tahodio, 28-VI-1984 (85 nymphs, 2♂♂ imagos); Embalse de Campitos, los Campitos, 29-VI-1984 (18 nymphs); pools in Bco. de Herque, Herque, 29-VI-1984 (8 nymphs); Bco. del Río, 29-VI-1984 (8 nymphs); reservoirs, San Miguel, 5-VII-1984 (34 nymphs); reservoirs, Vilaflor, 4-VII-1984 (112 nymphs, 5♂♂ and 1♀♀ imagos); Embalse de Mocan, 5-VII-1984 (190 nymphs, 2♂♀ subimagos); Embalse de Ciguaña, 5-VII-1984 (92 nymphs); pools in unnamed brook, Puerto de la Cruz, 3-VII-1984 (10 nymphs); rockpools in Bco. de las Moradas, La Concepción, 4-VII-1984 (2 nymphs); reservoirs, La Orotava, 3-VII-1984 (19 nymphs); reservoirs in trout farm, Aguamansa, 3-VII-1984 (6 nymphs); El Portillo, 3-VII-1984 (1♂ imago), (leg. T. SOLDÁN).

Gomera: rockpools near San Sebastian de la Gomera, 1-VII-1984 (45 nymphs); reservoirs, Hermigua, 1-VII-1984 (28 nymphs); Bco. de Hermigua, Hermigua, 1-VII-1984 (3 nymphs); reservoirs, Agulo, 1-VII-1984 (18 nymphs), (leg. T. SOLDÁN).

La Palma: reservoirs near Breña Alta, 2-VII-1984 (16 nymphs); Río de Taburiente, Caldera de Taburiente National Park, 2-VII-1984 (45 nymphs), (leg. T. SOLDÁN).

Fuerteventura: Los Molinos (pools) 7-VII-1984 (10 nymphs); Betancuria (pools), 6-III-1984 (8 nymphs), (leg. M. BAEZ).

The species most commonly occurring in the Canary Islands. It is recorded by McLACHLAN (1881), EATON (1885) and NAVAS (1906) from Tenerife. MÜLLER-LIEBENAU (1971) found this species (nymphs and subimagos) on all the islands with the exception of Lanzarote. This widespread Palaearctic species inhabits the Azores and Madeira (BRINCK & SCHERER, 1961) as well. Its very wide ecological range enables it to colonize even temporary aquatic habitats (like artificial water reservoirs or rockpools of brooks and streams during the dry summer season) as well as dam-lakes or permanent drinking water reservoirs ("depositos, estanques o embalses"). Usually, the nymphs of all developmental stages were found (in June and July in Tenerife). Emergence and mating flight on Madeira and the Canary Islands are described by BRINCK & SCHERER (1961) and by MÜLLER-LIEBE-

NAU (1971). She observed flying adults during strong rain or strong winds from noon to afternoon (around 17.00 p.m.). We observed (Embalse de Tahodio) late afternoon emergence of subimagos (at isolators deposited at the locality) and early morning mating flight (from 7.00 to 9.00 a.m.) at the localities of Embalse de Tahodio and reservoirs near Vilaflor. Males are active, forming groups especially about half an hour before and after sunrise. After full sunset, the mating flight (Embalse de Tahodio and reservoirs near Vilaflor) is completely finished.

Adults males collected at the above localities are morphologically very similar to those from Continental Europe. Differences in the arrangement of the turbinate eyes do not exceed current variability and their colour, in both living and fixed specimens, seems to be identical. Also, abdominal colour patterns are similar. However the external genitalia differ slightly, mainly in the shape of last forceps segments (more elongated and asymmetrical) and in the arrangement of the basal part of penis cover.

On the other hand, some nymphs and females show relatively pronounced differences in certain morphological characters. Abdominal colour patterns of some nymphs are uniform (i.e. from Barranco de Igueste), terga evenly dark, usually without pale spots and markings which are to be found in all species of the *Cloen dipterum*-group distributed in Europe. Distinct differences were noted in the arrangement of the gills (Figs. 1 to 6). Dorsal lamella of 1st gill is very small and narrow, rudimentary, without apparent tracheae, being about half as long as the ventral ones and resembling that of the *Cloen simile* species-group. Dorsal lamellae of the remaining gills are smaller and more rounded. The last gill lamella is much more elongated, longer than 8th abdominal segment, sometimes with a distinctly sclerotized inner margin. In addition, there are other small differences in the arrangement of the mouthparts and the last maxillary palp is much longer (Figs.: 7, 8). The costal and subcostal membrane of the female is not distinctly brown coloured as in *C. dipterum* but only very slightly brownish or even nearly transparent; there are only about 4-6 cross veinlets in the costal membrane, while female of *Cloen dispterum* from Continental Europe possess at least 10 cross veinlets (SOWA, 1975).

2. *Cloen cognatum* STEPHENS, 1835.

Material examined: Tenerife: Barranco de Igueste, Igueste de San Andrés, 30-VI-1984. 3 ♂♂ adults (leg. T. SOLDÁN).

This widespread Holarctic species is recorded for the first time from the Canary Islands. These three males were caught swarming at the village of Igueste de San Andrés. No nymphs were collected at the above locality. Adults were caught individually flying above rockpools in the stream bed.

3. *Caenis luctuosa* (BURMEISTER, 1839).

Material examined: Tenerife: Barranco de Igueste, Igueste de San Andrés, 30-VI-1984 (85 nymphs, 7 ♂♂ imagos); Embalse de Tahodio, 28-VI-1984 (22 nymphs); reservoirs, Vilaflor, 4-VII-1984 (5 nymphs); Embalse de Tamaide, Tamaide, 4-VII-1984 (2 nymphs); Embalse de Mocan, 5-VII-1984 (103 nymphs, 6 ♂♀ subimagos); Embalse de Ciguana, 5-VII-1984 (25 nymphs); rockpools in Bco. de las Moradas, la Concepción, 4-VII-1984 (3 nymphs); reservoirs, La Orotava, 3-VII-1984 (10 nymphs).

Gomera: reservoirs, Hermigua, 1-VII-1984 (5 nymphs); reservoirs, Agulo, 1-VII-1984 (1 nymph).

La Palma: reservoirs near Breña Alta, 2-VII-1984 (3 nymphs); Río de Taburiente, Caldera de Taburiente National Park, 2-VII-1984 (2 nymphs), (leg. T. SOLDÁN).

A species of common occurrence in the Canary Islands, previously unrecorded. MÜLLER-LIEBENAU (1971) records *Caenis macrura* STEPH. from Fuerteventura and Tenerife. Actually, these findings most probably refer to *C. luctuosa* as well. Nymphs of this genus were found on Gomera and La Palma for the first time. According to MÜLLER-LIEBENAU (1971) and BRINCK & SCHERER (1961), this genus does not occur on any of the Atlantic Islands. It is common in North Africa (see SOLDÁN & THOMAS, 1983 and others).

Similarity as with *Cloeon dipterum*, nymphs of *Caenis luctuosa* show a very wide ecological range and are able to colonize even temporary and seasonal localities. They inhabit both lentic (reservoirs, pools, etc.) and lotic (Brooks and stream) microhabitats. They live on submerged vascular plants, on stones on debris at sites with slow to moderate water currents. Contrary to Continental Europe (i.e.: ALBA-TERCEDOR, 1981 found nymphs of this species in Sierra Nevada—Southern of Spain—both in very slow and moderate—58 cm./seg.—current velocities; attaining densities of 1 to 38 nymphs/m²), they are very abundant in standing waters, sometimes attaining densities of over 1.000 individuals per m² (Embalse de Tahodio). Subimagines emerge about half an hour before sunrise, whilst the mating-flight of adults finished approximately one hour after sunrise. As with *Cloeon dipterum*, nymphs of all developmental stages were collected simultaneously so that the emergence seems to be continual, at least during the spring-summer period.

4. *Baetis canariensis* MÜLLER-LIEBENAU, 1971.

Material examined: Tenerife: Barranco del Río, Arico, 24-III-1983 (19 nymphs), (leg. M. BÁEZ); Bco. de Igueste, Igueste de San Andrés, 30-VI-1984 (2 nymphs); canals in trout farm, Aguamansa, 3-VII-1984 (3 nymphs), (leg. T. SOLDÁN).

La Palma: Río de Taburiente, Caldera de Taburiente National Park, 2-VII-1984 (4 nymphs), (leg. T. SOLDÁN).

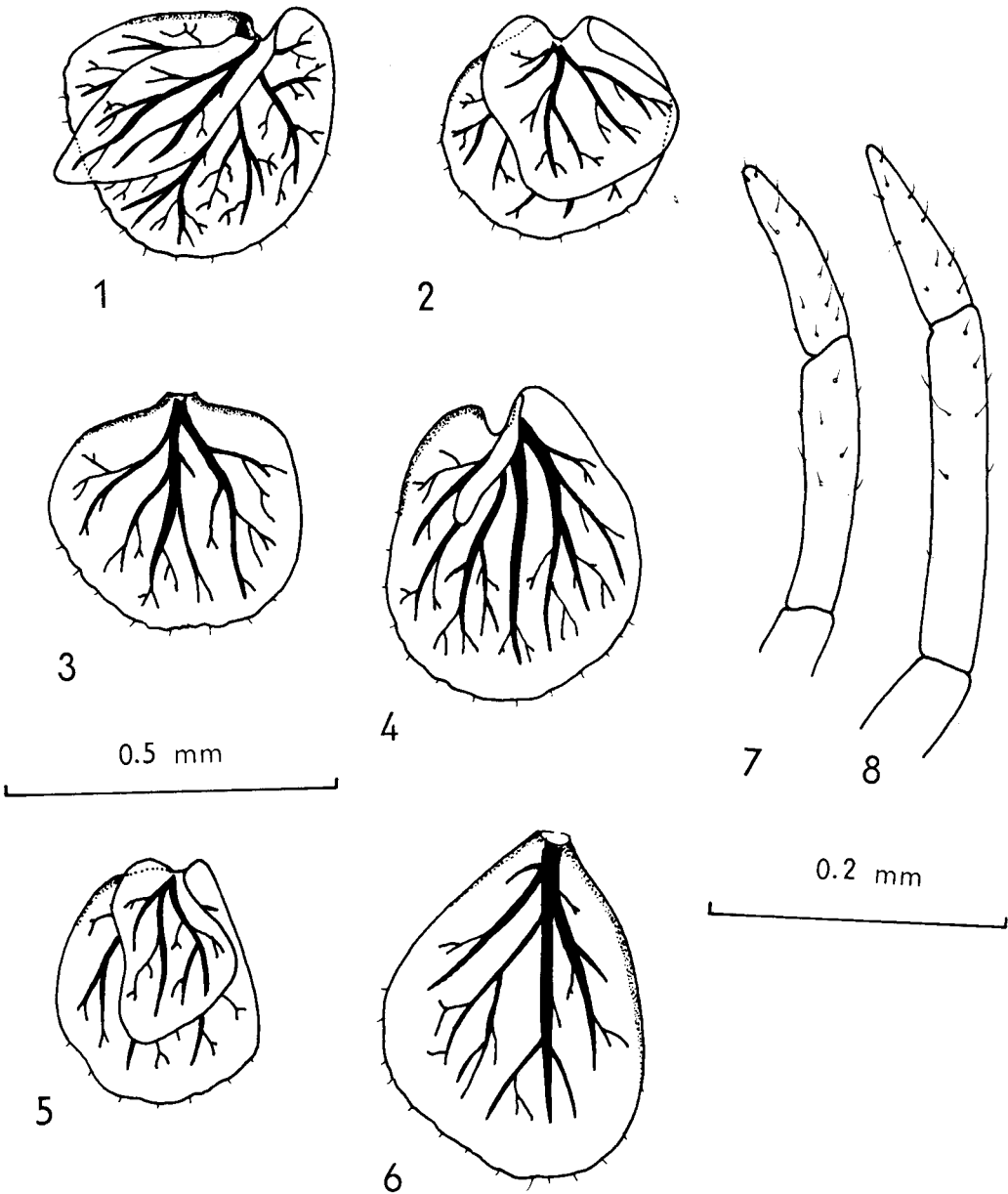
This species was collected on Tenerife, La Palma, Gomera and Gran Canaria by MÜLLER-LIEBENAU (1971). Also the findings of McLACHLAN (1881) and EATON (1885) from Tenerife might refer to it (recorded as *B. rhodani* Pict.). Nymphs found in March 1883 on Tenerife are older ones whilst nymphs found in July 1884 correspond to half-grown ones. They live under stones at places with current.

5. *Baetis nigrescens* NAVAS, 1932.

Material examined: Tenerife: artificial canal near Granadilla, 4-VII-1984 (6 nymphs).

Gomera: small stream near Agulo, 1-VII-1984 (1 nymphs), (leg. T. SOLDÁN).

The adult stage of this species was described by NAVAS (1932) from Gran Canaria. MÜLLER-LIEBENAU (1971) found and described nymphs from Algeria and Canary Islands (Gomera and Gran Canaria at 10 localities). Some years later MÜLLER-LIEBENAU and some others authors recorded *B. nigrescens* at different localities from the Iberian Peninsula (see ALBA-TERCEDOR, 1983). It seems to be



Figs. 1-8—1-6: gills; 7-8: apical part of maxillary palpus. 1-3 and 8) *Cloeon dipterum* (Embalse de Tahodio); 4-6 and 7) *Cloeon* sp. (Barranco de Igueste).

the most widespread species of *Baetis* on the Islands although it is recorded from Tenerife for the first time. Half-grown nymphs were collected in an approximately a 1 m. wide and 0.5 m. deep artificial irrigation canal with a very fast current (about 0.80 m. sec.⁻¹) living on its walls that were covered with fine algae. They were not found at sites with smaller stones on the canal bottom.

6. *Baetis pseudorhodani* MÜLLER-LIEBENAU, 1971.

Material examined: Tenerife: canals in trout farm, Aguamansa, 3-VII-1984 (2 nymphs), (leg. T. SOLDÁN).

This species was described by MÜLLER-LIEBENAU (1971) from Gomera and Gran Canaria. It was found on La Palma for the first time. Nymphs live at places where there is a very fast current. All nymphs found correspond to half-grown ones.

DISCUSSION.

Altogether six species were found on the islands of Tenerife, Gomera, La Palma and Fuerteventura. Two of them are recorded for the first time: *Cloeon cognatum* and *Caenis luctuosa*, the latter most probably having been recorded earlier by MÜLLER-LIEBENAU (1971) as *C. macrura* since it is very common and not other *Caenis* species was collected. Generally, the mayfly fauna is rather poor in comparison with e.g. that of some Mediterranean islands. On the other hand, it shows a relatively greater diversity in comparison with the remaining Atlantic Islands (e.g. only two species on Madeira and the Azores BRINCK & SCHERER, 1961) which is undoubtedly the result of the close geographical relationships between the Canary Islands and Continental Africa.

The possibilities of mayflies invading the Canary Islands in relation to the origin of this Archipiélago are discussed by MÜLLER-LIEBENAU (1971). She assumed that *Baetis nigrescens* reached the Canary Islands during the Pleistocene via the Eastern islands from Africa (Lanzarote and Fuerteventura are supposed to be detached parts of the African Continent for some authors). Although this species is found at some localities in the Sahara, its past or present occurrence on Lanzarote or Fuerteventura seems to be doubtful due to the absence of running waters on these islands and the generally very low vagility of mayflies. On the other hand, this opinion can be easily applied to *Cloeon cognatum* and *Caenis luctuosa*. These species are very common in Algeria, Morocco, and Mauritania inhabiting even temporary aquatic habitats. Moreover, ovoviviparity of the former species increases its vagility. Both these species are probably exist on Fuerteventura and Lanzarote.

The remaining species, *Baetis canariensis*, *B. pseudorhodani* (most likely a result of an adaptative radiation of some ancestral species from the *B. rhodani* species-group) and also *Cloeon dipterum* are supposed to have directly invaded the Western Islands, which are either volcanic or Oceanic in origin (cf. SCHMINKE, 1976) and possess permanent running water habitats, via Portugal and Madeira (cf. MÜLLER-LIEBENAU, 1971). As *Cloeon dipterum* is absent from North-West Africa, it most probably belongs to this group as well. It occurs on Madeira and the Azores (BRINCK & SCHERER, 1961). On the other hand, it represents one of most vagile species of mayflies with various morphological and ecological peculiarities at the population level. We found two clearly different morphological types of nymphs on Tenerife. Some populations (e.g. that in Barranco de Igueste) differ in the arrangement of gills and mouthparts as well as in colour patterns. These differences are even more pronounced than those found among the species of the *Cloeon dipterum* species-group (*C. dipterum*, *C. cognatum*, *C. inscriptum*, see

SOWA, 1975). This fact indicates a certain tendency to adaptative radiation of this *species*-group. Moreover, these larvae do not correspond to any species known from Western Africa (see GILLIES, 1980). Unfortunately, we have not yet studied reared adults of both these nymphs types. The adults collected by one of us (T. SOLDÁN) at different localities on Tenerife are nearly identical with adults of populations from Continental Europe. Consequently, this question remain open althout the populations of a morphological strikingly differ type might represent a new species.

As noted by MÜLLER-LIEBENAU, the occurrence of species of the genus *Baetis* on Fuerteventura and Lanzarote (and also Hierro) can hardly be expected as there is no permanent running water. These species (especially the Canarian endemics, *B. canariensis* and *B. pseudorhodani*) seem to be endangered by complete extinction even on the Western islands as a result of the restriction and continual disappearance of running water biotopes. *B. canariensis* appears to have become extinct at certain localities on Gomera where formely it used to be common (see MÜLLER-LIEBENAU, 1971). The continually expanding agriculture and tourism require regulation of most of the water resources and permanent running waters. Although *Baetis* nymphs can sometimes survive at such places (e.g. trout farm near Aguamansa on Tenerife) the majority of these biotopes are without mayflies. On the other hand, owing to a pronounced seasonality in rainfall, these species seem to be able to tolerate dry periods and survive in isolated pools.

Quite a different situation occurs with the species of *Cloeon* and *Caenis*. There are large amounts of standing water on all the islands providing very suitable habitats for nymphs of these species. All are very common, except for *Cloeon cognatum* which has so far only been found on Tenerife.

As these species inhabit different microhabitats (*Cloeon* species mainly vascular plants, *Caenis luctuosa* fine muddy bottoms or stones in running water), their populations reach relatively very high densities.

Nearly nothing is known about the life cycles found on the Canary Island. As usually nymphs of all the developmental stages (*Cloeon dipterum*, *Caenis luctuosa*) were collected, a continual emergence can be expected, at least during the spring-summer period. There are undoubtedly more than two generations a year. Also MÜLLER-LIEBENAU (1971) found in March-April 1966 and March 1968 all developmental stages of nymphs at localities where *Baetis* species occurred.

Resumen

Se recolectaron efemerópteros en las islas de Tenerife, Gomera, La Palma y Fuerteventura; habiéndose capturado un total de seis especies, de las cuales *Cloeon cognatum* STEPHENS y *Caenis luctuosa* (BURMEISTER) (ésta última probablemente citada como *C. macrura* por MÜLLER-LIEBENAU en 1971) son nuevas citas para las Islas Canarias y *Baetis nigrescens* NAVAS y *B. pseudorhodani* MÜLLER-LIEBENAU se citan por vez primera en las listas de Tenerife y La Palma respectivamente.

Además se describen poblaciones de *Cloeon dipterum* que presentan diferencias morfológicas (fundamentalmente en las branquias de las ninfas y en la venación de las alas de los adultos) y se discuten aspectos sobre la biología de las especies capturadas.

Summary

Mayflies were collected on Tenerife, Gomera, La Palma and Fuerteventura. Of the six species recently found at more than 25 localities, *Cloeon cognatum*

STEPHENS and *Caenis luctuosa* (BURMEISTER) (most probably cite earlier by MÜLLER-LIEBENAU (1971 as *C. macrura*) are recorded from the Canary Islands for the first time. *Baetis nigrescens* NAVAS and *B. pseudorhodani* MÜLLER-LIEBENAU represent new records for Tenerife and La Palma respectively.

Morphological differences of *Cloeon dipterum* populations (mainly the arrangement of gills and wing venation of adults) are described and some aspect of the biology of the species collected are discussed.

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Recibido el 16-IV-85

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