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FIRST DATA ON THE PRESENCE OF THE GENUS *BRANCHIPUS SCHAEFFERI 1766* (CRUSTACEA: ANOSTRACA) IN THE CANARY ISLANDS

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RESUM

Durant tres mesos dels últims dos hiverns vam observar i vam recollir per primera vegada a les Illes Canàries (Fuerteventura) gambetes d'aigua dolça del gènere *Branchipus*, les quals apareixen en abundància als tolls d'aigua de pluja localitzats als barrancs del nord-est de Fuerteventura. La reproducció del *Branchipus* al laboratori ens va permetre observar que el cicle efímer complet dura entre quinze i disset dies, i les característiques anatòmiques i taxonòmiques són similars a les descripcions existents del *Branchipus schaefferi* Fischer Waldheim, 1834. No obstant això, vam observar una petita variació al cap del mascle.

RESUMEN

Durante tres meses de los últimos dos inviernos fueron observados y recogidos por primera vez en las Islas Canarias camarones de agua dulce del género *Branchipus*, los cuales aparecen en abundancia en los charcos de agua de lluvia localizados en los barrancos del nordeste de Fuerteventura. La reproducción del *Branchipus* en el laboratorio nos permitió observar que el ciclo efímero completo dura entre quince y decisiete días, y las características anatómicas y taxonómicas son similares a las descripciones existentes del *Branchipus schaefferi* Fischer Waldheim, 1834. Sin embargo, se observó una pequeña variación en la cabeza del macho.

ABSTRACT

During three months of the last two winters fairy shrimps of the genus *Branchipus*, which appear in abundance in the raining rock pools located in a northeast gully of Fuerteventura, were observed and collected for the first time in the Canary Islands (Fuerteventura). *Branchipus* reproduction in the laboratory allowed us to observe that the complete cycle was ephemeral, lasting 15-17 days, and anatomic and taxonomic features were consistent with the existing descriptions of the *Branchipus schaefferi* Fischer, 1834 , although a small variation was observed in the male head.

Key words: *Branchipus schaefferi* - *Anostraca*, taxonomy- zoogeography

INTRODUCTION

The Anostraca *Branchipus schaefferi* belongs to the most endangered crustacean species in Europe. *Branchipus schaefferi* inhabits small, temporary ponds with turbid water, and overcomes periods of desiccation by laying resting eggs. *Branchipus schaefferi* is often associated with other rare crustacean species (Mura, 1999). In restrictive colonization of the ephemeral rock pool habitats, some groups of the specimen are considered to be typical of fresh water—including *cladocera, ostracoda*, *copepoda* and *branchipoda* (Williams, 1975)—but have rarely been described in rock pools of the Canary Islands. The presence or absence of these groups could be a consequence of their greater or smaller capacity to survive in a habitat with biota subjected to long periods of drought. Consequently, that biota would have to consist of organisms which have high rates of fertility and short life cycles and attain reproductive capacity quickly (Williams, 1985). These characteristics have been described for the adaptation of organisms that colonize puddles of rainwater in dry zones (Williams, 1985), much like the climate on the island of Fuerteventura. The aim of the present work is to describe, for the first time, the presence of freshwater crustaceans (*Branchipus*) in the raining rock pools of the island and to contribute new taxonomic and ecological data.

MATERIALS AND METHODS

The exanimate material was collected in Puerto del Rosario (Fuerteventura), in the temporary rock pools formed by rainwater during the months of December and January. The rock pools had depths of 0.5 to 1 metre, and sandy-muddy bottoms. The specimens were collected directly with the aid of small nets. Six of them were fixed, first in a solution of 4% formaldehyde and then in a solution of 70% alcohol. Thirty live *Branchipus* (70% females) specimens were conserved in a fishbowl with the substratum and water from the rock pools for observation and to carry out experiments 1 and 2. Five specimens, 3 females and 2 males, were dissected with tungsten needles.

RESULTS

The specimens were captured in the ephemeral, temporary rainwater puddles that form during the rainy period in areas of Fuerteventura Island. The puddle water was slightly mineralised (Table 1). In the puddles two well differentiated sizes of *Branchipus* were observed. In puddle 1, the collected specimens were orangeade colours and larger in size (maximum 27 mm) than those in puddle 2. In the sample from puddle 2, the specimens were as long as 15 mm and transparent pink in colour.

In both puddles (1 and 2) a great quantity of *cladocera*, *ostracoda* and some *copepoda* were found (12-4-0.25 respectively) for each specimen of *Branchipus*.

REPRODUCTION EXPERIMENTS ON *BRANCHIPUS* FROM THE DRY SUBSTRATUM

Experiment 1

Thirty *Branchipus* (70% females) were maintained in the water and substrate from the puddles in an aerated 8 litre fishbowl. Every four days a small quantity of complete goldfish food (TetraAmniMin) was added to the water. The number of *Branchipus* diminished during the first month, leaving a total of seven *Branchipus* (five females and two males) which stabilized in number and size during the second month. Two months after beginning the experiment, only five *Branchipus* remained (three females and two males) and two days later the *Branchipus* had disappeared completely. During all this time and after the *Branchipus* had disappeared, there were no *Branchipus* births. Only other crustaceans were observed (*cladocera, copepods* and others) and they too had practically disappeared in the end.

Experiment 2

Two hundred grams of substrate from the puddle of the *Branchipus* were extracted and put on a glass plate, 6 cm in diameter by 1 cm high, and placed in the sun at a temperature that oscillated between 18ºC at night and 28ºC during the day. After a month, the substrate was completely dry and was introduced with the plate of glass in a fishbowl with 1.5 litres of distilled water (50%) and puddle water (50%) which was not aerated. Four days later, 17 *Branchipus* of different sizes (0.2 to 0.5 cm) were observed. Five of them were extracted for taxonomic study. On the eighth day after the experiment started, three females with eggs in the ovisac were observed and a day later (the ninth day after the experiment began) there were already seven females with ovisacs full of eggs. During those two days the *Branchipus* increased in size from 0.8 to 1.5 cm and a small quantity of goldfish food (TetraAmniMin) was added to the water. Four *Branchipus* (two males and two females) were extracted for other studies.

On the 14th day after the experiment started, five females and two males measuring between 2 and 2.5 cm were observed. In the females' ovisacs multiple eggs and a white or clear gray mucous was observed. A day later (the fifteenth day) their size had stabilized at *2.5 cm, the mucous plug of the ovisac was disappearing and the Branchipus movements* were slow and clumsy. During the 15 days the water of the container had diminished by 30%. On the following day (day 16) only two females, with their ovisacs quite empty of eggs, and a male that tried to bury itself in the substrate with slow movements, were alive. Ten hours later only a female that practically could not move by herself was still alive; the other two were dead and half buried in the substrate. A day later (the sixteenth day after the start of the experiment) the *Branchipus* were all dead and not even their remains could be observed; only other types of small sized crustaceans such as *cladocera* and *copepods* were alive. On the seventeenth day after the beginning of the experiment, only other types of crustaceans (*cladocera* and others) were still alive.

Experiment 2 was repeated several times and similar results were obtained.

Morphologic description.

In most cases the *Branchipus* species are opaque, and have a fragile colourless body, although some specimens present reddish, orange and even green shades. As a result of this transparency, the digestive tract is seen to be rectilinear and passing through the telson.

The head bears a pair of stalked, lateral, compound eyes and a single, median, non stalked naupliar eye at the anterior end. The antennae are generally conical. The maxilla presents two bristles, one long and terminal and the other shorter and proximal. The labrum shows a short ellipsoidal extreme. The antennules present eight small scales and three long sub terminal bristles. The thoracopods have two sub terminal bristles and one long anterior bristle in the first and the second endites respectively. Proto epipodites have incisures which can be more or less prominent at the edge. The exopod is extended, and the proto epipodites have a serrated margin. The abdomen has visible ventral bristles in the fourth, sixth and eighth somites, lateral bristles in the third, fifth and seventh somites, and dorsal bristles are only observed in the eighth somite. The seminal vesicles are slightly notorious.

Female (Fig. 1A). The observed specimen has a maximum length of 27 mm. The antennae have concentrated sensory bristles on the base and around the sharp extreme (Fig. 1B, 2C). The thoracopods have the third and fourth endites equipped with two anterior and two posterior bristles. The proximal bristles are observed to be longer than the others inside the first ten thoracopods. The dorsal margin of the epipod is serrated with a lax form, and on the dorsal-distal part of the margin the proto epipodites are serrated. The brood sac (ovisac) is short and wide, with a ventral protuberance caudally directed till it reaches halfway on the second abdominal somite (Fig. 1C); moreover, the majority of the specimen show refringence. Eggs showed complex geometric forms, with several faces delimited by crests but, in the last stages they evolved a yellowish sphere with diameters between 0.20-0.30 mm.

Male (Fig.2B). The maximum length observed was 25 mm. The head had an indentation at the edge of its anterolateral part. The basal segments of the antennae were fused, while the apical segment did not show any widening in the middle parts (Fig. 1D, 2D-E). The antennal appendices were much longer than the antennae. The first thoracopods had three to five anterior bristles on the fifth endites.

Ventrally the male have a pair of tubular penes which have a split retractable arm of denticles (Fig. 1E-F).

The data described above suggest that this crustacean belongs to:

Order *Branchipoda Anostraca* G.OR. SARS

Family *Branchipodidae* MILNE-EDWARDS, 1840

Genus *Branchipus* SCHAEFFERI, 1766

Probable species *Branchipus schaefferi* Fischer, 1834

DISCUSSION

Fuerteventura is a part of the Canary Islands, which are a rocky archipelago constituted by seven larger and six smaller islands and located northwest of Africa, at the level of the 28th parallel. Fuerteventura, at 100 km from the Western Sahara, is the

island that is closest to Africa. It has an arid climate, where rainy periods are scarce and limited to December, January and April. During these months ephemeral freshwater rock pools are formed in the depths of gullies. Temporary freshwater rock pools occur in hollows of basaltic stone, containing a substrata with a solution of clay and limestone coming from upper levels of the gully. The freshwater from precipitation and runoff accumulates in such a solution, forming the rock pool environment. During the time the rock pools are filled with water, several macro and microplanktonic resident biota are present and dry flora of terrestrial macrophytes could colonise the substratum.

There are very few works on the localization of crustaceans *branchiopoda* in the Canary Islands. The specimens only mentioned on the islands correspond to the *Artemia parthenogenetica*, limited to the coastal region, living in saline or hypersaline water of Fuerteventura and Lanzarote Islands (Varo et al., 1987). With respect to inland rainwater rock pools, we did not find references to this *Branchipus* in the Canary archipelago. It could be due to the short existence of these habitats on the islands, which implies they were not considered and sufficient information on the presence of this *Branchipus* in the Canary Islands has not been found. However, in the present work, the ephemeral *Branchipus* cycle, using a fishbowl containing substratum and water precedent from the rock pools, was reproduced several times. On the other hand, the occurrence or co-occurrence of different species of *Branchipus* in ephemeral ponds throughout the Mediterranean countries and region (Beladjal et al., 2003) has been recorded and updated: in Italy (Mura, 2001; Mura et al., 2003), in Spain (Catalonia) (Sala et al., 2003) and in Macedonia (Petkovski, 1997).

The morphology of the specimens captured in Fuerteventura coincides well with the anatomy of *Branchipus schaefferi* described in recent taxonomic works (Alonso, 1990; Machado et al.,1999; Petkovski, 1997). However, the male head of the *Branchipus* found in Fuerteventura presents in its anterolateral part a slight anatomic difference from the *Branchipus schaefferi* described by Fischer.

Current reports confirm the distribution of *Branchipus schaefferi* Fischer in these latitudes, coinciding with the northern distribution (Alonso, 1990; Berrios and Sielfeld, 2000; Brendonck ,1989; Brtek and Thiery ,1995), although the existence of this species in the oceanic islands located in the northwest of Africa have not been described. In an environment more similar to Fuerteventura, such as the Maltese archipelago (Central Mediterranean), a sporadic occurrence of *Branchipus schaefferi* has also been recorded from inland pools and coastal mesohaline habitats (Lanfranco et al., 1991). Although the minimum temperature during the winter in Malta (0ºC) is lower than in Fuerteventura (12ºC) and the maximum is similar in both islands (26ºC in Malta and 30ºC in Fuerteventura), we could conclude that the *Branchipus* found in Fuerteventura Island have an ephemeral cycle of 15 days and is quite similar to *Branchipus schaefferi* Fischer, 1834 (*Branchiopoda, Branchipodidae*), although anatomic differences can be pointed out, such us the anterolateral part of the male head. Our study in preparation on "The genotype of the *Branchipus schaefferi* found in the Canary Islands" will confirm if this *Branchipus* belongs to this genus *Branchipus schaefferi* Fischer.

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Figures and table legend

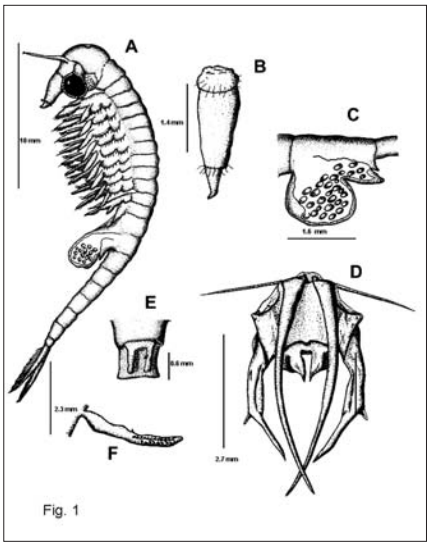

Fig. 1 - *Branchipus schaefferi:* A, female specimen, lateral view ; B, antennae, anterior dorsolateral view; C, ovisac; D, head of male specimen, anterior view; E, penis, ventral view; F, elongated penis, lateral view.

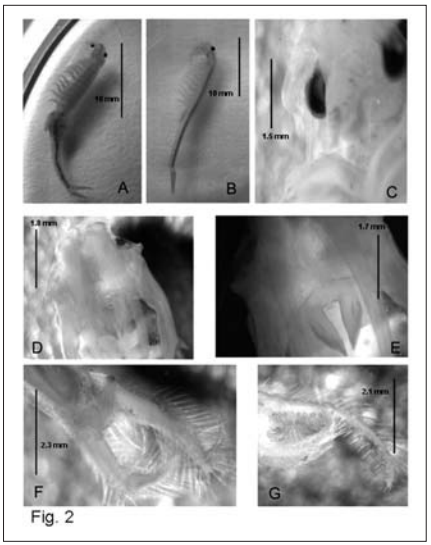

Fig. 2 - *Branchipus schaefferi*: A, female *Branchipus*, anterolateral view; B, male specimen, lateral view; C, female specimen, head detail; D, male specimen, head detail; E, mandible male specimen, anterior view; F, male pleon, G female pleon.

	Conductivity ms/cm a 25 ºC	pH	Salinity mg/l	T (ºC)
Puddle 1	1,160	7,76	742	14
Puddle 2	925	7,87	592	13

Table 1. *Data of the different puddles where the Branchipus specimens were captured*