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NEW INSIGHTS INTO THE DISTRIBUTION AND BIOLOGY OF SOME CUMACEANS (CRUSTACEA: PERACARIDA) FROM THE CANARY ISLANDS

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RESUMEN

Se detallan nuevos datos sobre la distribución y biología de algunas especies de cumáceos de las islas Canarias. *Campylaspis glabra, Nannastacus cf. ungiculatus* y *Diastylis rugosa* se citan por primera vez en estas islas. La distribución de la especie endémica *Speleocuma guanche,* conocida únicamente en la costa sur de Tenerife, se amplía a raíz de este trabajo a la costa norte y oeste de ésta, a la vez que se cita por primera vez en Gran Canaria y Lanzarote. A partir de los ejemplares recolectados de esta última especie, se ha estudiado su fecundidad estimándose en una media de 11,2 ± 2,9 embriones por puesta. Estos valores son de los más bajos observados en los cumáceos y se sugiere que son debidos a la vida cavernícola, donde la variabilidad ambiental es inferior y donde existe un menor impacto de la depredación.

Palabras clave: Cumacea, *Speleocuma*, *Iphinoe*, *Campylaspis*, *Nannastacus, Diastylis*, fecundidad, islas Canarias.

ABSTRACT

New data on the distribution and biology of some cumacean species from the Canary Islands are reported. *Campylaspis glabra*, *Nannastacus* cf. *ungiculatus* and *Diastylis rugosa* are first recorded from these islands. The distribution of the endemic species *Speleocuma guanche*, up to now only known from the south coast of Tenerife, is extended to the west and north coast of this island as well as it is first recorded from Gran Canaria and Lanzarote coasts. Fecundity of this species was estimated from the collected specimens, resulting in a mean of 11.9 ± 2.9 embryos per brood. These values are between the lowest observed in cumaceans, suggesting cave habitat influences that would support lower environmental variability as well as lower predation pressure.

Key words: Cumacea, *Speleocuma*, *Iphinoe*, *Campylaspis*, *Nannastacus*, *Diastylis,* fecundity, Canary Islands.

1. INTRODUCTION

The cumacean fauna of the Canary Islands has been scarcely studied. CORBERA *et al*. [4] compiled a checklist of the species recorded in waters of the archipelago. The catalogue includes 29 species, most of them inhabiting deep-water and mainly collected during a 1968 cruise of the *RRS Discovery*. Later, CORBERA *et al*. [5] studied interstitial cumaceans of *Cymodocea* meadows describing a new species, *Iphinoe canariensis*, and almost simultaneously (CORBERA [3]) described a new genus and species, *Speleocuma guanche*, dwelling in marine lava caves of Tenerife. Since then, only a few records of *I. canariensis* have been published (RIERA *et al*. [15, 16, 17]).

If the cumacean fauna has been poorly studied, no information is known about the biology of any cumacean species of this archipelago. Early study was due to FORSMAN [10], later on, COREY [6, 7] investigated the fecundity and reproductive strategies of some species. However, while a more or less constant number of taxonomic works has increased the number of currently known species about 1,600, only a few have dealt with its biology.

The study of the cumacean material recently collected in different monitoring programmes throughout the Canary archipelago allowed to increase the list of cumacean species as well as to extend the distribution range of some little known species. Additionally, data on the reproduction and fecundity of the endemic species *Speleocuma guanche* was also provided.

2. MATERIALS AND METHODS

All specimens were sampled by means of a 0.5 mm mesh size, wiping *Cymodocea nodosa* meadows, and cave walls and roofs (Fig. 1). Samples were deposited in a tray and all

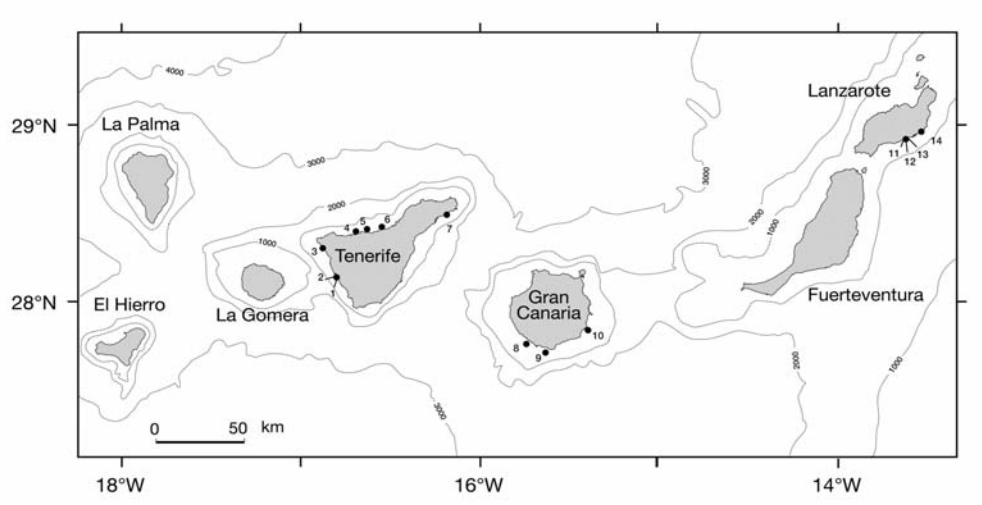

Figure 1.- Map of the study area, showing sampling locations where cumaceans were recorded: **1**. Los Cerebros Cave; **2**. Playa San Juan; **3**. El Carrizal Cave; **4**. Roque Garachico; **5**. Punta del Viento; **6**. Cave in Los Realejos; **7**. Las Teresitas Beach; **8**. Medio Almud Beach; **9**. Baja de Pasito Blanco; **10**. Cave north to El Cabrón Beach; **11**. Barranco del Kíkere; **12**. La Catedral Cave; **13**. Playa Chica; **14**. Sebadales de Guasimeta.

specimens were collected at the surface because of the impoverishment of aquatic climate (anoxia). *In vivo* photographs were taken of studied specimens and then they were conserved in alcohol 90º.

Specimens of *Speleocuma guanche* were measured (accuracy ± 0.025 mm) and the fecundity of females was estimated by counting intramarsupial contents that were classified into five developmental stages according to BISHOP [1].

Statistics were performed using R v2.13.0 software package (R DEVELOPMENT CORE TEAM [14]).

The studied material was obtained within the framework of the project MAKARONESIA 2000, funded by the Organismo Autónomo de Museos y Centros del Cabildo de Tenerife and "The biota inventory of marine ZECS from Tenerife, Gran Canaria, La Palma and Lanzarote", funded by the Viceconsejería de Medio Ambiente del Gobierno de Canarias (2011).

3. SYSTEMATICS

Order CUMACEA Kröyer, 1846
Family BODOTRIIDAE Scott, 1901
Subfamily BODOTRIINAE Scott, 1901

Iphinoe canariensis Corbera, Brito & Núñez, 2001
(Fig. 3 A-C)

Studied material.- Gran Canaria: Baja de Pasito Blanco, stn 1, UTM 438437/3066830, –18 m, 24 August 2011, 1 preadult female; Medio Almud Beach, stn 2, UTM 426611/3075515, –14 m, 24 August 2011, 1 adult male. Tenerife: Las Teresitas Beach, stn 1. UTM 384091/3153903, –7 m, 20 November 2011, 1 adult male. Lanzarote: Sebadales de Guasimeta UTM 638473/3203422, –8 m, 8 April 2011, 2 preadult females; Playa Chica, UTM 629884/3199599, sandy unvegetated seabeds, –20 m, 29 April 2012, 1 ind.

Distribution.- *Iphinoe canariensis* was described from southern coast of Tenerife Island on sandy bottoms and *Cymodocea* meadows between 7 and 16 m depth (CORBERA *et al*. [5]), it was later reported again in the same area (RIERA *et al*. [15]) and in a garden eel at deeper bottoms (29.8 m) (RIERA *et al*. [16]). RIERA *et al.* [17] reported for the first time the presence of this species in sandy bottoms of Gran Canaria estimating abundances up to 46 ind/m^2. Its distribution is here extended to Lanzarote Island and new localities from Gran Canaria and Tenerife are also provided.

Subfamily VAUNTHOMPSONIINAE Sars, 1878

Speleocuma guanche Corbera, 2002
(Fig. 3 D-E)

Studied material.- Tenerife: El Carrizal cave, stn 11, UTM 314276/3134470, –6 m, 24 May 2011, 1 adult male, 1 ovigerous female; Los Cerebros cave, stn 8, UTM 322536/3117655, –10 m, 22 May 2011, 12 preadult females, 17 ovigerous females; Baja de Los Realejos cave, stn 15, UTM 343440/3143984,

–37.5 m, 6 June 2011, 1 preadult females, 2 ovigerous females; Punta del Viento, stn 14, UTM 336586/3142697, –5 m, 6 June 2011, 1 preadult female; Roque de Garachico, stn 10, UTM 327359/3140338, –25 m, 24 May 2011, 1 ovigerous female. Gran Canaria: cave north to the Cabrón Beach, stn 7, UTM 462456/3083276, –18 m, 27 August 2011, 2 preadult females, 2 ovigerous females. Lanzarote: La Catedral Cave, UTM 629572/3199750, –32 m, 10 April 2011, 3 preadult females; Veril de Cagafrecho, in marine caves at different depths (29-39 m) (Puerto del Carmen wrecks UTM 629122/3199850; La Catedral UTM 629751/3199572; Los Camarones UTM 629623/3199631; Barranco del Kíkere UTM 628543/3199682), numerous individuals, 18-30 April 2012.

Taxonomic remarks.- Although CORBERA [3] included the newly described genus *Speleocuma* within the subfamily Mancocumatinae Watling, 1977, in a phylogenetic analysis of the Bodotriidae HAYE [11] found not discriminatory characters between the subfamilies Mancocumatinae and Vaunthopmsoniinae. Consequently, Mancocumatinae was synonymized with Vaunthopmsoniinae. Regardless, the relationship of the genus *Speleocuma* with others genera inhabiting northwestern Atlantic proposed by CORBERA [3] was supported by the phylogenetic analysis (HAYE [11]) that groups in the same clade *Mancocuma* Zimmer, 1943, *Spilocuma* Watling, 1977 and *Speleocuma* Corbera, 2002.

Biological remarks.- Within the collected specimens, we analyzed 43 of them: 1 preadult male, 4 adult males, 16 preadult females and 22 ovigerous.

The carapace length is often used in cumaceans as an easily and accurately measured reference instead of total length (BISHOP [1], COREY [6]). An allometric relationship (Major Axis estimation) between the carapace length (CL) and the total length (TL) was established (Fig. 2A):

$$TL = 3.8007CL^{0.9419} \ (R^2 = 0.9073;\ p<0.0001)$$

where the exponent is not significantly different of 1 ($df = 41$; $p > 0.05$) that supports the use of the carapace length as reference measurement. Carapace length of ovigerous females ranged from 0.725 to 0.9 mm with a mean value of 0.823 ± 0.043 mm. Their fecundity (F) fluctuated between 6 and 18 individuals per marsupium, with a mean value of 11.2 ± 2.9 individuals per marsupium. There is a significant positive correlation between this fecundity and the carapace length (CL in mm) of the adult females, but the coefficient of determination R^2 value is very low (Fig. 2B), meaning that less than 35% of the variation in the fecundity can be explained by carapace length.

Within the ovigerous females the following stages of development were found: stage I, 18.8%; stage II, 31.3%; stage III, 25%; stage IV 12.5%; stage V, 25%. The diameter of ellipsoid eggs/embryos (stage I) fluctuated between 0.175 and 0.275 mm with a mean value of 0.223 ± 0.026 mm and a mean volume of 0.004 m^3. The simultaneous presence of two successive stages (IV-V) in two of the examined marsupium suggests that development of *S. guanche* may be occasionally asynchronous.

Fecundity of *S. guanche* is one of the lowest within those of cumacean species so far known (see COREY [6, 7], JOHNSON *et al*. [13]). Only the deep-water species *Leucon jonesi* Bishop, 1982 and the summer generation of *Almyracuma proximoculi* Jones and Burbanck, 1959, inhabiting intertidal freshwater springs, have a lower mean fecundity (8.8 and 6 embryos per brood respectively; BISHOP [1], DUNCAN [8]). However, while mean carapace length for the summer generation of *A. proximoculi* is smaller than of *S. guanche*, in *L. jonesi* is con-

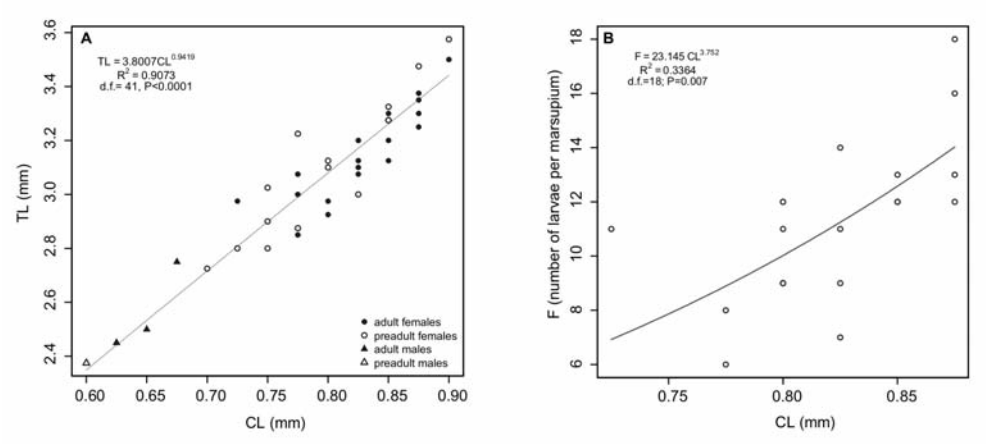

Figure 2.- *Speleocuma guanche* relationships between carapace length (CL) and total length (TL)(A), and between carapace length and fecundity (F) (B).

siderably bigger (mean 1.03 mm; BISHOP [1], 1982). On the other hand, *Pseudocuma longicorne* (Bate, 1858) that has a similar carapace length (0.85 mm), has a higher fecundity (mean 20.9 embryos per brood; COREY [7]). Although there is a relation between the carapace length (i.e. the size of the female) and the fecundity, COREY [7] pointed out that shallow water cumaceans has larger broods that of inhabiting deep sea in order to offset higher predation as well as to compensate instability of the environment. Submarine caves, like the deep sea, could act as a protective habitat, thus favouring a lower fecundity that at the same time may imply a lower energetic cost.

Distribution.- *Speleocuma guanche* was only known from the cave system of the type locality on the southeastern coast of Tenerife (CORBERA [3]). Its distribution is here extended to the west and the north coast of this island and also to the south coasts of Gran Canaria and Lanzarote.

Family NANNASTACIDAE Bate, 1866

Campylaspis glabra Sars, 1879
(Fig. 4 A-B)

Studied material.- Tenerife: El Carrizal cave, stn 11, UTM 314276/3134470, –6 m, 24 May 2011, 1 preadult female. Gran Canaria: cave north to El Cabrón Beach, stn 7, UTM 462456/3083276, –18 m, 27 August 2011, 1 preadult male.

Distribution.- *Campylaspis glabra* is an eurybathic species recorded from 15 to 3,000 m depth and widely distributed in the north Atlantic Ocean and the Mediterranean Sea. FAGE [9] reported this species from deep waters off the coast of Senegal (east Africa), but it is here recorded for fist time from shallow-water submarine caves of the Canary Islands.

Nannastacus cf. ***ungiculatus*** (Bate, 1859)

Studied material.- Tenerife: Playa San Juan, stn. 6, UTM, 3118099/322029, –15 m, 20 July 2011, 1 ovigerous female.

Distribution.- This species is known from the northeast Atlantic, the Mediterranean and the Black Sea. It inhabits among photophilic algae and in *Posidonia* meadows of shallow bottoms between 0 and 40 m depth. Although it has been recorder at deeper bottoms (110-120 m; LEDOYER [12]), the study of that material deposited in the MNHN-Paris confirmed that it actually belongs to *N. atlanticus* [see Supporting information File S2 pp 238-247, in COLL *et al*. [2]]. FAGE [9] reported this species from the Atlantic coast of Morocco. Its distribution is here extended to the Canary Islands.

Family DIASTYLIDAE Bate, 1856

Diastylis rugosa Sars, 1865
(Lám. 4 C-D)

Studied material.- Lanzarote, Puerto del Carmen, cueva de La Catedral, UTM 629751/3199572, –32 m, 29 April 2012, 2 specimens.

Distribution.- *Diastylis rugosa* has a depth range from 0 to 90 m, where it inhabit sandy and muddy sand seabeds of the upper shelf. This species is widely distributed in the Northeast Altantic Ocean (from Norway to the Bay of Biscay) and the Mediterranean Sea. Here, its Atlantic distribution is extended south to the Canary Islands.

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Figure 3.- A-C. *Iphinoe canariensis* Corbera, Brito & Núñez, 2002: adult male from Tenerife (A-B) and preadult female from Gran Canaria (C); **D-E.** *Speleocuma guanche* Corbera, 2002: individual from Lanzarote (D) and preadult female from Tenerife (E).

Figure 4.- A-B. *Campylaspis glabra* Sars, 1879: preadult female from Tenerife (A) and preadult male from Gran Canaria (B); **C-D.** *Diastylis rugosa* Sars, 1865 from Lanzarote.