

# New records of copepods associated with marine invertebrates from the Strait of Gibraltar and nearby areas

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López-González, P. J., Conradi, M., & García-Gómez, J. C., 1997. New records of Copepods associated with marine invertebrates from the Strait of Gibraltar and nearby areas. *Misc. Zool.*, 20.1: 101-110.

*New records of Copepods associated with marine invertebrates from the Strait of Gibraltar and nearby areas.*— In this work, 16 species of commensal or parasitic copepods associated with marine invertebrates from the Strait of Gibraltar are recorded. Eleven species are included into the order Cyclopoida, three into Poecilostomatoida, one into Siphonostomatoida, and another into a family *incertae sedis*. They have been found mainly associated with Ascidians, but also in Pelecypods, Polychaetes, Opisthobranch molluscs, Ophiuroids and Anthozoans. Among these, 13 are new records for the Iberian peninsula fauna, and three are also new for the African coasts. Moreover five species, *Haplostomella malacocera* Chatton & Harant, 1924; *Haplostomella tuberculata* Chatton & Harant, 1924; *Periproctia falsiarcuata* Stock, 1967; *Anthessius arcuatus* López-González, Conradi, Naranjo & García-Gómez, 1992 and *Botryllophilus conicus* Conradi, López-González & García-Gómez, 1994, are recorded for the first time since their original descriptions. Furthermore, new hosts and bathymetrical data of most of the species are provided.

Key words: Copepoda, Cyclopoida, Poecilostomatoida, Siphonostomatoida, Strait of Gibraltar, New records.

(*Rebut*: 12 I 96; *Acceptació condicional*: 7 X 96; *Acc. definitiva*: 29 IV 97)

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This study is part of the research project 'Estudio biológico de las comunidades bentónicas de la Bahía de Algeciras' supported by the Compañía Española de Petróleos, S. A., Fundación Sevillana de Electricidad, Excmo. Ayuntamiento de los Barrios, Mancomunidad de Municipios del Campo de Gibraltar y Agencia de Medio Ambiente (Junta de Andalucía).

## Introduction

British and West-Eastern Mediterranean faunas of copepods associated with marine invertebrates are relatively well-known (HUMES & STOCK, 1973; GOTTO, 1961, 1966, 1993; among others). Nevertheless, with the exception of several publications on symbiotic copepods from the Strait of Gibraltar, most studies have been carried out on molluscs, fishes and other commercial species (CORDERO et al., 1994).

The Strait of Gibraltar is a biogeographically interesting region since it is the meeting point of three marine biogeographical regions: the Lusitanic, Mauritanic, and Western Mediterranean areas, thus inducing an overlapping of its respective faunas. Its exceptional situation offers the opportunity to study distributional processes of the species. It has been considered one of the areas with the highest biodiversity of all European coasts (TEMPLADO et al., 1993). However, the fauna of copepods associated

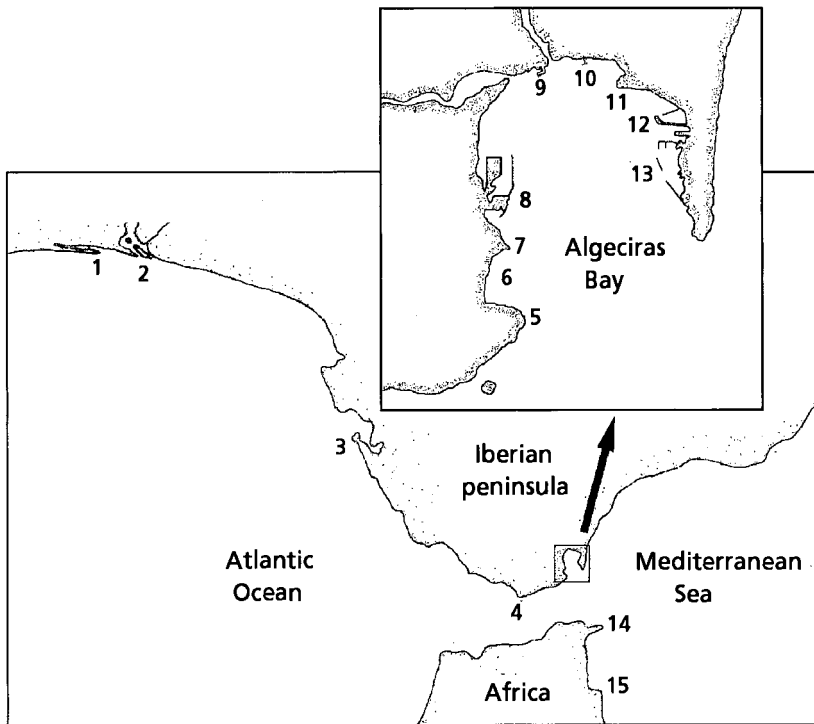


Fig. 1. Sampling localities. Huelva: 1. El Portil; 2. Punta Umbría. Cádiz: 3. La Caleta; 4. Tarifa Island; 5. Punta Carnero; 6. Getares.; 7. San García; 8. El Saladillo and Algeciras Harbour; 9. Thermal power plant harbour; 10. C.E.P.S.A. harbour; 11. El Campamento; 12. San Felipe; 13. Gibraltar harbour. Ceuta: 14. Benzú Bay. Morocco: 15. Cabo Negro.

*Localidades de muestreo. Huelva: 1. El Portil; 2. Punta Umbría. Cádiz: 3. La Caleta; 4. Isla Tarifa; 5. Punta Carnero; 6. Getares.; 7. San García; 8. El Saladillo y Puerto de Algeciras; 9. Puerto central térmica; 10. Puerto C.E.P.S.A.; 11. El Campamento; 12. San Felipe; 13. Puerto de Gibraltar. Ceuta: 14. Bahía de Benzú. Marruecos: 15. Cabo Negro.*

with marine invertebrates at this narrow communication between the Atlantic Ocean and the Mediterranean Sea is relatively unknown.

Little is yet known about the presence and distribution of the copepod fauna from the Strait of Gibraltar and Iberian peninsula. Although 230 species of copepods associated with marine invertebrates have been cited from the British islands (GOTTO, 1993), no more than 20 species have been reported in the Iberian peninsula. Recently, CORDERO et al. (1994) cited a total of seven copepod species associated with marine invertebrates in his catalogue of Iberian zooparasites. None of the species reported from the Strait of Gibraltar by the authors of the present work were included.

The Laboratorio de Biología Marina of the Universities of Sevilla and Cadiz (S Spain) has initiated a program to study the copepod fauna in the Strait of Gibraltar and nearby areas. So far, four marine biological expeditions have been carried out within a more comprehensive programme of marine benthos: 'Bahía 90' and 'Bahía 91' in Algeciras Bay (Southern Iberian peninsula), and 'Ceuta 91' and 'Marruecos 93' in North Africa. Many shorter (seven days) sampling expeditions were also accomplished during the development of the marine biological project 'Estudio Biológico de las comunidades bénticas de la Bahía de Algeciras'. Sporadically, there have been other collections in various localities along the Atlantic coast of Cádiz and Huelva (South-eastern Iberian peninsula).

Some results from these expeditions have now been published: CONRADI et al., 1992, 1993, 1994a, 1994b; CONRADI & LÓPEZ-GONZÁLEZ, 1996; LÓPEZ-GONZÁLEZ et al., 1992a, 1992b, 1993, in press; LÓPEZ-GONZÁLEZ & CONRADI, 1995. The aim of the present article was to further our knowledge of symbiotic copepods from the Strait of Gibraltar, to include the whole Iberian peninsula and North Africa. In addition to the faunistic data, some ecological aspects are also discussed, mainly regarding the host specificity shown by the different copepods species. Biogeographical comments on these symbiotic copepods are incomplete due to the scarce data available. However, the collected species may be included into biogeographical categories, and their relationship with host specificity is discussed.

## Material and methods

Marine invertebrates, hosts of the symbiotic copepods, were collected by hand in the mediolittoral zone, and by SCUBA diving, van veen dredge and box corer in the infralittoral zone. The sampling localities are shown in figure 1.

Hosts were isolated in plastic flasks to avoid contamination and ensure the true copepod-host relationship. When possible, the marine invertebrates were immediately relaxed by the addition of crystal of menthol to the sea-water. Later, the hosts were fixed adding 35-40 % formalin to the sea-water to reach the usual proportions for this fixative (4-6 %).

Commensal and most ectoparasitic copepods were obtained by sieving the formalin through a 100 µm mesh, after washing. Other ectoparasitic copepods were carefully removed directly from their hosts. Endoparasitic copepods were obtained by dissection of marine invertebrates under a dissecting microscope. All copepods were preserved in 70% ethanol. Copepods were cleared in lactic acid, slightly stained with clorazole black, and dissected under a stereomicroscope. Semipermanent preparations were made in lactophenol.

## Results

Table 1 summarizes the parasitic or commensal copepods reported, number of specimens studied, date of collection, locality where found, depth range observed, hosts, main references (with complete description, or with interesting anatomical characteristics or ecological data), and general distribution.

## Discussion

The present study has shown several copepod species to have a larger host range than was previously reported. *Gunenotophorus globularis* is recorded for the first time associated with an ascidian species belonging to the genus *Pseudodistoma* (see ILLG, 1958; GOTTO, 1993). *Haplostomella malacocera* was originally described by CHATTON & HARANT

Table 1. Species of parasitic or commensal copepods collected from the Strait of Gibraltar and nearby areas: \* New records for the Iberian fauna; + New records for the African fauna; ♀♀ Ovigerous females; ♂♂ Adult males; ♀ Young females; cop. Copepodid. (For locality codes see figure 1.)

	Specimens	Date	Locality
Order Cyclopoida Burmeister, 1834			
Family Notodelphyidae Dana, 1853			
Genus <i>Doropygus</i> Thorell, 1859			
<i>Doropygus pulex</i> Thorell, 1859 (*)	14 ♀♀	V 1992	1
Genus <i>Pachypygus</i> G.O. Sars, 1921			
<i>Pachypygus gibber</i> (Thorell, 1859) (*)	1 ♀♀	24 VIII 1991	12
Genus <i>Botachus</i> Thorell, 1859			
<i>Botachus cylindratus</i> Thorell, 1859 (*)	11 ♀♀, 1♂♂	23 VI 1991	7
	4 ♀♀	24 VIII 1991	12
Genus <i>Gunenotophorus</i> Buchholz, 1869			
<i>Gunenotophorus globularis</i> Buchholz, 1869 (*)	1 ♀♀	25 II 1992	12
Genus <i>Doroixys</i> Kerschner, 1879			
<i>Doroixys uncinata</i> Kerschner, 1879 (+)	25 ♀♀	VIII 1993	15
Genus <i>Periproctia</i> Stock, 1967			
<i>Periproctia falsiarcuata</i> Stock, 1967 (*)	8 ♀♀	27 IX 1993	7
	3 ♀♀	XI 1995	4
Family Ascidicolidae Thorell, 1859			
Subfamily Ascidicolinae Thorell, 1859			
Genus <i>Ascidicola</i> Thorell, 1859			
<i>Ascidicola rosea</i> Thorell, 1859 (*)	1 ♀♀	9 VII 1991	11
	1 ♀♀	4 VI 1993	4
Subfamily Haplostominae Chatton & Harant, 1924			
Genus <i>Haplostomella</i> Chatton and Harant, 1924			
<i>Haplostomella malacocera</i> Chatton & Harant, 1924(*)	11 ♀♀	23 XI 1991	13
	2 ♀♀	16 VII 1991	10

*Especies de copépodos parásitos o comensales recolectados en el estrecho de Gibraltar y áreas próximas: \* Nuevas citas para la península ibérica; + Nuevas citas para la fauna africana; ♀♀ Hembras ovígeras; ♂♂ Machos adultos; ♀ Hembras jóvenes; cop. Copepodito. (Para códigos de localidades ver figura 1.)*

Depth	Hosts	References	Distribution
0.5 m	<i>Styela plicata</i> (Lesueur)	SARS, 1921; ILLG, 1958; ILLG & DUDLEY, 1961; GOTTO, 1993	Mediterranean, North Atlantic, West Africa, Barbados, Japan, Srilanka, Australia, New Zealand
6 m	<i>Phallusia fumigata</i> (Grübe)	ILLG, 1958; OISHI, 1961; GOTTO, 1993	Mediterranean, North- eastern Atlantic, Japan, Australia?
3 m	<i>Ascidia mentula</i> Müller	SARS, 1921; ILLG, 1958; ILLG & DUDLEY, 1961;	Mediterranean, North- eastern Atlantic
6 m	<i>Phallusia fumigata</i> (Grübe)	GOTTO, 1993	
5 m	<i>Molgula bleizi</i> (Lacaze-Duthiers)	CANU, 1892; SARS, 1921; ILLG, 1958; GOTTO, 1993	Mediterranean, North- eastern Atlantic, Florida Southern Africa, Indic
3-6 m	<i>Pseudodistoma</i> <i>obscurum</i> Pérès	CANU, 1892; ILLG, 1958; GOTTO, 1993	Mediterranean, North- eastern Atlantic
9 m	<i>Polysincraton lacazei</i> Giard	ILLG & DUDLEY, 1961 (as <i>Bonnierilla arcuata</i>	Western Mediterranean
10-15 m	"	Brément, 1909); STOCK, 1967	
5 m	<i>Molgula</i> sp.	CANU, 1892; CHATTON &	Mediterranean, North-
15 m	<i>Halocynthia papillosa</i> (Linné)	BRÉMENT, 1915; SARS, 1921; MONNIOT, 1961; ILLG & DUDLEY, 1980	eastern Atlantic California, Canada, Antarctic
2-6 m	<i>Aplidium elegans</i> (Giard, 1872)	CHATTON & HARANT, 1924; OISHI & ILLG, 1977; ILLG &	Western Mediterranean
6 m	"	DUDLEY, 1980	

Table 1 (cont.)

	Specimens	Date	Locality
<i>Haplostomella tuberculata</i> Chatton & Harant, 1924 (*+)	6 ♀♀	VIII 1991	14
	5 ♀♀	22 VII 1994	5
Subfamily Botryllophilinae Sars, 1921			
Genus Botryllophilus Sars, 1921			
<i>Botryllophilus conicus</i> Conradi, López-González & García-Gómez, 1994	53 ♀♀	IX 1993	6
Family Mesoglicolidae Zulueta, 1911			
Genus <i>Mesoglicola</i> Quidor, 1906			
<i>Mesoglicola delagei</i> Quidor, 1906 (*)	19 ♀♀, 14 ♂♂	VII 1991	10
	4 ♀♀, 4 ♂♂	-	8
	5 ♀♀, 3 ♂♂	-	9
	10 ♀♀, 8 ♂♂	XI 1993	7
Orden Poecilostomatoida Thorell, 1859			
Family Sabelliphilidae Gurney, 1927			
Genus <i>Herrmanella</i> Canu, 1891			
<i>Herrmanella rostrata</i> Canu, 1891 (*)	25 ♀♀	VII 1995	2
Family Nereicolidae Claus, 1875			
Genus <i>Nereicola</i> Keferstein, 1863			
<i>Nereicola ovatus</i> Keferstein, 1863 (*)	3 ♀♀, 1 cop.	22 VII 1995	3
Family Anthessiidae Humes, 1985			
Genus <i>Anthessius</i> Della Valle, 1880			
<i>Anthessius arcuatus</i> López-González, Conradi, Naranjo & García-Gomez, 1992 (+) 4 ♀♀, 25 ♂♂, 40 cop.	18 VIII 1991	14	
Orden Siphonostomatoida Latreille, 1829			
Family Cancerillidae Giesbrecht, 1897			
Genus <i>Cancerilla</i> Dalyell, 1851			
<i>Cancerilla tubulata</i> Dalyell, 1851 (*)	1 ♀♀	XI 1992	12
	1 ♀♀	VII 1993	8
Family incertae sedis			
Family Antheacheridae M. Sars, 1870			
Genus <i>Staurosoma</i> Will, 1844			
<i>Staurosoma parasiticum</i> Will, 1844 (*)	5 ♀♀, 5 ♂♂	VII 1995	11

Depth	Hosts	References	Distribution
5 m	<i>Aplidium elegans</i> (Giard)	CHATTON & HARANT, 1924; OISHI & ILLG, 1977; ILLG &	Western Mediterranean
5-7 m	<i>Pseudodistoma obscurum</i> Perès	DUDLEY, 1980	
8 m	<i>Aplidium conicum</i> (Olivi)	CONRADI et al., 1994a	Strait of Gibraltar
20 m	<i>Corynactis viridis</i> Allman	QUIDOR, 1906, 1922, 1936; TATON, 1934; HAEFELFINGER	Western Mediterranean, North-eastern Atlantic
5-9 m	"	& LAUBIER, 1965; CONRADI	
9 m	"	& LÓPEZ-GONZÁLEZ, 1996	
7 m	"		
0.5 m	<i>Mactra coralina</i> (Linné)	CANU, 1892; HUMES & STOCK, 1973; GOTTO, 1993	Mediterranean, North- eastern Atlantic
5 m	<i>Platynereis dumerilii</i> (Audouin & Milne Edwards)	KEFERSTEIN, 1863; STOCK, 1966; GOTTO, 1993	Mediterranean, Black Sea, North-eastern Atlantic
8 m	<i>Berthellina</i> sp.	LÓPEZ-GONZÁLEZ et al., 1992b	Strait of Gibraltar
5 m	<i>Amphipholis squamata</i> Delle Chiaje	CARTON, 1968; KENSLEY, 1970; GOTTO, 1993	Mediterranean, North- eastern Atlantic, North- eastern Pacific, South- eastern Africa
4 m	"		
0.5 m	<i>Anemonia sulcata</i> Pennant	CAULLERY & MESNIL, 1902; ZULUETA, 1911; LAUBIER & SCHMIDT, 1971; GOTTO, 1993	Mediterranean, North- eastern Atlantic, Red Sea

(1924) but it was not assigned to any host species since the authors only commented 'dans un Aplidien'. In the present study the species was found associated with the compound ascidian *Aplidium elegans*. *Haplostomella tuberculata* was found for the first time associated with in *Aplidium elegans* and with a *Pseudodistoma* species (see CHATTON & HARANT, 1924; OISHI & ILLG, 1977). Finally, the recently described species *A. arcuatus* originally associated with the opisthobranch molluscs *Bertella stellata* (see LÓPEZ-GONZÁLEZ et al., 1992b) was found associated with a related host genus, *Bertellina*.

According to these records, 13 of the 16 species of commensal or parasitic copepods associated with marine invertebrates are new records for the Iberian peninsula fauna, and three are also new for the African coasts (see table 1). Moreover five species: *H. malacocera*, *H. tuberculata*, *P. falsiarcuata*, *A. arcuatus*, and *B. conicus*, are recorded for the first time since their original descriptions.

The species collected can be included into three different geographical categories according to previous bibliographical data (see ILLG & DUDLEY, 1961; 1980; GOTTO, 1993): cosmopolite (C), neighbouring Atlantic and Mediterranean (AM), and Western Mediterranean (WM). In addition, a further subdivision can be introduced with respect to the host range observed for the different copepod species; a wide range of hosts (WH), several genera of hosts (SH), and high specificity of hosts (HH). The species reported in this paper may thus be arranged as follows: C-WH: *D. pulex*, *P. gibber*, *G. globularis*, *A. rosea*; AM-SH: *B. cylindratus*, *D. uncinata*, *H. rostrata*; AM-HH: *M. delagei*, *N. ovatus*, *S. parasiticum* (plus Red Sea), *C. tubulata* (plus Southern Africa); WM-SH: *P. falsiarcuata*; WM-HH: *H. malacocera*, *H. tuberculata*, *B. conicus*, *A. arcuatus*.

It is not unexpected that those species with a wide distributional range also have a wide host range. Most species included in this category are associated with ascidian species usually found in fouling studies, attached to commercial ships or related with rafting processes. Moreover, most of the species here cited are included in AM

and WM geographical categories, with SH and HH. However, it is expected to find more cosmopolitan species in future research. Although the majority of these copepods are probably scientifically known and reported mainly from the European and North African coasts, it is likely that, in the next few years, new species from material obtained in the Iberian peninsula will be described. It will be possible to discuss the relationship between Iberian fauna and those from the other countries or regions once more data from the Iberian peninsula becomes available.

### Acknowledgements

The authors wish to thank the many researchers from different institutions and countries for their valuable collaboration with information and literature in order to improve the knowledge of the Iberian fauna of commensal and parasitic copepods. We also thank Drs. Rocío Juan and Cesar Megina for their help during the collecting period.

### Resumen

*Nuevos datos de copépodos asociados a invertebrados marinos en el estrecho de Gibraltar y áreas próximas*

En este trabajo se citan 16 especies de copépodos comensales o parásitos asociados a invertebrados marinos en el estrecho de Gibraltar y áreas próximas (fig. 1, tabla 1). Once de ellas pertenecen al orden Cyclopoida, tres a Poecilostomatoida, una a Siphonostomatoida, y otra a una familia de posición incierta.

La mayoría de estas especies han sido halladas asociadas a ascidias, aunque también se citan copépodos asociados a bivalvos, poliquetos, moluscos opisthobranchios, ofiuroides y antozoos. Se aportan nuevos datos sobre el rango de hospedadores de *Gunenotophorus globularis*, *Haplostomella malacocera*, *H. tuberculata* y *Anthessius arcuatus*.

De las 16 especies incluidas en este estudio, 13 son citadas por primera vez para la península ibérica, y tres lo son



también para la fauna africana. Además cinco especies son citadas por primera vez desde su descripción original: *Haplostomella malacocera* Chatton & Harant, 1924; *Haplostomella tuberculata* Chatton & Harant, 1924; *Periproctia falsiarcuata* Stock, 1967; *Anthessius arcuatus* López-González, Conradi, Naranjo & García-Gómez, 1992 y *Botryllophilus conicus* Conradi, López-González & García-Gómez, 1994.

Desde un punto de vista zoogeográfico resulta prematuro concluir afinidades faunísticas del estrecho de Gibraltar con regiones biogeográficas colindantes. El conocimiento de esta fauna en la península ibérica es aún insuficiente, y esperamos que en nuevos trabajos se sigan citando especies de copépodos simbioses para alcanzar un nivel de conocimiento comparable, al menos, al de otras regiones del Atlántico nordeste.

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