Iberus, 19 (1): 25-35, 2001

Eulimid gastropods (Caenogastropoda: Eulimidae) of the Canary Islands. Part II. Species parasiting the crinoid *Antedon bifida*

Eulímidos (Caenogastropoda: Eulimidae) de las Islas Canarias. Parte II. Especies parásitas del crinoideo *Antedon bifida*

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Recibido el 11-VII-2000. Aceptado el 18-XII-2000

ABSTRACT

The present work deals with two species of eulimids, *Curveulima dautzenbergi* and *Crinophtheiros collinsi*, found parasiting the crinoid *Antedon bifida* in Tenerife, Canary Islands. Data on shell, soft parts, lifestyle and infestation rates are provided.

RESUMEN

El presente trabajo versa sobre dos especies de eulímidos, *Curveulima dautzenbergi* y *Crinophtheiros collinsi*, que parasitan al crinoideo *Antedon bifida* en la Isla de Tenerife (Canarias). Se aportan datos sobre la concha, partes blandas, ecología y tasas de infección.

KEY WORDS: Mollusca, Gastropoda, Eulimidae, *Curveulima dautzenbergi*, *Crinophtheiros collinsi*, Crinoidea, *Antedon bifida*, Tenerife, Canary Islands.
PALABRAS CLAVE: Mollusca, Gastropoda, Eulimidae, *Curveulima dautzenbergi*, *Crinophtheiros collinsi*, Crinoidea, *Antedon bifida*, Tenerife, Islas Canarias.

INTRODUCTION

We follow the serie of works dealing with the eulimids gastropods of the Canary Islands. We dedicated a former paper in this same volume to the species parasiting sea urchins, and we deal here with those found on the crinoid *Antedon bifida* (Pennant), very common in littoral waters of this Archipielago. In a previous paper, RODRÍGUEZ (2000) described the new species *Melanella lutea*, which parasites the sea cucumber *Holothuria sanctori* Delle Chiaje. In the other hand, in recent year ENGL (1997a, 1997b, 1998) has described some new species of eulimids in circalittoral bottoms of Puerto del Carmen, Lanzarote, based upon dead shells.

MATERIAL AND METHODS

The material studied comes from samples of the crinoid *Antedon bifida* taken from the infralittoral zone of Tene-

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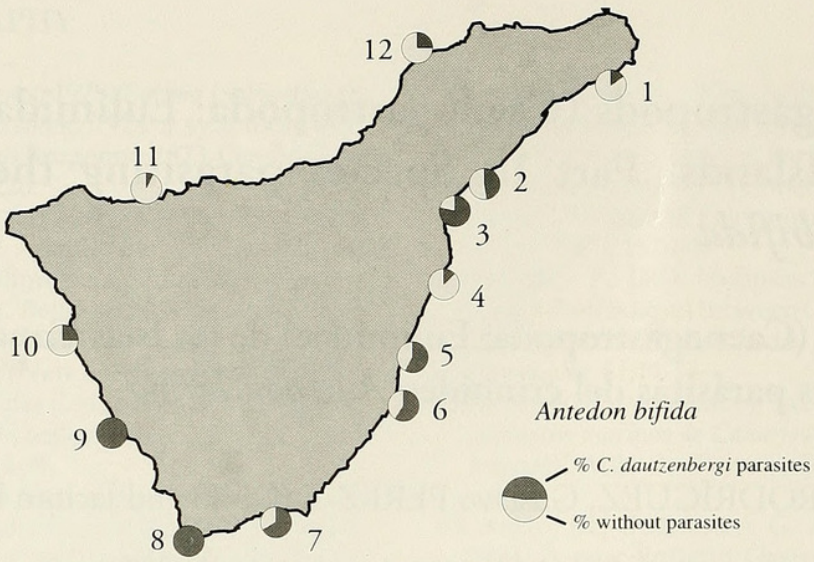


Figure 1. Sampling localities.
Figura 1. Localidades de muestreo.

rife in 16 dives, between 5 and 35 m in depth, in several localities throughout this island (see Table I and Figure 1). Some additional samples were taken in other islands (Fuerteventura, el Hierro y La Palma).

The crinoids captured (294 specimens) along with the eulimid parasites were preserved in ethanol 70% and voucher material was deposited at the Animal Biology Department of the University of La Laguna.

RESULTS

Family EULIMIDAE Philippi, 1853
Genus *Curveulima* Laseron, 1955

Curveulima dautzenbergi (Pallary, 1900) (Figs. 2, 4-10)

Eulima (Vitreolina) dautzenbergi Pallary, 1900 "Coquilles marines du littoral du département D`Oran." *Journal de Conchyliologie*, 48: 211-422.

Type locality: Roseville (Orán).
Material studied: The material studied in Tenerife Island is detailed in Table I and Figure 1, as well as the infestation rate for each locality (Table II). A total of 181 specimens of this eulimid were found in the 294 specimens of *Antedon bifida* collected. Additional specimens were obtained in most of the samples of *A. bifida* from Fuerteventura, El Hierro and La Palma islands.

Shell: Live specimens with transparent shell, smooth, glossy, clearly curved and delicate aspect (Figs. 4, 5). The curvature of the axis of the shell varies in the specimens studied and it is very obvious in the larger. In big specimens the shell is clearly curved towards the right. Sometimes a slight dorsal curvature of the apex with respect to the aperture is observed.

Whorls slightly convex. Suture slightly marked, like a thin line along the whorl. False suture very evident, parallel and below the true suture. The space between the sutures is approximately one third of the height of the whorls.

Surface of the shell without ornamentation. A fine line is observed marking the suture and the scars left by

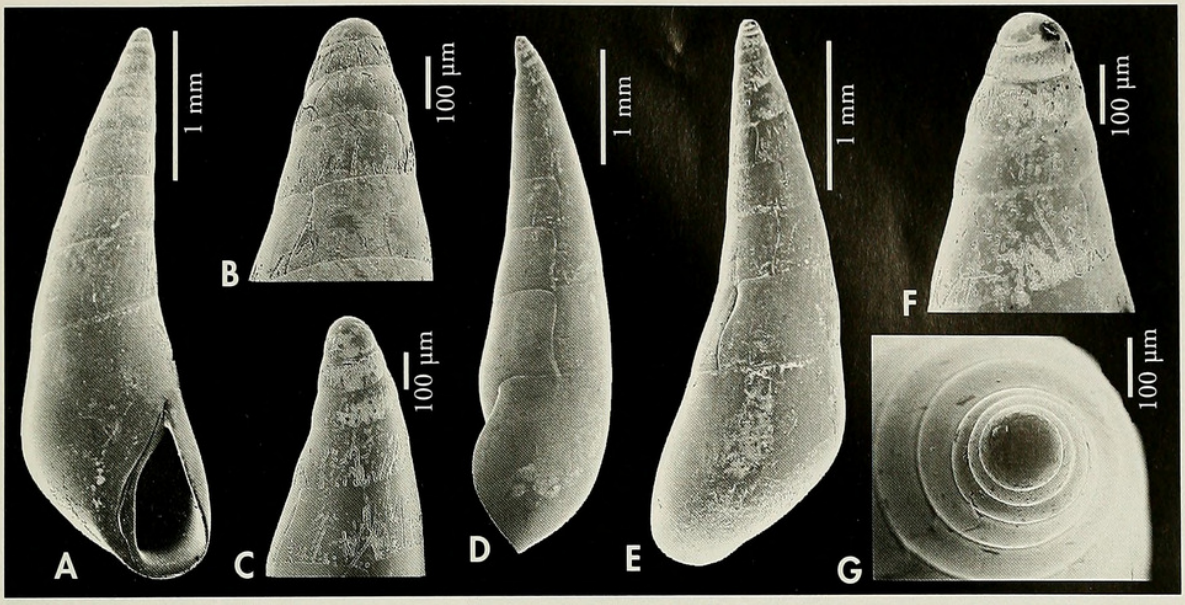


Figure 2. *Curveulima dautzenbergi.* A: ventral view of the shell; B: apex in ventral view; C: apex in lateral view; D: shell in lateral view; E: shell in dorsal position; F: apex in dorsal view; G: upper view of the protoconch.

Figura 2. Curveulima dautzenbergi. *A: vista ventral de la concha; B: ápice en vista ventral; C: ápice en vista lateral; D: concha en vista lateral; E: concha en posición dorsal; F: ápice en vista dorsal; G: vista superior de la protoconcha.*

the previous position of the inner lip during the periods when the animal growth stopped. These scars are mainly on the right margin, although the position varied in the specimens studied. There were shells with scars clearly lined up that presented a very marked curvature; others had a scar ahead or behind with respect to the previous one. The study of the shells with SEM confirms the absence of ornamentation or micro-sculpture on the surface of the shell, only the sutures and growth scars are appreciated. In spite of the live shells studied, a high degree of abrasion was observed (Fig. 2).

Protoconch smooth, transparent, without ornamentation or colour. The presence of individuals with one whorl adhered to the host seems to indicate the absence of a planktotrophic larval phase. This would be corroborated by the lack of marks on the shell that indicate the presence of protoconch II.

Aperture oval, drop-shaped, tall, quite sharp adapically and rounded at the base. The lower margin of the aperture exceeds the shell edge. Outer lip not swelled, projected at the centre forming a sinus. The internal margin of the aperture swelled. This callus is appreciable in younger specimens and very marked in larger shells.

Size: The number of whorls of the specimens studied ranged from one to nine. The average size was 4.90/1.56 mm (width/length) in specimens of nine whorls (Table III).

Soft parts: Can be perfectly observed by transparency in living specimens, held to the host or crawling once they are free (Fig. 6). Two zones are clearly differentiated:

1. Gonad-visceral zone yellow-orange in colour. Reddish tones may be present in larger specimens. Juveniles paler, almost hyaline in smaller individuals. A series of small reddish dots, located in all the whorls and without any pattern, are visible in this zone. In larger specimens the reddish dots are more numerous and intense.

Table I. Sampling localities in Tenerife Island.
Table I. Localidades de muestreo en Tenerife.

Nº	Nº samples	Latitude	Longitude	Locality
1	3	3153502	383734	Las Teresitas
2	2	3142338	369506	Radazul
3	1	3139345	366594	Las Caletillas
4	1	3130701	365361	Ptito. Güímar
5	1	3118638	359865	Las Eras
6	2	3116209	359468	Porís de Abona
7	1	3101415	344499	Agua Dulce
8	1	3098165	334277	Pta. La Rasca
9	1	3112015	325169	Playa Paraíso
10	1	3120183	320729	Alcalá
11	1	3139814	326886	Garachico
12	1	3155267	360932	La Barranquera

2. Cephalic zone orange with numerous reddish dots, whose position varies according with the size of the specimens:

a) In smaller specimens the dots had not an apparent pattern on the dorsal view and they are slightly aligned parallel to the suture on the ventral one. In some medium or large specimens this same pattern was observed.

b) In larger specimens the colour of the dots is much more intense, in some areas they join forming a red band, and the lines starting at the suture of the shell progress towards the centre of the last whorl where they fragment forming a transverse band with clearly defined dots. The red lines beginning at the suture alternates with orange zones and glassy yellow highlights are observed.

On the head, a dorsal zone, whitish with yellow highlights, is appreciated, flanked at both sides by small pale-orange dots (Fig. 7). Cephalic tentacles thin, long and blunt. The edge is hyaline and the mid-line yellow. An orange spot is observed at the base of the tentacles.

Eyes black, immediately behind the orange cephalic spot, very obvious and always inside the shell. The vision is through the shell whether the animal is crawling or adhered to the host.

Foot hyaline with small orange and yellow dots (Fig. 8).

Operculum slender, paucispiral, transparent, slightly yellowish with tenuous growth lines.

Radula absent.

Data on life history: *Curveulima dautzenbergi* parasites the crinoid *Antedon bifida* (Fig. 9). It is a sporadic parasite, which if disturbed looses itself from the host and crawl freely around the substratum without suffering any damage.

The position of the parasite on the host is variable. Specimens of *C. dautzenbergi* were observed adhered to the finials, arms or central disk in both dorsal and ventral sides of crinoids (Fig. 10). Those adhered to the central disk were always large specimens and juveniles were never seen in this zone. Parasites of different sizes were observed in arms and finials.

The maximum number of parasites per crinoid was 19, all small sized, on a specimen of *A. bifida*.

A total of 181 specimens of *C. dautzenbergi* were found in 294 specimens of *A. bifida*. The results obtained in the samples are detailed in Tables I, II and Figure 1, as well as the infestation rates for each locality and total.

In all the samples taken in the islands of Fuerteventura, El Hierro and La Palma this species was observed, which confirms that it is a common

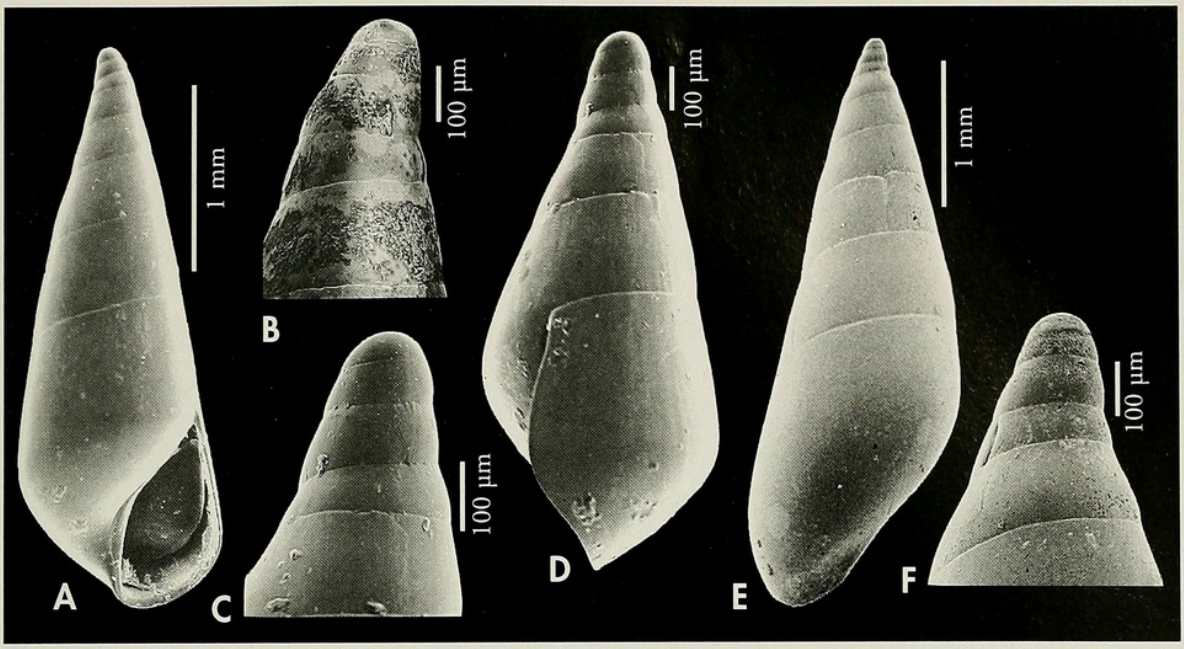


Figure 3. *Crinophtheiros collinsi.* A: ventral view of the shell; B: apex in ventral view; C: apex in lateral view; D: shell in lateral view; E: shell in dorsal position; F: apex in dorsal view.
Figura 3. Crinophtheiros collinsi. *A: vista ventral de la concha; B: ápice en vista ventral; C: ápice en vista lateral; D: concha en vista lateral; E: concha en posición dorsal; F: ápice en vista dorsal.*

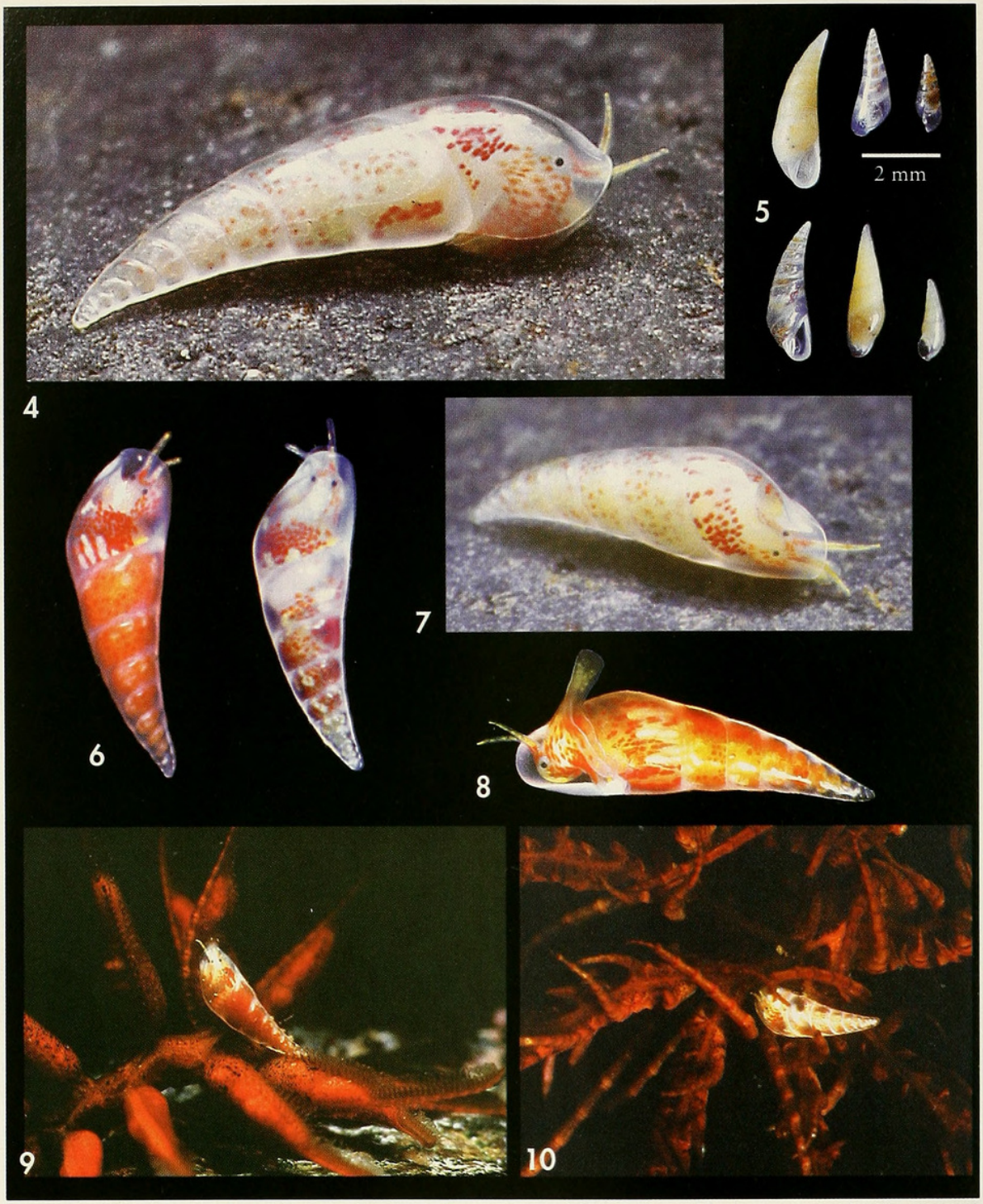
species all around the Canarian Archipelago.

Distribution: Until now it was only known from the western Mediterranean Sea. We extend here its geographical range of distribution to the Canary islands.

Remarks: The specimens studied has been identified as *C. dautzenbergi* by Dr. Warén (com. pers.). PALLARY (1900) des-

Table II. Number of specimens studied of *Antedon bifida, Curveulima dautzenbergi* and *Crinophtheiros collinsi* in each locality.
Table II. Número de ejemplares de Antedon bifida, Curveulima dautzenbergi *y* Crinophtheiros collinsi *estudiados en cada localidad.*

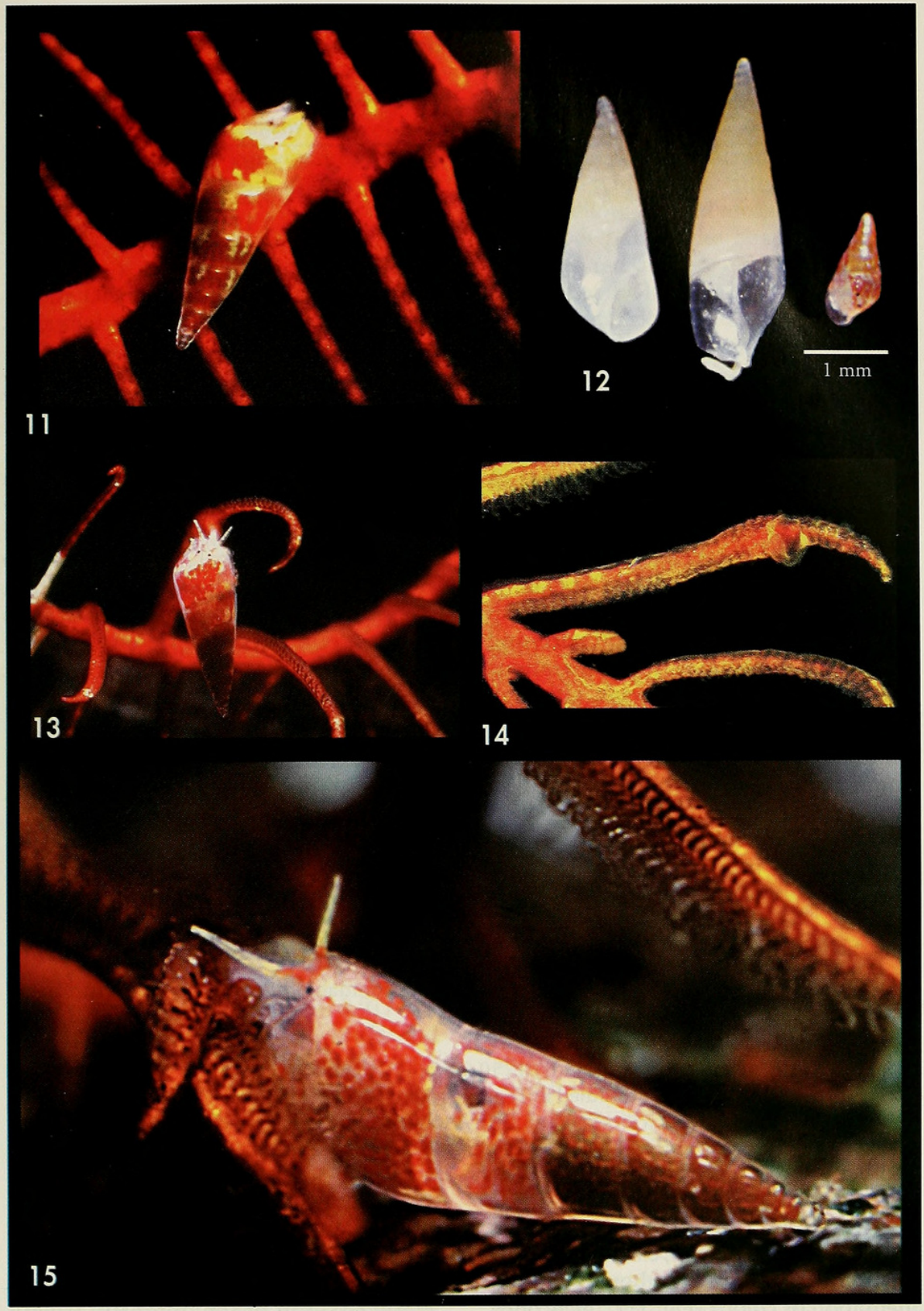
Locality	Nº of crinoids	Nº of *C. dautzenbergi*	% *C. dautzenbergi* parasited	Nº of *C. collinsi*	% *C. collinsi* parasited
1	93	14	15.1	3	3.2
2	36	17	42.2	2	5.5
3	46	36	78.3	5	10.9
4	24	3	12.5	2	8.3
5	19	11	57.9	3	15.8
6	39	23	59.0	1	2.5
7	6	4	66.6	1	16.6
8	1	5	100.0	0	0
9	4	64	100.0	3	75.0
10	8	2	25.0	0	0
11	14	1	7.1	0	0
12	4	1	25.0	0	0
TOTAL	294	181	$\bar{X}$ = 49.1	20	$\bar{X}$ = 6.8



Figures 4-10. *Curveulima dautzenbergi*. 4: living specimen; 5: several specimens; 6-8: common colour pattern; 9: an specimen adhered to the finial of *Antedon bifida*; 10: another specimen adhered to the central disk of *A. bifida*.
Figuras 4-10. Curveulima dautzenbergi. *4: ejemplar vivo; 5: conchas; 6-8: patrones de coloración; 9: ejemplar fijado a un brazo de* Antedon bifida*; 10: otro ejemplar fijado al disco central de* A. bifida.

cribed this species under the genus *Vitreolina*, due great similarity with others species of this genus. Later, LASERON (1955) erected the genus *Curveulima* to embrace a group of Australian and Antarctic species.

In the book of NORDSIECK AND TALAVERA (1979) on marine molluscs from Madeira and Canary Island, some species of eulimids with curved shell were included, but none fit well with *C. dautzenbergi*. Only the species cited by



Figures 11-15. *Crinophtheiros collinsi*. 11: living specimen; 12: several specimens; 13: common coloration; the proboscis of the parasite is observed adhered to the finial of the crinoid; 14: pinna scar of *Antedon bifida*; 15: an specimen parasiting *A. bifida*.
Figuras 11-15. Crinophtheiros collinsi. *11: ejemplar vivo; 12: conchas; 13: coloraciones; se ve la probóscide del parásito sujeta al brazo del crinoideo; 14: cicatriz en la pinna de* Antedon bifida*; 15: un ejemplar parasitando* A. bifida.

Table III. Number of whorls and mean sizes of 48 specimens of *Curveulima dautzenbergi*.
Table III. Número de vueltas y talla media de 48 especímenes de Curveulima dautzenbergi.

Nº whorls	Nº of specimens	width/ length (mm)
9	2	4.85 / 1.55
8	15	3.62 / 1.40
7	5	3.11 / 1.18
6	8	2.28 / 0.85
5	9	1.92 / 0.58
4	5	1.38 / 0.49
3	4	1.07 / 0.39
TOTAL	48	$\bar{X}$ = 2.61 / 0.92

these authors as *Eulima* (*vitreolina*) *cf. spiridioni* Dautzenberg and Fischer, 1896, could refer to *C. dautzenbergi*, although they described the shell as white in deep water of Azores, Porto Santo and Tenerife, without any mention to the depth or information concerning soft parts and lifestyle of the animal. The illustrations slightly resemble this species, although the aperture is clearly different.

WARÉN (1984), in his revision of the eulimids genera, included in *Curveulima* some species from Japan and Cuba, pointing out the similarities between *Curveulima* and *Vitreolina*. BOUCHET AND WARÉN (1986), in their revision of bathyal and abyssal eulimids of the northeastern Atlantic, included within the genus *Curveulima* two deep waters species found near the Canary Islands: *C. macrophtalmica* (Warén, 1972), and *C. eschara* described as new.

We record *C. dautzenbergi* for the first time in the Canary Islands, and no other species parasiting *Antedon bifida* has been previously mentioned in this area.

Genus *Crinophtheiros* Bouchet and Warén, 1986

Crinophtheiros collinsi (Sykes, 1903) (Figs. 3, 11-15)

Eulima collinsi Sykes, 1903. Notes on some British Eulimidae. *Proceedings of the Malacological Society of London*, 5: 348-353.

Type locality: Guernsey (British Islands), in 10 fathoms.
Material studied: The material studied in Tenerife Island is detailed in Table I and Figure 1, as well as the infestation rate for each locality (Table II). A total of 20 specimens of this eulimid were found in the 294 specimens of *Antedon bifida* collected. Additional specimens were obtained in samples of *A. bifida* from El Hierro and La Palma islands.

Shell: Shell completely transparent, glossy, thin, very delicate, extremely fragile and perfectly smooth, without any ornamentation or colour (Fig. 11). Teleoconch straight and protoconch generally slightly curved with respect to the shell axis, but some specimens may have a straight shell (Fig. 12). Last whorl very high.

Suture very faint, hardly noticeable under magnifying glass. False suture evident and clear, even if the animal is completely or halfway inside the shell. Faint scars on the surface of the previous position of the outer lip, irregularly arranged since the animal growths more than one whorl each growth period. The study of the shells with SEM confirms the absence of ornamentation or micro-sculpture on the surface of the shell, and only the sutures and

growth scars are appreciated (Fig. 3). Some shells present an eroded surface, this may be caused by erosion or chemical attack due to preservative fluids. Teleoconch whorls smooth, those of the protoconch slightly convex and width not constant originating a faint curvature of the larval shell.

Apex round. Protoconch transparent, smooth, without ornamentation or colour. Distinguished from the teloconch by a slight curvature of the shell and by the convex whorls. According to FRETTER AND GRAHAM (1982) the protoconch has four whorls, but in the specimens studied by us only three larval whorls are visible. There is no trace in the protoconch indicating the presence of protoconch II, therefore this species probably lacks planktotrophic larval phase.

Aperture extremely fragile. Only five specimens collected in Tenerife presented the aperture entire. Parasites alive on the host had the aperture broken or broke it when released. It is tall, narrow and slightly rectangular in the central zone. Upper part sharpened. Outer lip thin, not swelled terminally and almost straight in the middle. Base rounded and surpassing the edge of the shell, making it elongated.

Size: The specimens collected in Tenerife presented a range of 3-7 whorls. The dimensions (length/width) of the shells with intact aperture were: 3.56/1.20 mm and 4.06 mm/1.33 mm in two specimens with 7 whorls; 2.91/1.04 mm in one specimen with 6 whorls; and 2.18/0.49 mm and 2.49/0.97 mm in two specimens with 5 whorls.

Soft parts: Perfectly visible by shell transparency. The gonad-visceral zone varies in colour from orange, red, brownish-gray-greenish to clearly greenish. In all cases intense red dots are observed in this area. These dots are clearly defined as small rounded spots with diffuse edges. In the last three whorls of some specimens small yellow spots are observed close each other and forming lines starting at the suture and almost reaching the next one (Fig. 13).

Last whorl with many red dots arranged without an apparent order. The centre of the spots has a more intense colour and the edges much more diffuse. In many specimens these spots are very close and look like an unique crimson red coloured area. Close to the suture the dots are arranged in order, forming wide lines alternating with bright yellow spotted areas.

Upper part of the head yellow. On the sides, red dots are observed from the red spot of the last whorl to the tentacles. Eyes big, black, rounded and very evident, located at the centre of this dotted line. The animal can see by shell transparency either when held to the host or crawling freely on the substratum.

Tentacles long, blunt, divergent, hyaline, with yellow highlights on the surface and red base. Foot whitish, with red dots at the posterior end and middle part, with hyaline margins.

Proboscis whitish, without coloured area, strongly fixed to the host. Once the eulimid is detached from its host a marked scar left (Fig. 14).

Operculum yellowish, paucispiral, very thin and transparent, hence two orange spots on the foot can be observed, one on the apex and another on the base of the aperture. The study of the operculum with SEM shows that it presents faint growth lines in the inner basal zone and the rest is completely smooth.

Radula absent.

Data on life history: *Crinophtheiros collinsi* lives parasite on the crinoid *Antedon bifida* (Fig. 15). It is sporadic parasite, able of releases from the host and crawls over substratum.

All the specimens collected in Tenerife remained adhered to the host during the study. In the laboratory they were only freed after persisten disturbation. This fact, along with the absence of specimens in the scraped stones, washed seaweeds or free in the sediment, presumes that in spite of the ability of freeing themselves from the host, this occurs infrequently in nature.

The insertion zone of the eulimid on the host is variable. Specimens have been found in the arms or finials of the crinoid, but never near the central disk. In all the cases one only specimen of *C.*

collinsi was found on the crinoid, although they frequently had simultaneously one specimen of *C. collinsi* and one or several of *Curveulima dautzenbergi*.

In the samplings conducted in Tenerife a total of 294 crinoids were studied, obtaining 20 specimens of *C. collinsi*. In all the cases there was only one parasite per host, and the infestation rate of *C. collinsi* was 6.8% (Table II).

Distribution: It was known from the northeastern Atlantic.

Remarks: SYKES (1903) described this species as *Eulima collinsi* in British waters, without providing any data regarding soft parts of the animal or lifestyle.

FRETTER (1955) make a detailed description of the anatomy and way of life of an eulimid gastropod (identified as *Balcis devians*) parasite of *Antedon bifida*. According to BOUCHET AND WARÉN (1986) and judging from the figure of FRETTER AND GRAHAM (1962, fig. 139), this species should probably be referred to *C. collinsi*. Subsequently, the same authors (FRETTER AND GRAHAM, 1982) included a complete description of *Vitreolina collinsi* within their serie on the prosobranch molluscs of Britain and Denmark. This description of *V. collinsi* fits well with the specimens found in Tenerife, except for some details regarding colour pattern, although this minor differences could be caused by the fixative process.

BOUCHET AND WARÉN (1986) erected the new genus *Crinophtheiros* to include some species of eulimids parasite of crinoids. Up to date this genus includes *C. comatulicola* (Graff, 1875), parasite of *Antedon mediterranea* (Lamark) and *C. giustii* Gaglini, 1991, probable parasite of *Leptopmetra phalangium* (Müller) (see GAGLINI, 1991), in the Mediterranean, and *C. collinsi*, parasite of *Antedon bifida* and *C. junii*, in the northeastern Atlantic, the last one only known from deep water of the Azores area (J. Templado com. per.).

ACKNOWLEDGEMENTS

Our gratitude to Dr. Anders Warén (Swedish Museum of Natural History) for his interesting comments and identification of the specimens. To Dr. José Templado (Museo Nacional de Ciencias Naturales) for the revision of the manuscript. To Leopoldo Moro, author of the photo nº 15, for his generous contribution.

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