Eulimid gastropods (Caenogastropoda: Eulimidae) of the Canary Islands. Part I. Species parasiting sea urchins

Eulímidos (Caenogastropoda: Eulimidae) de las Islas Canarias. Parte I. Especies parásitas de erizos de mar

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ABSTRACT

The present paper deals with 4 species of eulimid gastropods parasitic on sea urchins: *Echineulima leucophaes* parasite of *Diadema antillarum*; *Vitreolina philippi* parasite of *Arbacia lixula, Paracentrotus lividus* and *Sphaerechinus granularis;* and *Nanobalcis nana* and *Sabinella bonifaceae* both parasites of the sea urchin *Cidaris cidaris*. A complete description of shell and soft parts of these species along wiht data on lifestyle and infestation rates is provided.

RESUMEN

Este trabajo versa sobre 4 especies de eulímidos parásitos de erizos de mar: *Echineulima leucophaes* parásita de *Diadema antillarum*; *Vitreolina philippi* parásita de *Arbacia lixula, Paracentrotus lividus* y *Sphaerechinus granularis;* y *Nanobalcis nana* y *Sabinella bonifaceae* ambas parásitas del erizo *Cidaris cidaris*. Se incluyen descripciones de concha y partes blandas, así como datos sobre su ecología y tasas de infección.

KEY WORDS: Mollusca, Gastropoda, Eulimidae, *Echineulima leucophaes, Vitreolina philippi, Nanobalcis nana, Sabinella bonifaciae,* Tenerife, Canary Islands, NE Atlantic.
PALABRAS CLAVE: Mollusca, Gastropoda, Eulimidae, *Echineulima leucophaes, Vitreolina philippi, Nanobalcis nana, Sabinella bonifaciae,* Tenerife, Islas Canarias, Atlántico NE.

INTRODUCTION

The Eulimidae is a large family of parasitic gastropods. Almost all species are parasites on echinoderms and typically have small, glossy, white shells. Many are free-living, able to move from one host to another, but some are permanently attachet to their host, or have become endoparasites. There are probably thousand species worldwide, many of them undescribed. According to WARÉN (1984), there have been described about 850 living species, of which about 150 from North Atlantic, but few of them are known from their host. Nevertheless, the species of eulimids are almost impossible to place in genera if the host is unknown, and often difficult to determine. In many species there is a pronounced sexual dimorfism and to some extent the development of the shell depends on sex of the animal or on the presence or absence of additional individuals of the same species, which in some of them determine the sex of

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

newly settle larvae (WARÉN, 1984). This complicates specific classification. A complete review of the biology and systematic of the family can be seen in the above mentioned work (WARÉN, 1984).

The eulimids from the Canary Islands are poorly known. NORDSIECK AND GARCÍA-TALAVERA (1979) included eighteen species of Eulimidae in their book on marine molluscs of Madeira and Canary Islands, mainly based upon the work of WATSON (1897). The status of most of these nominal species must be questioned in light of recent work. BOUCHET AND WARÉN (1986) in their revision of the northeast Atlantic bathyal and abyssal molluscs described six new species of Eulimidae near the Canary Island, between 500 and 850 m in depth. In recent year ENGL (1997a, 1997b, 1998) has described three new species of eulimids in circalittoral bottoms of Puerto del Carmen, Lanzarote. All these descriptions were based upon dead shells. An additional paper was published by ENGL (1999) on *"Eulima" fuscozonata* Bouchet and Warén, 1986.

In recent years we have carried out an exhaustive searching for species of Eulimidae, mainly in Tenerife Island. In a former paper the first author (RODRÍGUEZ, 2000) described the new species *Melanella lutea*, which parasites the sea cucumber *Holothuria sanctori* Delle Chiaje. Here we deal with four species found parasiting sea urchins. In another paper in this volume we focus our attention on two species found parasiting the crinoids *Antedon bifida* (Pennant), and a next work will deal whith the species found in sediments.

MATERIAL AND METHODS

The specimens of eulimids studied in this paper come from samples of the more common littoral species of sea urchins in the Canary Islands: *Paracentrotus lividus* (Lamark), *Arbacia lixula* (L.), *Sphaerechinus granularis* (Lamark) and *Diadema antillarum* (Philippi). Twenty eight samples were taken by scuba diving in eighteen localities of Tenerife Island (see Figure 1) between 5 and 35 m in depth. Besides, some samples of the circalittoral sea urchin *Cidaris cidaris* (L.) coming from fishing nets were studied. These samples were caught from some localities of Tenerife, Gran Canaria and Fuerteventura (see Table VIII).

In the laboratory each specimen of sea urchin was carafully examined under a binocular microscope. The living specimens of eulimids found in each one were recorded and measured. Some specimens were photographied alive an others were selected to be observed at scanning electron microscopy.

Voucher material of all the species studied was deposited in the Department of Animal Biology, La Laguna University, Tenerife.

RESULTS

Family EULIMIDAE Philippi, 1853
Genus *Echineulima* Lützen and Nielsen, 1975
Echineulima leucophaes (Tomlin and Shackleford, 1913) (Figs. 2, 4-9)

Mucronalia leucophaës Tomlin, J. R, le B. and Shackleford, L. J. "Descriptions of new species of *Marginella* and *Mucronalia* from São Thomé. *The Journal of Conchology,24*: 1913-1915.

Type locality: São Thomé
Material estudied: The number of specimens studied and the localities where they were collected are specify in Table I and Figure 1.

Description: Shell solid, white, glossy, translucent, rather globular, sharpened apically and last whorl inflated occupying $^2/_3$ of the shell. Spire straight without curvature. Whorls clearly convex. Suture very evident because of the whorl convexity. Below the suture a narrow whitish band is appreciated which corresponds to the false suture.

Surface smooth with only growing scars, strongly marked in some shells.

Protoconch clearly differentiated, since the larval whorls have a very reduced diameter, meanwhile the teleoconch diameter increases rapidly. It consists of three whorls and lacks ornamentation or colour that differentiates from the rest of the shell. Male and female shells have been studied with scanning electron microscopy and no significant differences with respect to their morphology were observed (Fig. 2).

Protoconch smooth, increasing slightly its diameter between one whorl and the next. These larval whorls easily differentiate from those of the teleoconch, the diameter of the latter increase more rapidly, are clearly more convex and have fine grooves that cross the whorl perpendicularly with respect to the suture. These grooves appear on the shell of both sexes, although in males they are more marked. The growing scars are very clear.

Aperture rounded and large in males, and slightly more quadrangular in females. Outer lip fine, no terminal swelling. In profile almost straight, first third part projected faintly and withdraws ending at the base, further behind than the apical union with the suture. Inner lip slightly swelled forming a small columelar callosity.

Size: The specimens studied had a range of 4 to 9 whorls. The measurements were carried out separating previously the males from the females, because of the great difference in size. A male of a determinate number of whorls presents a much smaller size with respect to a female with the same number of whorls. Terefore, males have less whorls inflated and smaller diameter (Figs. 5, 6).

In the 54 specimens measured the ratio (width/length) ranged from 2.44/1.73 mm in a male of 4 whorls to 13.45/7.15 mm in a female of 9 whorls (Tables II and III).

Soft parts: Soft parts white and similar in both sexes. Neither spots nor coloured marks are normally appreciated in the head-foot or mantle. In some specimens small dark spots are seen by transparency in the suture zone and areas slightly yellowish that correspond to the internal organs.

Tentacles long, fine, sharpened at the tip, strong yellow in colour with some whitish spots on the surface. Tip and ventral zone white. Some animals with lighter coloured tentacles were observed, sometimes almost white.

Eyes small, black, located at the base of the tentacles, with a yellow border. Vision through the shell.

Once the animal is in the parasite position on the host the different parts of the foot are observed, partially covering the base of the shell. When it is

Table I. Material studied of *Diadema antillarum* and *Echineulima leucophaes*, and infestation rates.
Tabla I. Material estudiado de Diadema antillarum *y* Echineulima leucophaes*, y porcentajes de infección.*

Locality	Nº of specimens of *D. antillarum* studied	Nº of specimens of *D. antillarum* parasited	Infestation rates (%)	Nº of specimens of *E. leucophaes*
Abades	100	4	4.0	7
Agua Dulce	180	7	3.9	13
Alcalá	115	1	0.9	1
El Palm-mar	61	1	1.6	2
El Tablado	80	2	2.5	3
La Barranquera	100	0	0.0	0
Las Aguas	30	0	0.0	0
Las Caletillas	290	11	3.8	21
Las Eras	258	5	1.9	10
Playa Paraiso	200	4	2.0	11
Pta. Salema	125	2	1.6	2
Pta. La Rasca	166	2	1.2	4
Punta del Hidalgo	6	0	0.0	0
Tajao	200	2	1.0	3
Total	1.911	41	$\bar{X}$ = 2.1	77

repeatedly disturbed it withdraws partly in the shell, unable to completely introduce itself, leaving part of the foot covering the base of the shell.

Snout elongated, thick, cylindrical, used to hold on to the host, slightly swelled at the centre, with an apical disk to adhere on to the host. The proboscis, used to suck food, penetrates this disk and outer tissue of the host, and it inserts itself inside (Fig. 7).

According to LÜTZEN AND NIELSEN (1975) the species of this genus present an operculum oval and transparent, not observed in our specimens.

Radula absent.

Data on life history: *Echineulima leucophaes* seems to be an exclusive parasite of the sea urchin *Diadema antillarum* (Philippi, 1845). It is a permanent parasite, once adhered to the host it is unable to free itself. The apical disk of the snout fuses with the host's tissue, wich in response creates a callosity or fibroid gall leaving the snail's snout firmly adhered (Fig. 4).

Proboscis very long, sometimes duplicating the length of the shell completely stretched out. Several specimens had the proboscis evaginated after the fixative procedure. A female presented a shell of 11.7 mm and a proboscis of 22.3 mm; another had a shell of 11.4 mm and a proboscis of 25.1 mm (Fig. 7). The snail, using this appendix, can reach any internal organ of the sea urchin to feed on. The proboscis has a slight swelling at the apical end where the suction pump is located. According to LÜTZEN and NIELSEN (1975), the gonadal tissues of the sea urchins are the food source of this species.

Inside the sea urchin fixation zone of the parasite is clearly appreciated as a necrotic spot, darker and black rimmed, surrounding the proboscis. In this zone, the shell of the sea urchin is soft and brakes easily. If several parasites are located next to each other the necrotic zone is shared by all, although the same number of spots as parasites are appreciated (Fig. 9).

The insertion zone of the parasite is variable. *E. leucophaes* was observed adhered to the oral side, to the sides or on the aboral zone of the sea urchin.

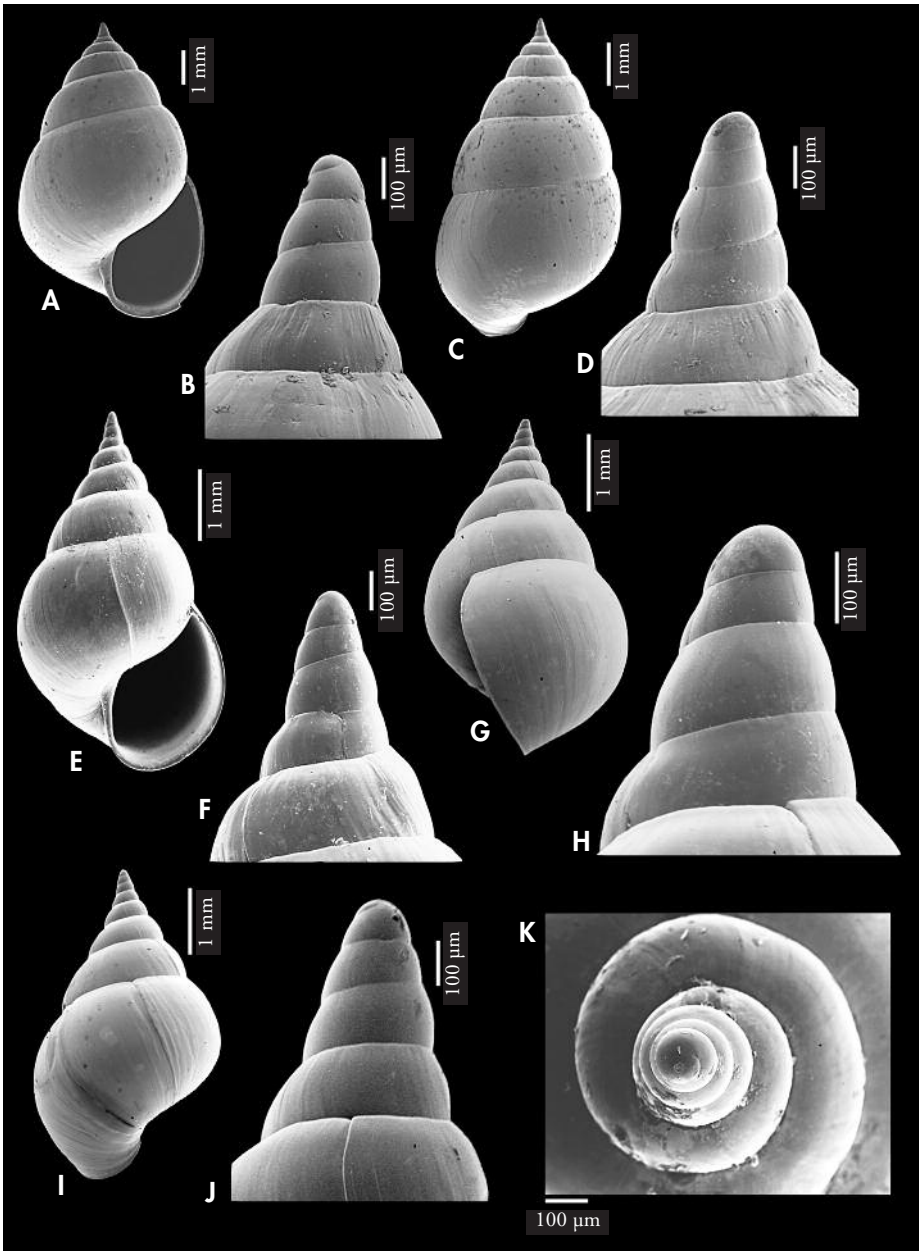


Figure 2. *Echineulima leucophaes,* female (A-D), male (E-K). A: ventral view of the shell; B: apex in ventral view; C: shell in dorsal position; D: apex in dorsal position; E: ventral view of the shell; F: apex in ventral view; G: shell in lateral view; H: apex in shell profile; I: shell in dorsal position; J: apex with shell in dorsal position; K: upper view of the protoconch.

Figure 2. Echineulima leucophaes*, hembra (A-D), macho (E-K). A: vistra ventral de la concha; B: ápice en vista ventral; C: concha en posición dorsal; D: ápice en posición dorsal; E: vista ventral de la concha; F: ápice en vista ventral; G: concha en vista lateral ; H: ápice en el perfil de la concha; I: concha en posición dorsal; J: ápice con la concha en posición doral; K: vista superior de la protoconcha.*

Table II. Number of whorls and mean size of the male specimens of *Echineulima leucophaes* studied. *Tabla II. Número de vueltas y talla media de los machos de* Echineulima leucophaes.

Nº whorls	Nº of specimens	width/ length (mm)
7	4	6.06/3.47
6	17	4.98/3.08
5	10	3.41/2.24
4	1	2.44/1.73
TOTAL	32	$\bar{X}$ = 4.22/2.63

Table III. Number of whorls and mean size of the female specimens of *Echineulima leucophaes* studied. *Tabla III. Número de vueltas y talla media de las hembras de* Echineulima leucophaes.

Nº whorls	Nº of specimens	width/ length (mm)
9	6	12.29/6.86
8	5	10.84/6.64
7	7	8.85/5.38
6	4	6.23/3.83
TOTAL	22	$\bar{X}$ = 9.55/5.67

Several specimens were also seen adhered to the same sea urchin, forming clearly differentiated groups. The groups can be made up of one or more specimens, and each group has a sole female and one or several males. The high grade of aggregation examined in the individuals of *E. leucophaes* assumes the existence of some type of chemical attraction among them.

Internally, the insertion area is also variable. Parasites were seen on the ambulacralia or interambulacralia plates. Occasionally some specimens were observed adhered to the peribuccal soft area.

The experiments conducted to determine the ability of the species to free themselves from the host indicate that the fixation is definitive and irreversible. The parasites released artificially lost the locomotor capacity.

This species is protandric hermaphrodite with environmental sex determination (ESD). The first individual, once settled on the host, spends a short phase as a male and continues to grow as a female. The following specimens that settle next to her develop as males and remain like this until the female disappears, then one of them reverses and becomes a female. There also exists a marked sexual dimorphism, males are much smaller than the females, therefore very easy to differentiate. Frequently there is one or several groups of individuals on a same host, each with only one female along with one or more males (Fig. 8).

The infestation rate of *E. leucophaes* on *D. antillarum* is very low, never higher than 4.0% (see Table I).

Distribution: This species seems to be restricted to the tropical and subtropical Eastern Atlantic. It is only known from São Thomé Island, Guf of Guinea, and Canary Islands.

Remarks: This species was described for the first time as *Mucronalia leucophaes* in São Thomé Island by TOMLIN AND SHACKLEFORD (1913). This description did not provide any data on soft parts or host.

LÜTZEN AND NIELSEN (1975) described the new genus *Echineulima* to include some species parasitic on sea

urchins of the families Diadematidae and Echinometridae. These authors synonymized *M. leucophaes* with the type species (by original designation) of *Echineulima*, *E. mittrei*, that is widespread throughout the tropical Indo-Pacific. They recorded it also from the Gulf of Guinea and Tenerife Island. WARÉN (1980) revised the genus *Echineulima* and considered *E. mittrei* and *E. leucophaes* as different species, being the former of Indo-Pacific distribution and the latter Atlantic. Although the shell appearance is quite similar in both species, we follow the opinion of Warén due the big gap in disribution between them from the Gulf of Guinea (West Africa) to Mozambique (East Africa). Nevertheless, the divergence of these species must be confirmed by mean of genetic or DNA studies.

According to WARÉN (1980) the species of this genus presents planktotrophic larval development, since the egg diameter ranges from 65 to 70 μm and the height of the protoconch is 300 μm or more, evidencing the presence of protoconch I and II.

Genus *Vitreolina* Monterosato, 1884.

Vitreolina philippi (Rayneval, Hecke and Ponzi, 1854) (Figs. 3, 10-12)

Eulima philippi Rayneval, Hecke and Ponzi, 1854. "Catalogue des fossiles du Monte Mario (prés Rome), recueillis par M. le Cte de Rayneval, Mgr Van den Hecke et M. le professeur Ponzi, 1854." *Versailles Beaujeune*: 20 + 6 pp.

Type locality: Monte Mario, Roma, fossil
Material studied: The number of specimens studied and the localities where they were collected are specify in Tables IV, V and VI, and Figure 1.

Description: Shell conical, slender, sharpened, slightly curved, generally towards the right, more clear in larger individuals (Fig. 10), glossy, completely transparent, without any colouration and fragile in appearance; ornamentation absent.

True suture hard to observe in live specimens, forming a fine and tenuous groove along the whorls causing a discontinuity in the shell's brilliance. False suture very evident, appreciated as a more opaque line. Both sutures are parallel, false under true. The space between them is quite narrow, approximately $^1/_5$ of the height of the whorls.

On the shell surface the sutures and growth scars are observed. Most shells have scars located dorsally on the right side, each one ahead of the one before, indicating that the animal has grown more than one whorl in each growth period. One scar per whorl is observed. The study of the shells with scanning electron microscopy confirms the absence of ornamentation or microsculpture on the shell's surface, only the sutures and growth scars are appreciated (Fig. 3). Whorls of teleoconch flat, and those of the protoconch slightly convex. On some areas of the surface deteriorated zones appeared, probably due to chemical disintegration by immersion in preservative fluids or by erosion caused by friction with the substratum when the animal was alive.

Protoconch of four whorl, with pointed apex, smooth, transparent and without sculpture or colour.

Aperture ovated, small, with apical zone faintly sharpened. Outer lip not swelled, withdrawn at the suture forming a sinus, very marked at the centre. Inner lip straight, swelled at the base forming a patent callus at the base of the columella.

Size: The sizes (length/ width) of the specimens studied ranged from 3.73/1.32 mm, in an specimen of 8 whorls, and 0.52/0.17 mm in the smallest specimens of 2 whorls. The average sizes obtained are shown in Table VII.

Table IV. Material studied of *Vitreolina philippi* parasiting *Arbacia lixula* and infestation rates.
Table IV. Material estudiado de Vitreolina philippi *parasitando* Arbacia lixula *y porcentajes de infección.*

Locality	Nº of specimens of *A. lixula*	Nº of sea urchins with parasites	Nº of specimens of *V. philippi*	Max nº of specimens of *V. philippi* /sea urchin	Infestation rates
Abades	5	1	1	1	20.0
Aguadulce	10	8	38	12	80.0
Alcalá	7	2	2	1	28.6
El Médano	3	0	0	0	0.0
El Palm-mar	2	1	5	5	50.0
Garachico	4	4	16	7	100.0
La Barranquera	25	7	16	6	28.0
Las Aguas	7	5	17	7	71.4
Las Caletillas	11	8	26	8	72.7
Las Eras	15	13	53	6	86.7
Las Teresitas	3	1	3	3	33.3
Playa Paraíso	10	5	6	2	50.0
Porís de Abona	24	19	118	27	79.2
Pta. Hidalgo	13	0	0	-	0.0
TOTAL	139	74	301	$\bar{X}$ = 6.5	$\bar{X}$ = 49.9

Table V. Material studied of *Vitreolina philippi* parasiting *Patacentrotus lividus* and infestation rates.
Table V. Material estudiado de Vitreolina philippi *parasitando* Patacentrotus lividus *y porcentajes de infección.*

Locality	Nº of specimens of *P. lividus*	Nº of sea urchins with parasites	Nº of specimens of *V. philippi*	Max nº of specimens of *V. philippi* /sea urchin	Infestation rates
Abades	31	8	12	3	25.8
Aguadulce	1	0	0	-	0.0
Alcalá	27	6	7	2	22.2
El Médano	25	4	5	2	16.0
El Palm-mar	2	1	29	29	50.0
Garachico	29	29	187	18	100.0
La Barranquera	15	4	10	4	26.7
Las Aguas	34	31	148	12	91.2
Las Caletillas	19	19	131	19	100.0
Las Eras	1	1	2	2	100.0
Las Teresitas	10	5	8	3	50.0
Playa Paraíso	0	0	0	-	-
Porís de Abona	9	8	90	30	88.9
Pta. Hidalgo	25	5	6	2	20.0
TOTAL	228	121	635	$\bar{X}$ = 10.5	$\bar{X}$ = 53.1

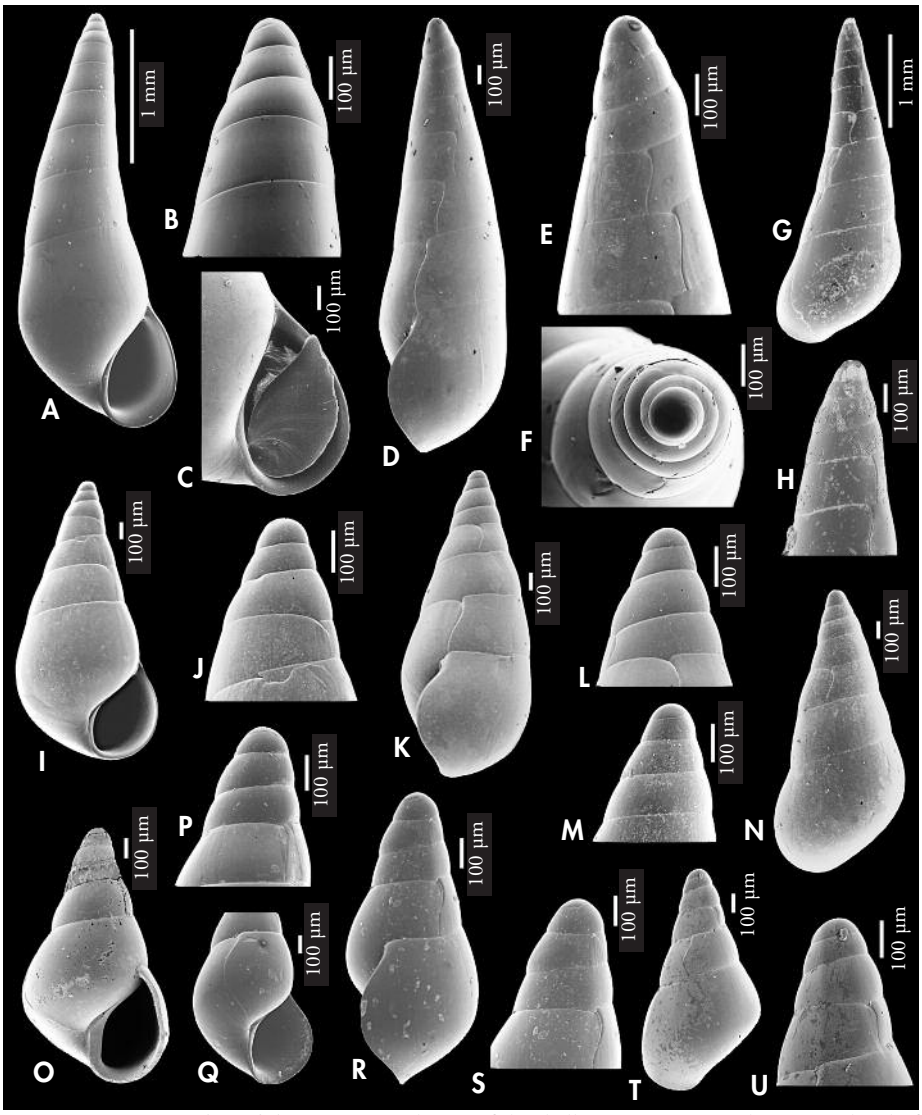


Figure 3. A-H: *Vitreolina philippii*, A: ventral view of the shell; B: apex in ventral view; C: detail of aperture and operculum; D: profile of shell; E: apex in lateral view; F: upper view of the protoconch; G: shell in dorsal position; H: apex in dorsal position. I-N: *Nanobalcis nana*, I: ventral view of the shell; J: apex in ventral view; K: profile of shell; L: apex in lateral view; M: apex in dorsal position; N: shell in dorsal position. O-U: *Sabinella bonifaciae*, O: ventral view of the shell; P: apex in ventral view; Q: detail of aperture and growth scar of the last whorl; R: profile of shell; S: apex in lateral view; T: shell in dorsal position; U: apex in dorsal position.

Figura 3. A-H: Vitreolina philippii, *A: vista ventral de la concha; B: ápice en vista ventral; C: detalle de la apertura y el opérculo; D: perfil de la concha; E: ápice en vista lateral; F: vista superior de la protochocha; G: concha en posisicón dorsal; H: ápice en posición dorsal. I-N:* Nanobalcis nana*, I: vista ventral de la concha ; J: ápice en vista ventra; K: perfil de la concha; L: ápice en vista lateral; M: ápice en posición dorsal; N: concha en posición dorsal. O-U:* Sabinella bonifaciae*, O: vista ventral de la concha; P: ápice en vista ventral; Q: detalle de la apertura y marca de crecimiento de la última vuelta; R: perfil de la concha; S: ápice en vista lateral; T: concha en posición dorsal; U: ápice en posición dorsal.*

Soft parts: The soft parts are perfectly observed by transparency. The first whorls are plain yellow and the last ones have a series of orange and yellow-whitish spots on the head and foot. The disposition of these spots is variable but there are two patterns that repeat frequently.

In the first pattern when observed from the side of the aperture, the first four whorls are yellowish, the fifth and sixth have orange dots arranged forming lines perpendicular to the sutures, the seventh whorl has disperse punctuation and the last one presents scattered orange and yellow-whitish dots. These orange dots are mainly disposed around the eyes and sides of the head and the most whitish areas are placed at the top of the head. In dorsal view the same colour pattern of the whorls is appreciated, but in the last one a series of orange dots aligned parallel to the suture are observed, along with orange and whitish dots dispersed around the head (Fig. 11). The two black eyes are very patent in this position with an orange dot under each one.

The second pattern differs from the previous in the third, fourth and fifth whorls, which have three reddish lines per whorl. These lines are wide in the upper suture and they get narrower until disappear at the lower one. The sixth whorl has a very patent red dot.

Cephalic tentacles long and slender, translucent, with a row of small bright yellow dots on its dorsal surface. At the base of each one a small orange dot is observed besides the large and black eyes, located in faint protuberances at the sides of the head. The vision is by transparency through the shell.

Foot dorsally yellow with bright orange and yellow scattered dots at its base.

Operculum paucispiral, transparent, slightly yellowish. Fine growth lines are observed that emerge from one point within the inner margin and head towards the outer one gradually fading before reaching the edge of the operculum (Fig. 3).

Radula absent.

After short fixative periods in preservative fluids, the pattern of coloration disappears and the colour becomes uniform from white to yellow-orange.

Data on life history: *Vitreolina philippi* was found parasiting the sea urchins *Arbacia lixula*, *Sphaerechinus granularis* and *Paracentrotus lividus*. It is a sporadic parasite, associates with sea urchins to feed, but capable of freeing himself and crawl around looking for another host. The adherence to the sea urchin is weak, freeing himself very easily once disturbed and therefore occasionally seen on rocks or substratum.

In the specimens of *A. lixula* studied in Tenerife, *V. philippi* was parasite always on the oral zone (Fig. 12). In *P. lividus* and *S. granularis* the position of this parasite is more difficult to specify, since these sea urchins adhere algae, stones or other objects on their surface, being very difficult locate the eulimids.

Most of the specimens of *V. philippi* freed themselves from the host during the trip to the laboratory, appearing free in the bags. The ones remaining on the host were adhered to the soft parts at the base of the ambulacralia feet in the peri-buccal zone.

A total of 502 sea urchins were studied, collected in 14 localities of the coast of Tenerife, in a depth range of 5-20 m (Tables IV, V and VI). *V. philippi* parasites preferably on *Sphaerechinus granularis*, and 80% of the specimens of this sea urchin had parasited. The infestation rate on *Arbacia lixula* and *Paracentrotus lividus* is quite similar and somewhat greater than 50%. The maximum number of specimens of *V. philippi* found on a single host (*P. lividus*) was 30.

Distribution: It is known from north to Norway to the Canary Islands, including the Mediterranean Sea.

Remarks: Despite the high specificity of host choice that characterises most of the genera of Eulimidae, the species of the genus *Vitreolina* present a wide variety of hosts, Ophiuroidea (Warén, 1984) and several genera of sea urchins (Warén, Burch and Burch, 1984). Fretter and Graham (1982) indicated that they have appeared also on holot-

Table VI. Material studied of *Vitreolina philippi* parasiting *Sphaerechinus granularis* and infestation rates. *Table VI. Material estudiado de* Vitreolina philippi *parasitando* Sphaerechinus granularis *y porcentajes de infección.*

Locality	Nº of specimens of *S. granularis*	Nº of sea urchins with parasites	Nº of specimens of *V. philippi*	Max nº of specimens of *V. philippi* /sea urchin	Infestation rates
Abades	6	0	0	-	0.0
Aguadulce	16	16	125	20	100.0
Alcalá	7	5	21	11	71.4
El Médano	4	0	0	-	0.0
El Palm-mar	27	18	83	16	66.6
Garachico	0	0	0	-	-
La Barranquera	1	0	0	-	0.0
Las Aguas	0	0	0	-	-
Las Caletillas	6	5	31	21	83.3
Las Eras	25	22	113	14	88.0
Las Teresitas	12	11	64	12	91.7
Playa Paraíso	20	12	27	5	60.0
Porís de Abona	9	9	78	18	100.0
Pta. Hidalgo	2	1	1	1	50.0
TOTAL	135	99	543	$\bar{X}$ = 13.1	$\bar{X}$ = 59.2

Table VII. Number of whorls and mean size of 48 specimens of *Vitreolina philippi*. *Table VII. Número de vueltas y talla media de 48 ejemplares de* Vitreolina philippi.

Nº whorls	Nº of specimens	width/ length (mm)
8	4	3.50 /1.26
7	6	2.87 /1.15
6	10	2.38 /0.95
5	7	1.90 /0.64
4	6	1.46 /0.47
3	9	1.13 /0.29
2	6	0.60 /0.19
TOTAL	48	$\bar{X}$ = 1.97 / 0.71

hurians and crinoids, if all available data are correct.

Several works record *V. philippi* in the Mediterranean. MIFSUD (1990a) point out that it is common on *P. lividus*, but very rare on *A. lixula* in Malta, but RINALDI (1994) found it very common on both species of sea urchins in Sardinia. OLIVERIO, BUZZURRO AND VILLA (1994) add *S. granularis*, *Centrostephanus longispinus* (Philippi) and *Psammechinus microtuberculatus* (Blainville) to their host list in the Eastern Mediterranean. FRETTER AND GRAHAM (1982) recorded *V. philippi* in the Atlantic coasts of Europe and lastly, NORDSIECK AND TALAVERA (1979) in Madeira and Tenerife.

Genus *Nanobalcis* Warén and Mifsud, 1990.

Nanobalcis nana (Monterosato, 1878) (Figs. 3, 13 -15)

Eulima nana Monterosato, 1878. "Note sur quelques coquilles draguées dans les eaux de Palerme, par le Marquis de Monterosato". *Journal de Conchyliologie,* 26: 143-160.

Type locality: Palermo, Sicily, 50-90 m deep.
Material studied: The number of specimens studied and the localities where they were collected are specify in Table VIII.

Description: Shell conical, almost straight in profile, small, completely transparent, without ornamentation or coloured zones (Fig. 13). The transparency fades with the fixation, although it is maintained in those preserved dried. In these, the sutures and growth scars are well observed.

Teleoconch whorls flat and slightly convex at the protoconch. Last whorl quite high, occupying almost half of the height of the shell.

In the dry specimens, the suture and false suture are clearly distinct. Both are parallel, the space between them quite narrow and more opaque in appearance than the rest of the shell.

The growth scars are not aligned, located at a different place in each whorl. There are growth periods in which the animal almost form a complete whorl, while in others only a half whorl is formed. The scars appearing irregularly. The SEM photographs show the surface of the shell totally smooth, without any kind of micro-sculpture, except the sutures and growth scars (Fig. 3). These scars are strongly marked and located irregularly in the different whorls.

Apex slightly sharpened. Protoconch with 2 whorls faintly convex, transparent, whitout ornamentation or colour that differentiates it from the teloconch. There is no mark indicating the existence of protoconch II, and therefore this species might lack a planktotrophic larval phase. No micro-sculpture is appreciated in the protoconch (Fig. 3).

Aperture wide, round and slightly sharpened at its upper margin. It is quite low and faintly surpasses the edge of the lower part of the shell. In lateral view, the inner lip presents the first section straight coinciding with the zone between the sutures; then projected forming a sinus, very marked at the centre. Inner lip with columelar callus very patent, located at the lower margin of the aperture, coinciding with the base of the columella.

Size: The size (length/width) of the specimens from Tenerife ranged from 0.45/0.31 mm in an specimen with one whorl to 1.85/0.79 mm in other of 6 whorls.

The average size of the specimens studied are shown in Table IX.

Soft parts: Soft parts orange-brown, clearly observed by shell transparency.

Several yellowish spots are observed in the gonad-visceral zone and other reddish stand out on an orange background. These spots do not seem to follow a constant colour pattern.

In the suture of the last whorl a reddish spot is appreciated, diffused and edges scarcely defined. At the sides of the head there are also small reddish zones.

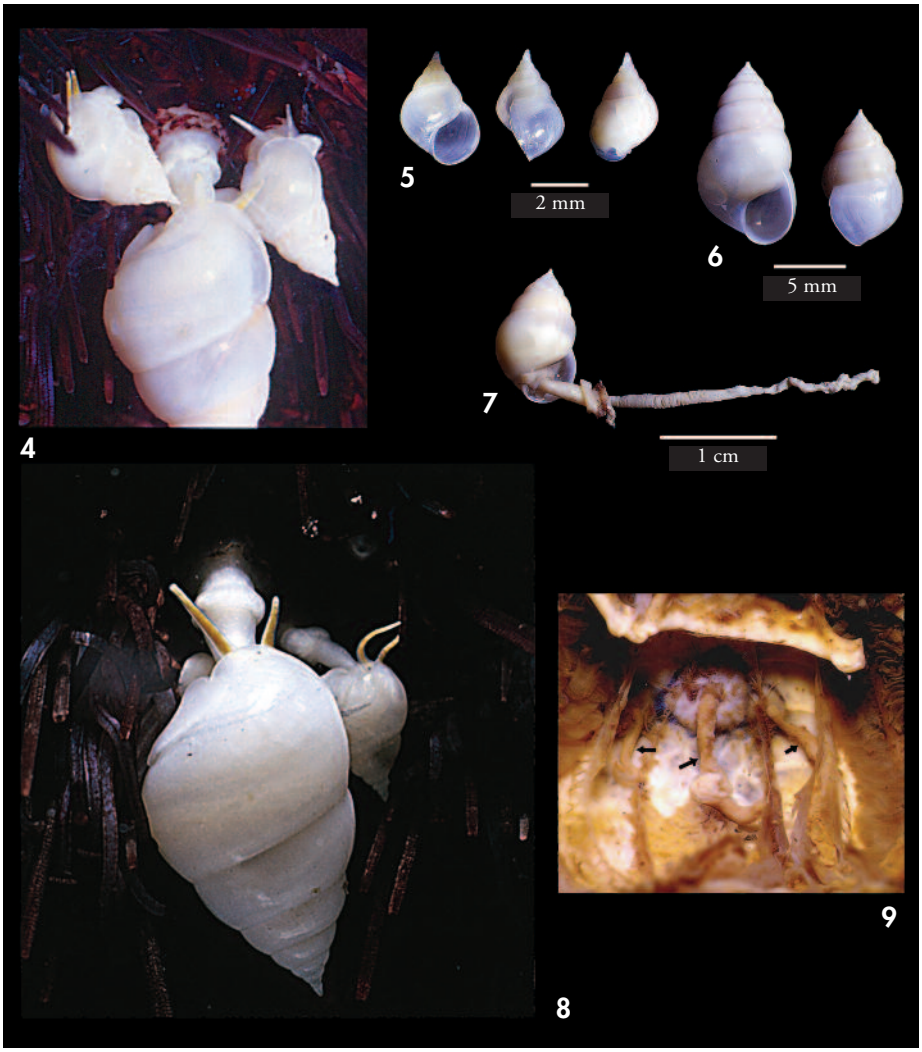
Cephalic tentacles very long, slender, sharpened and almost transparent, with faint yellow highlights on the surface, mainly on the apical zone.

Eyes black and large, placed quite close and slightly behind with respect to the tentacles. At the base of each eye a more intense orange spot is observed. Vision by transparency through the shell (Fig. 14). Foot also orange.

Operculum very thin, transparent, oval, with faint growth lines. Animal capable of complete retraction inside the shell.

Radula absent.

After fixation the soft parts loose their pigmentation becoming pale



Figures 4-9. *Echineulima leucophaes*. 4: group of one female and two males; 5: males; 6: females; 7: female with snout and proboscis evaginated; 8: male and female, in parasitic position on *Diadema antillarum*; 9: inner face of *Diadema antillarum* where three necrotic marks, the proboscis of a female (centre) and two males of *E. leucophaes* are observed.
Figuras 4-9. Echineulima leucophaes. *4: grupo de una hembra y dos machos; 5: machos; 6: hembras; 7: hembra con el morro y probóscide evaginados; 8: macho y hembra, parasitando un ejemplar de Diadema antillarum; 9: cara interna de* Diadema antillarum *con tres marcas necróticas correspondientes a la probóscide de una hembra (centro) y dos machos de* E. leucophaes.

yellow, almost white or even hyaline in smaller specimens. Some individuals, after fixation, present faint dark spots in the last whorl of the suture and on the cephalic zone.

Date on life history: *Nanobalcis nana* was found on the sea urchin *Cidaris cidaris* (L., 1758). It is an sporadic parasite, capable of freeing itself when disturbed. The insertion zone of the parasite

on the host is at the base of the largest spines (MIFSUD, 1990b), although most of the specimens from Tenerife was found free in the transportation bag, crawling, floating or moving on the surface of the sea urchin (Fig. 15). Therefore the insertion zone was not determined.

The sea urchins were captured using fishing nets, suffering an intense manipulation to untangle and free them. It is possible that during this process some parasites freed themselves. The sea urchins were introduced together in a container with sea water, many parasites were liberated, making it difficult to determine the number of eulimid parasiting each sea urchin.

The localities studied and the number of hosts and parasites are shown in Table VIII.

Distribution: It was only known from Malta, Sicily and Gulf of Naples. We recorded it here for the first time in the Atlantic ocean. Engl (com. pers.) has found this species in sediments coming from the CANCAP expeditions, and Templado (com. pers.) has found a quite similar species (probably the same) in Cape Verde Islands parasiting the Cidarid *Eucidaris tribuloides*.

Remarks: MONTEROSATO (1875) named for the first time this species as *Eulima nana*, collected in Palermo at a depth of 90 m. There is not more data on the species in this work. Later MONTEROSATO (1878) presented the first formal description of the shell of this species. This description was based on specimens from sediment dredged and no data on soft parts of the animal or possible hosts were done.

MIFSUD (1990) found several specimens of this species (cited as *Eulima nana*) adhered to the largest spines of the sea urchin *Cidaris cidaris*. The same year, WARÉN AND MIFSUD (1990) erected the new genus *Nanobalcis* to embrace a group of small eulimids parasitic on cidaroid sea urchins, and designed *E. nana* as type species of this genus. They recorded this species from Malta and the Gulf of Naples. Until now this species has not been recorded outside of the Mediterranean Sea.

Genus *Sabinella* Monterosato, 1890

Sabinella bonifaciae Nordsieck, 1974 (Figs. 3, 16)

Eulima (Sabinella) bonifaciae Nordsieck, 1974. "Molluscs from the continental shelf bottom betwen Corsica and Sardinia (Bocche di Bonifacio, station K1)". *La Conchiglia*, 61: 11-14.

Type locality: off Capo Comino, between Sardinia and Corsica, 200-220 m deep.
Material studied: The number of specimens studied and the localities where they were collected are specify in Table VIII.

Description: Shell conical, small, quite translucent but not totally transparent, apex slightly sharpened and aperture very large. Ornamentation or colour absent (Fig. 16). Shells in preservative fluids become white and opaque. Profile straight, whorls convex, the last one very high, occupying $^2/_3$ of the shell height. Sutures clearly distinct by whorl convexity. The false suture is very evident as a fine opaque line located under the true suture. Both sutures are parallel and the space between them is very narrow. The growth scars are strongly marked. Normally there are two per whorl, located irregularly because the snail grows more than half a whorl each growth period. These scars are the only marks appreciated on the surface of the shell. The shells lack micro-sculpture in the teleoconch and protoconch (Fig. 3). Some shells present the first whorls deeply eroded, probably due to chemical attack of the preservative fluids, indicating a greater debility of the larval shell with respect to the teleoconch.

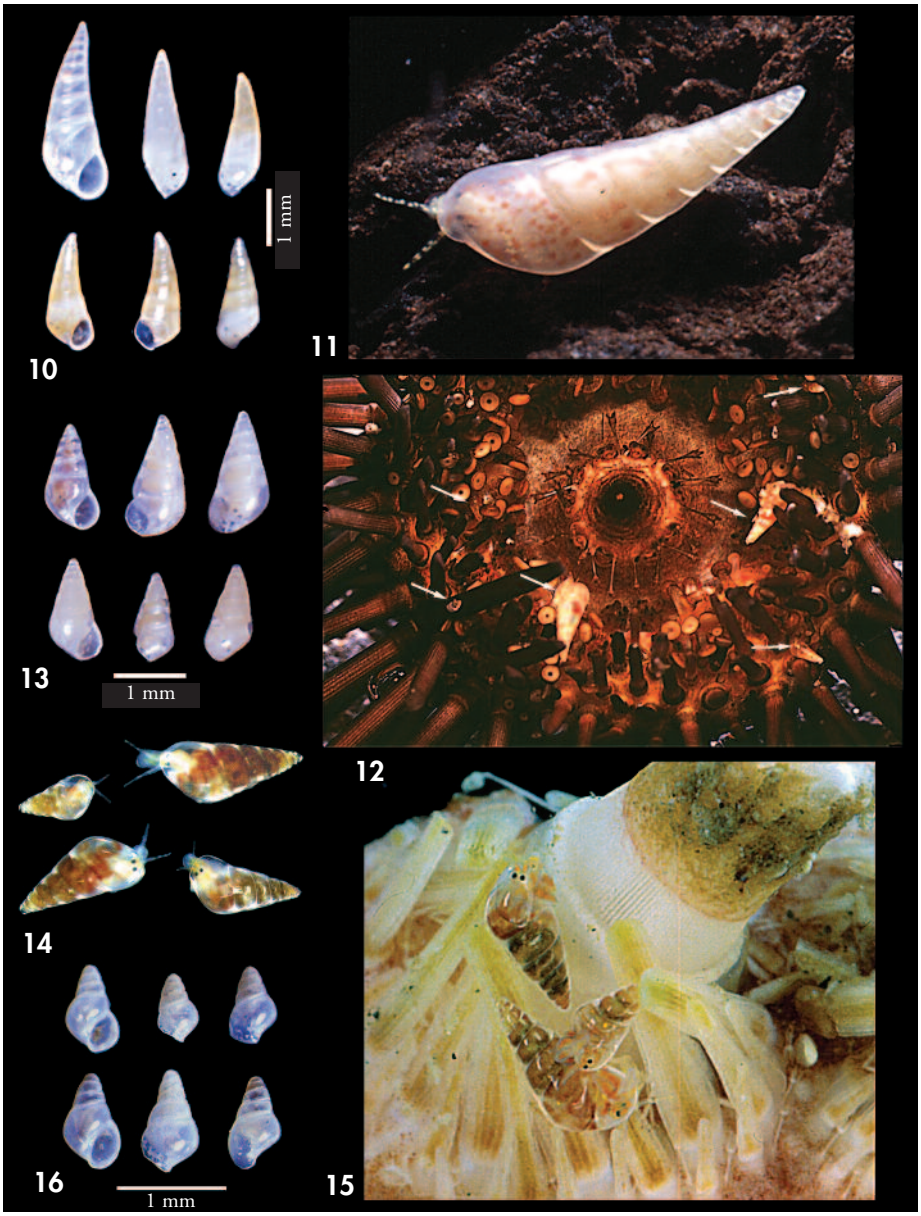


Figure 10. Some specimens of *Vitreolina philippi*. Figure 11. *Vitreolina philippi* crawling on the substratum after freeing himself from the host; the most common colour pattern of soft parts can be observed. Figure 12. Oral zone of *Arbacia Lixula* with 6 specimens of *Vitreolina philippi.* Figure 13. Some specimens of *Nanobalcis nana*. Figure 14. Common colour pattern of *Nanobalcis nana.* Figure 15. Three specimens of *Nanobalcis nana* on *Cidaris cidaris.* Figure 16. Some specimens of *Sabinella bonifaciae*.
Figura 10. Varios ejemplares de Vitreolina philippi. *Figura 11.* Vitreolina philippi *arrastrándose sobre el sustrato tras alimentarse del hospedador; se puede observar el patrón de color más común de las partes blandas. Figura 12. Zona oral de* Arbacia Lixula *con 6 ejemplares de* Vitreolina philippi. *Figura 13. Varios ejemplares de* Nanobalcis nana. *Figura 14. Patrón de color habitual de* Nanobalcis nana. *Figura 15. Tres ejemplares de* Nanobalcis nana *sobre* Cidaris cidaris. *Figura 16. Varios ejemplares de* Sabinella bonifaciae.

Table VIII. Material studied of *Cidaris cidaris* and its parasites *Nanobalcis nana* and *Sabinella bonifaciae*.
Table VIII. Material estuciado de Cidaris cidaris *y sus parásitos* Nanobalcis nana *y* Sabinella bonifaciae.

Locality	Island	Date	Depth (m)	Nº of specimens studied		
				C. cidaris	*N. nana*	*S. bonifaciae*
Mogán	Gran Canaria	22-11-94	100	32	12	10
Ptito. de Güímar	Tenerife	13-11-96	-	1	28	0
28° 29,38 N, 16° 09,15 W	Tenerife	5-12-96	293	70	437	0
28° 22,80 N, 16° 20,23 W	Tenerife	6-12-96	253	2	13	1
Los Gigantes	Tenerife	4-12-97	135	2	2	0
28° 10,56 N, 14° 22,32 W	Fuerteventura	1-10-97	232	68	280	5
Pto. de la Cruz	Tenerife	28-2-98	198	1	3	0

Table IX. Number of whorl and mean size of 47 specimens of *Nanobalcis nana*.
Table IX. Número de vueltas y talla media de 47 ejemplares de Nanobalcis nana.

Nº whorls	Nº of specimens	width/ length (mm)
6	1	1.85 / 0.79
5	13	1.57 / 0.70
4	12	1.27 / 0.59
3	8	0.93 / 0.47
2	11	0.67 / 0.35
1	2	0.47 / 0.31
TOTAL	47	$\bar{X}$ = 1.13 / 0.53

Table X. Number of whorl and mean size of 9 specimens of *Sabinella bonifaciae*.
Table X. Número de vueltas y talla media de 9 ejemplares de Sabinella bonifaciae.

Nº whorls	Nº of specimens	width/ length (mm)
4	2	1.27 / 0.72
3	4	0.93 / 0.53
2	3	0.81 / 0.45
TOTAL	9	$\bar{X}$ = 1.00 / 0.56

Mucronate protoconch of 2.5 whorls, without coloration or ornamentation that differentiates it from the teloconch.

Aperture large, oval, slightly sharpened at it upper part and rounded at the base. Outer lip faintly swelled at the tip of the aperture, surpassing largely the edge of the shell. In profile, the lip in the sutural zone is withdrawn and then projected forming a very marked sinus. Inner lip swelled forming a notable columelar callus.

Size: The specimens obtained in the Canary Islands (Tenerife, Gran Canaria and Fuerteventura) had from 2 to 4 whorls. The average sizes are shown in Table X.

Soft parts: The study of *S. bonifaceae* was done with specimens kept in fixative fluids, therefore we have not photos

of living animals nor description of colour patterns were obtained. The preserved animals presented a uniform whitish coloration in the cephalic zone, and only big black eyes stood out. The gonad-visceral zone presents the same colour as the cephalic area, although some individuals were reddish brown.

Operculum very thin, yellowish and transparent.

Date on life history: *Sabinella bonifaciae* was found living on the sea urchin *Cidaris cidaris* (L., 1758). The specimens observed in the Canary Islands were found crawling freely on the sea urchin, indicating that they are sporadic parasite, capable of freeing themselves from the host.

S. bonifaciae is parasite of *C. cidaris* jointly with the eulimid above mentioned, *Nanobalcis nana*. In specimens of *C. cidaris* from Tenerife the latter was much more abundant than the former.

The localities studied and the number of hosts and parasites are shown in Table VIII.

The intense manipulation suffered by the sea urchins using the fishing nets, as with *Nanobalcis nana*, could have made caused the parasites to free themselves from the host.

Distribution: It was known from the Western Mediterranean and Sicilian Chanel, and from Bay of Biscay to the Ibero-Moroccan Gulf. Here recorded for the first in the Canary Islands.

Remarks: MONTEROSATO (1875) described this species for the first time as *Eulima piriformis* Brugnone, in Palermo. Later, MONTEROSATO (1890) created the new genus *Sabinella*, were *S. piriformis* was included.

NORDSIECK (1975) described the new species *Eulima (Sabinella) bonifaciae*, for the area between Corsica and Sardinia. The description was obtanied from shells of sediments, therefore lacks data on possible hosts. VAN AARTSEN (1978) and GAGLINI (1990) considered *Sabinella bonifaciae* as synonum of *S. piriformis* Brugnone, 1873, but WARÉN (1984) and BOUCHET AND WARÉN (1986) discusses on the taxonomy of these taxa and considered the former as a valid species.

According to BOUCHET AND WARÉN (1986) the females of this species are larger than the males and are permanently adhered to the host, meanwhile the males may crawl freely. This species has tentacles smooth, wide and short, with eyes located at the base of each one. The foot is well developed and functional and, after comparing the shell's size of the veliger larva with the postlarval specimens, concluded that the size difference indicated a planktotrophic development.

WARÉN AND MIFSUD (1990) found some specimens of *S. bonifaciae* on *C. cidaris* in Malta and provided new additional data on sof parts and life-style. They noted that the insertion zone of this eulimid on its host is at the base of the primary spines, originating a distinc thickening. When the specimens had a size of 1-2 mm they attached permanently to the host with a mucous collar, covering the base of the proboscis, which remained in the sea urchin once the parasite was separated from the host. The small size of the specimens found in Canaries and the fact that they were observed free on *C. cidaris* may indicate that they were juveniles or males. Although the spines of this sea urchin were carefully examined, none specimen of *S. bonifaciae* was found attached to them.

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