



Two new species of the genus *Monophorus* (Gastropoda, Triphoridae) in the east Atlantic and Mediterranean Sea

Dos nuevas especies del género *Monophorus* (Gastropoda, Triphoridae) en el Atlántico oriental y el Mediterráneo

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ABSTRACT

The species of the genus *Monophorus* Grillo, 1877, (Gastropoda, Triphoridae) in the east Atlantic are studied. Two new species are described, together with a form that possibly represents *M. thiriotae*. The new species are compared with those previously known and distribution are plotted.

RESUMEN

Se revisan las especies del género *Monophorus* Grillo, 1877, (Gastropoda, Triphoridae) existentes en el Atlántico oriental, describiendo dos especies nuevas y mostrando un morfo que podría corresponderse con la especie *M. thiriotae*, pero cuya relación específica no está todavía bien determinada. Las especies nuevas se comparan con las previamente conocidas y se aporta un esquema de las áreas de distribución del género *Monophorus* en el Atlántico oriental.

KEY WORDS: *Monophorus*, Triphoridae, West Africa, Canary islands, Alboran Sea, new species, distribution range.

PALABRAS CLAVE: *Monophorus*, Triphoridae, Africa Occidental, Islas Canarias, Mar de Alborán, nuevas especies, área de distribución.

INTRODUCTION

In recent years several works on the eastern Atlantic Triphoridae have been published. These studies provide important information on the colour of the soft parts, on radula and protoconch, as correct method of the study of this family. In contrast with those of the older authors who considered shell characters alone, MARSHALL (1983) treated shell and radulas, being the first author who provided unique and original interpretations of the family in the Australian species. BOUCHET AND GUILLEMOT (1978)

and BOUCHET (1984) made a revision on the Mediterranean and the close Atlantic species. FERNANDES AND ROLÁN (1988, 1993) studied the family in the Cape Verde archipelago. BOUCHET (1996) added new observations on the family and reported a list of the known species for European and closer Atlantic.

Some Triphoridae from Canary Islands (like *Triphora decorata canarica* Nordsieck and García-Talavera, 1979) have been studied by BOUCHET (1984) showing it is a valid species in the genus

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Cosmotriphora more extended in the West African coast. Further more, other species described by NORDSIECK AND GARCÍA-TALAVERA (1979) present additional taxonomic problems, as a shell described with the name *Triphora pseudo-besula* n. sp. in the plates and as *Triphora grimaldi macaronesica* n. spp. in the text.

New observations on material recently collected belonging to the genus *Monophorus* Grillo, 1877, are the object of the present work. Some other species belonging in this genus have been previously studied in BOUCHET (1984) and FERNANDES AND ROLÁN (1988), and we have nothing to add on them: they will be mentioned only with the references to the previous studies.

Since much of the West African coast has not been adequately sampled, the

fauna is poorly known, and precise distributions of few species are known.

Abbreviations:

MNCN Museo Nacional de Ciencias Naturales, Madrid

MNHN Muséum National d'Histoire Naturelle, Paris

CAP collection of A. Peñas, Vilanova i la Geltrú

CDM collection of D. Moreno, Cabo de Gata

CER collection of E. Rolán, Vigo

CFA collection of F. Azpilicueta, San Sebastián

CWE collection of W. Engl, Düsseldorf
sp shells with soft parts

s empty shell

f fragment

RESULTS

Genus *Monophorus* Grillo, 1877

Type species: *Trochus perversus* Linné, 1758

Description: Following BOUCHET (1984, p. 20) the generic characters are: animal with red blotches; protoconch embrionic shell with cruciform tuber-

cles; radular formula (8-13)-1-C-1-(8-13), marginal teeth with 4-5 cusps, somewhat different from the lateral and central ones.

Monophorus perversus (Linné, 1758)

Material examined: That mentioned in BOUCHET (1984) in the MNHN. Some additional shells from several Mediterranean localities.

Description: See BOUCHET (1984).

Distribution: Mediterranean Sea, Canary Islands, Senegal, Ivory Coast and Angola (BOUCHET, 1984). ROLÁN's (1983)

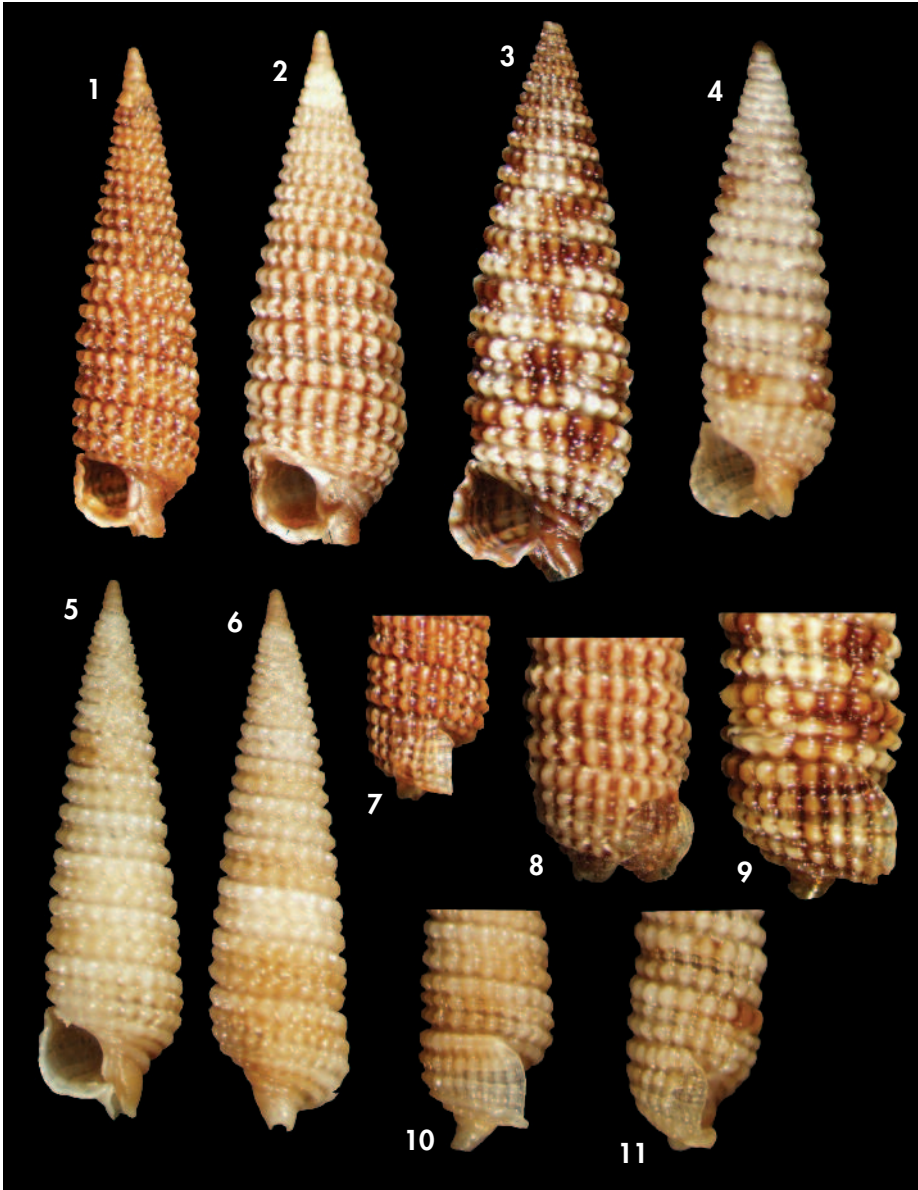
record from Galizian coasts (NW Spain) is of uncertain identity being based on a single shell from ship sediments transported from elsewhere by fishermen.

Monophorus erythrosoma (Bouchet and Guillemot, 1978)

Material examined: That mentioned in BOUCHET (1984) in the MNHN. Six specimens more from Cape Verde Islands.

Description: See BOUCHET AND GUILLEMOT (1978) and BOUCHET (1984). The animal colour has been always black in head and foot.

Distribution: Mediterranean and the Gulf of Gascoigne (BOUCHET, 1984). Cape Verde Islands (FERNANDES AND ROLÁN, 1988).



Figures 1, 7. *Monophorus thiriota*, holotype, 6.3 mm, Calvi, France (MNHN); 7: last whorl. Figures 2, 8. *Monophorus* sp., 6.9 mm, Sal Rei, Boa Vista, CV (CER); 8: last whorl. Figures 3, 9. *M. pantherinus*, holotype, 8.5 mm, Las Canteras, Gran Canaria (MNCN); 9: last whorl. Figures 4, 11. *M. verdensis*, paratype, 5.3 mm, Sal Rei, Boa Vista, CV (CER); 11: last whorl. Figures 5, 6, 10. *M. alboranensis*, holotype, 7.6 mm, Alborán Sea (MNCN); 10: last whorl.
 Figuras 1, 7. *Monophorus thiriota*, holotipo, 6,3 mm, Calvi, Francia (MNHN); 7: última vuelta. Figuras 2, 8. *Monophorus* sp., 6,9 mm, Sal Rei, Boa Vista, CV (CER); 8: última vuelta. Figuras 3, 9. *M. pantherinus*, holotipo, 8,5 mm, Las Canteras, Gran Canaria (MNCN); 9: última vuelta. Figuras 4, 11. *M. verdensis*, paratipo, 5,3 mm, Sal Rei, Boa Vista, CV (CER); 11: última vuelta. Figuras 5, 6, 10. *M. alboranensis*, holotipo, 7,6 mm, Mar de Alborán (MNCN); 10: última vuelta.

Monophorus verdensis Fernandes and Rolán, 1988 (Figs. 4, 11)

Material examined: All the type material and about 40 additional shells more from several localities in the Cape Verde Archipelago.

Description: See FERNANDES AND ROLÁN (1988).

Distribution: Cape Verde archipelago.

Remarks: We represent photographs of one paratype of this species for comparison with the new species to be described (see below), which are somewhat similar.

Monophorus thiriota (Bouchet, 1984) (Figs. 1, 7, 21A)

Material examined: Holotype (Fig. 1) and the material recorded from Calvi (France) and Açores by BOUCHET (1984) (MNHN). Açores: 1 sp, Agua d'Alto, São Miguel, infralittoral rocks (MNHN); 1 sp, Feteiras, São Miguel, infralittoral rocks (MNHN); 1 sp, Ponta Galera, São Miguel, infralittoral rocks (MNHN). Spain: 8 s, 4 f, San Sebastián, intertidal sediments (CFA); 1 sp, St. Jean de Luz, Costa Vasca, infralittoral rocks (MNHN); 1 sp, Candás, Ermita de San Pedro, Oviedo, (MNHN), infralittoral rocks. Canary: 10 s, 7 f, Puerto del Carmen, Lanzarote, 30-50 m (CWE).

Description: See BOUCHET (1984).

Distribution: Atlantic European and the Açores (BOUCHET, 1984). Species

here recorded from Canary islands are probably this species, but soft parts and radula are not available for checking.

Monophorus sp. (Figs. 2, 8, 21B)

Material studied: Canary: 44 s, Puerto del Carmen, Lanzarote, 30-50 m (CWE); 1 s, Mala, Lanzarote, 40 m (CWE). Cape Verde Islands: the material mentioned in FERNANDES AND ROLÁN (1993) as *M. thiriota*; 1 s, Furna, Brava, 30 m (CER); 1 s, Palmeira, Sal, 30 m (CER). Senegal: 3 s, Madeleines, 30 m (CER). Angola: 1 s, Luanda, 20 m (CER).

Description: Shell (Fig. 2) conic elongate, moderately wide for the genus, solid, sinistral. Protoconch of about 3 whorls; first whorl with a diameter of about 170 μ m wide, sculptured with cruciform tubercles that interconnect to form a net; subsequent whorls with 2 spiral cords and numerous axial ribs. Teleoconch of 9-11 whorls, flat, with axial ribs crossed by spiral cords, forming nodules at intersections; nodules rounded, only shouldered on the adapical part of the cord 3. Spiral cords 1 and 3 appearing at the beginning, cord 2 appears on the 7th whorl, remains smaller than others. On base there are 4 additional cords numbers, 4 and 5 with nodules similar to those on 2 and 3 and smaller than those on cord 1; cord 6 irregularly nodulous, the 7th smooth. Aperture ovoid, siphonal canal short and almost closed by a reflection of the external lip.

First 2-3 whorls of teleoconch white, the rest cream in background with dark

brown in interspaces between nodules, not extended around them.

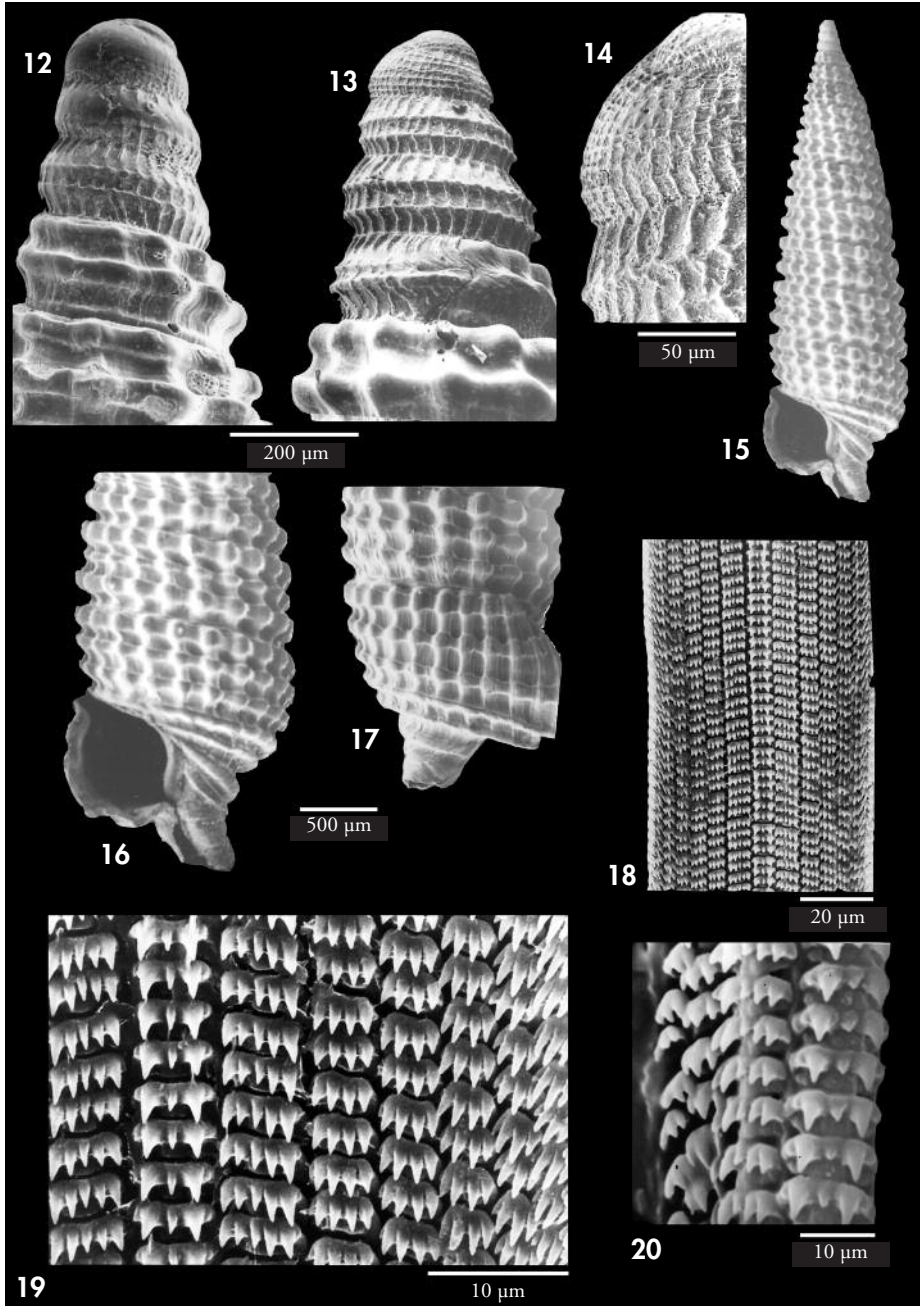
Dimensions: Up to 9 mm high, but smaller shells (5-6 mm) may be adult. The diameter up to 3 mm.

Animal cream and white with reddish blotches.

Radula (Figs. 20, 21B): Formula n-1-C-1-n, central tooth with 7 cusps, medial cusp small, adjacent cusp larger, outer 4 cusp smallest. Lateral teeth each with 6 cusps of different size: counting outwardly, the largest are cusps 2 and 5, the smallest being 1 and 4. The marginal teeth each have 4 cusps, large innermost and outermost small, median 2 large.

Distribution: Canary Islands, Cape Verde Islands, Senegal and Angola.

Remarks: The present morph was recorded in FERNANDES AND ROLÁN (1993) as *M. thiriota*. All the shells included in this morph had a very similar morphology. We thought that these



Figures 12, 18, 19. *Monophorus pantherinus*. 12: protoconch; 18, 19: radula. Figures 13-17. *M. alboranensis*. 13: protoconch; 14: detail of the protoconch; 15: paratype; 16, 17: paratypes, detail of the last whorl. Figure 20. *Monophorus* sp., radula.

Figuras 12, 18, 19. Monophorus pantherinus. 12: protoconcha; 18, 19: rádula. Figuras 13-17. M. alboranensis. 13: protoconcha; 14: detalle de la protoconcha; 15: paratipo; 16, 17: paratipos, detalle de la última vuelta. Figura 20. Monophorus sp., rádula.

shells could be really assigned to the taxon *M. thiriota*, but, in comparison with the holotype and the shells of *M. thiriota* from Europe and the Açores, we have some doubts for the following reasons:

- the shells can be larger reaching 9 mm (while the holotype of *M. thiriota* is 6.1 mm and most of the shells of similar size);
- the shells are typically wider, with a length/width ratio of 2.9 (in *M. thiriota* is 3.5);
- the background of the shell is lighter, cream or almost white (brown in *M. thiriota*);
- the first whorls of the teleoconch are white (brown in *M. thiriota*);
- the nodules are larger than in *M. thiriota* and most of them are not shouldered adapically;

- there are some radular differences: *Monophorus* sp (Fig. 21B) has a the central tooth with two external cusps more than in *M. thiriota*; in the lateral teeth, *Monophorus* sp has the cusps more irregular (while *M. thiriota* has four small cusps and one larger).

The problem with this comparison is that it was made from a small number of samples, and the value of these differences remains to be established.

We have found some shells with the typical morph of *M. thiriota* from the Canary Islands (see material studied). This would seem to be a case of sympatry without intergradation, but the problem could not be resolved because of the lack of intact protoconchs and soft parts. Accordingly, we are doubtful about whether or not they belong to the taxon *M. thiriota*.

Monophorus pantherinus spec. nov. (Figs. 3, 9, 12, 18, 19, 21B)

Type material: Holotype (Fig. 3) and 1 paratype in MNCN (15.05/44158). Paratypes: 1 in MNHN and 1 in CER. All alive collected at the type locality.

Other material examined: Canary Islands: Gran Canaria: 1 sp, intertidal, Las Canteras, Las Palmas, (dissolved for the radular study). Lanzarote: 2 s, 1 j, El Reducto, Arrecife, 5 m (CWE); 1 s, Puerto del Carmen, 5 m (CWE); 3 f, Tamara, intertidal (CAP). La Palma: 2 s, 3 f, Los Cancajos, Santa Cruz de la Palma, 20-40 m (CWE). Gomera: 1 s, San Sebastián de la Gomera, 12 m (CWE).

Type locality: Las Canteras Beach, Las Palmas de Gran Canaria, Canary Islands.

Etymology: The specific name alludes to the blotched pattern of the shell.

Description: Shell (Fig. 3) conic elongate, moderately wide for the genus, solid, sinistral. Protoconch (Fig. 12) of about 3 whorls, the first whorl 180 μ m wide, with a microsculpture of cruciform tubercles that interconnect to form a net; subsequent whorls with 2 spiral cords and numerous axial ribs. Teleoconch of about 9-12 whorls, flat-sided, with axial ribs crossed by spiral cords forming nodules at intersections; nodules relatively large and rounded, only shouldered on the last whorl on the adapical side of cord 3. Spiral cords 1 and 3 commencing immediately, cord 2 commencing on about 9th whorl, smaller up to the last whorl, where all are similar. Base with 4 additional cords, the 4 and 5 with nodules similar to those of 2 and 3 and smaller than those on cord

1; cord 6 irregularly nodulous, 7 smooth. Aperture ovoid with a small sinus adapically. Siphonal canal short and a gently curved towards the dorsum, borders of siphonal aperture on its upper part are in contact.

First 2-3 whorls of teleoconch darker brown than rest of shell; later whorls cream with numerous dark brown blotches, the latter more evident in subsutural area; interspaces between nodules brown, limited to the cord except in the area with brown blotches.

Dimensions: the holotype is the largest specimen, reaching 8.5 mm x 2.5 mm.

Animal with head brown between eyes, the eyes rounded by a white area. Tentacles transparent with yellow dots. Foot with irregular black and brown

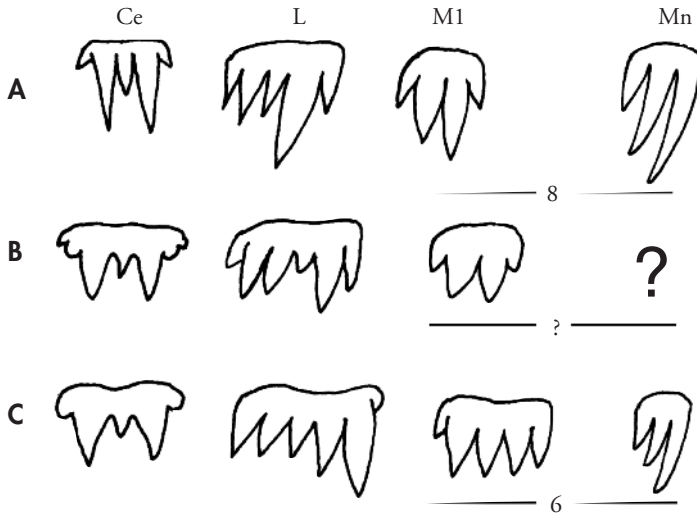


Figure 21. A: *Monophorus thiriotaе*, drawing made from BOUCHET (1984, fig. 9); B: drawing of the radula of *Monophorus* sp., Sal Rei, Boa Vista; C: drawing of the radula of *Monophorus pantherinus*, Las Canteras, Gran Canaria. (Ce: central tooth; L: lateral tooth; M1: marginal tooth number 1; Mn: most external marginal tooth).

Figura 21. A: *Monophorus thiriotaе*, dibujo tomado de BOUCHET (1984, fig. 9); B: rádula de *Monophorus* sp., Sal Rei, Boa Vista; C: rádula de *Monophorus pantherinus*, Las Canteras, Gran Canaria. (Ce: diente central; L: diente lateral; M1: primer diente marginal; Mn: diente marginal más externo).

blotches in middle, with some irregular yellow parts. Both sides of frontal and caudal part of foot reddish.

Operculum rounded, paucispiral, nucleus central.

Radula (Figs. 18-19, 21C). Formula n-1-C-1-n; central tooth with 5 cusps, median smaller, adjacent cusps larger, outermost cusp very small; lateral tooth with 6 cusps of different size: from the internal side, 4 are similar, the following larger, and outer very small. Marginal teeth with 5 cusps, the innermost smallest. Outermost marginal teeth with only three cusps.

Distribution: Canary Islands.

Remarks: The differences with the most similar species of the genus are the following (see also Table I):

- *M. perversus* usually forms more whorls, the shell is narrower, and more elongate, the colour is darker brown with fewer white blotches, and the protoconch has weaker sculpture with smooth parts.

- *M. thiriotaе* has a more uniformly dark shell, and more darkly pigmented brownish background colour, without darker blotches, and the darker colour in the interspaces between the nodules is more extended. The nodules are smaller, and all are clearly shouldered adapically. The distribution of the colour of the soft parts as given in the original description is quite different.

- *M. erythrosoma* has a monochrome brown-red shell, with up to 15 teleoconch whorls, it is not darker in the interspaces between nodules, and spiral cord 2 appears on about the 10th or 11th whorl. The colour of the soft parts as described by BOUCHET (1984) is quite different.

- *M. verdensis* has a small and narrower shell, and it is cream-whitish in background colour with only isolates subsutural brown blotches.

- *M. sp.* (also present in Canary Islands) has a shell more uniform in pattern colour without dark blotches,

the first whorls of the teleoconch being white.

• Some other triphorids present in Canary Islands belonging to different genera can be confused with these *Monophorus* species: *Cosmotriphora canarica* (Nordsieck and Talavera, 1979) has smaller nodules, three cords on most of

the teleoconch, and lacks of dark colour between tubercles. *Cosmotriphora pseudocanarica* Bouchet, 1984 has a smaller shell, with only one cord on the first two whorls of the protoconch, brown axial lines continued along the shell and no dark brown colour in the inter-nodular spaces.

Monophorus alboranensis spec. nov. (Figs. 5, 6, 10, 13-17)

Type material: Holotype (Figs. 5, 6, 10) in MNCN (15.05/44159). Paratypes: 1 in MNHN, 2 in CER, 4 in CAP, all from type locality ex-CAP.

Other material examined: 2 s, 2 j, 3 f, Alborán Sea, 200 m (CAP); 1 s, Piedras del Charco, Almería Bay, 50 m (CDM).

Type locality: Alborán Sea, Mediterranean, 100-200 m.

Etymology: The specific names alludes to the area where the species was collected.

Description: Shell (Figs. 5, 6, 15) conic elongate, solid, sinistral. Protoconch (Figs. 13, 14) of almost 4 whorls, the first one with a diameter of about 200 μ m, and a microsculpture formed by cruciform tubercles which form a net; subsequent whorls with 2 spiral cords crossed by numerous axial ribs. Teleoconch of about 11 whorls, flat-sided, with axial ribs crossed by spiral cords forming nodules at intersections; nodules rounded and not shouldered except on last adult whorl, adapically on cord 3. Spiral cords 1-3 appearing immediatly, cord 2 commencing on 6th whorl, smaller before adult penultimate whorl, where equal to the 3 primaries. Base, with 4 additional cords, 4 and 5 with nodules similar to those on 2 and 3, smaller than those on cord 1; cord 6 irregularly nodulous; cord 7 very small, smooth and adherent to the siphon. Spiral cords without additional duplications at end of last whorl. Aperture ovoid with small sinus on its upper part. Siphonal canal larger than other species, reaching almost diameter of the aperture.

Colour cream, with some variations, of light brown. First 2-3 whorls of teleoconch same colour as rest of shell; some whorls with cream white or light brown colour, more evident sometimes on the 2 lower spiral cords includind nodules; colour in interspaces between nodules same colour as nodules.

Dimensions: Holotype 7.6 mm long, being the largest shell studied.

Animal unknown. Operculum (found into a shell from which animal had decayed) rounded and paucispiral.

Radula unknown.

Distribution: Only known from the Alborán Sea and the Almería Bay, Spain.

Remarks: The shell of *M. alboranensis* has a typical pattern different from most of the species of the area.

- *M. perversus* usually has more teleoconch whorls, is more elongate, is darker in colour with a pattern of blotches of white and brown, with a protoconch that typically has weaker sculpture with smooth parts.

- *M. thiriota* has a darker shell, has brownish background colour, lacks blotches, is darker in the interspaces between the nodules, and has smaller nadules, that are well shouldered apically.

- *M. erythrosoma* has a monochrome brown-red shell, with up to 15 teleoconch whorls, spiral cord 2 appearing about on the 10th or 11th whorl.

- *M. verdensis* has a shorter and narrower shell, is cream-whitish in background colour with only isolated small brown blotches limited to the subsutural cord. Spiral cord 2 appears only on the last adult whorl. Finally, the siphonal canal is shorter.

Table I. Differences between *Monophorus thiriota*, *M. sp.* and *M. pantherinus*.
 Tabla I. Diferencias entre *Monophorus thiriota*, *M. sp.* y *M. pantherinus*.

	<i>M. thiriota</i>	<i>M. sp</i>	<i>M. pantherinus</i>
Form	elongate-narrow	moderately wide	wider
Ratio length/wigth	3.5	2.9	2.7
General impression of colour	brown	light brown	spotted cream with dark brown blotches
Background colour	brown	cream or whitish	spotty
Pattern colour	nodules light brown; dark brown in interspaces	nodules cream; dark brown in interspaces	nodules anternating 2-3 cream with other light brown; dark brown in interspaces
Brown colour of internodes	extended a little around the nodules	extended below but not around the nodules	except in the brown blotches limited only to cord between nodules
Colour of suture	darker	same colour	alternating parts cream and other darker
Colour of first 3 whorls of teleoconch	same as rest of shell	lighter than rest of shell	darker than rest of shell
Medium spiral cord	at 8th whorl	at 7th whorl	at 9th whorl
Nodules	small	medium size	large
Nodules	clearly shouldered adapically	weakly shouldered adapically on cord 3	weakly shouldered adapically on cord 3 on last whorl only
Whorls of protoconch	3.75	3	3

- *M. sp.* from Canary and Cape Verde (see above) has a wider shell and a very uniform colour pattern without differences in other parts of the shell, the first whorls of the teleoconch are

white and the spaces between nodules are dark brown.

- *M. pantherina* has a larger and wider shell, with more dark brown blotches, the 2nd spiral cord appears about the 7th whorl.

Table II. Distribution range of the species of the genus *Monophorus* in East Atlantic. EM: East Mediterranean; WM: West Mediterranean; EA: European Atlantic; AÇ: Açores; C: Canary; CV: Cape Verde Islands; S: Senegal and close areas; AN: Angola.

Tabla II. Distribución de las especies del género *Monophorus* en el Atlántico este. EM: Mediterráneo este; WM: Mediterráneo oeste; EA: Atlántico europeo; AÇ: Azores; C: Islas Canarias; CV: Cabo Verde; S: Senegal y áreas cercanas; AN: Angola.

	EM	WM	EA	AÇ	C	CV	S	AN
<i>M. perversus</i>	•	•	•	•	•		•	•
<i>M. erythrosoma</i>		•	•			•		
<i>M. verdensis</i>						•		
<i>M. thiriota</i>			•	•	•			
<i>M. sp</i>					•	•	•	•
<i>M. pantherina</i>					•			
<i>M. alboranensis</i>		•						

DISCUSION

At present we have scarce information on the West coast of Africa but we have tried to represent in Table II the known distribution range of the species of the genus *Monophorus* in East Atlantic.

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BIBLIOGRAPHY

- BOUCHET, P., 1984. Les Triphoridae de Méditerranée et du proche Atlantique (Mollusca, Gastropoda). *Lavori S.I.M.*, 21: 5-58.
- BOUCHET, P., 1996. Nouvelles observations sur la systématique des Triphoridae de Méditerranée et du proche Atlantique. *Bollettino Malacologico*, 31 (9-12): 205-220.
- BOUCHET, P. AND GUILLEMOT, H., 1978. The *Triphora perversa*-complex in Western Europe. *Journal of Molluscan Studies*, 44: 344-356.
- FERNANDES, F. AND ROLÁN, E., 1988. A familia Triphoridae (Mollusca: Gastropoda) no arquipélago de Cabo Verde. *Publicações Ocasionalis da Sociedade Portuguesa de Malacologia*, (11): 17-32.
- FERNANDES, F. AND ROLÁN, E., 1993. Nuevas aportaciones a la familia Triphoridae (Mollusca, Gastropoda) para el Archipiélago de Cabo Verde. *Iberus*, 10 (1): 143-148.
- MARSHALL, B. A., 1983. A revision of the Recent Triphoridae of Southern Australia. *Records of the Australian Museum*, supl. 2: 1-119.
- NORDSIECK, F. AND GARCÍA-TALAVERA, F., 1979. *Moluscos marinos de Canarias y Madera (Gastropoda)*. Aula de Cultura de Tenerife, Madrid. 208 pp, 46 pls.
- ROLÁN, E., 1983. Moluscos de la Ria de Vigo. I. Gasterópodos. *Thalassas*, 1, supl. 1: 1-383.