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HEXAPLEX BIFASCIATUS (A. ADAMS, 1853), A VALID MURICID SPECIES OCCURRING IN THE CAPE VERDE ARCHIPELAGO (PROSOBRANCHIA, NEOGASTROPODA) (***)

KEY WORDS: Gastropoda, Prosobranchia, Muricidae, Distribution, Cape Verde, West Africa

Resumo:

Hexaplex bifasciatus (A. ADAMS, 1851) (Neogastropoda, Muricidae), do Arquipélago de Cabo Verde, geralmente tida como con-specifica com *Hexaplex rosarium* (RÖDING, 1798), é considerada neste trabalho, espécie válida e endémica de Ilha da Boavista, onde as duas espécies ocorrem em simpatria.

Incluem-se considerações de ordem taxonómica, zoogeográfica e ecológica sobre estas espécies, as quais, juntamente com *H. duplex* (RÖDING, 1798) e *H. turbinatus* (LAMARCK, 1822) constituem um complexo próprio da zona tropical do Atlântico oriental.

Riassunto:

Hexaplex bifasciatus (A. ADAMS, 1851), una specie dell'Arcipelago di Capo Verde, è stata spesso considerata sinonimo di *Hexaplex rosarium* (RÖDING, 1798); in questo lavoro viene invece separata come specie valida, endemica dell'isola di Boavista, dove si trova simpatricamente con *H. rosarium*. Per entrambe le specie vengono fornite considerazioni concernenti tassonomia, zoogeografia ed ecologia.

Le due specie di *Hexaplex* dell'Arcipelago del Capo Verde, unitamente a *H. duplex* (RÖDING, 1798) delle coste della Senegambia e « *H. turbinatus* (LAMARCK, 1822) » delle Isole Canarie, costituiscono un complesso di quattro specie caratteristico della zona tropicale dell'Atlantico orientale.

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Summary:

Hexaplex bifasciatus (A. ADAMS, 1851) from the Cape Verde Archipelago, often considered conspecific with *Hexaplex rosarium* (RÖDING, 1798), is here separated as a valid species, endemic to Ilha da Boavista and occurring sympatrically with *H. rosarium*.

A taxonomic, zoogeographical and ecological survey of both species is given.

The 2 capeverdian *Hexaplex* belong to a complex of 4 species in the tropical Eastern Atlantic:

<i>H. bifasciatus</i> (A. ADAMS, 1851)	Cape Verde Is.
<i>H. duplex</i> (RÖDING, 1789)	Mainland (Senegambia)
<i>H. rosarium</i> (RÖDING, 1789)	Cape Verde Is.
« <i>H. turbinatus</i> (LAMARCK, 1822) »	Canary Islands

Introduction:

During the German-Portuguese Expedition to the Cape Verde Islands in December 1978 - January 1979, 3 live specimens and additional beach shells of an unidentified muricid of the Genus *Hexaplex* PERRY, 1877, were collected in Baía de Gata, in the north-eastern part of Ilha da Boavista. After thorough study and comparison they were identified as *Hexaplex bifasciatus* (A. ADAMS, 1851), first referred to and figured by REEVE (1845) as a variety of *Hexaplex rosarium* (RÖDING, 1798) and later described by A. ADAMS (1851) as a valid species from Senegal.

In spite of the evident constant anatomical and conchological differences between this species and *H. rosarium*, in subsequent publications both species were regarded conspecific (SOWERBY, 1876; FAIR, 1976; PAIN, 1976; RADWIN & d'ATTILIO, 1976), *bifasciatus* being only a colour form or variety of *rosarium*.

There was indeed the possibility that *H. bifasciatus* would be merely a local subspecies of *H. rosarium*, (as it is the case with a number of Conidae, see RÖCKEL, ROLAN & MONTEIRO, 1981); especially as *H. rosarium* had not been found on Boavista Island until very recently. But as local fishermen were able to distinguish *H. bifasciatus* from typical *H. rosarium* (which they warranted to be a common species around Boavista), it was assumed that both species may occur sympatrically. This was finally proved by the first author, when he found in Derrubado Bay (Pta. Antonia) Boavista Island, in July 1981, 2 specimens of *H. bifasciatus* in the same area together with typical specimens of *H. rosarium* by Scuba diving. This fact, and the absence of intergrades lead to the conclusion that *H. bifasciatus* is a valid species, endemic in Ilha da Boavista, until further information on zoogeographical distribution become available.

Abbreviations:

C.Z. (J.I.C.U.): Junta de Investigações Científicas do Ultramar, Centro de Zoologia, Lisboa

M.N.H.N.: Muséum national d'Histoire naturelle, Paris

Z.I.M.: Zoologisches Institut und Zoologisches Museum der Universität Hamburg

Z.M.K.: Zoologisk Museum, Copenhagen

Material and Methods

Most studied specimens of both species have been collected by skin- or Scubadiving or by dredging, during the various expeditions to the Cape Verde Islands, in which the authors or the first author took part. Additional specimens of *H. bifasciatus* have been loaned for study by Dr. Emilio Rolan Mosquera (Vigo, Spain) and Mr. Guilherme Soares (Lisboa), who also had collected them in Boavista. Specimens of *H. rosarium* in the Museums of Paris, Copenhagen and Hamburg were also examined.

The radulae were cleaned in 10% caustic soda solution and mounted in Prof. Tendeiro Liquid. The drawings were made with camera lucida.

Systematic account:

Hexaplex bifasciatus (A. ADAMS, 1851)

1845 *Murex rosarium* var. - REEVE, Conch. Icon., Murex pl. 3, fig. 14 (non RÖDING, 1798)

1851 *Murex bifasciatus* A. ADAMS, Proc. Zool. Soc. London, 19: 269

1876 *Murex bifasciatus* var. of *rosarium* - SOWERBY II, Thes. Conchyl., Murex, pl. 16, fig. 155 (partim)

1880 *Murex rosarium* var. *bifasciatus* - TRYON, Man. Conch. 2: pl. 28, fig. 255 (partim)

1886 *Murex rosarium* var. *bifasciatus* - ARRUDA FURTADO, Journ. Sci. Math. Phys. Nat. 43: 15 (partim)

1887 *Murex anguliferus* var. *bifasciatus* - NOBRE, ibid. 46: 111-112 (partim)

1976 *Murex bifasciatus* - FAIR, Murex Book: 25

1976 *Murex bifasciatus* - PAIN, Brit. Shell Coll. Newsl. 24: 3 (partim)

1976 *Phyllonotus duplex* - RADWIN & d'ATTILIO, Murex shells of the World: 88 (partim)

Description: Shell medium-sized, up to 64 mm, strong, globose-fusiform, with moderately low to moderately elevated spire and broad short canal typical for *Hexaplex*. Body whorl large, globose, with 8-9 more or less thick varices, which bear short, anteriorly nearly closed spines or sharp knobs only. Spire slightly concave-sided to straight. Canal with 1-2 short spines per varice. Protoconch with apparently 2 whorls, mostly corroded, teleoconch with 5-5½ whorls. Between the varices sometimes 1 more or less pronounced irregular axial ridge, but mostly obsolete. Surface with strong spiral cords forming the knobs resp. the shoulder spines where they cross the varices. Besides this,

fine spiral threads and fine irregular growth lines. Aperture fairly large, rounded oval, with an anal sinus and a spiral ridge on the parietal wall just below it, which becomes obsolete towards the interior of the aperture.

Shell whitish to bluish white, rosy white or pale yellow, with 3 dark brown to brownish-violet spiral bands, 2 of them on the body whorl, 1 on the base. Uppermost band also visible on the spire whorls. Protoconch chocolate brown. Aperture whitish, with the dark spiral bands showing through in deep purple violet to purplish brown, becoming lighter towards the interior. Columella light brownish-rosy to light orange-rosy.

Radula typically rachiglossate with more or less 94 teeth rows. Rachidian tooth with a sharp oblique central cusp, which in each row changes the direction of torsion. Two intermediate small cusps with narrow base, the basal end points channelled and somewhat triangular. Lateral teeth with large trapezoidal proximal end, distal end strong and sharp, with small fold.

Specimens examined

Boavista: Baía da Gata [Punta Rodrigo], 1-3 m, on rocks and hard bottom, often partly buried in sand pockets: 5 specimens and various beach shells; Derrubado [Pta. Antonia]: 2 specimens; Sal Rei: 3 specimens.

Measurements (mm): (incl. varices, excl. spines or knobs)

Lenght	width	Loc. and Collector	Collection
70,0	56,3	Sal Rei leg. Soares	G. SOARES
64,3	42,0	B. da Gata leg. Rolan	E. ROLAN
58,2	40,9	Sal Rei leg. Soares	G. SOARES
56,8	42,7	B. da Gata leg. Rolan	E. ROLAN
56,5	38,9	B. da Gata leg. Burnay	C.Z. (J.I.C.U.)
55,2	40,4	Sal Rei leg. Soares	G. SOARES
54,9	38,6	B. da Gata leg. Rolan	Z.I.M.
54,6	40,0	Derrubado leg. Burnay	C.Z. (J.I.C.U.)
51,6	37,3	Derrubado leg. Burnay	C.Z. (J.I.C.U.)
46,9	32,4	B. da Gata leg. Burnay	v. Cosel

Distribution:

Cape Verde Islands, endemic to Ilha da Boavista

Habitat:

In small quiet bays, in 2-3 m, generally on rocky bottom, partly buried in sand between the rocks. Not very common, more than 2 specimens have never been observed together. Beach shells also quite rare, mostly eroded. In the same biotope were found several *Conus* species.

Hexaplex rosarium (RÖDING, 1798)

- 1798 *Murex rosarium* RÖDING, Mus. Boltenianum: 170
1822 *Murex melonulus* LAMARCK, Hist. nat. Anim. s. vert. 7: 171
1845 *Murex rosarium* - REEVE, Conch. Icon., Murex: pl. 9 sp. 14 b
1853 *Murex rosarium* - MENKE, Zeit. f. Malak 10: 78
1879 *Murex rosarium* - SOWERBY II, Thes. Conchyl. Murex: pl. 16, fig. 156
1893 *Phyllonotus rosarium* - STEARNS, Proc. U.S. Nat. Mus. 16 (940) 330
1897 *Murex pomiformis* LOCARD, Exp. Sci. Travailleur et Talisman 2: 308 (non GMELIN, 1791)
1906 *Murex (Phyllonotus) rosarium* - DAUTZENBERG et FISCHER, Res. Camp. Sci. Albert I er ... Monaco 32: 32
1909 *Murex rosarium* - NOBRE, Bull. Soc. Port. Sci. Nat. 3 (Supl. 2): 20
1913 *Murex rosarium* - MELVILL & STANDEN, Trans. Roy. Soc. Edinb. 46: 341
1923 *Murex (Phyllonotus) rosarium* - LAMY, C.R. Soc. Sav. 1922: 25
1950 *Murex turbinatus* - NICKLES, Manuals Quest Africains 2: 90-91 (fig.) (non LAMARCK, 1822)
1956 *Murex saxatilis* - KNUDSEN, Atlantide Report 4: 15-17 (partim) (non LINNE, 1758)
1956 *Murex rosarium* - MARCHE-MARCHAD, Bull. I.F.A.N. 18 (1^a): 52
1976 *Hexaplex rosarium* - FAIR, Murex Book: 72, Pl. 10
1976 *Hexaplex rosarium* - PAIN, Brit. Shell Collect. News1. 24: 2, fig. 5-8
1976 *Phyllonotus duplex* - RADWIN & d'ATTILIO, Murex Shells of the World: 88 (partim)
1977 *Murex (Hexaplex) rosarium* - SAUNDERS, La Conchiglia 97-98: 8 (fig.)
1977 *Phyllonotus duplex* - BURNAY & MONTEIRO, Seashells from Cape Verde Islands: 35, fig. 28 (non RÖDING, 1798)
1980 *Hexaplex rosarium* - HOUART, Inform. Soc. Belg. Malac. 1 (8 ser.): 8-12 (partim)

Description: Shell large, un to 120mm, strong to very strong, thick-shelled and heavy, globose-fusiform, with moderately elevated spire. Canal short and broad, body whorl large and globose, with 7-8 (rarely 6) more or less thick varices, bearing short shoulder spines or knobs. Spire in juveniles often less elevated than in adults, giving the latter a somewhat convex-sided spire. Canal mostly with 2 short spines per varice. Protoconch with two whorls, in adults mostly eroded. Teleoconch with 6-6½ whorls. In some specimens in the intervarical spaces an axially prolonged knob or irregular axial ridge. Surface with strong spiral cords forming knobs resp. the shoulder spines where they cross the varices. Besides this, fine, dense, somewhat irregular spiral threads. Aperture large and rounded-oval, with anal sinus and a spiral ridge on the parietal wall just below it, which in some specimens is more a long knob, becoming rapidly obsolete towards the interior of the aperture.

Shell whitish, yellowish white or light brown, canal darker. On the body whorl 2 darker brownish to pinkish broad spiral bands, one on the shoulder and one in the middle; the third is « formed » by the darker canal. Often bands only visible on varices. Spiral cords in brown specimens often lighter than the interspaces. Protoconch light rosy. Surface often eroded or incrustated with sessil organism (bryozoarians, calcareous algae etc.). Aperture white, outer lip inside bright red, specially where the darker spiral bands on the outside are located. These are marked in the aperture as red bands

usually only in the first half or full centimeter behind the lip, in some specimens also more interiorly slightly visible, mostly at the location of the varices. Columella, parietal callus and often also interior of the siphonal canal bright rosy to deep red.

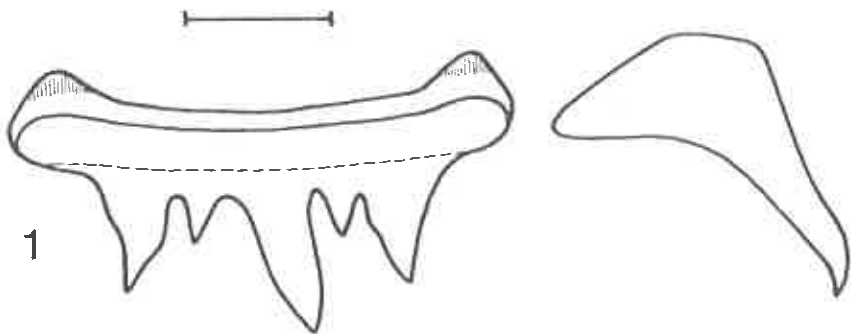


Fig. 1
Middle and one lateral tooth the radula of *H. bifasciatus*

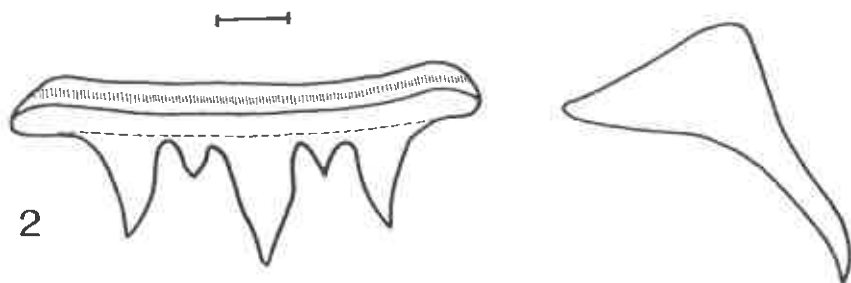


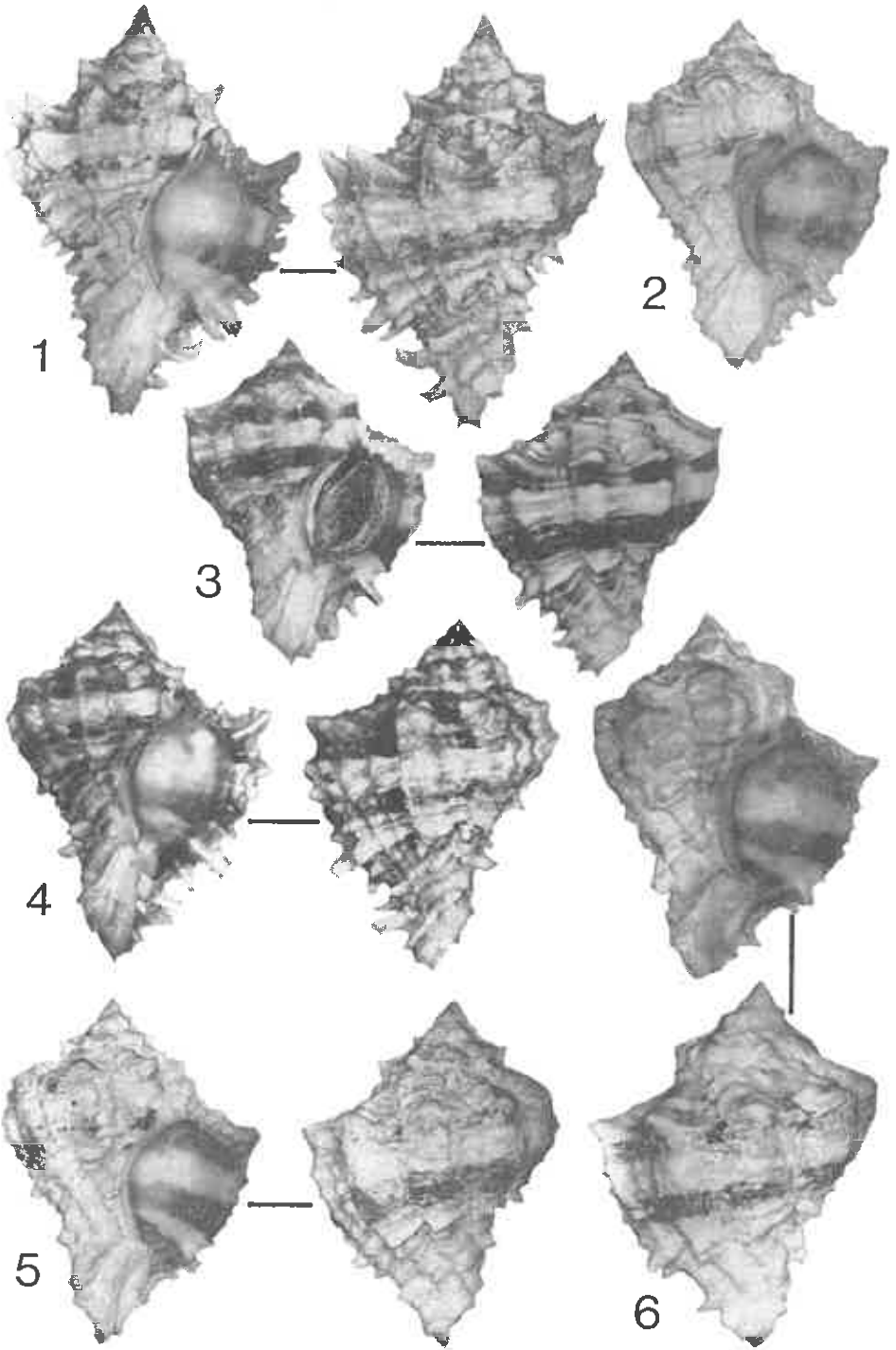
Fig. 2
Middle and one lateral tooth of the radula of *H. rosarium*
= 1 mm

Radula typically rachiglossate with more or less 158 rows. Middle tooth with a sharp triangular central cusp, 2 intermediate small cusps and 2 strong lateral cusps, with a narrow channelled base without noticeable basal end points. The 2 lateral teeth with sharp and narrow distal end and large triangular proximal end.

Plate 1

Hexaplex bifasciatus (Ads.), Boavista, Cape Verde Islands (all x 0,9)

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| 1. Baía da Gata (Punta Rodrigo) | leg. & coll. Rolan |
| 2. Derrubado | leg. Burnay, coll. C.Z. (J.I.C.U.) |
| 3. Derrubado | leg. Burnay, coll. C.Z. (J.I.C.U.) |
| 4. Baía da Gata (Punta Rodrigo) | leg. Burnay, coll. C.Z. (J.I.C.U.) |
| 5. Baía da Gata (Punta Rodrigo) | leg. Rolan, coll. Z.I.M. |
| 6. Baía da Gata (Punta Rodrigo) | leg. & coll. Rolan |



Specimens examined:

SÃO VICENTE: Baía da Matiota, 10-15 m, sand with calcareous algae and foraminifera: 2 specimens; Mindelo, old port jetty, 3-4 m, fine sand and mud: 3 specimens; Baía de São Pedro, 40 m, foraminifers and corals (Atlantide Sta. 40): 1 fresh empty shell; (without precise locality), 8 fms. and 6 fms. PAESSLER: 4 specimens; ILHA, DO SAL: Santa Maria, 2-4m, on jetty poles; 3 specimens; beach: 1 shell; 27-45m, calcareous algae (Calypso Sta. 83): 1 juv. specimen; Baía do Algodoeiro, beach: 1 shell; Palmeira, beach: 1 shell; ILHA DA BOAVISTA: Southwest side, 45m, sand with shells (Calypso Sta. 75, 16° 01' N/23° 00' W): 3 juvenile specimens; Derrubado, 1 specimen; São TIAGO: Porto de Tarrafal, 40-45 m, sand with calcareous algae (Calypso Sta. 23, 15° 16,5' N/23° 47,5' W): 1 specimen; 50-65 m, coarse sand with shells (Calypso Sta. 26, 15° 16,5' N/23° 41,5' W): 2 specimens.

Measurements (mm) (incl. varices, excl. spines or knobs):

Lenght	Width	Loc. and Collector	Collection
116,0	79,5	Sta. Maria leg. Rolan	v. COSEL
113,0	73,3	Palmeira leg. v. Cosel	v. COSEL
111,4	70,8	Mindelo old port leg. v. Cosel	v. COSEL
101,9	73,2	Algodoeiro leg. v. Cosel	v. COSEL
100,2	66,0	Derrubado leg. Burnay	C.Z. (J.I.C.U.)
96,1	65,0	S. Vincente leg. Paessler	Z.I.M.
96,1	63,0	S. Vincente leg. Paessler	Z.I.M.
91,6	55,5	Porto de Tarrafal (Calypso Sta. 26)	M.N.H.N.
90,0	64,9	S. Vincente leg. Paessler	Z.I.M.
88,6	59,0	S. Vincente leg. Paessler and Petersen 18.8.1888	Z.I.M.
88,1	57,8	S. Vincente old port leg. Burnay	C.Z. (J.I.C.U.)
84,1	51,7	Mindelo old port leg. v. Cosel	v. COSEL
78,8	52,2	Porto de Tarrafal (Calypso Sta. 23)	M.N.H.N.
78,6	52,5	Porto de Tarrafal (Calypso Sta. 26)	M.N.H.N.
58,0	39,1	S. Vincente leg. Paessler 1893 (an <i>Arca bouvieri</i> is attached to this specimen)	Z.I.M.
46,3	31,7	Matiota leg. Burnay	C.Z. (J.I.C.U.)
44,6	28,8	São Pedro (Atlantide Sta. 40)	Z.M.K.
43,0	27,4	Boavista (Calypso Sta. 75)	M.N.H.N.
42,2	27,6	Matiota leg. v. Cosel	v. COSEL
36,4	23,0	Boavista (Calypso Sta. 75)	M.N.H.N.
34,0	21,4	Boavista (Calypso Sta. 75)	M.N.H.N.
21,2	16,3	Sta. Maria (Calypso Sta. 83)	M.N.H.N.

Distribution:

Cape Verde Islands; According to PAIN (1976) and HOUART (1980) the species occurs also in Angola.

Habitat:

On sandy or muddy-sandy bottom as well as on coral and calcareous algae substratum, mostly partly buried, often near small or large rocks, also on wharf poles and other secondary hard substratum. Common in many places. Depth range from shallow water to 60 m and more. In greater depths (15-20m) more frequent than in very shallow water (under 2 m).

Discussion:

Hexaplex bifasciatus is clearly distinguished from *H. rosarium* by the following constant features:

Smaller size.

One varice more on body whorl.

Colour of spiral bands on the outside dark brownish, always visible, at least on the whole body whorl.

Spiral bands within the aperture brownish-purplish, also always visible.

Columella pale rosy-orange, not red, inside the outer lip never with red rim.

General shape of the shell. Shell of *H. bifasciatus* with straight or concave-sided spire, whereas the spire of *H. rosarium* often is slightly convex-sided with globose second whorl.

Radular morphology.

Egg capsules have not been found yet, but from the size of the protoconch (which yet could be studied in one specimen only, although here also somewhat corroded) it can be assumed that *H. bifasciatus*, like many other muricids, does not have a planctonic veliger phase, and that the hatchlings leave the egg-case as late pediveligers or tiny snails. So they would not be able to cross the depth of more than 1000 m between Boavista and Sal.

The protoconch of *H. rosarium* has about the same size as that of *H. bifasciatus* (perhaps a bit smaller), but in comparison to the size of the adult specimen, it is smaller than that of *H. bifasciatus*. The presence of *H. rosarium* within the whole Cape Verde Archipelago leads to the assumption that, like in the related *H. erythrostomus* (SWAINSON, 1831) from the Eastern Pacific (RADWIN & d'ATTILIO, 1976: 10), *H. rosarium* may pass a (not too long) free swimming veliger stage.

Both species belong to a complex of 4 closely related *Hexaplex* species in the tropical Eastern Atlantic. The corresponding species along the coast of Senegambia is *Hexaplex duplex* (RÖDING, 1789), which is also known as *Murex saxatilis* LINNE (today considered nomen dubium) and *Murex hoplites* F. FISCHER (junior synonym). Another species occurs around the Canary Islands, usually known as *Murex turbinatus* LAMARCK, 1822 (RADWIN & d'ATTILIO, 1976 wrongly consider it conspecific with the mediterranean *Phyllonotus trunculus* (L., 1758), and described by NORDSIECK (1975) newly as a subspecies of the latter under the name *Trunculariopsis trunculus canariensis*. The taxonomy of this has not been worked out yet, but it is obvious that it is not conspecific with either *H. rosarium* or *H. duplex*.

All species probably have derived from a common ancestor. *H. bifasciatus* is clearly distinguished from the other 3 by its colour with lack of any red, as it is typical for the remaining species, and by its smaller size.

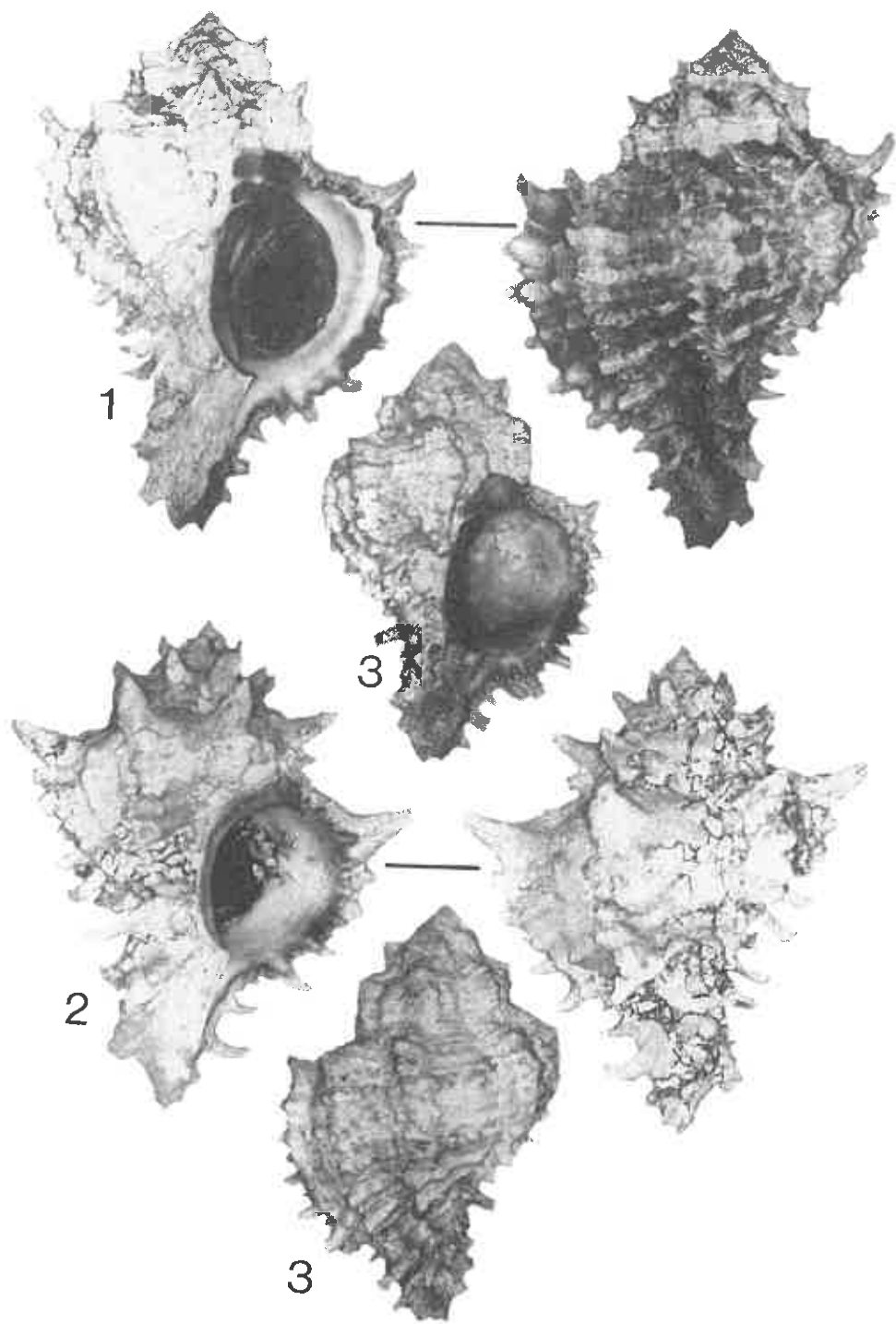
Acknowledgments

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Plate 2

Hexaplex rosarium (RDG.) (x 0,45)

1. São Vicente, Matiota-Mindelo leg. & coll. v. Cosel
2. São Tiago, Tarrafal (Calypso Sta. 26) coll. M.N.H.N.
3. Boavista, Derrubado leg. Burnay, coll. C.Z. (J.I.C.U.)



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