

A new species of *Bohadschia* (Echinodermata, Holothuroidea)
 from the Western Indian Ocean
 with a redescription of *Bohadschia subrubra* (QUOY & GAIMARD, 1833)

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Abstract

Bohadschia atra sp. nov. from the Western Indian Ocean is described and compared with *Bohadschia subrubra* (QUOY & GAIMARD, 1833). *B. subrubra* is redescribed and compared to the new species and related *Bohadschia* species. The shape of the ossicles varies with body size for both species.

Key-words: Echinodermata, Holothuroidea, *Bohadschia*, new species, ossicle changes, Western Indian Ocean.

Résumé

Bohadschia atra sp. nov., vivant dans la partie ouest de l'océan indien, est décrite et comparée à *Bohadschia subrubra* (QUOY & GAIMARD, 1833). *B. subrubra* est redécrite et comparée à la nouvelle espèce ainsi qu'à d'autres espèces de *Bohadschia*. Pour les deux espèces décrites, la forme des spicules varie en fonction de la taille du corps.

Mots-clefs: Echinodermata, Holothuroidea, *Bohadschia*, nouvelle espèce, variation de la spiculation, Océan Indien ouest .

Introduction

Recent collections on the Grand Récif of Toliara (Tuléar), Madagascar, along the Kenyan Coast (Mombasa, Shariyani) and on the reefs of Pemba Island (Fundu South Reef), Tanzania (see map) yielded large specimens of two shallow-water species belonging to the genus *Bohadschia*. One species is considered new to science, whilst the second, the little-known *B. subrubra* (QUOY & GAIMARD, 1833) is shown to be fairly wide-spread in the western region of the Indian Ocean.

Taxonomy

Family Holothuriidae LUDWIG, 1894
 Genus *Bohadschia* JAEGER, 1833
Bohadschia atra sp. nov.
 Fig. 1(A-J), Fig. 2(A-E), Pl. 1B, D

Bohadschia subrubra; CHERBONNIER, 1988: 40, fig. 13 (A-K); ROWE & RICHMOND, 1997: 302 (text).

Bohadschia sp.; ROWE & RICHMOND, 1997: 303 (fig.).

Map
 Map with observation sites (a) and maps with collection sites (b)(c)(d).

Kenya.

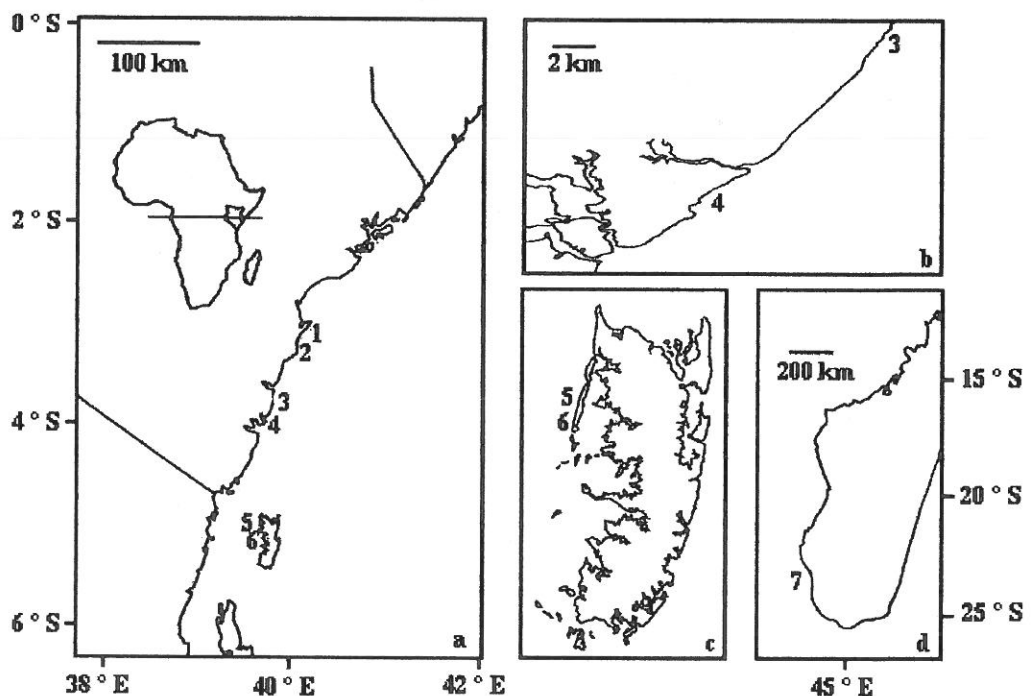
- 1: Malindi Marine National Park;
- 2: Watamu Marine National Park;
- 3: Shariyani;
- 4: Mombasa Marine National Park.

Tanzania,

- Pemba Island.:
- 5: Fundu North Reef;
- 6: Fundu South Reef.

Madagascar.

- 7: Tuléar.



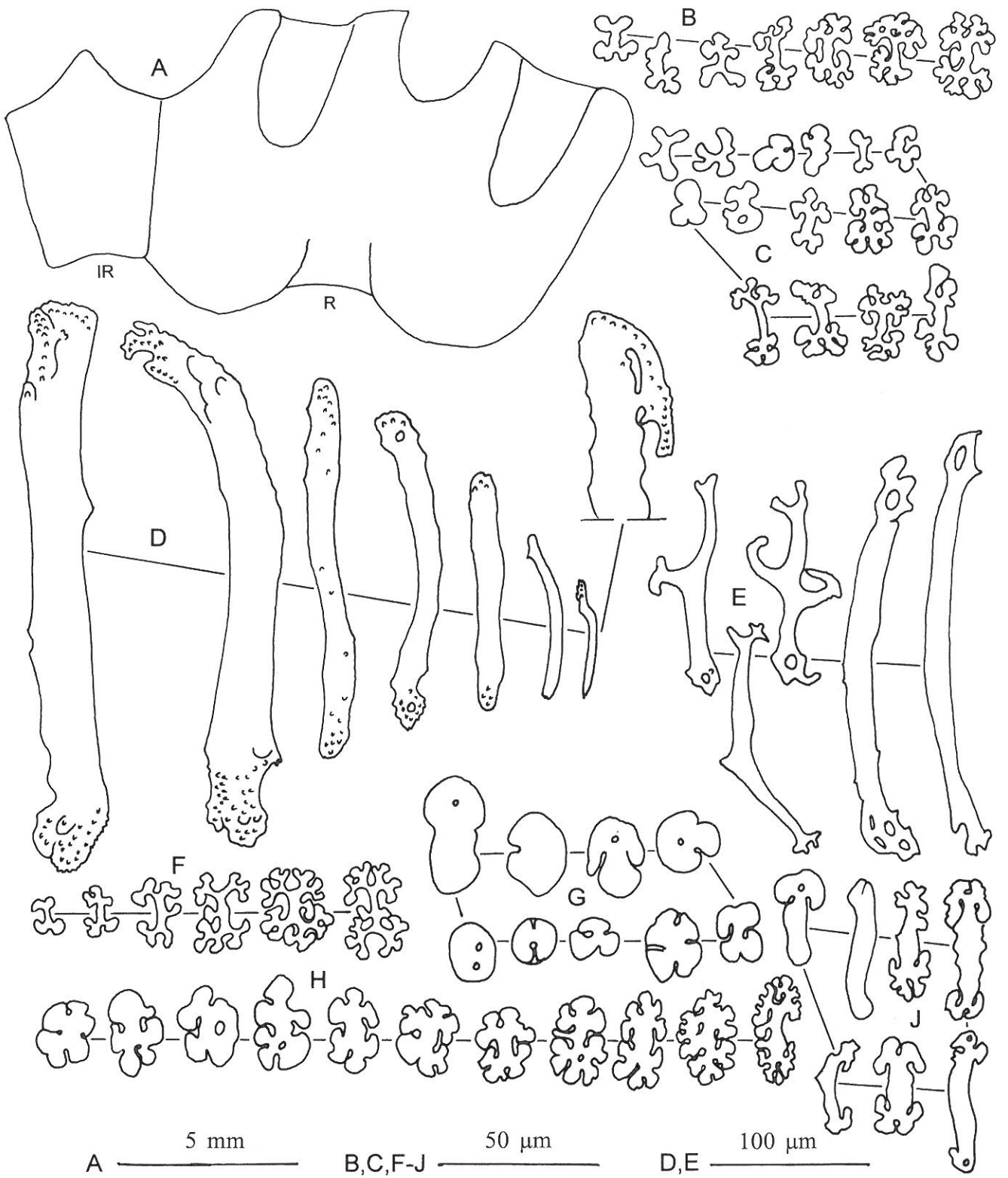


Fig.1. - *Bohadschia atra* nov. sp. A: calcareous ring (r: radial plate; ir: interradial plate)(L=270 mm); B: rosettes of dorsal body wall (L=270 mm); C: rosettes of ventral body wall (L=270 mm); D: rods of the tentacles (L=270 mm); E: rods of the tube feet (holotype, L=220 mm); F: rosettes of dorsal body wall (L=108 mm); G: perforated grains of ventral body wall (L=108 mm); H: rosettes of ventral body wall (L=108 mm); J: small rods of ventral body wall (L=108 mm).

MATERIAL

Holotype: Mayotte (Comores), 1977, 8 m depth, coll. Ph. BOUCHET, MNHNP, Ec HN-7133; Paratypes: Tanzania (Pemba Island, Fundu South Reef), 21-vii-1998, 12 m depth, coll. Y. SAMYN, IRSNB, IG 28 268/Fun90-91 (2 specimens); Kenya (Mombasa), 12-viii-1997, 10 m depth, coll. Y. SAMYN, IRSNB, IG 28 268/Mom12 (1 specimen); Kenya (Shariani), 3-viii-1997, 2 m depth, coll. Y. SAMYN, IRSNB, IG 28 268/Shar11 (1 specimen); Kenya (Mombasa), 10-viii-1998, 2 m depth, coll. Y. SAMYN, IRSNB, IG 28 268/Mom60-61 (2 specimens); Toliara (Tuléar, Madagascar), several specimens observed and photographed (see pl. 1D).

DESCRIPTION

Preserved specimens from 108 X 32 to 270 X 65 mm. Living specimens up to 400 mm long and 150 mm wide. Dorsal surface deep brown to black with small round, brown-red spots (pl. 1B, D). Each red spot surrounds the base of at least one dorsal papillae. On some specimens transverse brown-red bands are more visible anteriorly than posteriorly. Ventral surface brown to light brown covered by numerous small, black tube feet, spread without alignment over both the ambulacral and interambulacral areas. Dorsal papillae also black, without alignment. Tube feet more numerous than the dorsal papillae. Mouth ventral, anus dorsal without anal teeth; tentacles 18-20, black; body wall 2-5 mm thick.

Calcereous ring stout with radial pieces at least twice as large as the interradiation ones; radial pieces (fig. 1A) with a central notch and two lateral hollows. One Polian vesicle, one stone canal; long tentacular ampullae. Gonad well developed comprising a bunch of very long and thin undivided tubules. Cuvierian tubules very numerous.

Ossicles of body wall granules and rosettes. Large specimens (>25 cm) with rosettes only (figs 1B, C) somewhat larger dorsally (fig. 1B) than ventrally (fig. 1C). Medium (15-24 cm) and small (<14 cm) specimens with massive rosettes (fig. 1H), some rod-like (fig. 1J), and perforated grains ventrally (figs 1G)(exceptionally an unperforated grain can be observed); with branched rosettes (fig. 1F) dorsally.

Ventral tube feet without any ossicles except an end plate 285-300 µm across in large specimens; with rods 110-210 µm long (fig. 1E) and an end plate in medium specimens; with a few rods (fig. 2A) 50-110 µm long, perforated grains (fig. 2B), rosettes (fig. 2C) and an end plate 360-400 µm across in small specimens. Dorsal papillae of medium specimens with rods (cf. CHERBONNIER 1988: fig. 13H, I), those of small specimens with rosette only (fig. 2D).

Tentacles of large specimens with spiny rods (fig. 1D) sometimes bent at the extremities (fig. 1D), 80-360 µm long; in medium specimens rods up to 340 µm long (cf. CHERBONNIER, 1988, fig. 13F); in small specimens rods 100-330 µm long (fig. 2E).

ECOLOGY

B. atra dwells in shallow (up to 12 m depth) inner reefs, on sandy patches between coral heads and on the leeward side of seagrass beds (mainly *Thalassodendron ciliata*). Contrary to *B. subrubra* it has not been observed on coral rubble. *B. atra* has been observed feeding on sand, faeces also composed of sand, no rubble.

DISTRIBUTION

Madagascar (Toliara), Comores (**Mayotte**), Kenya [Mombasa, Shariani; Watamu & Malindi (Samyn, pers. observ.)]; Tanzania (Pemba Island: Fundu South Reef).

ETYMOLOGY

Atra means black and refers to the black colour pattern of the body wall.

DISCUSSION

Species belonging to the genus *Bohadschia* are difficult to identify and unfortunately to add to the confusion, *B. atra* nov. sp. has, in the past, been misidentified as *B. subrubra* (cf. CHERBONNIER, 1988). Moreover, there is an inversion in the text referring to *B. subrubra* and *B. sp* (here *B. atra* nov. sp.) in ROWE & RICHMOND (1997).

B. atra is easy to distinguish from all the other *Bohadschia* species by its dorsal black to deep brown colour with red dots and by its black tube feet and papillae. The misidentification by CHERBONNIER (1988) is surprising because the original description by QUOY & GAIMARD (1833) clearly states that the colour of the dorsal side is light brown with deep brown patches and that the ventral side is white with yellowish tube feet ("Le dessus du corps, sur fond terre de Sienne clair, a de large taches irrégulières terre de Sienne calcinée (...) Le dessous du ventre est blanc parsemé irrégulièrement d'un grand nombre de suçoirs d'un jaune légèrement verdâtre"). This does not fit with the specimen from Madagascar described by CHERBONNIER (1988). This specimen is brown ventrally with black tube feet.

Bohadschia atra can not be a black form of *B. subrubra* because their ossicles are quite different. Ossicles of the tentacles of *B. atra* are always slightly curved rods with spinose extremities whereas those of *B. subrubra* are much more intricate mainly in small specimens. Moreover, *B. atra*, whatever the size, does not have unperforated grains (with a very few exceptions) whereas they are present and numerous in medium and large *B. subrubra*. Perforated grains are present in small *B. atra* and absent in large ones. It is the reverse for *B. subrubra*. Dorsal and ventral tube feet are present in *B. subrubra* whereas *B. atra* has ventral tube feet and dorsal papillae.

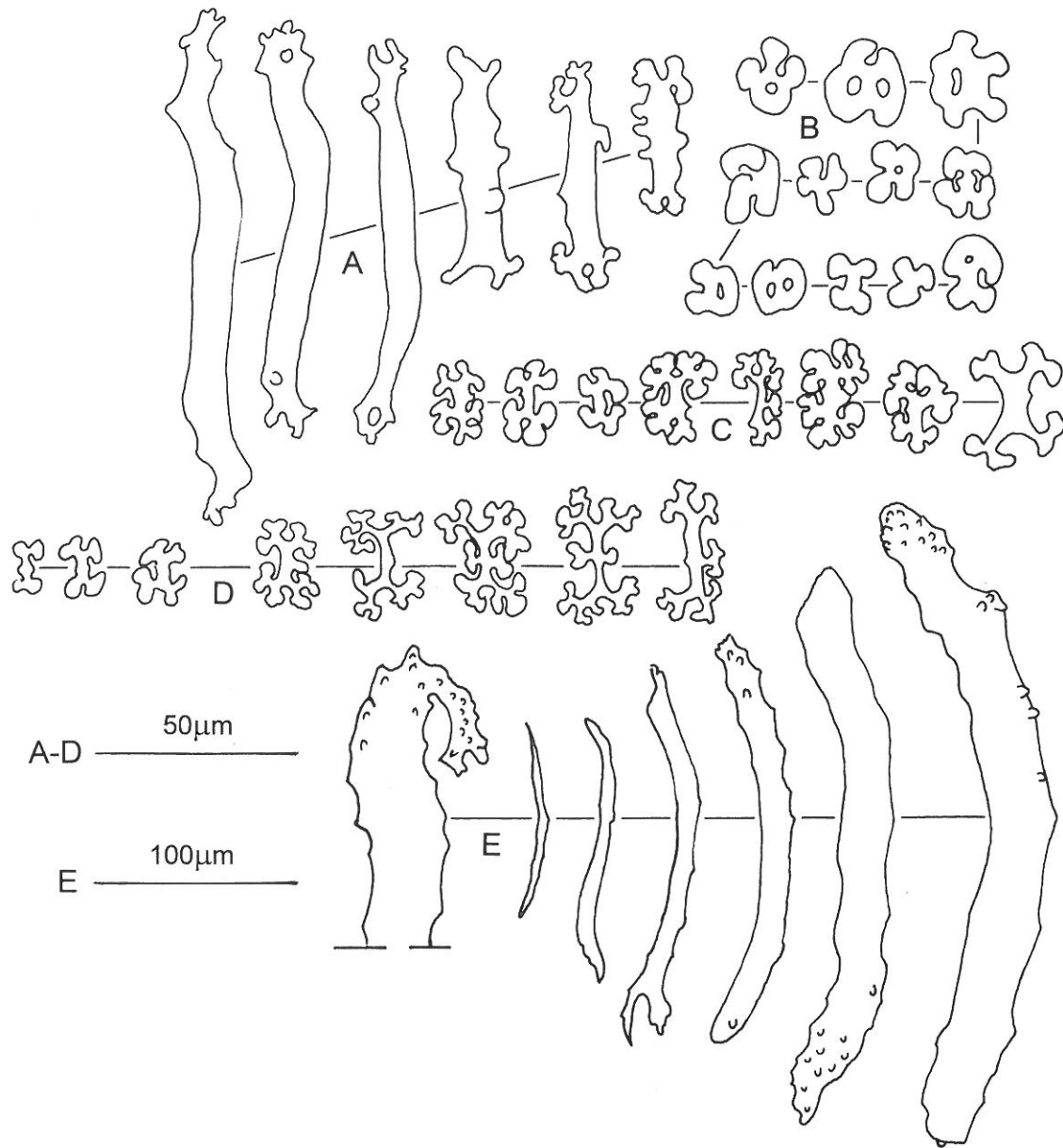


Fig.2. – *Bohadschia atra* nov. sp. A: rods of ventral tube feet (L=108 mm); B: perforated grains of ventral tube feet (L=108 mm); C: rosettes of ventral tube feet (L=108 mm); D: rosettes of dorsal papillae (L=108 mm); E: rods of the tentacles (L=108 mm).

Bohadschia argus (JAEGER, 1833) presents ossicles quite similar to the ones of *B. atra* nov. sp. (see Panning, 1944: fig. 8). Both species present ventrally the same kind of perforated grains and massive rosettes. However, they clearly differ in their colour pattern. *B. argus* has irregular, very large, dorsal ocelli always surrounded by a whitish

space whereas *B. atra* has small, regular ocelli never lined with a whitish space. Moreover, the dorsal papillae of *B. argus* are translucent whereas those of *B. atra* are black. *B. argus* presents also numerous variations in its colour pattern (PANNING, 1944; FÉRAL & CHERBONNIER, 1986) whereas *B. atra* has a constant colour pattern.

Bohadschia subrubra (QUOY & GAIMARD, 1833)

Fig. 3(A-G), Fig. 4 (A-P),
Fig. 5 (A-G), Pl. 1A, C, D

Holothuria subrubra QUOY & GAIMARD, 1833: 136;
HOFFMANN, 1874: 55.

Bohadschia subrubra; CHERBONNIER, 1952: 36, fig. 14(A-J);
A.M. CLARK & ROWE, 1971:176; ROWE & RICHMOND,
1997: 303.

Bohadschia sp.; ROWE & RICHMOND, 1997: 302 (text).

MATERIAL

Madagascar, Grand Récif of Toliara, inner reef flat, 9-iii-97,
coll. C. CONAND (2 specimens); Kenya (Shariani), 3-viii-1997,
1 m depth, coll. Y. SAMYN, IRSNB IG 28 628/Shar 10
(1 specimen); Kenya (Mombasa), viii-1998, 14 - 18 m
depth, coll. Y. SAMYN, IRSNB IG 28 628/ Mom89-92-93-94
(4 specimens); Tanzania (Pemba Island, Fundu North Reef),
20-vii-1997, 14 m depth, coll. Y. SAMYN, IRSNB IG
28628/Fun7 (1 specimen).

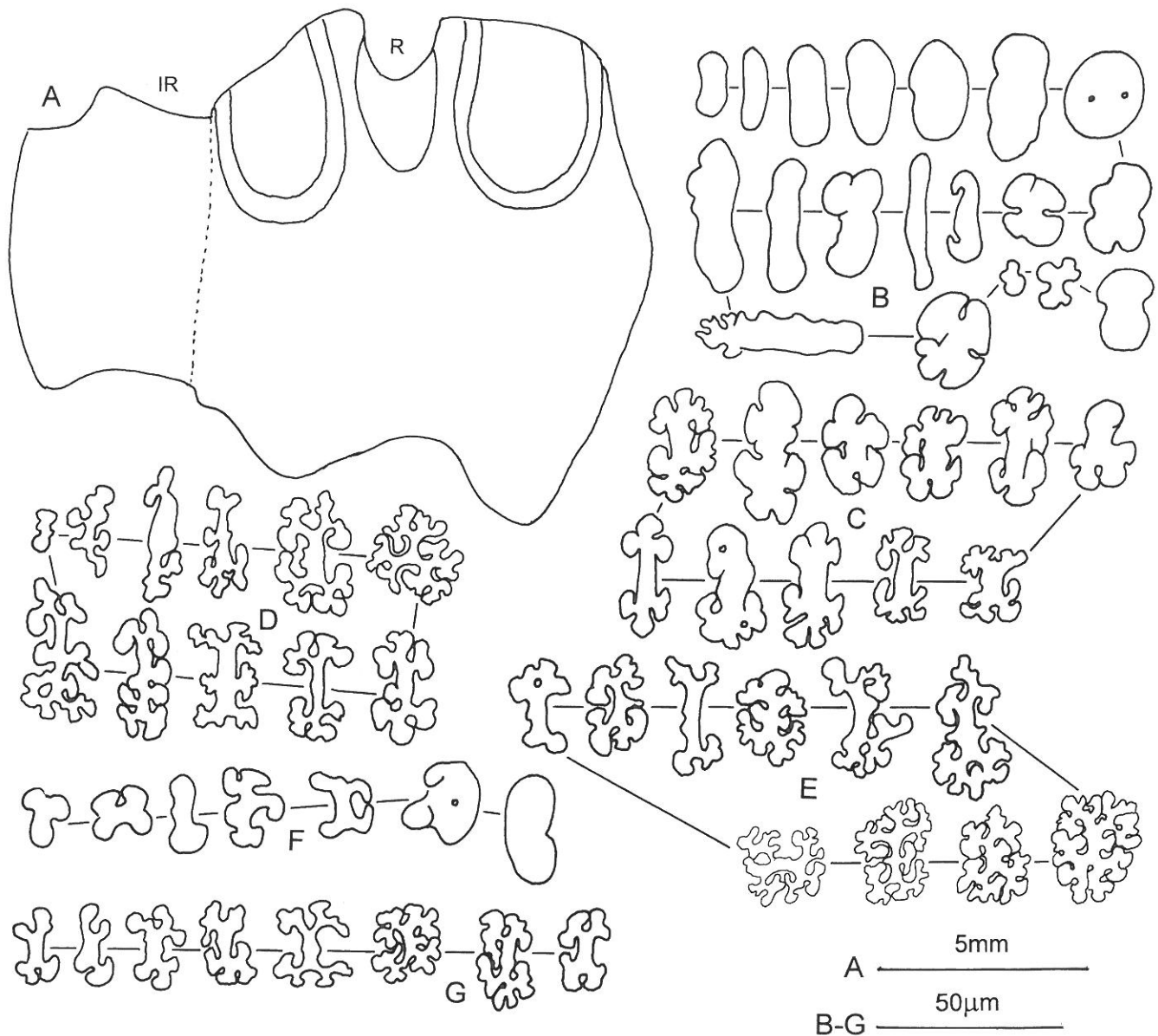


Fig.3. – *Bohadschia subrubra* (QUOY & GAIMARD, 1833). Calcareous ring and body wall ossicles. A: calcareous ring (r: radial plate; ir: interradial plate); B: ventral granules of a large specimen; C: ventral rosettes of a large specimen; D: Dorsal rosettes of a large specimen; E: ventral rosettes of a small specimen; F: ventral granules of a small specimen; G: dorsal rosettes of a small specimen.

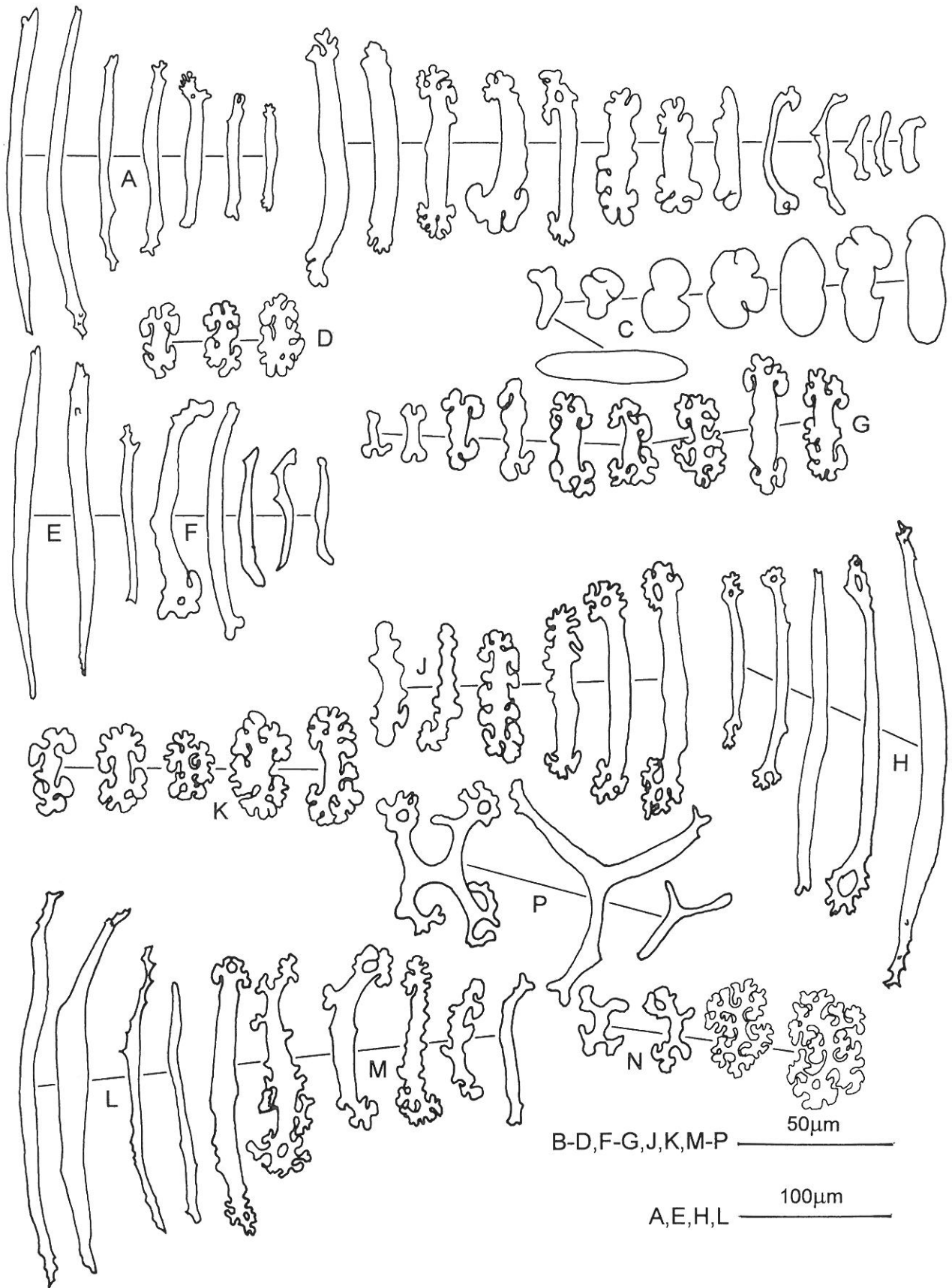


Fig.4. – *Bohadschia subrubra* (QUOY & GAIMARD, 1833). Tube feet ossicles. A & B: ventral rods of a large specimen; C: ventral granules of a large specimen; D: ventral rosettes of a large specimen; E & F: dorsal rods of a large specimen; G: dorsal rosettes of a large specimen; H & J: ventral rods of a small specimen; K: ventral rosettes of a small specimen; L & M: dorsal rods of a small specimen; N: dorsal rosettes of a small specimen; P: dorsal irregular bodies of a small specimen.

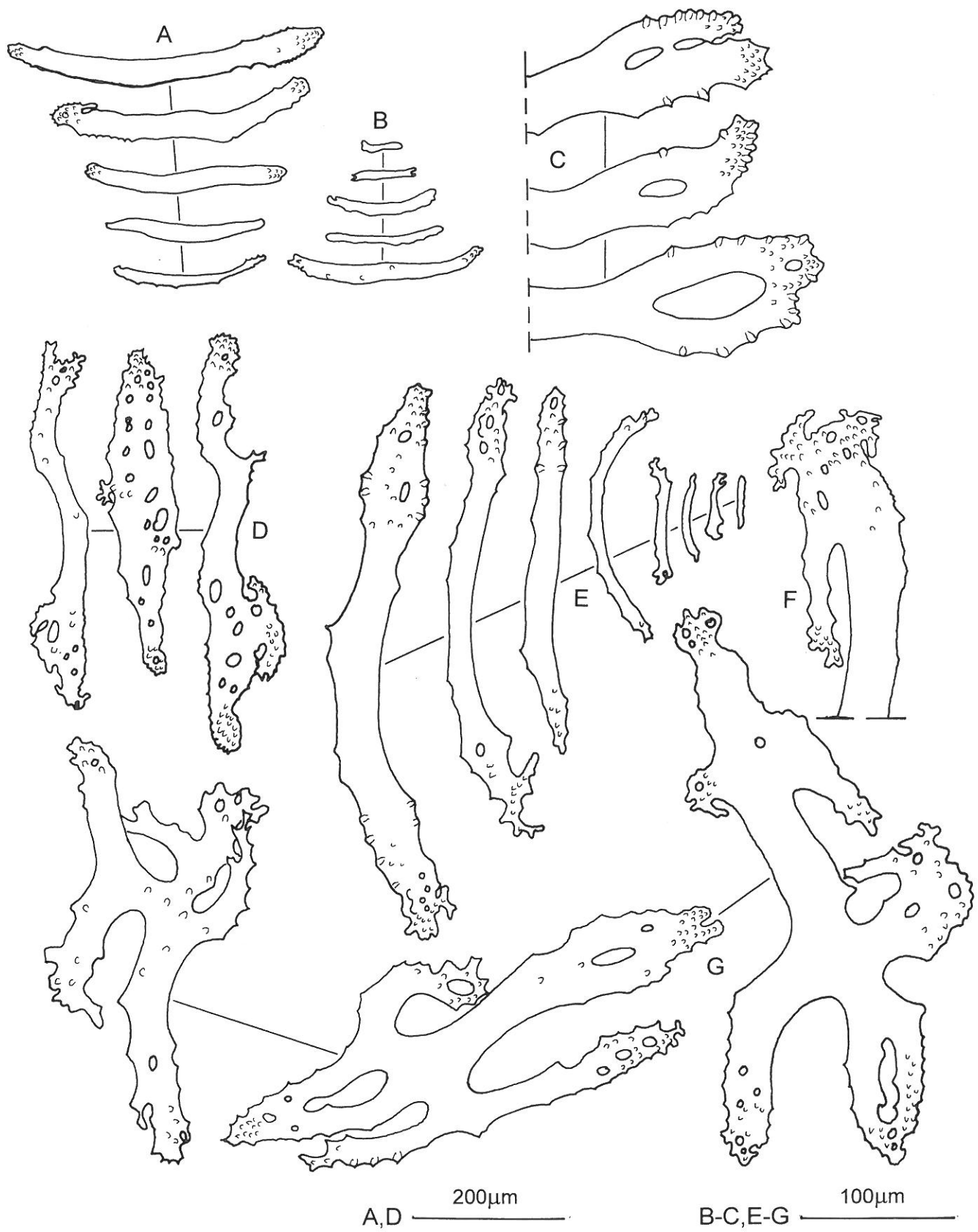


Fig.5. – *Bohadschia subrubra* (QUOY & GAIMARD, 1833). Tentacular ossicles. A & B: rods of a large specimen; C: rod extremities of a large specimen; D & E: regular rods of a small specimen; F: rod extremity of a small specimen; G: irregular rods of a small specimen.

DESCRIPTION

Specimens from 113 X 48 to 250 X 75 mm. Living specimens 130 to 350 mm long (pl. 1). Colour of living specimens brown-orange background with a patchwork of irregular, large, black patches (pl. 1A-D). Specimens from Madagascar are more orange (pl. 1D) than the ones from Kenya (pl. 1C). In alcohol dorsal surface beige-brown with irregular black patches; ventral surface grey-white with minute brown-black spots. Limit between dorsal and ventral surfaces well marked by a dotted brown line. Tube feet white, numerous, densely crowded, spread without alignment on the whole dorsal and ventral surfaces. Mouth ventral, anus dorsal without anal teeth. Tentacles 18, grey-white. Body wall 2-5 mm thick.

Calcareous ring stout with radial plates twice as large as interradial plates (fig. 3A); radial plates with a deep central notch and two lateral hollows (fig. 3A). One Polian vesicle, one stone canal; tentacular ampullae 33-35 mm long. Gonads well developed, made of a bunch of long, undivided tubules. Cuvierian tubules present, numerous, white.

Ossicles of body wall granules and rosettes. Large specimens (>15 cm) with numerous unperforated granules (fig. 3B) and small rosettes (fig. 3C) ventrally and rosettes only (fig. 3D) dorsally; small specimens (<15 cm) with numerous large rosettes (fig. 3E) and a few granules (fig. 3F) ventrally, and rosettes only (fig. 3G) dorsally. Small rosettes, dorsally located, slightly larger in large specimens than in small ones: maximum 41 and 33 μm long, respectively.

Ossicles of tube feet rods, rosettes and granules. Ventral tube feet of the large specimens with rods, 17-210 μm long (figs 4A-B), granules (fig. 4C) and a few rosettes (fig. 4D); end plate 500-650 μm across. Dorsal tube feet of the large specimens with rods, 35-230 μm long (figs 4E-F) and rosettes (fig. 4G); end plate 450-500 μm across. Ventral tube feet of the small specimens with rods, 40-310 μm long (figs 4H-J) and a few rosettes (fig. 4K); end plates 400-450 μm across. Dorsal tube feet of the small specimens with rods 50-250 μm long (figs 4L-M), numerous large rosettes (fig. 4N) and a few irregular bodies (fig. 4P); end plate 260-360 μm across.

In the tentacles rods only. Large specimens with regular rods, 25-410 μm long with spiny extremities (figs 5A-B); a few with forked or perforated extremities (fig. 5C). Small specimens with rods 35-540 μm long (figs 5D-E), very often with irregular extremities (fig. 5F); numerous irregular rods (fig. 5G).

ECOLOGY

Bohadschia subrubra lives in the intertidal zone on inner flats of the barrier reef near Toliara. It is generally found on sandy areas located in between alive or dead coral heads. It is also often found inside coral cavities. This particularity is recognised by the local Madagascan names "Falalijaka madrasy" or "Falalijaka bato" which mean

"rocky *Bohadschia*". Obviously this species has long been known to Madagascan fishermen. *B. subrubra* has also been observed on the sea-grass beds of the inner flat and on deeper sandy-muddy bottoms (Nosy Bé, P. LABOUE, see pl. 1A; pers. communication). The species is also able to live on coral rubble (Zélée Banks, Mayotte; P. DURVILLE, photo and pers. observation of C. CONAND).

GEOGRAPHICAL RANGE

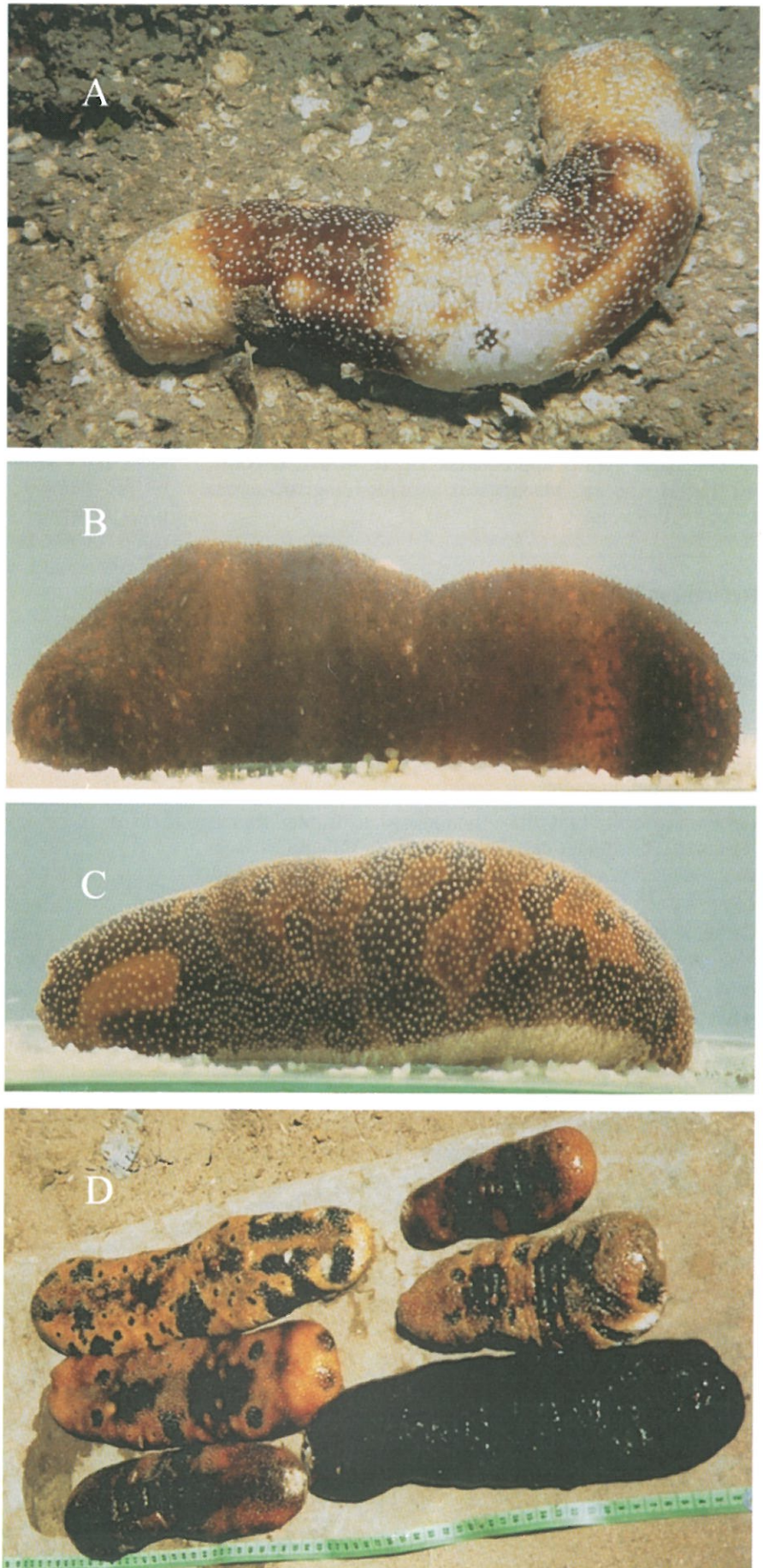
Madagascar (Toliara Reef, Nosy Bé), **Mauritius** (île aux Cerfs), Kenya (Mombassa, Shariani), Tanzania (Pemba Island, Fundu North Reef).

DISCUSSION

In a given area (Madagascar or Kenya) large and small specimens have the same colour pattern. However, their ossicles are so different that they could be considered as separated species. Some *Bohadschia* species, e.g. *Bohadschia marmorata* (JAEGER, 1833), are known to present changes in their ossicles with increasing body size (PANNING 1944, ROWE & DOTY 1977). This led to a lot of confusion and several species have been successively lumped and split again (PANNING 1929, 1944, ROWE & DOTY 1977, CHERBONNIER 1988, ROWE & GATES 1995). *Bohadschia subrubra* is yet another example showing high ossicle variability within a *Bohadschia* species.

B. subrubra exhibits a range of colour pattern similar to the one described by ROWE & DOTY (1977) for *B. marmorata* from Guam. However, the orange-brown background has never been mentioned for *B. marmorata*. The ossicles of *B. subrubra* show characteristic of *B. marmorata* and *B. cousteaui* CHERBONNIER, 1954, which are both present in Madagascar (CHERBONNIER 1988). The ossicles of the tentacles show the same evolution in *B. subrubra* and *B. cousteaui*. Those of the small specimens of *B. subrubra* (135 mm long; figs 3C-D) are identical to those of the *B. cousteaui* (130 and 140 mm long) described by CHERBONNIER (1988: figs 15I-J). Whereas the ossicles of the tentacles of the large specimens of *B. subrubra* (230 mm long; figs 3A-B) are identical to those of the *B. cousteaui* (212 mm long) described by CHERBONNIER (1954, 1955: pl. 23, figs j-k). However, *B. cousteaui* differs from *B. subrubra* by the colour pattern and by the presence of numerous unperforated ventral granules whatever the size of the specimens. Moreover, the complexity of the ossicles of *B. marmorata* increases with increasing size (ROWE & DOTY 1977) whereas it is the reverse for *B. subrubra*: rosettes and tentacular rods are more complex in the small specimens than in the large ones.

The most characteristic features of *B. subrubra* are the presence of rosettes in the tube feet whatever the size of the specimen and particularly the large, complex rosettes in the tube feet of the small specimens, and the colour of the body wall.



Pl. 1.

- A. *Bohadschia subrubra* (QUOY & GAIMARD, 1833) on a sandy-muddy bottom at 10 m depth, near Nosy Bé (photo P. LABOUTE, IRD).
 B. *Bohadschia atra* nov sp. from Kenya (photo Y. SAMYN).
 C. *Bohadschia subrubra* (QUOY & GAIMARD, 1833) from Kenya (photo Y. SAMYN).
 D. Colour range of freshly collected *Bohadschia subrubra* (QUOY & GAIMARD, 1833) with one *Bohadschia atra* nov. sp. (black one) from Madagascar (photo C. CONAND).

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