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Epitonium dendrophylliae (Gastropoda: Epitoniidae) feeding on *Astroides calycularis* (Anthozoa, Scleractinia)

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Epitonium dendrophylliae Bouchet & Warén, 1986 is a rare, thin-shelled, eastern Atlantic and western Mediterranean epitoniid usually found on the deep shelf or in the bathyal zone, associated with the scleractinian corals *Dendrophyllia* and *Balanophyllia* (Dendrophylliidae).[1,2] It was originally recorded from Madeira, the Mediterranean, the Atlantic coast of Morocco, and as far as Luanda (Angola). All known records of *E. dendrophylliae* are from depths exceeding 40 m, and most of them consist of empty shells. Although the species may reach 15.2 mm, the holotype measures only 5.6 mm. The species is here reported for the first time from shallow water, living on colonies of the scleractinian dendrophylliid *Astroides calycularis* (Pallas, 1766).

A single living specimen was hand collected (by SCUBA diving) on *Astroides calycularis* in Punta de la Mona (Granada province, SE Spain) at 19 m depth, and kept alive on the coral in an aquarium at 20°C for 12 days. Subsequently, it was relaxed in $MgCl_2$ isotonic with sea water, fixed in 70% ethanol, dissected and studied under the stereomicroscope. The radula was extracted and mounted for SEM.

The shell, of 4 mm length, with about 5 teleoconch whorls and an eroded protoconch of about 3 whorls, matched the original description, and was covered by a thin, light brown periostracum.

The head-foot, mantle and visceral mass of the living animal was golden yellow, with scattered, minute, white spots that were dense on the margin of the foot and the base of the cephalic tentacles (Fig. 1A, B). The hypobranchial gland, yellow with narrow transverse black bands on its anterior part, lay on the right side of the mantle, encompassing the last whorl of the teleoconch. The head possessed a pair of relatively long cephalic tentacles with well-developed black eyes at the base; the proboscis was rather short. A relatively deep transverse groove ran along the anterior margin of the foot, and the posterior end of the foot was tapered and slightly bilobed with a short mid-longitudinal slit. A short cylindrical tentacle with an annular thickening at the base was located on the midline of the dorsal surface of the anterior propodium. This tentacle may be sensory, since the animal, while creeping, retracted and stretched it and changed its orientation. The round operculum was paucispiral, thin and transparent and covered the whole metapodial sole.

Within the buccal apparatus were a pair of fragile lateral jaws, more or less semicircular in outline, minutely serrated on the convex cutting edge and with a reticulate pattern on the surface. Chitinous stylets were absent. The radula (Fig. 1C, D) had a large number (not determined) of slender teeth with long, thin basal shafts and from three to six pointed cusps. The distal cusp was the largest and bent upwards, appearing sinusoid in lateral view; the next two cusps were more or less equally developed and slightly curved upwards (especially the subdistal one), and the basal cusps shorter and less curved.

The animal moved freely on the polyps of *Astroides calycularis*, secreting a thin but resistant mucous filament, whereby it remained attached to the polyp when the foot lost its attachment. The gastropod fed by attaching the tip of the proboscis to the cenosarc and oral disc of the polyps and biting off minute pieces of tissue; it was never observed introducing the proboscis through the oral aperture or perforating the oral disc. Contraction or relaxation of the polyp column and tentacles were not observed during feeding, suggesting that no anaesthetic was injected by the snail. During 10 days the gastropod restored the broken peristome and secreted eight additional, regularly spaced, axial lamellae, which encompassed slightly less than a quarter whorl, reaching 4.08 mm in shell length. This resulted in a growth rate of 0.008 mm/day.

The shells of the Mediterranean and amphi-Atlantic *Epitonium striatissimum* (Monterosato, 1878) and the Indo-Pacific *E. billeeanum* (DuShane & Bratcher, 1965) closely resemble that of *E. dendrophylliae*[1, 2] in shape and sculpture. The protoconchs of these three species are also very similar. They are multispiral (3–4 whorls), with numerous fine, incised axial lines.[1,2] *Epitonium billeeanum* feeds and even spawns on the dendrophylliid coral genera *Dendrophyllia* and *Tubastraea*[2–6] throughout its wide biogeographic Indo-Pacific range, which extends from the Red Sea[2] to the Galapagos Islands, Ecuador and Gulf of California.[6–8] This species shows preference for shaded, shallow-water areas (2–14 m),[2,8] but can be found at depths to 45 m.[2,5] As in the described specimen of *E. dendrophylliae*, the shell of *E. billeeanum* is covered by a thin periostracum, light brown or of a yellowish buff, and the animal is brightly golden yellow or orange coloured (it is commonly named 'golden wentletrap')[2,4, 5–7], with minute lighter yellow ('lime') specks on the whole body[2], and with a round and thin operculum.[7,8] Nevertheless, no propodial tentacle has been described for *E. billeeanum*. The polyps of both *Tubastraea* and *Astroides calycularis* are of a bright pink-orange or orange colour. As has been suggested,[2] the striking colour differences between the light yellow epitoniids and the pink or orange corals do not support the previous hypothesis that the pigments of the snails directly originate from corals[4] or that snails are cryptic.

A radula very similar to that of *Epitonium dendrophylliae* has been described for small specimens (up to 8.6 mm in length) of *E. billeeanum* from the Great Barrier Reef.[5] The middle lateral teeth of the studied specimen of *E. dendrophylliae* have from three to six cusps (denticles), whereas small *E. billeeanum* has three to seven cusps. The distal cusp has a more sinusoid shape in *E. dendrophylliae* than in *E. billeeanum*. Large specimens of *E. billeeanum* (>12.3 mm) have smooth middle lateral teeth, whereas intermediate specimens (8.6–12.3 mm) show transitional radulae with either denticulate (1–7) or smooth middle lateral teeth. This suggests an ontogenetic change in the radular morphology that may be related to sex change.[5] However, the radular teeth of the holotype (7 mm in length) are figured either smooth or with a single denticle,[7] at a size in which denticulate teeth should be expected; thus, further ontogenetic studies on eastern Pacific material are needed to resolve this matter.[5] A similar ontogenetic change in the radular teeth of *E. dendrophylliae* is expected to be found when radulae of enough spec-

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imens of different sizes are studied. The radulae of *E. dendrophylliae* and *E. billeeanum* are rather different from those known of other epitoniids.[2,9,11–19] However, it must be emphasized that no complete descriptions of the teeth for different shell sizes were made.

The similar shell (protoconch and teleoconch), periostracum, operculum, pigmentation pattern of the body, and radula support a possible close relationship between *E. dendrophylliae* and *E. billeeanum*. In addition, these features differ sufficiently from those of the type species of *Epitonium* (*Turbo scalaris* Linnaeus, 1758) to warrant a generic separation. *Epitonium scalare* has a higher shell, with different shape, sculpture and soft part colour (yellowish brown to dark brown), a thick and black operculum, and unicuspid radular teeth.[13,14] In the currently chaotic state of epitoniid taxonomy (both at the generic and specific levels), it is difficult to propose a suitable genus name for these species. *Epitonium dendrophylliae* has been recently included in the subgenus *Sodaliscala*, whereas the related *E. striatissimum* is included in *Parviscala*, and *E. billeeanum* in *Limiscala*?, in all cases without any evidence.[20] The latter species has also been included in the genus *Asperiscala*,[6] and even in *Alora*,[21] again without discussion. Due to the unclear diagnoses of all the genera or subgenera included under *Epitonium*, we here use the name in a very broad sense. A worldwide generic review based on anatomical and biological features will probably group *E. dendrophylliae*, *E. billeeanum* and *E. striatissimum* in a genus different from *Epitonium scalare*.

The growth rate measured in *Epitonium dendrophylliae* is much lower than that of recently metamorphosed post-larvae of *Epitonium ulu* (0.2 mm/day at 24–28°C) fed with *Aiptasia* sp.,[22] which it is not its natural prey (this species feeds on a variety of *Fungia* species[23,24]). The growth rate is also lower than that of young individuals of *E. albidum* ranging between 2.2 and 3.5 mm, which over a period of 13.8–15.8 days feeding on its natural prey, the actiniarian *Stichodactyla helianthus* (Ellis, 1768), increased on average 0.17 mm/day and secreted 1.5 ribs/day.[25] Considering that *E. dendrophylliae* may reach 15.2 mm,[1] the specimen here studied is a young one. Differences in growth rate might be due to the usual rapid growth of post-larvae of carnivorous gastropods,[22] the larger size of our individual compared with the young *E. albidum*, or the lower water temperature during our observations. Also, it may reflect the slower growth characteristic of a usually deep-water species or the low energetic value of the scleractinian versus actiniarian prey.

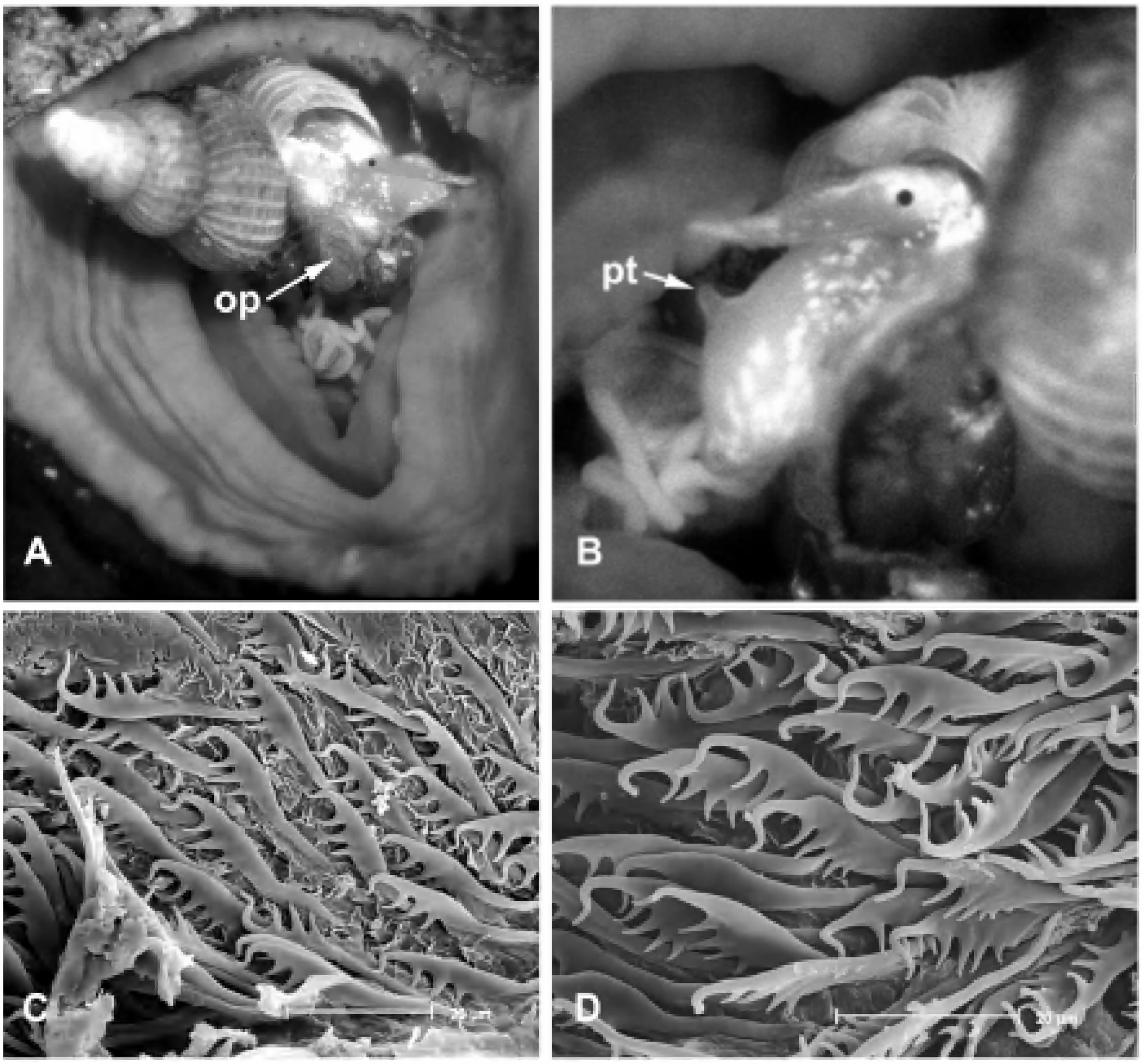

Figure 1. *Epitonium dendrophylliae.* **A.** Living animal on a polyp of *Astroides calycularis.* **B.** Detail of the head-foot, showing the propodial tentacle. **C, D.** Radula. Abbreviations: op, operculum; pt, propodial tentacle. Scale bar = 20 µm.

Astroides calycularis is included in Annexe II (list of endangered or threatened species) of the Barcelona Convention. It is considered a relict species restricted to the western Mediterranean.[26] At least two uncommon gastropods are now known to live and feed on this coral (*Epitonium dendrophylliae* and the coralliophilid *Babelomurex cariniferus* (Sowerby, 1834), personal observation), and this fact reinforces the arguments for its protection.

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