

Alora redefined (Gastropoda, Caenogastropoda, Epitoniidae)

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Alora gouldii, the type species of *Alora*, is compared with the *Epidendrium* species, to investigate whether *Epidendrium* is a junior synonym of *Alora*. It turns out that these nominal taxa are not closely related among the Epitoniidae.

Key words: Caenogastropoda, Epitoniidae, *Alora*, *Epidendrium*, taxonomy.

INTRODUCTION

In general, species of the caenogastropod family Epitoniidae Berry, 1910, can be recognized easily by their slender, whitish to cream-coloured shells, sometimes with an irregular pattern of dark blotches. Usually there is a species-specific sculpture of axial riblets, which vary from periostracal, thin and fragile, to calcareous, and solid. The aperture is roundish. The suture varies from shallow to very deep or even non-existing in scalaride species. Despite this variation and the presence of some aberrant taxa, classification as an epitoniid species is usually not disputed. Far more problematic is the nomenclature at the generic and subgeneric level.

Similar to what is the case in nominal genera like for example *Cypraea* L., 1758, or *Conus* L., 1758, there are authors on the one hand, who use the generic name *Epitonium* Röding, 1798, for most of the epitoniid species, next to others,

who classify those species with several generic or subgeneric taxa. In general, the latter approach does not aim at a phylogenetically based classification, but is meant to be convenient for identification by combining species on the basis of conchological similarity.

Gittenberger, A. & E. (2005) introduced three generic taxon names for monophyletic species groups of Epitoniidae, that can be distinguished on the basis of molecular data (COI sequences) and morphological characters of the radula, the jaw, the operculum, and the egg-capsules. While doing so, they overlooked that a species, which they classified in *Epidendrium* A. & E. Gittenberger, 2005, i.e. *E. billeeanum* (DuShane & Bratcher, 1965), has occasionally been referred to as *Alora billeeana* in the literature (e.g. Okutani, 2000). Thus, the question arose whether *Epidendrium* (type species *E. sordidum* A. & E. Gittenberger, 2005) is not a junior synonym of *Alora* H. & A. Adams, 1853. For that reason, *Alora gouldii* (A. Adams, 1857), the type species of *Alora*, should be described in more detail than hitherto done. Here we provide more data on that species with a conclusion regarding the synonymy.

MATERIAL AND METHODS

A specimen of *Alora gouldii* (A. Adams, 1857), collected intertidally among small rocks in fine sand in Vera Cruz, Panama,

May 15, 1975, by Richard G. Callaway (Los Angeles County Museum of Natural History, no. 10606) was kindly sent in loan for study. A sample of eggs was added to the specimen. The shell contained dry tissue with the operculum attached to it. As much as possible of the dry tissue was removed from the shell with a sharp scalpel and placed in a vial with a mixture of 3 µl proteinase K (20 mg ml⁻¹) and 0.5 ml CTAB buffer, i.e. 2% CTAB, 1.4 M NaCl, 0.2% mercapto-ethanol, 20 mM EDTA and 100 mM TRIS-HCl pH8, 60°C, for c. 15 hours. The solution was pipetted off the dissolved tissue remains into a new vial for DNA extraction. The tissue remains were searched through a microscope for radular teeth and jaws.

Not a single radular tooth was traced amidst the dissolved tissue remains, but the operculum was loosed and both jaws could be isolated. The operculum and both jaws were cleaned further and mounted on a SEM stub, by coincide the jaws with the outside up.

The solution in which the tissue was dissolved was mixed with 0.5 ml chloroform/isoamyl alcohol and centrifuged for 10 minutes at 8000 rpm. The supernatant was extracted, mixed with 0.35 ml isopropanol, put aside for c. 15 hours at 4°C and finally centrifuged for 10 minutes at 8000 rpm to precipitate the DNA. The supernatant was discarded and the remaining DNA-pellet was washed at room temperature with 0.5 ml of an ethanol / ammonium-acetate solution for 30 minutes. After centrifugation for 10 minutes at 8000 rpm, this solution was discarded. The pellet was dried in a vacuum centrifuge and then dissolved in 20 µl MilliQ. A part from the 3'-end of the CO1 (Cytochrome Oxidase 1) region was amplified using the Folmer Universal CO1 primers LCO-1490 and HCO-2198 (Folmer et al., 1994) and an annealing temperature of 53°C (AT). The PCR was performed in a Peltier Thermal Cycler, using the following PCR program: 1 cycle of 94°C for 4 minutes and 60 cycles of 94°C for 5 seconds; AT (Annealing Temperature; Table 2) for 1 minute; 0.5°C s⁻¹ to 60°C; 72°C for 1 minute. The PCR reaction mix consisted of 2.5 µl PCR buffer (10×), 0.5 µl MgCl₂ (50 mM), 1.0 µl forward primer (10 pM), 1.0 µl reverse primer (10 pM), 0.5 µl dNTP's (10 mM), 0.3 µl Taq polymerase (5 units ml⁻³), 13.2 µl MilliQ and 1.0 µl 1:10 DNA stock-solution (= c. 0.1 µg DNA). Cytochrome Oxidase 1 of the *A. gouldii* specimen was successfully sequenced.

ALORA GOULDII VERSUS EPIDENDRIUM SPECIES

Alora H. Adams, 1861: 272.

Type species (monotypy): *A. gouldii* (A. Adams, 1857)

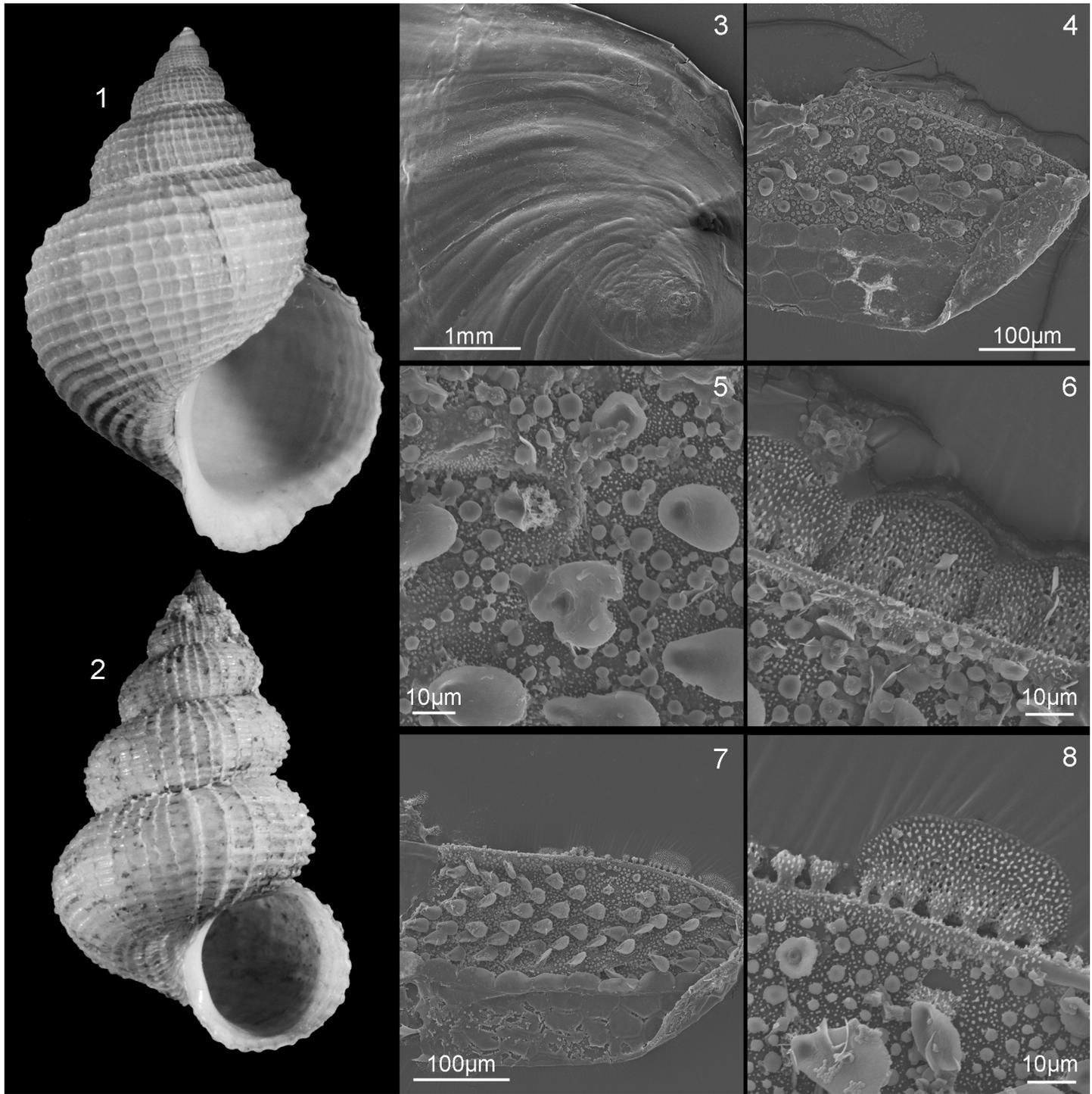
Alora gouldii (A. Adams, 1857) (Figs 1, 3-8)

Trichotropis gouldii A. Adams, 1857: *Alora gouldii*; Weil et al., 1999: 144, 145 fig. 439.

Shell. – *Alora gouldii* recalls the *Epidendrium* species by the reticulate sculpture of the shell. The relatively large aperture has a broad parietal border; its apertural border is reflected at the shell base and straight at the upper part of the palatal side. The umbilicus is closed. In *Epidendrium* (Fig. 2) the shells are more fragile and the aperture is relatively smaller and more roundish because its palatal side passes more gradually into the narrower parietal side. The umbilicus is open in *E. aureum* A. & E. Gittenberger, 2005, *E. billeanum*, and *E. sordidum*, but closed in *E. dendrophylliae* (Bouchet & Warén, 1986).

Radula and jaw (Figs 4-8). – The radula remains unknown. The outside of the jaw has a remarkable complicated structure, which does not recall that of any of the known epitoniid species in particular. The free edge has small protuberances, which are broadening somewhat after their narrow bases; up to seven of these structures are connected to a relatively large screen, which is regularly curved at its border and provided with many small dots on the SEM photograph. At their sides, the screens slightly overlap. A loose jaw-flap along the jaw-edge, as in other epitoniid species described by A. & E. Gittenberger (2005), is at least not clearly visible, but there is a narrowly curled structure along the

Figs 1-8. Epitoniidae. 1, *Alora gouldii* (A. Adams, 1857), Panama, Vera Cruz (Los Angeles County Museum of Natural History, no. 10606); shell height 16.4 mm. 2, *Epidendrium sordidum* A. & E. Gittenberger, 2005 (holotype), Indonesia, Sulawesi, Selat Lembeh, 01°28' N 125°15' E (Naturalis Biodiversity Center, Moll. 100208); shell height 15.9 mm. 3-8, *Alora gouldii* (A. Adams, 1857). 3, operculum, inside. 4, 7, jaws, outside, with details, 5-6 and 8.



edge, which might be homologous with the jaw-flap. The broadest zone of the jaw has very many dots that are as small as those on the edge structure, many small mushroom-like (in side-view) protuberances, and several larger roundish triangular structures with an eccentric indentation. The next zone has a regular row of rounded quadrangular planes, which is followed by a pattern of two to three slightly larger polygonal ones.

Operculum (Fig. 3). – As in *Epidendrium*, as far as known (see A. & E. Gittenberger, 2005), there is no sculpture other than growth-lines at the outside of the operculum.

Eggs. – As in *Surrepifungium* A. & E. Gittenberger, 2005, and some species in *Epifungium* A. & E. Gittenberger, 2005, the ovoid to short-cylindrical egg-capsules are completely covered by relatively large sand grains and shell grit particles, so that they cannot be measured accurately. Their width is c. 0.4-0.5 mm and the length c. 0.7-0.8 mm. According to A. & E. Gittenberger (2005), the egg-capsules of *Epidendrium* snails are not covered with sand or shell grit particles. Instead they are yellowish and slightly transparent, with protuberances.

Habitat. – The *Epidendrium* snails are known to live on or near their dendrophyllid host corals (Scleractinia: Dendrophylliidae). According to the admirably detailed label, the live *A. gouldii* was found in a different habitat, viz. intertidally 'on small rocks that were located in fine sand, usually about 50 to 70 yard above the low tide mark.' On May 15, 1975, 5 snails were collected and in total, from May through July 17 snails.

Distribution. – According to Weil et al. (1999: 144) *A. gouldii* occurs from southern Mexico to Ecuador.

Molecular data. – The Cytochrome Oxidase 1 sequence of the *A. gouldii* specimen was compared with sequences of specimens of the sea-anemone associated species *Epitonium clathratulum*, *E. clathrus*, and *E. ancillottoi*, and the hard-coral associated species *Epidendrium sordidum*, *E. aureum*, *Epifungium hartogi*, *E. lochi*, *E. twilae*, *E. ulu*, *E. pseudotwilae*, *E.*

marki, *E. pseudolochi*, *E. adgravis*, *E. adscabra*, *E. nielsi*, *E. adgranulosa*, *E. hoeksemai*, *Surrepifungium patamakanthini*, *S. ingridae*, *S. costulatum* and *S. oliverioi*. The *A. gouldii* sequence does not fall within the monophyletic group that includes all the coral associated species, among which *Epidendrium sordidum* and *E. aureum*. Instead the sequence of *A. gouldii* most closely resembles those of the sea-anemone related *Epitonium* species *E. clathratulum*, *E. clathrus*, and *E. ancillottoi*.

Conclusion. – The present study enables the conclusion that *Epidendrium* is not a junior synonym of *Alora*. Although the shell and the operculum of the studied specimen of *Alora gouldii*, type species of *Alora*, supervisually resemble those of *Epidendrium* species, the jaws and egg-capsules do not. Also the intertidal habitat in which the *A. gouldii* snails were collected differs clearly from the hard coral habitat in which *Epidendrium* is found. The Cytochrome Oxidase 1 sequence indicated that *A. gouldii* is most closely related to sea-anemone associated epitoniid species.

Remarks. – Nothing is known about the life history of *Alora gouldii*.

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REFERENCES

- GITTENBERGER, A. & GITTENBERGER, E., 2005. A hitherto unnoticed adaptive radiation: epitoniid species (Gastropoda: Epitoniidae) associated with corals (Scleractinia). – *Contributions to Zoology* 74: 125-203.
- OKUTANI, T., ed., 2000. *Marine mollusks in Japan*: i-xlviii, 1-1173. Tokyo.
- WEIL, A., BROWN, L. & NEVILLE, B., 1999. *The wentletrap book. Guide to the Recent Epitoniidae of the world*: 1-246. Rome.