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A MARGINELLID GASTROPOD PARASITIZES SLEEPING FISHES

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ABSTRACT

The marginellid gastropod *Hydroginella caledonica* (Jousseaume, 1876) has been observed parasitizing sleeping fishes of the families Scaridae, Serranidae and Pomacentridae at coral reefs in New Caledonia during the night. The snail inserts its proboscis in the fish tissues and probably pumps some body fluids. Fish parasitism is also exhibited by another species in the genus *Tateshia* Kosuge, 1986, here transferred from the Olividae to the Marginellidae. Several Indo-Pacific marginellids conchologically resemble *H. caledonica*, and it is anticipated that more species in the family will prove to have a similar feeding biology.

Gastropods are known to parasitize or to be associated with many phyla of marine invertebrates. The most successful parasitic prosobranch radiation is certainly the eulimid radiation, parasitic on the five classes of echinoderms (Warén, 1984), but there are also significant gastropod radiations parasitizing various groups of Cnidaria (Architectonicidae, Epitoniidae, Coralliophilidae, Ovulidae and Pediculariidae). Species in the gastropod family Pyramidellidae parasitize other gastropods, bivalves, crustaceans, polychaetes or sipunculans. Other specialized host/prey associations include radiation of the families Triphoridae, Cerithiopsidae, and Fissurellidae (in part) on Demosponges; of the families Lamellariidae and Triviidae on tunicates; and many Opisthobranch radiations on Demosponges, Cnidaria and Bryozoa.

The association reported here between a prosobranch gastropod and a fish occurs only at night, and appears to be parasitism.

In this paper, I will (a) describe the occurrence and nature of the association; (b) discuss the taxonomy of the gastropod involved in the association; (c) discuss the taxonomic position of the recently described fish parasite genus *Tateshia,* and (d) finally discuss the marginellid radiation in the light of this new finding.

Parasitism of the ray *Torpedo californica* Ayres by the cancellarid gastropod *Cancellaria cooperi* Gabb has recently been reported both in the field and in aquarium (O'Sullivan et al., 1987). The snails penetrate the fish tissues by their proboscis and appear to suck blood from the ray.

Description of the Association

Fishes of the families Serranidae, Scaridae and Pomacentridae were first casually observed to carry small gastropods (Fig. 1) when sleeping in small cavities in coral reefs off Nouméa, New Caledonia. Those fishes usually hide in cavities from dusk approximately 1800, until early in the morning, at sunrise. In the cavities, they lie in contact with the bottom by the ventral or lateral sides, sometimes protecting themselves by producing a mucus cocoon (Casimir, 1971; Winn, 1955; Winn and Bardach, 1959; Fourmanoir and Laboute, 1976). After this initial observation, several night dives were conducted specifically to look for such associations.

Dives were made by J. C. Estival at Ilot Crouy (22°21'S, 166°20.5'E) in November 1981, and Ilot Goéland (22°22'S, 166°22'E) in May 1982; by myself at Ilot Goéland in October 1985. P. Laboute and J. L. Menou also supplied observations made during their dives in the area between 1980 and 1985.

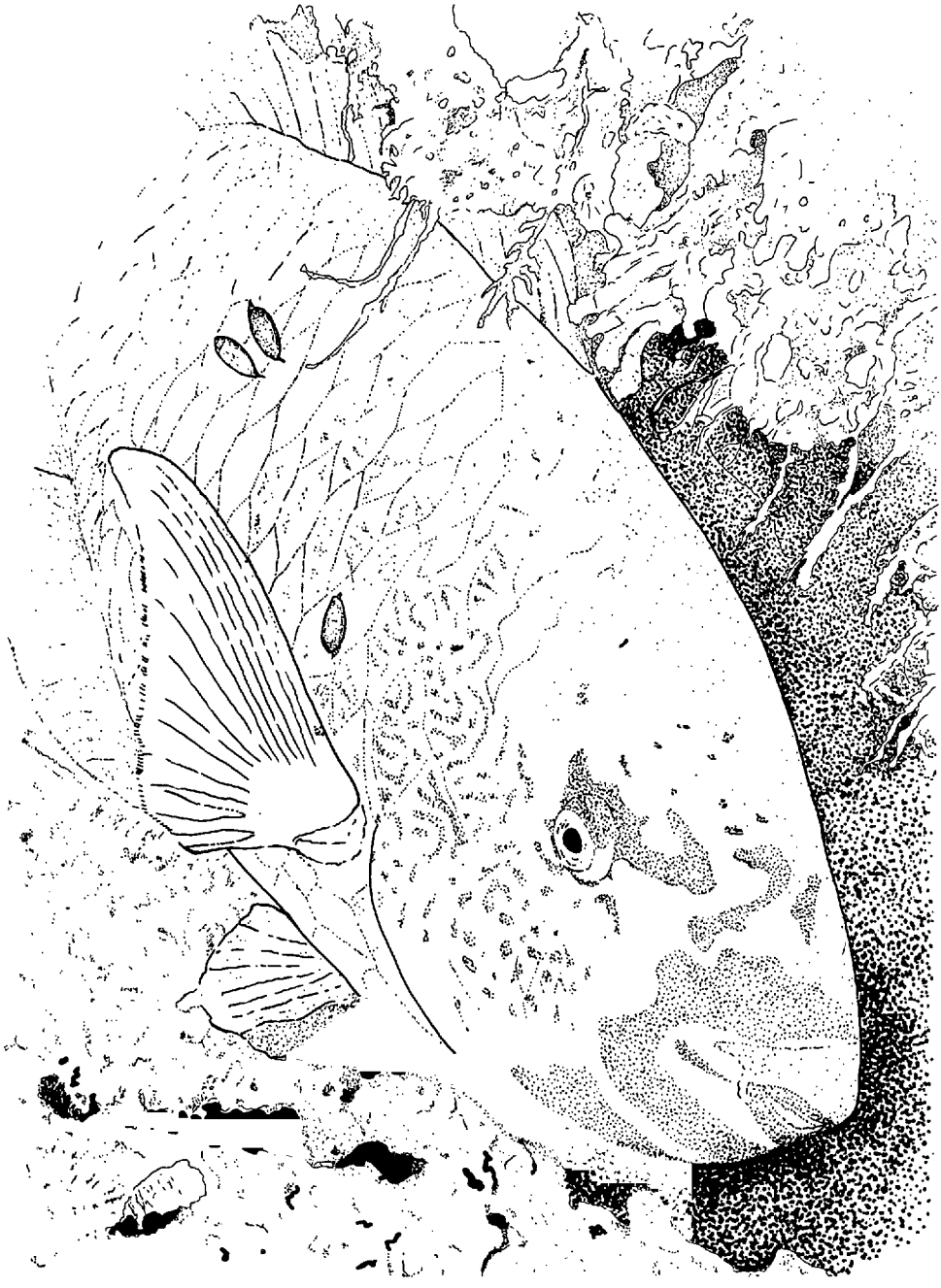

Figure 1. A Scaridae protected in its mucus cocoon, parasitized by three *Hydroginella caledonica* (prepared after a photo by P. Laboute and field observations).

The association does not occur on every reef of the Nouméa area. Although most, if not all, undisturbed reefs house sleeping fishes at night, marginellids were not observed except at these two out of a dozen reefs inspected at night (Menou, pers. comm.).

Observations were made between 2000 and 2300, at depths between 2 and 6 m. Reef slopes were inspected with a torch for fishes hiding in cavities. When lit by the torch, most fishes would show little or no movement; the presence of protective cocoon was not reflected in difference in behavior. The behavior of the gastropods, however, was very different on different fishes: on some fishes, the gastropods would fall off the fish within seconds after being lit; on other fishes, the gastropods appeared to be firmly attached, and would not move after several minutes of illumination. Using a small suction bulb, such snails proved to be firmly attached to the fish by their proboscis which was inserted in the tissues between scales. While the shell of the snails measures approximately 6 mm, the proboscis can be extended to 2–3 times that length before the snail can be loosened from the fish.

A total of approximately 30 fishes carrying snails have been observed, 70% of which belonged to Scaridae. Except for the parrot-fish *Scarus venosus* Valenciennes, fishes were not identified to species; several other parrot-fishes are involved in the association, as well as several species of Serranidae and at least one black species of Pomacentridae. Many species of Scaridae are present in New Caledonia and their identification is difficult (Fourmanoir and Laboute, 1976). Snails were collected, using a suction bulb, from hosts belonging to the three fish families involved. All snails belong to a single species of the prosobranch family Marginellidae. The association is thus not host-specific.

One to several (Fig. 1) snails per fish were observed. A maximum of 10 snails has been observed on a serranid, but usually a single or two snails are present. There does not appear to be a preferred attachment site on the fish, snails have been observed on the sides as well as on or near the head (near eyes, near mouth, near gills), and also on the pectoral fins. Snails are sometimes encountered on the mucus cocoons.

The association between the snail and the fish is here interpreted as parasitism. I believe that the snails spend the day in small crevices or small sediment pockets of the reef (they have so far never been collected alive away from their fish hosts). At dusk, when fishes come into contact with the bottom and spend the night asleep in reef cavities, the snails crawl out and presumably locate their hosts by chemoreception. According to Fourmanoir and Laboute (1976), Scaridae are very much home-abiding and every night use the very same shelter in the reef: this would certainly help the snails to find the host. When a fish has been found, the snail crawls on the fish until it finds a spot suitable for inserting the proboscis. I believe that the snails that drop off the fish when lit by the torch are snails that were still actively crawling in search for such a spot. When the snail starts feeding, it inserts its proboscis in the fish tissues (between scales or on a part that is not protected by scales) and sucks some fluids from the fish. If lit by the torch while its proboscis is penetrating the fish, the snail remains attached to the host. It is not known if feeding occurs all night long, since night dives were performed only between 2000 and 2300. No fish has ever been observed during daytime carrying this snail.

It is obvious from the observations made using the suction bulb that the snail proboscis penetrates the host tissues. It is, however, only an assumption that the snails pump fluids from the fish; this assumption is supported by similar behavior by Eulimidae on echinoderms, or Pyramidellidae on bivalves and polychaetes.

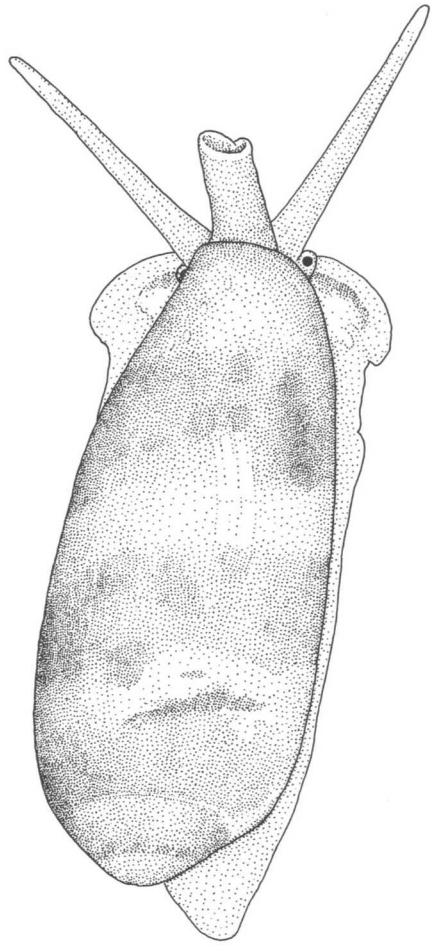

Figure 2. Living *Hydroginella caledonica* collected from a Scaridae.

H. caldeonica does not appear to have its external morphology modified by parasitism: the animal can crawl on its foot like any gastropod or withdraw completely in the shell; the head-foot has a color spot, eyes are pigmented and tentacles are present (Fig. 2). The radula is however very reduced, consisting of only 10 membranaceous teeth measuring approximately 25 μm in breadth (Fig. 3).

Taxonomy of the Parasitic Snail

Taxonomy of the small Indo-Pacific species of Marginellidae is very confused, both at generic and specific levels (Ponder, 1970). The generic classification is mostly based on shell morphology, which is usually smooth, with three–five columellar folds. Laseron (1957) introduced 30 new genera for eastern Australian marginellids, without much comparison with other Indo-Pacific marginellid faunas. Coan's (1965) classification of the family is based on radular characters and the value of most of Laseron's conchologically defined genera has never been critically examined.

At specific level, Bavay (1922) published a catalogue of the 16 New Caledonian

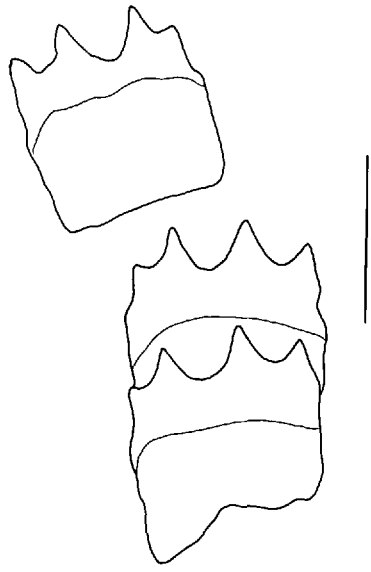

Figure 3. *Hydroginella caledonica*: radula. Scale line 25 μm.

marginellids then recorded; despite being over 60 years old, his catalogue has not been updated.

I have examined all marginellid types in British Museum (Natural History) (BMNH), Muséum National d'Histoire Naturelle (MNHN) and some in the Australian Museum (AMS). On the basis of general conchological similarities and type localities I identified the fish parasite (Fig. 4a, b) as *Serrata caledonica* Jousseaume, 1876, and place it in the genus *Hydroginella*. Further research, which is beyond the scope of this paper, may however prove both these generic and specific names to be junior synonyms.

Systematics

Hydroginella Laseron, 1957: 284

Type Species.—*H. dispersa* Laseron, 1957, by original designation (Holotype AMS C103353: Fig. 4e; type locality: Murray Is., Torres Strait, North Queensland, 9–15 m).

Hydroginella caledonica (Jousseaume, 1876)

Serrata caledonica Jousseaume, 1876: 267, pl. 5, figs. 8–10.

Type Material.—Holotype in MNHN (Fig. 4c).

Type Locality.—New Caledonia.

Hydroginella has been considered by Coan (1965) a subgenus of *Serrata* Jousseaume, 1875. I have examined in BMNH the type material of *Marginella serrata* Gaskoin, 1849, type species of *Serrata,* and do not agree with Coan's classification. The radulae of the type species of *Hydroginella* Laseron, *Neptoginella* Laseron and *Serrata* Jousseaume are not known.

Hydroginella caledonica is conchologically very similar to a group of species including *Serrata scinctilla* Jousseaume, 1876 (Fig. 4d), *Hydroginella dispersa* Laseron, 1957 (Fig. 4e) and *Neptoginella fascicula* Laseron, 1957 (Fig. 4f). All

Figure 4a–f. Shells of fish-parasitizing and presumed fish-parasitizing Marginellidae. a–b, *Hydroginella caledonica* taken from scarid fish, 5.9 and 5.6 mm. c, *Hydroginella caledonica*, holotype (MNHN), 6.7 mm. d, *Hydroginella dispersa*, holotype (AMS C103353), 5.2 mm. e, *Hydroginella scinctilla*, holotype (MNHN), 6.2 mm. f, *Neptoginella fascicula*, holotype (AMS C48716), 4.5 mm.

species have in common a smooth shell with rather parallel outlines, low spire, crenulated outer lip and 3 columellar folds that are crowded at the base of the columella; this last character is rather unique in the family, most species having the columellar folds extending over a third or half the height of the inner lip.

Another group of South African marginellids (*Marginella chrysea* Watson, 1886, *M. electrina* Sowerby, 1892 and *M. ponsonbyi* Sowerby, 1897) is similar in that respect, but the shell is broader with a higher spire; they might be congeneric with *Tateshia yadai* Kosuge (see below). Two other species might also be related on the basis of their columellars folds situated close together at the base of the columella, viz. *Marginella sordida* Reeve, 1865 from Mauritius, which has four (instead of three) columellar folds, and *M. amydrozona* Melvill, 1906, from northwest Indian ocean, which has a sunken spire with the outer lip projecting above the apex.

Taxonomical Position of *Tateshia* Kosuge, 1986

Tateshia yadai Kosuge, 1986 has been described as an ectoparasite on the scorpaenid fish *Helicolenus hilgendorfi* (Steindachner and Döderlein). It is not clear from Kosuge's description if the 50 snails were collected from a single or several fishes, taken from banks off Kagoshima, southern Japan at a depth of 300 m. Most snails were found "on the inside of the pectoral fin, and few specimens obtained on the outside of that fin," "no specimen was found attached to other parts of the fish." The fisherman who reported the association found the snails firmly attached to the skin of the fish, and "connected with the fish with a somewhat thread-like mucus" (Kosuge, 1986). The snail was described as a new species in the new genus *Tateshia,* placed by Kosuge in the family Olividae.

There is little doubt that the association is indeed parasitism. The base of the pectoral fin of Scorpaenidae is devoid of scales, and the "somewhat thread-like mucus" connecting the snail to the fish is here interpreted as a proboscis; that proboscis must have been deeply inserted in the fish host for the snail to remain attached to the fish during the 300-m journey to the surface. Because the association occurs in deep water, no other information is available.

Kosuge (1986) noted the conchological similarity of *Tateshia* and marginellids, but the radular formula 1 + R + 1 induced him to place the new genus in the family Olividae. At least one further marginellid, *Cystiscus jewettii* (Carpenter, 1857) from west Central America, has a radula with lateral teeth (Behrens, 1984) and rather than classifying *Tateshia* as an olivid with unusual shell, I regard *Tateshia* as a marginellid with a primitive radula. All other known marginellids have a radula with only the rachidian tooth, or no radula at all (Coan and Roth, 1976), but evolutionary history of the rachiglossan families implies that Marginellidae derive from rachiglossate ancestors (Ponder, 1973).

If *Tateshia* is correctly interpreted as a primitive marginellid, it is interesting to note that its columellar folds are grouped together at the base of the shell, a character that is shared with *Hydroginella.*

Discussion on the Marginellid Radiation

What are the consequences of the finding that *Hydroginella caledonica* parasitizes sleeping fishes at night?

The family Marginellidae is known as a fossil only in the upper Cretaceous (Maastrichtian) and younger (Taylor et al., 1980). Despite several hundred described species, the feeding biology of the family is still very poorly known. Taylor et al. (1980) give gastropods as a major prey item, and Foraminifera as a minor

item, for the family. South African species have been reported to feed on "small gastropods and bivalves, which are enveloped in the posterior part of the foot and dragged beneath the sand for consumption" (Kilburn and Rippey, 1982: 113). West African species have also been observed to prey on moribund or freshly dead gastropods shortly after their collection in the field (S. Gofas, pers. comm.). Taylor and Reid (1984) found polychaete setae (family Maldanidae and Capitellidae) in the stomach contents of *Gibberula teveriana* in the Red Sea. Several small species are regularly collected in bryozoan samples in Australia and New Zealand (W. Ponder, pers. comm.), and an association cannot be excluded.

Surprisingly, *Tateshia* has the most primitive radula in the family, while *Hydroginella caledonica* has a very reduced radula, that is the last grade before the total loss of radula that occurs in several genera (Coan, 1965 and references therein). Fish parasitism could have evolved independently several times during marginellid evolution or, alternatively, *Tateshia* and *Hydroginella* may represent different evolutionary levels of a monophyletic clade of marginellid radiation.

The fish families Scaridae, Serranidae, Pomacentridae and Scorpaenidae, hosts of *Hydroginella* and *Tateshia,* are classified within the orders Scorpaeniformes and Perciformes respectively, which account together for more than 40% of all marine fish species (Nelson, 1984) (and even a higher percentage in the upper 500 m where most marginellids live). Fishes from several more families are known to sleep on the bottom at night: Labridae, Chaetodontidae, Pomacanthidae, Acanthuridae, Syngnathidae, Balistidae, Canthigasteridae, some Mullidae, some Gobiidae, and several other minor families (Collette and Talbot, 1972; Hobson, 1965; 1972; Starck and Davis, 1966; M. Harmelin-Vivien, pers. comm.). This means that the niche is a common one and offers many possibilities for fish parasitism in the family Marginellidae.

With the limited information available on marginellid feeding biology, it would probably be no more correct to speculate that all marginellids are fish parasites than to consider the two known fish parasites as exceptions. If conchological characters are correctly interpreted as indicating phylogenetic affinities, then the nine described species discussed earlier could also be fish parasites. This could be an indication that a sizeable portion of the family is parasitizing fishes. Obviously fish parasitism within the marginellids awaits further observations.

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