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## **Cannibalism and Mating in *Gymnodoris citrina* (Bergh, 1877)**

By Scott Johnson

While working at the Mid-Pacific Research Laboratory at Enewetak Atoll, Marshall Islands, in the early 1980s, I spent many hours snorkeling on the lagoon reef of Enewetak Island counting and collecting nudibranchs. Often I tried to collect multiple specimens of a single species so I could observe mating in the laboratory. However, whenever I tried to collect multiple specimens of a small, rather nondescript species, *Gymnodoris citrina* (Bergh, 1877), I inevitably returned to shore with only a single one. I figured the others somehow managed to slip out of my collecting bottle. I figured wrong.

Enewetak supports at least 17 species of nudibranchs belonging to the family Gymnodorididae. So far, only seven have been even tentatively identified. All species whose feeding habits are known prey upon other opisthobranch mollusks such as cephalaspideans or sacoglossans (Young, 1967; Kay & Young, 1969; Johnson & Boucher, 1982). Several species eat other species of gymnodorid nudibranchs and it turns out that one, *Gymnodoris citrina*, is cannibalistic.

This cannibalism has been observed before. Young (1967) reported a *Gymnodoris citrina* eating a conspecific (that is, a member of its own species) at Enewetak. Young considered this an aberration due to captivity and stated that this species normally eats opisthobranch eggs. It does eat eggs of other species of *Gymnodoris*—but it also engulfs individuals of other *Gymnodoris* species and conspecifics.

*Gymnodoris citrina* is a common species at Enewetak. In two years of nudibranch studies, over 200 specimens were observed. They live singly beneath chunks of dead coral on intertidal and shallow subtidal reefs, and are occasionally found eating the eggs of the much larger *Gymnodoris ceylonica* (Kelaart, 1858) as well as those of other gymnodorid species. Placing different opisthobranch species near individuals of *G. citrina* shows that they also prey upon *G. plebeia* (Bergh, 1877); *G. okinawae* Baba, 1936; at least two unidentified species of *Gymnodoris*; and other individuals of *G. citrina*.

Gymnodorids, like other nudibranchs, are hermaphrodites—that is, each individual carries both male and female reproductive organs. They cannot, however, fertilize themselves. In most nudibranchs, two individuals line up in opposite directions and press their right sides together, aligning their reproductive systems. The two exchange sperm, then each is capable of depositing an egg mass.

Considering this, you'd think that cannibalism would tend not to contribute to a species' success! When would they mate? It turns out they mate while they're trying to eat each other.

Whenever two specimens of *Gymnodoris citrina* are placed within reach of each other, each one immediately opens its mouth wide and grasps the other. (The radular ribbon of a gymnodorid is composed of numerous long and curved, needle-like teeth well designed for grasping prey.) At this point, the ejaculatory duct of each individual everts, becoming a long (longer than the nudibranch) nearly transparent tentacle. The female mass of the reproductive system is clearly visible protruding from the body into the base of the tentacle.

After waving around for a few moments, the reproductive tentacles of the two nudibranchs come into contact. When the tentacles touch, they twist into a long tight coil with the tips pressed together. Transfer of sperm in both directions presumably is accomplished at this

time. This position is maintained while (usually) the larger specimen (the “predator”) gradually gains the upper hand and swallows the smaller (the “prey”). The coiled-up tentacles slowly uncoil as the prey is engulfed. Usually, the last visible part of the prey is the end of its tentacle, which finally disengages from the predator’s tentacle and is slurped into the mouth of the predator like a strand of spaghetti.

This was observed many times—almost every time two or more specimens were placed together—in the field, in aquaria, and even in collecting jars (which is why I could never make it back to shore with more than one specimen). In one case, a single individual ate three smaller ones in rapid succession.

These observations suggest that cannibalism is normal behavior for *Gymnodoris citrina*. But why they would develop such behavior is uncertain. It may be due to an irregular food source. The other items on *G. citrina*’s diet—other gymnodorid species and their eggs—are not always available. Many gymnodorids at Enewetak, including *G. ceylonica*, *G. striata*, *G. cf subornata*, and at least two unidentified species, undergo periodic population blooms. Most of the time they are not found at all, but occasionally they are quite common. I found one unidentified species by the hundreds in shallow water on Enewetak Island’s lagoon side over a period of about one week in 1983; for over a year before, I had found none; afterwards, I found one or two a month for the next three months, then no more. *G. citrina*, which is found constantly throughout the year, may have developed cannibalism to tide them over times when no other gymnodorids were available.

#### Literature Cited

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