MASTER'S THESIS

Biodiversity and Ecology of Corallivorous Nudibranchs in Hong Kong Waters

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Abstract

Coral communities play critical roles in the marine ecosystem as habitats and food sources to support a variety of life. Massive coral destruction by corallivory has been reported since 1998. Among the corallivorers in Hong Kong waters, the sea urchin *Diadema setosum* and the snail *Drupella rugosa* are common and have been studied. Several corallivorous nudibranch species have been recorded from Hong Kong, but their corallivory and the impact of this small group of nudibranchs are poorly known. To fill in this knowledge gap, this study aimed to determine the diversity, distribution, host-specificity, impact, and potential biological control of corallivorous nudibranchs in Hong Kong.

In field surveys covering a total of 56 sites, I found four species of corallivorous nudibranch: *Phestilla fuscostriata* feeding on the leave coral *Pavona decussata*, *Phestilla goniophaga* feeding on several species of the flowerpot coral *Goniopora*, *Phestilla melanobrachia* feeding on several genera of the tree coral family Dendrophylliidae, including *Tubastraea* and *Dendrophyllia* , and *Phestilla subodiosa* feeding on the pore coral *Montipora*. Among the four species of coral-eating nudibranchs, *P. subodiosa*, a tiny species with a length of ~3.5 mm in the adults, was rarely found, therefore was not quantified. Only *P. fuscostriata*, *P. goniophaga* and *P. melanobrachia* were enumerated in the field, with very low mean densities: 0-0.050m^{-2} for *P. fuscostriata*, 0-0.001m^{-2} for *P. goniophaga*:, and 0.002-0.004m^{-2} for *P. melanobrachia*. No seasonal changes in nudibranch density were found in my study. *P. fuscostriata* and *P. goniophaga* were found in both sheltered and exposed habitats, but *P. melanobrachia* was found in exposed habitats only.

For *P. melanobrachia*, previous studies reported only black and orange colour morphs and they feed on non-reef forming genera of Dendrophylliidae that live in relatively deep waters. In this study, I discovered a beige morph of *P. melanobrachia* that fed on the disc coral *Duncanopsammia peltata* (Dendrophylliidae) in shallow waters, indicating that this species can utilise members of Dendrophylliidae in both shallow-water and deep-water as its prey, therefore this species has a broader food spectrum than previously thought. Moreover, a previous study found *P. subodiosa* on *Montipora* colonies in an indoor aquarium. In this study, I discovered *Montipora*-eating *P. subodiosa* in the field for the first time and provided morphological description that supplement for the type specimens, especially in the coloration pattern and larval development. I also found that the four species of corallivorous nudibranchs exhibit different levels of host specificity: while *P. fuscostriata* and *P. subodiosa* was found to feed on *Pavona decussata* and *Montipora peltiformis* respectively, *P. goniophaga* was found

to feed on *Gonipora* spp., and *P. melanobrachia* was found to feed on several genera of the family Dendrophylliidae including *Tubastraea*, *Dendrophyllia* and *Duncanopsammia*.

My laboratory experiment showed that the feeding rate of the corallivorous nudibranch on their most favoured host varied with their body sizes: 1.44-8.33 polyps/day/individual in *P. goniophaga*; 0.10-2.75 polyps/day/individual in *P. melanobrachia*; 0.031 polyp/day/individual in *P. fuscostriata*; and 3.2 polyps/day/individual in *P. subodiosa*:). Due to their small body sizes and small feeding rates, *P. fuscostriata* and *P. subodiosa* should not be able to cause significant harm on their respective host coral, but aggregates of the large sized *P. goniophaga and P. melanobrachia* should be able to remove large area of coral tissues. My laboratory culture experiment showed that the shortest time it took for the veliger larvae to settle was in general shorter and more variable among the species: 1 day for *P. goniophaga*, 2 days for *P. melanobrachia*, 3 days for *P. fuscostriata*, and 6 days for *P. subodiosa*. Also, the chemical cues released from their host can induce the larval metamorphosis of *P. goniophaga*, *P. melanobrachia* and *P. subodiosa*; but in *P. fuscostriata* the inductive effect of chemical cues was not clearly demonstrated. I also conducted field and laboratory experiments to determine the potential predators of the corallivorous nudibranchs. In the field, I only found predation of the *P. goniophaga* egg masses by Chocolate hind *Cephalopholis boenak*; I did not observe predation of the egg masses or adults of other nudibranchs. In the laboratory, I found that *Cephalopholis boenak* and Scissortail sergeant *Abudefduf sexfasciatus* attacked the adults of *P. goniophaga* and *P. melanobrachia*, respectively. Although they did not ingest the nudibranchs, the preys were found dead after the attacks. I also found that eight-banded butterflyfish *Chaetodon octofasciatus* ingested the adults of *P. subodiosa*, *Chaetodon octofasciatus* and pearl-spot chromis *Chromis notata* were found to feed on *P. fuscostriata* in the laboratory.

Overall, my study indicates that aggregates of the bigger *P. goniophaga* and *P. melanobrachia* are capable to cause significant impact on the coral colonies, but *P. fuscostriata* and *P. subodiosa* are too small to exert significant impact on coral health. The natural fish communities have the potential to keep the nudibranch populations in check, but further studies should be conducted to understand the drivers of population changes in corallivorous nudibranchs. Coral community survey programmes, such as Reef Check Hong Kong, should include corallivorous nudibranch as one of the indicators in order to better conserve coral communities in Hong Kong. Management actions may be warrant should there be outbreaks of corallivorous nudibranchs in the future.