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Observation of a coral-dwelling gall crab (Cryptochiridae) in a dead coral host highlights their vulnerability to reef degradation

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ABSTRACT

Coral-associated fauna contributes greatly to coral reef biodiversity. Many species are obligately associated with their hosts on which they depend for food and/or refuge from predators. Their close relationship with their hosts makes them vulnerable to coral mortality. Here I report on a coral-dwelling gall crab (Cryptochiridae) inhabiting a partially dead *Echinopora* Lamarck, 1816 coral, at Magoodhoo Island, Faafu Atoll, Maldives. Cryptochirids are thought to feed off the mucus provided by their coral host, although some questions about their feeding biology remain. This observation highlights that these crabs remain associated with a dead host, even if it can no longer provide nutrients. The strong host association makes gall crabs vulnerable to widespread habitat degradation.

KEYWORDS

Associated fauna, coral mortality, feeding biology, Maldives, Scleractinia, symbiosis

Stony corals are a crucial and threatened habitat for a diverse range of reef-associated invertebrates. Coral reefs are under pressure from natural and anthropogenic disturbances, at local, regional and global scales. Global warming and overfishing are some of the main factors contributing to reef decline. Coral bleaching, a result of rising ocean temperatures, is predicted to become more frequent and intense over coming decades, with potentially devastating effects on the organisms living in close association with these corals (Bravo *et al.*, 2021). For example, the community structure of coral-associated crabs inhabiting *Pocillopora* Lamarck, 1816 corals changed after mass coral bleaching, with fewer individuals and species of obligate symbionts inhabiting bleached versus unbleached colonies (Tsuchiya, 1999).

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Cryptochiridae crabs inhabit stony corals on shallow reefs and in deep water (down to > 500 m) (Kropp and Manning, 1987). Gall crabs have even been recorded from the hostile upper intertidal zone, where *Lithoscaptus* sp. was observed living in a partially dead *Coelastrea aspera* (Verrill, 1866) colony occurring (mostly) above the high water line (van der Meij *et al.*, 2017). This particular specimen appeared to be able to survive without access to coral mucus, thought to be the primary food source (Kropp, 1986). If gall crabs were to solely rely on coral mucus for their food intake, the question arises how long they can survive in dwellings in (partially) dead or bleached corals (van der Meij *et al.*, 2017).

This report of an observation of the gall crab *Lithoscaptus tri* (Fize and Serène, 1956) in an overturned colony of *Echinopora lamellosa* (Esper, 1795), was recorded during a diversity survey of gall crabs (Cryptochiridae) carried out on Wallino reef (03°05'13"N 72°57'24"E), Magoodhoo Island, Faafu Atoll, Maldives (16 – 26 February 2015) at 22 m depth. It is not uncommon to find dislodged fragments of this coral species because of its delicate nature. After flipping the piece of coral to an upright position it became clear that the coral was partially dead; tissue was no longer present in the centre of the coral, whereas the sides of the coral appeared healthy and seemed to be growing outwards (Fig. 1A). The complete lack of tissue in the central part of the coral suggests that the coral fragment was turned upside down for a long period of time, possibly several weeks. Two dwellings belonging to gall crabs were observed in the dead, central part of the coral (Fig. 1B). While one dwelling was empty, the other dwelling contained a living, ovigerous female, later identified as *L. tri* (Fig. 1C). This is a new record for this species in the Maldives.

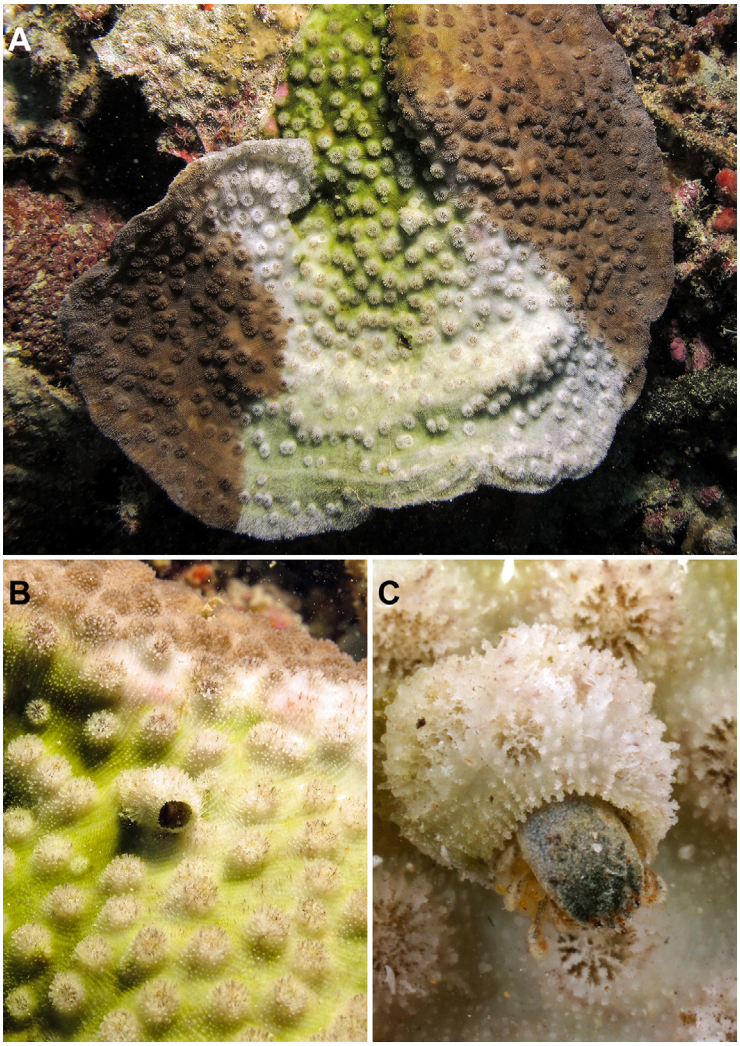

Figure 1. (**A**) Partially dead *Echinopora lamellosa* on Wallino Reef; (**B**) dwelling of the cryptochirid crab; (**C**) ovigerous female of *Lithoscaptus tri* partially extended from her dwelling (photo taken *ex-situ*).

There is continuing debate about the feeding biology of gall crabs, and possibly two or more distinct feeding mechanisms are in place. Kropp (1986) refuted the long-standing hypothesis that cryptochirid crabs are filter feeders, and instead suggested they feed on detritus and coral mucus. This conclusion is supported by Simon-Blecher *et al.* (1999) who suggested a trophic relationship between gall crabs and their host corals. A study on the hydrodynamic advantages of the skeletal modifications in the host coral induced by gall crabs analysed the impact of the flow over the coral and possible settlement of particles for the crab to feed on (Abelson *et al.*, 1991). The 'raised' dwelling of *L. tri* on top of its host coral (Fig. 1B, C) will likely alter the ambient flow over the coral, and the finding of a living, egg-bearing gall crab in a (partially) dead coral suggests that, either crabs can live for extended periods without food, or that multiple feeding strategies could be at play. Based on the availability of food sources, the feeding strategy could change over time. Lastly, there could be species-specific feeding differences. A stable isotope analysis of the food sources of *Hapalocarcinus marsupialis* sensu lato showed somewhat ambiguous results with the crab possibly feeding on both coral mucus and suspended organic particles (Terrana *et al.*, 2016; and see Bähr *et al.*, 2021, for a study on cryptic species in the genus *Hapalocarcinus*). Additional research is needed to understand the impact of coral die-off on obligate coral-dwelling taxa, especially for those species that rely on their host for food. Similarly, more data is needed on the feeding biology and natural history of host-associated fauna, which for many species is not or only partially known.

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