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First Report of Potential Coral Disease in the Coral Hatchery of Thailand

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Abstract: In this study, coral disease was first reported in the coral hatchery in Thailand. Disease were usually found on corals aged two to five years old during the months of November to December of each year. To identify bacterial strains, culture-based methods for strain isolation and molecular techniques of the 16S rRNA gene analysis were used. The resuts showed that the dominant genera of bacteria in diseased corals were *Vibrio* spp. (comprising 41.01% of the isolates). The occurrence of the disease in the coral hatchery can have a significant effect on the health and survival of juvenile corals before being transplanted to natural reefs for restoration.

Keywords: coral; culture; disease; Thailand; temperature

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Coral restoration has long been implemented in Thailand. However, most programs use asexual reproduction methods to produce new corals. In 2008, the first coral hatchery was established at Samea San Island, upper Gulf of Thailand to culture several coral species using a sexual reproduction technique, and to raise corals to an age of five years old before being transplanted to natural reefs. In this study, we report for the first time on the incidence of coral disease found in the hatchery. During the months of November and December, annually since 2015, coral disease has been found on cultured *Platygyra* corals. Diseases were usually found on corals aged two to five years old (Figure 1). More than 100 coral colonies infected by disease (approximately 25% of total corals in the hatchery) were recorded each year.

To identify bacterial strains, culture-based methods for strain isolation and molecular techniques of the 16S rRNA gene analysis were used. Partial sequences of the 16S rRNA gene revealed that the dominant genera of bacteria in diseased corals were *Vibrio* spp. (comprising 41.01% of the isolates, followed by *Bacillus megaterium* 25.28%, *Pseudoalteromonas* spp. 21.35%, *Promicromonospora citrea* 6.74%, and unidentified bacterium 2D804 5.62%). In comparison, healthy corals possessed a small quantity of *Vibrio* spp. (7.76%). These findings indicate that certain bacteria were able to become dominant in coral hosts (e.g., *Vibrio*) while others were drastically reduced or lost (e.g., *Alteromonas* and *Nocardiopsis*) during the low water temperatures when disease was most prevalent. In addition, analysis of the culture-independent bacterial ribosomal intergenic spacer showed the differences in bacterial communities between diseased and healthy corals, which was similar to the findings of Bourne et al. of which *Vibrio* was dominant in the diseased community [1]. The occurrence of dominant *Vibrio* spp. suggested that these bacteria species may be opportunistic pathogens on healthy corals during winter seasons when coral immunity may be

reduced due to lower water temperatures [2,3]. In addition to corals, the winter disease scenarios were also found in shrimp and crab species [2,4,5]. In Thailand, coral disease can be found throughout both the Gulf of Thailand and the Andaman Sea, particularly after bleaching events [6,7].

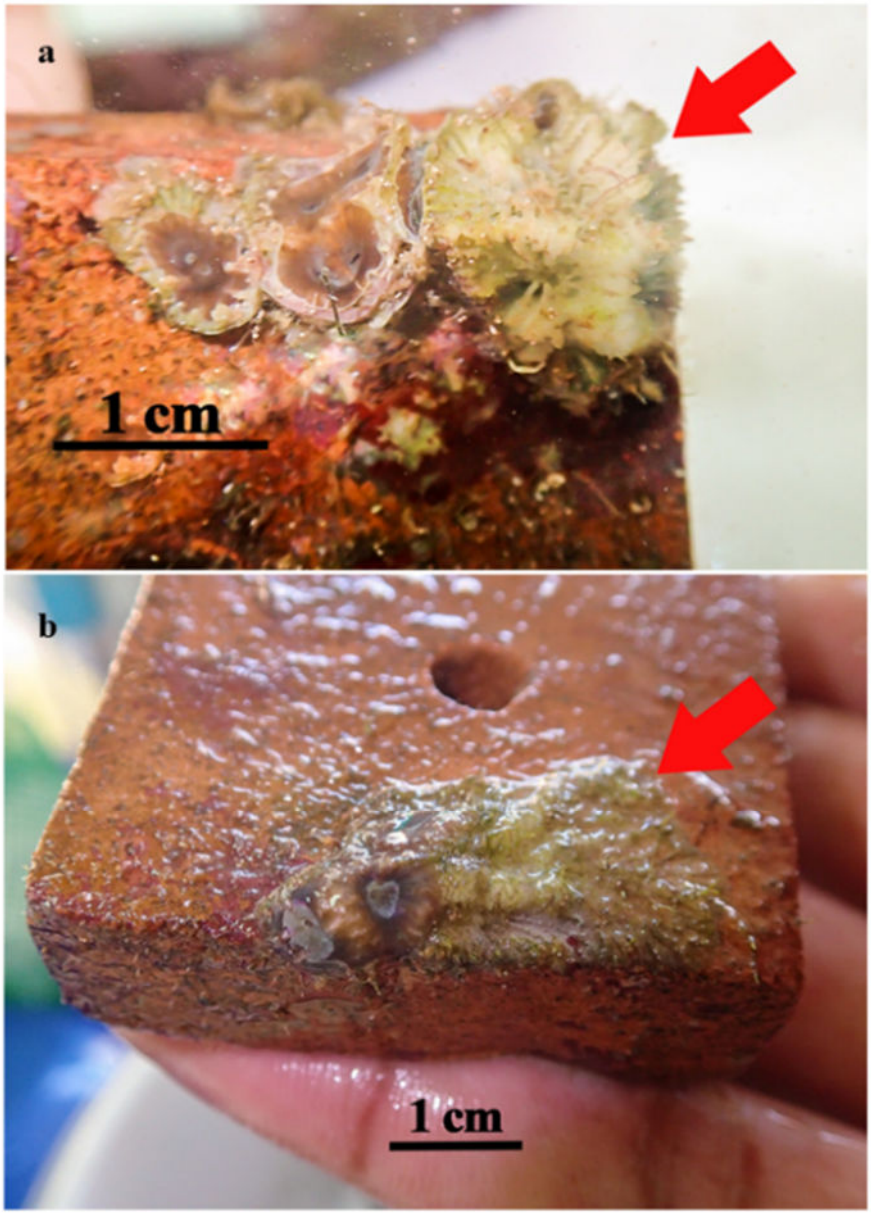

Figure 1. Potential coral disease in the coral hatchery (**a**,**b**). The red arrows indicate where the coral disease was found.

Our findings are the first to demonstrate the dominance of *Vibrio* and the changing bacterial assemblages in diseased corals in the hatchery during winter or low temperature seasons. The occurrence of the disease in the coral hatchery can have a significant effect on the health and survival of juvenile corals before being transplanted to natural reefs for restoration.

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References

1. Bourne, D.G.; Iida, Y.; Uthicke, S.; Smith-Keune, C. Changes in coral-associated microbial communities during a bleaching event. *ISME J.* **2008**, *2*, 350–363. [CrossRef] [PubMed]
2. Gunalan, B.; Soundarapandian, P.; Dinakaran, G.K. The effect of temperature and pH on WSSV infection in cultured marine shrimp. *Penaeus monodon* (Fabricius). *Middle East J. Sci. Res.* **2010**, *5*, 28–33.
3. Toledo-Hernández, C.; Ruiz-Diaz, C.P. The immune responses of the coral. *Invertebr. Surviv. J.* **2014**, *11*, 319–328.
4. Gavish, A.; Shapito, O.H.; Kramarsky-Winter, E.; Vardi, A. Microscale tracking of coral-vibrio interactions. *ISME Commun.* **2021**, *1*, 18. [CrossRef]
5. Bulan, D.E.; Wilantho, S.; Tongsima, V.; Viyakarn, V.; Chavanich, S.; Somboonna, N. Microbial and small eukaryotes associated. with reefs in the upper Gulf of Thailand. *Front. Mar. Sci.* **2018**, *5*, 436. [CrossRef]
6. Chavanich, S.; Viyakarn, V.; Loyjiw, T.; Pattaratamrong, P.; Chankong, A. Mass bleaching of soft coral, *Sarcophyton* spp. in Thailand and the role of temperature and salinity stress. *ICES J. Mar. Sci.* **2009**, *66*, 1515–1519. [CrossRef]
7. Roder, C.; Arif, C.; Bayer, T.; Aranda, M.; Daniels, C.; Shibl, A.; Chavanich, S.; Voolstra, C.R. Bacterial profiling of white plague disease (WPD) in a comparative coral species framework. *ISME J.* **2014**, *8*, 31–39. [CrossRef] [PubMed]