

Coral-killing sponge *Terpios hoshinota* invades the corals of Gulf of Mannar, Southeast India

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***Terpios hoshinota* is an encrusting cyanobacterio-sponge which grows aggressively over live coral colonies and has been reported to undergo outbreaks which kill corals. In an underwater survey conducted on the reefs of Gulf of Mannar, an outbreak of this coral-invading sponge was witnessed for the first time. It was found invading approximately 5% of the *Montipora divaricata* colonies ($n = 383$) at 1 m depth in Vaan Island. The affected site had a high coral cover (85.13%) dominated by montiporids (79.97%). *T. hoshinota* was confirmed via underwater morphology and microscopic observation of distinctive lobed tylostylespicules. This sponge is reported to have caused significant damage to many reefs around the world and hence immediate steps are needed to protect the reefs of Gulf of Mannar. Further studies are needed to assess the extent of *T. hoshinota* invasion in Gulf of Mannar and progression rate over live coral colonies.**

Keywords: Coral reefs, invasion, *Montipora divaricata*, sponge, *Terpios hoshinota*.

CORAL reefs are known for their ecological and economical benefits, yet coral reefs are in serious decline due to natural and human-induced impacts. Coral bleaching, coral diseases, poor water quality, destructive fishing activities, tourism, and other human impacts have degraded many pristine reefs¹. The Gulf of Mannar, in southeastern India, is known for high diversity and productivity of its reefs². After coral mining was stopped in 2005, corals in the Gulf of Mannar were found to be recovering from past human impacts³. However, reports of coral mortality due to coral bleaching³ and coral diseases^{4,5} are a concern.

Marine sponges are an integral part of coral reef ecosystems and are considered strong space-competitors with corals^{6,7}. It has been reported that some sponge species overgrow corals and outcompete them⁸⁻¹¹. Generally dead coral skeletons have been recorded to host high number of sponge species than live corals^{7,12,13}. However, there are few species of sponge, which can overgrow live corals and eventually kill them^{7,14,15}. *Terpios hoshinota* is an encrusting cyanobacteriosponge that aggressively over-

grows live coral and can undergo outbreaks causing significant decline in live coral cover¹⁴. *T. hoshinota* was first reported in Guam¹⁶ and subsequently in Japan^{14,17}, Taiwan^{18,19}, American Samoa, Philippines, Thailand²⁰, Great Barrier Reef²¹, Indonesia²² and Maldives²³. It was recently reported in the Indian reefs of Palk Bay by Thinesh *et al.*²⁴ who have predicted that this coral-killing sponge will invade the reefs of Gulf of Mannar²⁴.

Here we report the first occurrence of an outbreak of *T. hoshinota* on reefs at Vaan Island (08°49.979'N, 078°12.754'E) in the Gulf of Mannar. In September 2015, during routine coral monitoring underwater surveys, thin (<1 cm), black encrusting sponges were found overgrowing live *Montipora divaricata* colonies at 1 m depth (Figure 1 a). A total of six 20-m lines were haphazardly laid on the reef parallel to each other and separated by a minimum of 5 m to assess the prevalence of the impact. Substrate underlying the entire 20 m transect and coral cover was recorded via line intercept transect method²⁵. Total number of coral colonies, species specific colony numbers and number of colonies affected by *T. hoshinota* within 50 cm on each side of all transect lines (20 × 1 m) were recorded by applying belt transect method²⁵.

T. hoshinota was identified based on the *in situ* morphology (Figure 1 b). Distinctive lobed tylostylespicules were identified via microscopic observations (Figure 1 c) following Rutzler and Muzik¹⁴. Further, sponge fragments placed in ethanol turned the solvent dark green which denotes the presence of large numbers of endosymbiotic cyanobacteria. We have been monitoring the coral reefs of 21 islands within Gulf of Mannar since 2004 and this is the first time *T. hoshinota* has been recorded. Results of the line intercept transects showed that average live coral cover was as high as 85.13% at the affected site with 79.97% of montiporids. *Acropora*, *Turbinaria*, *Porites*, *Favia*, *Favities*, *Goniastrea* and *Platygyra* were the other coral genera observed at the site in very small numbers. Soft corals (0.12%), algae (2.77%), sand (4.44%) and rubbles (3.87%) were the other substrates at the site. Belt transects showed that there were a total of 520 coral colonies at the affected site, of which 383 were *M. divaricata* (Figure 2). A total of 13 coral species were recorded at the site that is dominated by *M. divaricata*. Of the total of 383 *M. divaricata* colonies, 5% ($n = 19$) were found to be invaded by *T. hoshinota* (Figure 3). *T. hoshinota* is overgrowing in large areas on these colonies and the invasion seems to be progressing to nearby colonies.

Invasion of *T. hoshinota* has been established as a devastating phenomenon to corals as the sponge can outcompete and kill coral colonies²⁶. Invasion of *T. hoshinota* on reefs in Guam resulted in about 30% loss of coral cover²⁰. The sponge is causing severe damage in other regions as well¹¹. Thus, the present observation of *T. hoshinota* in the Gulf of Mannar poses a significant new threat to the corals. Persistent threats such as bleaching, diseases,

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Figure 1. *T. hoshinota* on reefs at Vaan Island, Gulf of Mannar. *a*, *T. hoshinota* overgrowing live *M. digitata* colonies (scale 5 cm). *b*, Close-up of sponge showing numerous small oscula (scale 0.5 cm). *c*, Distinctive lobed tylostylespicules of *T. hoshinota* (scale 50 µm).

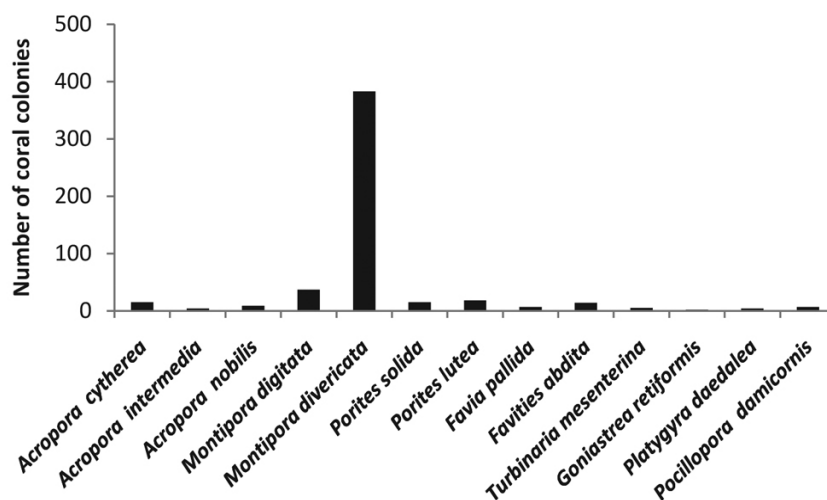


Figure 2. Coral community structure at the *T. hoshinota* invaded site in Vaan Island.

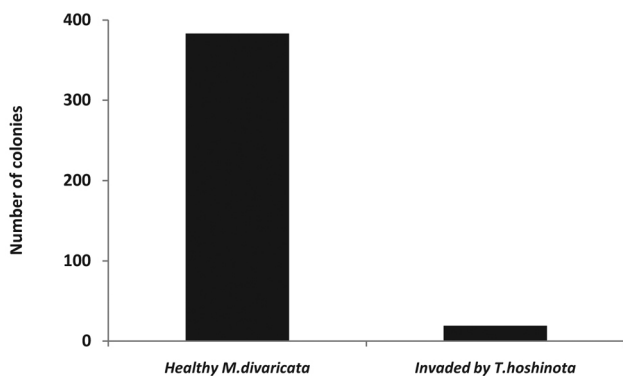


Figure 3. Proportion of *M. divaricata* colonies invaded by *T. hoshinota* in Vaan Island.

destructive fishing and pollution are already causing significant damage to the corals of the Gulf of Mannar. Since multitudes of fishermen along the coast depend directly on coral reefs for their livelihood, any loss in the productivity of the system would be of huge concern.

Immediate steps are needed to protect the reefs, thus protecting the livelihood of the dependant people. *T. hoshinota* has been reported from Palk Bay²⁴ which is about 150 km from Vaan Island. Hence, it is highly likely that other islands of the Gulf of Mannar which are between the Palk Bay and the Vaan Island have also been invaded by *T. hoshinota*. Further studies are needed to determine the extent of the invasion of *T. hoshinota* on reefs in the Gulf of Mannar and the rate of progression over live coral colonies.

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