

Two introduced tunicate species, *Ecteinascidia thurstoni* Herdman, 1891 and *Clavelina cyclus* Tokioka & Nishikawa, 1975, in Thailand

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Abstract

Recently, two introduced tunicate species *Ecteinascidia thurstoni* Herdman, 1891 and *Clavelina cyclus* Tokioka & Nishikawa, 1975 were discovered in the coastal waters of Thailand. *E. thurstoni* was found in Andaman Sea, the west coast of Thailand while *C. cyclus* was first recorded in the east coast, upper Gulf of Thailand. From the historical records, *E. thurstoni* can be found in South Asia, South Africa, Australia, and Red Sea while *C. cyclus* can be found in the tropical Indo-West Pacific.

Key words: tunicate, *Ecteinascidia thurstoni*, *Clavelina cyclus*, Thailand, introduced species

At present in Thailand, there is an increasing interest in marine introductions particular on tunicates; however, little information is available (Chavanich et al. 2005; Chavanich et al. 2007). Recently, two species of tunicates have been discovered. *Ecteinascidia thurstoni* Herdman, 1891 was reported in Andaman Sea, the west coast of Thailand, and *Clavelina cyclus* Tokioka & Nishikawa, 1975 was first recorded in the east coast, upper Gulf of Thailand (Figure 1 and Figure 2).

Ecteinascidia thurstoni Herdman, 1891

Ecteinascidia thurstoni has been recently discovered (Chavanich et al. 2005). Specimens of *E. thurstoni*, were collected during November 22-28, 2003 by scuba diving at the pier of Phuket Marine Biological Center, Phuket Province (7°80.13'N, 98°40.57'E). They were later identified and confirmed by Teruaki Nishikawa. At first, it was not realized that this tunicate was

a non-indigenous species in Thai waters. However, using the ten criteria of Chapman and Carlton (1991), *E. thurstoni* is considered as an introduced species. Previous papers showed that this species was found in Sri Lanka, South Africa, Australia, Gulf of Manar, Gulf of Aden, and Gulf of Suez (Gab-Alla 2008; Herdman 1906; Kott 2003; Kott 2005; Manniot and Manniot 1997; Primo and Vazquez 2004). Gab-Alla (2008) reported that in the Red Sea, *E. thurstoni* was found in mangrove habitats, while along Suez Canal coasts, *E. thurstoni* occurred in high densities on piling of jetties and the metal and cement banks of the Canal. In Thailand, at present, this tunicate can now be found only in one location in Phuket Province (Chavanich et al. 2005). It grows on the pier, and is also found growing on dead corals on the adjacent reef in the shallow water area. From our intensive scuba diving surveys both in the Andaman Sea and in the Gulf of Thailand, no other colony of *E. thurstoni* has yet been found

in other locations. A typical colony of *E. thurstoni* consisted of several hundred individual zooids held together by a stolon (Chavanich et al. 2005). When comparing sizes of zooids, the sizes in length of introduced *E. thurstoni* (ranging between 0.8-1.2 cm) were similar to ones found in the Red Sea, but were smaller than ones in the Suez Canal (Chavanich et al. 2005; Gab-Alla 2008). This may be due to suitable environmental conditions.

In Thailand, *E. thurstoni* attracts many attentions due to its bioactive compounds. From the study of Suwanborirux et al. (2002), a group of alkaloids, the Ecteinascidins (Et) 770 and 786, which exhibited potent cytotoxic activity against cancer cells, were isolated from *E. thurstoni*, and these extracts can be a potential source of new anticancer compounds (Chavanich et al. 2005; Suwanborirux et al. 2002).

In addition, from the surveys, a commensal amphipod *Leucothoe spinicarpa* (Abildgaard, 1789) was found living inside the introduced tunicate, but was not found in other native tunicates (Chavanich et al. 2007). From historical records, *L. spinicarpa* occurred only in the Mediterranean, Scandinavia, and North Atlantic, and it associated with tunicate species in those areas (Crowe 2006; Norman 1895; Thiel 1999). Since there was a presence of introduced amphipods in the introduced tunicate, the finding confirmed that both tunicate and amphipod were introduced from areas outside Thai waters. The assumption can also be endured by the criterion 4: association with or dependency on other introduced species by Chapman and Carlton (1991).

Clavelina cyclus Tokioka & Nishikawa, 1975

The other invasive tunicate species recently found in the upper Gulf of Thailand was *Clavelina cyclus* Tokioka & Nishikawa, 1975. It can be found in the tropical Indo-West Pacific; however, very little is known about its biology and ecology (Hirose et al. 1997). In the past years, this tropical tunicate occurred only on reefs and piers in the Andaman Sea, west coast of Thailand. However, on May 20, 2007, it was observed and collected at a pier at Kho Mar Jor, Sattahip, Chonburi Province (12°35.55'N, 100°57.14'E), upper Gulf, the east coast of Thailand. Since then, it spread covering cement pilings of the pier, and spread to an adjacent reef. The results from the recent field surveys in March



Figure 1. The introduced tunicate, *Ecteinascidia thurstoni* Herdman, 1891 in the Andaman Sea, Thailand. Photograph by S. Chavanich



Figure 2. The introduced tunicate, *Clavelina cyclus* Tokioka & Nishikawa, 1975 in the upper Gulf of Thailand. Photograph by S. Chavanich

2008 showed that *C. cyclus* became a dominant fouling organism on the pier covering more than 20% of the piling areas. The largest size of this tunicate was 6 cm in length.

Further studies and monitoring of these two introduced tunicate species are needed in Thailand. In addition, since little is known about marine introduced species in Thai coral reefs, and there are likely more introduced species to be found, more surveys should be conducted.

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References

- Chapman JW, Carlton JT (1991) A test of criteria for introduced species: the global invasion by the isopod *Synidotea laevidorsalis* (Miers, 1881). *Journal of Crustacean Biology* 11: 386-400 [doi:10.2307/1548465](https://doi.org/10.2307/1548465)
- Chavanich S, Koeysin P, Viyakarn V, Piyatiratitivorakul S, Menasveta P, Suwanborirux K, Poovachiranon S (2005) A tunicate from a Thai coral reef: a potential source of new anticancer compounds. *Coral Reefs* 24: 621 [doi:10.1007/s00338-005-0036-y](https://doi.org/10.1007/s00338-005-0036-y)
- Chavanich S, Ketdecha N, Viyakarn V, Bussarawit S (2007) Preliminary surveys of the commensal amphipod, *Leucothoe spinicarpa* (Abildgaard, 1789), in the colonial tunicate, *Ecteinascidia thurstoni* Herdman, 1891, in the Andaman Sea, Thailand. *Publications of the Seto Marine Biological Laboratory* 8: 97-101
- Crowe SE (2006) A redescription of *Leucothoe spinicarpa* (Abildgaard, 1789) based on materials from the North Atlantic (Amphipoda: Leucothoidae). *Zootaxa* 1170: 57-68
- Gab-Alla AA-FA (2008) Distribution of the sea squirt *Ecteinascidia thurstoni* Herdman, 1890 (Asciacea: Perophoridae) along Suez Canal and Egyptian Red Sea coasts. *Oceanologia* 50: 239-253
- Herdman WA (1906) On the Tunicata. Report to the Government of Ceylon on the Ceylon pearl oyster fisheries of the Gulf of Manaar. Supplementary reports 39: 295-348
- Hirose E, Lambert G, Kusakabe T, Nishikawa T (1997) Tunica cuticular protrusions in ascidians (Chordata, Tunicata): A perspective of their character-state distribution. *Zoological Science* 14: 683-689 [doi:10.2108/zsj.14.683](https://doi.org/10.2108/zsj.14.683)
- Kott P (2003) New syntheses and new species in the Australian Ascidiacea. *Journal of Natural History* 37: 1611-1653 [doi:10.1080/00222930110104258](https://doi.org/10.1080/00222930110104258)
- Kott P (2005) Catalogue of tunicata in Australian waters. Australian Biological Resources Study, Department of the Environment and Heritage, Australia, 301 pp
- Monniot C, Monniot F (1997) Records of ascidians from Bahrain, Arabian Gulf with three new species. *Journal of Natural History* 31: 1623-1643 [doi:10.1080/00222939700770871](https://doi.org/10.1080/00222939700770871)
- Norman AM (1895) A month on the Trondhjem Fiord. *Annals and Magazine of Natural History* 6: 476-494
- Primo C, Vazquez E (2004) Zoogeography of the southern African ascidian fauna. *Journal of Biogeography* 31: 1987-2009 [doi:10.1111/j.1365-2699.2004.01144.x](https://doi.org/10.1111/j.1365-2699.2004.01144.x)
- Thiel M (1999) Host-use and population demographics of the ascidian-dwelling amphipod *Leucothoe spinicarpa*: indication for extended parental care and advanced social behavior. *Journal of Natural History* 33: 193-206 [doi:10.1080/002229399300371](https://doi.org/10.1080/002229399300371)
- Suwanborirux K, Charupant K, Amnuoyopol S, Pumangura S, Kubo A, Saito N (2002) Ecteinascidins 770 and 786 from the Thai tunicate *Ecteinascidia thurstoni*. *Journal of Natural Products* 65: 935-937 [doi:10.1021/np010485k](https://doi.org/10.1021/np010485k)