

Red Tide and Paralytic Shellfish Poisoning Phenomena in Thailand

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Introduction

Red tide seems to be a seasonal phenomenon that occurs from the end of January to August. This phenomenon, which occurs particularly in the inner part of the Gulf of Thailand where four major rivers, Bang Pakong, Chao Phraya, Tha Chin, and Mae Klong open into the sea, has been observed during the past 30 years.

In 1957, Charenpol reported on its impact on the fisheries industry. Since then, the red-tide phenomenon has been observed more frequently. *Ceratium*, *Rhizosolenia*, *Chaetoceros*, *Skeletonema*, *Nitzschia*, *Thalassionema*, *Pleurosigma*, and *Trichodesmium* were recorded as the major species of phytoplankton usually found during the algal bloom (Paphavasit and Tamiyavanich 1984). Certain species were reported to be associated with estuarine areas of the Chao Phraya and Bang Pakong rivers. They included *Bacteriastrum*, *Triceratium*, *Coscinodiscus*, *Cyclotella*, *Hemidiscus*, *Thalassiotrix*, and *Surirella*.

Between 12 and 21 February 1981, an extensive red tide was observed at the Tha Chin estuary. Chernbamroong and Tharnbupha (1981), from the Department of Fisheries, reported that the bloom was dominated by the dinoflagellates *Noctiluca miliaris* and *Ceratium furca*.

Suvapepun (1982) reported that during the blooms in 1981-1982 the colour of the red tide, which was yellowish-green, was from *Trichodesmium*, whereas the gelatinous white colour was from the combination of *Coscinodiscus*, *Rhizosolenia*, and *Hemidiscus*, which also gave rise to a strong fishy odour. *Noctiluca*, the bloom of which is found seasonally along the coast during February and March, caused the green colour.

Suvapepun et al. (1984) stated that *Trichodesmium erythraeum* was the major species of algal bloom in 1983 along the east coast of the

inner gulf from Chonburi to Chantaburi; it lasted from May to June. When washed ashore, it resulted in a very bad smell. This bloom caused extensive damage to fish farms in Rayong and Chonburi. At the same time, *Trichodesmium erythraeum* also bloomed along the west coast of the inner gulf from the mouth of the Mae Klong River to Petchaburi.

A Case Study of Shellfish Toxicity in Thailand

From 12-16 May 1983, the same time when an extensive bloom of *Trichodesmium erythraeum* was reported in the gulf, a case of shellfish poisoning was reported at Pranburi, Prachuabkirikan Province on the west coast of the gulf. When the green mussel, *Perna viridis*, collected locally from the natural population within Pranburi River, was consumed by the local people, they showed symptoms of paralytic shellfish poisoning (PSP), such as numbness of the mouth, hands, and feet; disruption of breathing; and vomiting. Thirty-four people were rushed to the hospital, fourteen were hospitalized, and a 3-year old girl died (Subcommittee on the Water Quality and the Quality of Living Resources in Thai Waters 1983).

Investigations of that case were carried out by various groups, such as the Department of Fisheries, Department of Public Health, and Department of Marine Science of Chulalongkorn University. During preliminary investigations, phytoplankton samples were collected along with environmental parameters and it was found that the algal bloom consisted of a combination of various species of diatoms, dinoflagellates, and Cyanobacteria. Dinoflagellates of several species were found to be more abundant than usual. *Protoperdinium quinquecorne*, *Prorocentrum micans*, two species of *Peridinium*, and three species of *Gonyaulax* were reported, with maximum

densities of *Protopeiridium quinquecorne* and Cyanobacteria. The water in Pranburi River had a high BOD value, with the maximum being 5.8 mg/L (Subcommittee on the Water Quality and the Quality of Living Resources in Thai Water 1983). Details of phytoplankton composition and environmental quality can be found in Suvapepun (1984).

The Study of Toxicity

The green mussel was collected from the area and it was found that the concentration of water-soluble paralytic shellfish poison was about 100 times higher than the permissible standard of 4 MU/g as reported by the Environmental Health Division, Department of Health. Saitanu and Tamiyavanich (1984) reported the maximum toxicity of PSP as 12057 µg/100 g, which was quite high.

Investigation of the Source of Toxicity

The Department of Marine Science, Chulalongkorn University, became involved in the investigation immediately after the Pranburi incident was reported. After more than 1 year of investigation, and in cooperation of Japanese experts Drs Yasuwo Fukuyo and Takashi Ishimaru, from the University of Tokyo, and Dr. Masaaki Kodama, from Kitasato University, the results point out that this was truly a case of PSP. The study of the toxin from the green mussels collected showed that it was a gonyautoxin. Investigations are now going on to confirm whether *Protogonyaulax* sp., which was found although not in very high concentrations during the incident, could be the source of this biotoxin; and the specific name of this organism is being looked into. It is suspected to be *Protogonyaulax* sp., which occurs naturally in the inner gulf in low concentrations, because *P. tamarensis* was reported to cause toxicity elsewhere. The physical appearance of the *Protogonyaulax* sp. collected is very similar to *P. tamarensis*, although there are some structural differences and *P. tamarensis* is a cold-water species. As of now, pure cultures of *Protogonyaulax* sp. are being studied.

It should also be noted that Pranburi, where this case of PSP was reported, is not a location for mussel culture. Local people gather naturally grown mussels for their own consumption. Therefore, this case should not be confused with commercially farmed mussels in the market.

It should be mentioned that, along with studies on PSP, investigations are also under way on diarrhoeal shellfish poisoning (DSP). The organism believed to be the source of DSP, *Dinophysis caudata*, is also found in the inner gulf.

This paper has discussed the first occurrence of biotoxin in relation to algal blooms in Thailand. However, Piyakarnchana and Tamiyavanich (1979) have emphasised that the red-tide phenomenon could become more serious because of increasing pollution from rivers. Because mariculture has become widespread along estuarine areas of the inner gulf, it is important that more attention be given to this problem.

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