

A B S T R A C T

MARINE ALGAE AS A POSSIBLE SOURCE OF CIGUATERA TOXINS

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Several authors have suggested that benthic marine algae may be the source of the toxin which causes ciguatera. Knowledge of the food habits of fishes provides us with the strongest evidence of this. Some fishes which feed only on benthic algae may produce ciguatera when eaten. This does not constitute proof of an algal origin of the toxin, however, for herbivorous fishes often ingest detrital material of sundry origin and some fragments of animals incidentally with their plant food. Thus some other organism such as a sponge or a fungus might be the causal agent. Or it might be an organism such as a bacterium growing in association with an alga. Another reason to suspect algae is that toxic substances have been isolated from them (although none yet resemble ciguatoxin).

Algae were collected from reefs where poisonous fishes are found in the Society Islands, especially those which grow early on new surfaces, for testing of toxicity, but none displayed any significant quantity of toxin. The first alga tested was the chrysophyte *Chrysonephos lewisii*; it was clearly the dominant organism on surfaces of concrete, coral rock, and durotex placed on three toxic reefs in Tahiti and one in Moorea during the southern winter after a period of two to three weeks. The green alga *Enteromorpha* sp. and the brown *Ectocarpus* sp. succeeded *Chrysonephos* on the new surfaces after about a month in the sea. Still later these algae were largely replaced by many species such as the bluegreens *Calothrix crustacea* and *Lyngbya majuscula*, the brown *Sphacelaria* sp., the green *Cladophora* sp., and the reds *Polysiphonia* sp., *Centroceras clavatum*, and *Laurencia* sp. These algae were tested enmasse. The bluegreens *Hormothamnion enteromorphoides*, *Lyngbya aestuarii*, and *Calothrix* sp. and assorted diatoms were the principal algae growing on a concrete surface placed on a sand bottom in the lagoon near a toxic reef in Tahiti; this surface was subject to some silting by sand. A new surface placed in the sea on December 23 for twenty days yielded primarily *Cladophora*, and one in 15 days beginning February 29 mainly *Enteromorpha* (with some *Eryptotrichia*, *Sphacelaria*, and *Cladophora*). The bluegreen *Phormidium* sp., which was found growing naturally at the edge of Teavaraa Pass, Tahiti, was also tested. The two mice injected with extracts of this alga died in 34 minutes at the dosage of 2000 μ /g. Deaths from other algae required at least 3000 μ /g. A test with seawater alone produced death in two mice in 85 minutes at 3500 μ /g.

The following algae were collected at toxic sectors at Ishigaki in the Ryukyu Islands: the green *Chlorodesmis* sp., the diatom *Synedra* sp., and the bluegreens *Phormidium* sp. and *Lyngbya* sp. None were toxic beyond the level of 3000 μ /g.

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| Activity | Frequency | Time of day | Duration | Location | Notes |
|----------------------|-----------|-------------------|-----------|----------------|---|
| 1. Morning routine | 1 | 7:00 AM | 15 min | Home | Brush teeth, wash face, get dressed |
| 2. Breakfast | 1 | 7:30 AM | 10 min | Home | Eat cereal, drink milk |
| 3. School commute | 1 | 8:00 AM | 10 min | Home to school | Walk to school bus stop |
| 4. School activities | 1 | 8:30 AM - 3:00 PM | 4.5 hours | School | Attend classes, participate in sports |
| 5. Afternoon routine | 1 | 3:30 PM | 15 min | School to home | Walk home, change clothes |
| 6. Dinner | 1 | 6:00 PM | 10 min | Home | Eat dinner, talk with family |
| 7. Evening routine | 1 | 7:30 PM | 15 min | Home | Brush teeth, wash face, get ready for bed |
| 8. Bedtime | 1 | 8:00 PM | 10 min | Home | Go to bed, read book |

Although these results do not suggest that any of the algae tested are the source of ciguatera toxins, it should be remembered that the toxic level in the responsible organism may be very low and thus difficult to demonstrate by direct feeding or injection of extracts into mice. Also it is possible that a precursor of the toxic substance occurs in an alga which exhibits no toxic properties until it is metabolized by animals.

Although the Commission has not yet received any information from the State Department regarding the proposed legislation, it is possible that the Commission will be able to obtain information from the State Department regarding the proposed legislation.