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THE GROWTH OF *G. TOXICUS*, A TOXIC DINOFLAGELLATE IN POHNPEI ISLAND AND ANT ATOLL, THE FEDERATED STATES OF MICRONESIA

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Introduction

Ciguatera is a ubiquitous phenomenon throughout tropical and subtropical regions. This intoxication is induced both by herbivorous and carnivorous coral reef fish whose toxins originate and are transferred from a toxic dinoflagellate, *Gambierdiscus* toxicus (YASUMOTO *et al.*, 1977) by preference inhabiting the surface of macro-benthic algae in the coral reef (YASUMOTO *et al.*, 1979). According to the accumulated data in the South Pacific Commission on ciguatera occurrences of the tropical Pacific, only six cases of ciguatera intoxication have officially been recorded (SPC, 1993) in 1992 in the Federated State of Micronesia (FSM). The actual figure was larger because only some intoxicated people visited doctors for treatment. In FSM three places have been reputed to be toxic for their fishes which include Pingelap Island and Mokil Island in the State of Pohnpei, and Ulithi Atoll in the State of Yap (EDWARD, unpublished). Except for these three islands, only uncertain reports have been made, for example, in the State of Chuuk, but none of them have been confirmed. In Pingelap Island, almost the entire population have come down with ciguatera, including one fatal case. One adult lost his life in 1983 after eating a grouper *Cephalopholis argus*. In 1990 a young mother in Mokil had a miscarriage after eating another fish, of a species of the family Ballistidae. It seems to hold true for both Pingelap and Mokil that the frequent intoxication of ciguatera actually started when the Japanese fishing vessels went aground on the reefs although very few cases have occurred previous to the groundings. At first it was only at the grounding sites that people would get sick from fish consumption. Recently, intoxication could have occurred anywhere either on the reef or in the lagoon.

The distribution of *G. toxicus* in FSM was studied in Pingelap Island and two islands in the State of Chuuk by one of the authors (INOUE and GAWEL, 1986). A similar study was carried out in Ulithi Island (INOUE *et al.*, 1987). Through these two studies it was found that ciguatera could occur in such investigated places as Pingelap, Ulithi and Chuuk Atoll at any moment and at any locality, because a rather large *G. toxicus* population was observed growing which might lead to bloom under some unexpected environmental changes.

Here the authors describe the results of ecological survey on the distribution of *G. toxicus* and another kind of dinoflagellate *Ostreopsis renticularis*, which commonly shares the habitat with *G. toxicus*, carried out in Pohnpei Island and Ant Atoll in November, 1994.

Methods

Sampling sites around Pohnpei Island are shown in Fig. 1. All the sites (A~F) were located within the barrier reef at the northern part of the island. All sampling sites were less than 10m deep and several macro-algal samples were collected for attaching substrates of the dinoflagellates at each site. *Turbinaria ornata* was collected if found, for this tufted alga was known as one of the favorite host algae for *G. toxicus* and other dinoflagellates species (INOUE, 1980). Fourteen samples of *T. ornata* were picked up from about 25 m^2 at Site A, where its big population was recognized, to compare the attached number of the dinoflagellates among different individuals of substrate algae within a narrow area. The substrate algal growth except in Site A was rather poor where fewer samples, 9~29g depending on the situation of the individual sites, were collected. The sampling sites in Ant Atoll (G, H and K) are shown in Fig. 2. Site G was located near a passage washed by rapid current resulting in meager growth of benthic algae. Two other sites, H and K, were in the inner part of the lagoon. The collected algae, both at Pohnpei Island and Ant Atoll, were put in a plastic bag by sample and carried to the ship as soon as possible and the attached sediments including the dinoflagellates were detached by shaking vigorously with about 300 ml of filtered sea water which were then passed through three filters having different mesh sizes. The residues on the filter of smallest mesh size (37 μm) were gathered together and the number of the dinoflagellates was counted under microscope. The macro-algal growth was comparatively poor at all sampling stations, determined mainly by the time of the year, for one of the authors (EDWARD) found later that algal flora was noticed growing well at some places. The algal specimens collected for the attaching substrate of dinoflagellates were mainly the members of brown algae, because it had been known that brown algae was one of the preferable substrates among benthic algae (INOUE, 1980).

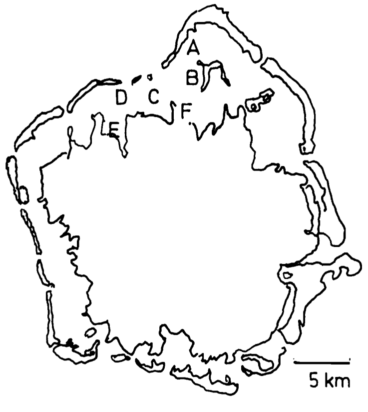

Fig. 1 Sampling sites around Phonpei Island

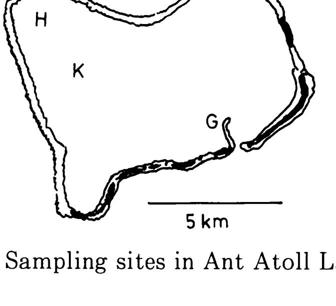

Fig. 2 Sampling sites in Ant Atoll Lagoon

Results and Discussion

The results of the surveys in Pohnpei Island and Ant Atoll are indicated in Table 1 and 2, respectively. In Pohnpei Island the growth of *G. toxicus* was confirmed in 9 benthic algal samples among 23 tested, whereas that of *O. renticularis* was in 7 samples. Thus the growth

Table 1. Growth of *Gambierdiscus toxicus* and *Ostreopsis renticularis* in the coral reef around Pohnpei Island

Sampling Site	Sample Number	Benthic Algae	Weight of algae (g)	No. of *G. toxicus*	No. of *O. renticularis*
A	1	*Turbinaria*. sp.	241	39	–
	2	ditto	262	14	134
	3	ditto	231	30	–
	4	ditto	309	63	221
	5	ditto	204	–	–
	6	ditto	195	9	–
	7	ditto	272	–	–
	8	ditto	294	–	–
	9	ditto	253	–	–
	10	ditto	228	–	–
	11	ditto	317	–	9
	12	ditto	205	–	–
	13	ditto	233	6	59
	14	ditto	251	–	–
B	15	ditto	29	12	3
	16	*Sargassum* sp.	18	–	–
C	17	ditto	9	–	–
D	18	*Turbinaria* sp.	52	51	104
E	19	ditto	16	–	–
	20	*Sargassum* sp.	22	–	–
F	21	*Turbinaria* sp.	11	10	–
	22	ditto	18	–	–
	23	*Sargassum* sp.	15	–	–

No. of *G. toxicus* and *O. renticularis* is demonstrated by the total number found on 100g (wet basis) of benthic algae – : not detected

Table 2. Growth of *Gambierdiscus toxicus* and *Ostreopsis renticularis* in the lagoon of Ant Atoll

Sampling Site	Sample Number	Benthic Algae	Weight of algae (g)	No. of *G. toxicus*	No. of *O. renticularis*
G	1	*Halimeda* sp.	34	11	–
	2	*Halimeda* sp. + *Microdityon* sp.	51	–	–
H	3	*Halimeda* sp.	42	–	17
	4	*Avrainvillea* sp.	37	–	–
	5	*Microdictyon* sp.	19	–	–
	6	*Halimeda* sp.	11	–	–
	7	*Avrainvillea* sp.	43	–	–
	8	ditto	25	–	28
	9	*Halimeda* sp.	37	–	–
	10	ditto	8	–	–
	11	*Microdictyon* sp.	17	–	–
	12	Mixed red algae	42	–	–
	13	*Halimeda* sp.	30	–	–
	14	*Microdictyon* sp.	23	6	8
	15	*Dictyosphaeria* sp.	18	–	–
K	16	*Halimeda* sp.	55	–	–

No. of *G. toxicus* and *O. renticularis* is demonstrated by the total number found on 100g (wet basis) of benthic algae – : not detected

of the two dinoflagellates was confirmed only on limited samples. The biggest population density of both *G. toxicus* (63 cells per 100g of benthic algae) and *O. renticularis* (221 cells per 100g algae) was recognized on No. 4 sample of *Turbinaria* sp. collected at Site A. This biggest density in Pohnpei Island, however, was far less than those reported previously in Micronesia (INOUE, 1988) and in the southern islands of Japan (KOIKE *et al.*, 1991). The population density of the two dinoflagellates tested here differed from sample to sample even among the same species of *Turbinaria* sp. collected at the same area, Site A. Clear relation of the density between the two dinoflagellates examined in this study was not observed. Neither *G. toxicus* nor *O. renticularis* was observed on the samples of *Sargassum* sp. This might partly be attributable to the smaller amount of benthic algae collected because of their meager growth at sampling sites. *G.toxicus* was found on at least one algal sample at each sampling site except Site C where only one sample was collected because of the poor growth of benthic algae.

Only two samples among sixteen were observed to have *G. toxicus* in Ant Atoll. *O.*

renticularis was also growing poorly. Algal growth was generally poor in this Atoll where *Turbinaria* sp. was not found, and *Halimeda* sp., *Microdictyon* sp. or other algal species were picked up instead. These algae are not favorable substrates for the dinoflagellates which might have been one reason why so small a number of the two dinoflagellates tested here was found. Another reason is attributable to the fact that most benthic algae was covered with small granules of corals which should have prevented the attaching of epibenthic micro-algae. The number of both dinoflagellates was very small even when found. The number of *G. toxicus* was extremely small throughout the investigated stations. That may suggest ciguatera by fishes caught in the lagoon of Ant Atoll and in the coral reef at northern lagoon of Pohnpei Island can not be induced immediately. Ciguatera, however, can be induced without any previous notice. Because the greater part of the population of FSM is in the northern Pohnpei Island and the people have ready access to the surrounding coral reef for fish, it would be better to continue periodical surveillance on the growth of *G. toxicus* there, to prevent or minimize ciguatera occurrences.

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