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DETERMINATIONS OF TOXICITY ON SOME CORAL REEF CRABS OF LA UNION, PHILIPPINES

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ABSTRACT

The A.O.A.C. mouse assay for paralytic shellfish toxins on coral reefs crabs collected mainly from the area of Lingsat, San Fernando, La Union confirmed the toxicity of two species believed to have caused two of three known human deaths in the northern coastal province as well as added two species to the list of dangerous Philippine marine crabs which now include: *Atergatis floridus, Zozymus aeneus, Lophozozymus pictor, Demania toxica, Demania alcalai, Atergatis integrrimus, Carpilius maculatus, Calappa calappa, Dromidiopsis* sp., *Etisus splendidus, Etisus rhynchophorus, Ozius* sp., and *Pilumnus vespertilio*, the last two being the new additions. Lethal potencies of the coral reef crabs ranged from nondetectable toxicity to 209.8 MU/g and a total toxin content of 5475.8 MU which is more than sufficient to intoxicate a person. Because of the marked individual variability in toxicity levels even within and among the toxic species, it is advisable for the public to avoid coral reef crabs altogether as food.

Introduction

During the past five or six decades or so, only very few cases of crab poisoning occurring in the northern coastal province of La Union are known. This is mainly because the fishermen in the area are quite aware that some crabs, especially those caught in the coral reefs, are deadly. At present with fast growing populations in the countryside and increasing numbers of people migrating from other towns to inhabit the sea coasts, there is need to warn the public about these crabs, especially since some people might be forced to glean on the rock beds for food.

Some time in 1935, a 57-year-old from a neighboring barrio had joined his fishermen friends in barrio Lingsat for torch fishing of sea cucumbers. As he walked apart from the group to warm himself by fire on the shore, he stepped on a crab which he then picked up to broil. Later, his companions saw him lying on the sand, dying with his mouth frothy. He had eaten what was described as a "hairy crab". This was the first fatality recounted by those who had heard from the witnesses.

On February 10, 1987, a fisherman aged about 59 and a woman in-law aged 54 from barrio Lingsat were rushed at about midnight to the Ilocos Regional Hospital in San Fernando, La Union. The man complained of spasms on the left side of

his body followed by his feeling of dizziness and numbness of both extremities. The woman complained of dizziness which started a few hours after eating supper.

Ten minutes after admission, the man was connected to a respirator and his secretions were sucked. Medications such as prostigmine and atropine sulfate were to no avail. Against medical advice, the man was discharged the following afternoon and died. The woman given the same medication but without being connected to the respirator recovered and was discharged three days later. Both had eaten a crab which was earlier discarded by other fishermen as unwanted catch of their nets and actually recognized by the man as poisonous. The family members could only explain the attempt to eat it as a case of suicide.

A third fatality was another fisherman from another barrio. He was enticed to eat a large reddish crab caught in his net. Fortunately, he had not shared his meal and thereby saved his housemates from a certain death.

Based on the descriptions of the crabs, the first fatality could have been due to *Pilumnus vespertilio.* The second case was due to *Atergatis floridus,* positively identified by members of the family of the victim from photos of various crabs. A barriomate of the third victim had pointed to *Etisus dentatus.*

Other countries have reported that several species of coral reef crabs could be toxic not only three or four. In this report the toxicity of only a few representatives of different species are presented.

MATERIALS AND METHODS

Specimens were collected from September to December in 1987 and 1988. Except for two specimens of *Zozymus aeneus* which were collected from the coral reef in Paraoir, Balaoan, La Union, the crabs were all from Lingsat, San Fernando, La Union. Many were gathered by a tedious process of turning over and breaking the rocks at daytime during the low tide, while some were caught at night by torch fishing as the crabs characteristically come out of the rock crevices and forage for food at night. A few were caught in the nets of fishermen who donated them for the study.

The crabs were immediately frozen and either transported as such to the U.P.-NSRI laboratory in Diliman, Quezon City for the bioassay or used for the toxicity experiments in the collecting station. Most of the specimens were identified by Miss Marivene Manuel of the Carcinology Section of the National Museum in Manila.

The coral reef crabs collected were: Family Calappidae, *Calappa gallus;* Family Dromiidae, *Dromidiopsis dormia;* Family Grapsidae, *Plagusia depressa tuberculata;* Family Majidae, *Composcia retusa, Cyclocoeloma tuberculata, Tiarinia depressa,* and *Schizophrys aspera;* Family Parthenopidae, *Daldorfia horrida;* Family Zanthidae, *Actaeodes tomentosus, Atergatis floridus, Atergatis subdentatus, Carpilius convexus, Carpilius maculatus, Eriphia sebana, Etisus dentatus, Euxanthus melissa, Lachnopodus subacutus, Leptodius exaratus, Leptodius gracilis, Lophozozymus* sp., *Ozius* sp., *Pilumnus* sp., *Pilumnus vespertilio,* and *Zozymus*

aeneus. However, not all could be assayed as some crabs were too small or only one or two were available to provide homogenates for the assay and sample for species identification. The dates of collection of the crabs that were assayed are shown in Table 1.

Table 1. Lethal potencies of some coral reef crabs of La Union, Philippines

Species	*Date of Collection**	*Weight of Crab, g*	*Sex*	*Lethal potency, MU/g*	*Total Toxin-Content, MU*
Family Calappidae					
Calappa gallus	11-27-88	6.7	M	–	–
Family Grapsidae					
Plagusia depressa tuberculata	10-29-88	10.2	F	–	–
Family Majidae					
Composcia retusa	*10-27-88*	*23.4*	M	–	–
Family Parthenopidae					
Daldorfia horrida	*9-15-87*	84.5	M	–	–
		102.2	F	–	–
		141.1	M	–	–
Family Xanthidae					
Actaeodes tomentosus	9-16-87	20.3(9)	F+M	–**	–**
	9-18-87	17.7(5)	F+M	–**	–**
		26.5(7)	F+M	–**	–**
	10-27-88	23.7(5)	F	–	–
		23.3(7)	M	–	–
		38.8*5)	M	–	–
Atergatis floridus	9-10-88	19.4	M	–**	–**
		22.0(3)	M	1.8	28.8
	10-27-88	16.0	M	1.8	28.8
	10-27-88	11.0	F	–	–
		14.0	F	1.7	23.8
	10-29-88	19.0	F	2.0	38.0
		20.0	M	2.0	40.0
	11-15-88	21.0	F	1.4	29.4
	12-2-88	17.3	F	<1.5	<26.0
		13.3	M	–	–
	12-18-88	26.1	M	209.8	5745.8
	12-21-88	31.0	M	2.5	77.5
		24.1	F	10.0	241.0
Atergatis subdentatus	9-30-88	236.7	M	–	–
Carpilius convexus	10-27-88	45.0	M	–	–
	10-29-88	14.3	M	–	–
		32.3	M	–	–

Species	*Date of Collection**	*Weight of Crab, g*	*Sex*	*Lethal potency, MU/g*	*Total Toxin-Content, MU*
	12-21-88	12.8	M	–	–
		12.3	M	–	–
Carpilius maculatus	10-29-88	30.0	M	–	–
		15.4	M	–	–
Eriphia sebana	9-10-88	43.9	M	–	–
		57.5	F	–	–
		72.6	M	–	–
		33.8	F	–	–
		58.2	F	–	–
		41.4	F	–	–
		52.8	M	–	–
		43.4	F	–	–
		46.5	F	–	–
		18.5	F	–	–
Lachnopodus subacutus	9-16-87	7.2(3)	F+M	–	–
Leptodius exaratus	11-15-88	9.6	M	–	–
Lophozozymus sp.	9-16-87	15.0	M	–	–
		23.3	F	–	–
Ozius sp.	9-12-88	12.6	M	< 1.8	< 22.7
Pilumnus sp.	11-15-88	19.0	F	–	–
		21.0(3)	M	–	–
Pilumnus vespertilio	9-10-88	12.7	F	< 0.7	< 8.9
		9.8	M	–	–
Zozymus aeneus	12-15-88	18.9	F	2.6	49.1
	12-15-88	106.7	F	45.3	4833.5
		74.5	F	15.8	1177.1

*All specimens collected from Lingsat, San Fernando, La Union except for *Zozymus aeneus* from Paraoir, Balaoan, La Union.

**Death of all three mice two to five hours after injection.

– Nondetectable toxicity

The toxicity of the different crabs were determined by the A.O.A.C. assay method for paralytic shellfish poisons as used by experimenters, particularly in Japan (Horwitz, 1965; Yasumoto, Raj, and Bagnis, 1984). Usually, crabs weighing at least 10g were tested individually. Those weighing less than 10g were combined for the test. The procedure was the same as that used to screen for paralytic shellfish poisons in molluscs (Pocsidio, 1987) with a slight modification as follows. After obtaining the median death time, the number of mouse units/ml was determined and the toxicity of the sample calculated as

$$\text{Toxicity (MU/g)} = \text{(MU/ml X dilution factor) X 2}$$

A death time > 60 min for survivors was considered as equivalent to < 0.875 MU/ml as recommended in the standard assay procedure.

RESULTS AND DISCUSSION

The results of the mouse lethality tests are summarized in Table 1.

Crabs with dark or black pincers or those with equal sized chelipeds have always been classified by fishermen in La Union as the harmful ones. Remarkably, these crabs which have their "fingers" black or brown "as if marked as such by Nature" have been described in literature as those avoided by Amboinese natives in the Moluccas (Rumphius (1705) cited by Holthuis, 1968). These black-fingered species are common in Family Zanthidae. The observation regarding their unfitness for consumption is reasonably accurate since so far all xanthid species, except *Dromidiopsis* sp. of Family Dromiidae and *Calappa calappa* of Family Calappidae, have been found to be toxic. Moreover, equal sized chelipeds are not rare among coral reef crabs.

So far, the following xanthids have been demonstrated to be toxic, the latter four reported recently to possess marginal toxicities as in *Dromidiopsis* sp. and *Calappa calappa: Atergatis floridus, Zozymus aeneus, Lophozozymus pictor, Demania toxica, Demania alcalai, Atergatis* intege *integerrimus, Carpilius maculatus, Etisus splendidus,* and *Etisus rhynchophorus* (Alcala and Halstead, 1970; Carumbana, Alcala and Ortega, 1976; Koyama *et al., 1983; Yasumura et al,* 1986). Two more xanthids, *Pilumnus vespertilio* and Ozius sp., may be added to this list as evidenced from the results of the present assay.

The toxicity of *Atergatis floridus* and *Pilumnus vespertilio* which are claimed to have caused two of the human fatalities mentioned above is confirmed by the mouse lethality experiments.

Despite the black fingers and equal sized chelipeds, there was the entire range of toxicity from nondetectable toxicity to a lethal potency of 209.8 MU/g. The highest total toxin content in a crab was in one specimen of *Atergatis floridus* with 5475.8 MU. Ingestion of paralytic shellfish toxins above 3000 MU is assumed to intoxicate man (Yasumoto, Raj, and Bagnis, 1984).

Variability in the responses of the test animals to the crab extracts was likewise observed in the present experiments. A person may be more vulnerable than another, so one who treasures life on this earth should probably totally ignore the coral reef crabs as food.

It should alarm people also that a possible change in toxicity levels within a locality through time can take place. For example, a screening of toxic crabs by Hashimoto *et al.* (1969) on 72 species in the Ryukyu and Amami Islands produced only three species, namely *Atergatis floridus, Zozymus aeneus,* and *Platypodia granulosa,* but in 1983 from the same region and among the species assayed in 1969, seven additional species were found toxic (Yasumoto *et al.*, 1983).

A calcareous red alga, *Jania* sp., ingested by crabs was found to be a source of paralytic shellfish toxins (Kotaki *et al., 1983).* Poisonous crabs may also contain tetrodotoxin and palytoxin as well (Yasumura *et al.*, 1986; Yasumoto *et al.*, 1985). For the crabs found toxic in this study further investigation will have to be conducted, specially the particular toxins, origin of toxins, and the factors for their occurrences.

Summary

Mouse lethality tests conducted on extracts of some coral reef crabs of Lingsat, San Fernando, La Union and Paraoir, Balaoan, La Union confirmed the toxicities of *Atergatis floridus* and *Pilumnus vespertilio* which were believed to have caused human deaths.

The study adds to the list of dangerous Philippine marine crabs two xanthid crabs, *Pilumnus vespertilio* and *Ozius* sp. It also adds evidence to the highly individual variability in the lethal potencies of the coral reef crabs.

A general caution to the public is to beware of coral reef crabs and to the content with the Portunid crabs of traditional delicacies.

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