Screening of Toxic Crabs in the Ryukyu and Amami Islands*

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As already reported¹⁾, intoxication in humans and domestic animals due to crabs occurred sporadically in the Ryukyu and Amami Islands, and several toxic species of crab were reputed by the inhabitants to be present. To identify the toxic species, a screening test was conducted on a large number of specimens from these areas, and three species, *Zosimus aeneus*, *Platypodia granulosa*¹⁾ and *Atergatis floridus*²⁾, were found to contain a potent neurotoxin³⁾. Thereafter, the screening has been extended to the crabs around the mainland of Japan, aiming chiefly at *A. floridus*.

The present paper describes the overall results of these screenings.

Materials and Methods

In the Ryukyu and Amami Islands, we tried to obtain the species suspected by inhabitants to be toxic and to collect specimens as many as possible at the places where the poisoning cases occurred. As some of poisoning cases were reported to have been caused by small-sized crabs, those as small as 1~2 cm in carapace width were also collected. When many specimens of a given species were collected at a place, each 10 of both sexes were selected at random for examination. If the number of specimens of either sex did not reach 10, a deficiency was filled up with those of the other sex. Except in the case of suspicious species, we did not collect the species which had been previously shown to be non-toxic in lots of 20 specimens. All specimens of the three toxic species previously reported as toxic were tested.

Crabs were collected between July of 1966 and June of 1968 at the places shown in Fig. 1 and by various ways, such as gill nets, skin diving, shore collection at the ebb-tide and torch-fishing. They were caught mainly on the shallows of coral reefs in the Ryukyu and Amami Islands and in rocky areas around the mainland of Japan.

Most of the specimens collected in Tokunoshima Island were subjected to screening immediately after being caught, while the others transported frozen to the laboratory of The University of Tokyo and kept at -20°C until use.

Since the toxin was assumed to be water-soluble, fairly heat-stable, and of a

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paralytic type similar to tetrodotoxin or saxitoxin from the epidemiological investigation of crab poisonings¹⁾, the principle of testing methods for these toxins was adopted and the procedure was simplified as much as possible. The validity of this method was ascertained with toxic specimens of *Z. aeneus* and *P. granulosa* early in the present study.

Fig. 1. Map showing the place of catches.

Specimens were cut into halves symmetrically, except those of the three toxic species which were mostly divided into the appendages and cephalothorax or into several parts. A half of the body or each part was minced thoroughly in a mortar. One gram of the minced material was heated with 9 ml of water in a boiling water bath for 5 minutes under occasional stirring, and cooled in running tap water. In an initial stage of this work, extraction was carried out with 5 ml of water for 15 minutes. After being centrifuged or filtered, each 0.5 ml portion of the extracts was injected intraperitoneally into two mice weighing approximately 20 g. If the mice were not killed within 30 minutes, the specimen was regarded as non-toxic. Toxic samples usually killed the mice within 20 minutes and those surviving for 30 minutes never died during a subsequent observation period of a week.

Results and Discussion

Results of the screening test on a total of about 1,000 specimens covering 72 species and 8 families are given in Table 1. The presence of toxin in the three species of xanthid crab was confirmed, although they showed the considerable in-

Table 1. Results of screening test for toxic crabs.

Scientific name (Japanese name)	Place of catch*	Number of specimens tested**		
		♂	♀	Total
Toxic species				
Xanthidae:				
<i>Atergatis floridus</i> (Subesube-manjū-gani)	A~L, O, P, Q	71(47)	73(55)	144(102)
<i>Zosimus aeneus</i> (Umore-ougi-gani)	L, M, N, P	76(51)	36(30)	112(81)
<i>Platypodia granulosa</i> (Hiraashi-ougi-gani)	O, P	21(6)	17(6)	38(12)
Non-toxic species				
Xanthidae:				
<i>Pilumnus vespertilio</i> (Kebuka-ougi-gani)	N, O, P	40	21	61
<i>Actaea tomentosa</i> (Awatsubu-ougi)	L, P	26	14	40
<i>Daira perlata</i> (Kanoko-ougi-gani)	L, N, O	15	25	40
<i>Carpilius convexus</i> (Yūmon-gani)	H, L, N, O	21	17	38
<i>Eriphia scabricula</i>	N, P	25	6	31
<i>Eriphia sebana</i> (Yafutsuan-gani)	N, O, P	12	14	26
<i>Epixanthus frontalis</i> (Sebiro-gani)	N, Q	13	9	22
<i>Etisus laevimanus</i> (Hizume-gani)	O, P	19	2	21
<i>Phymodius monticulosus</i>	O	13	7	20
<i>Lydia annulipes</i>	Q	14	6	20
<i>Leptodius nudipes</i>	N	13	7	20
<i>Leptodius exaratus</i> (Ougi-gani)	G	10	10	20
<i>Actaea rufopunctata</i> (Ibo-ougi-gani)	L	7	11	18
<i>Carpilius maculatus</i> (Akamon-gani)	L, N	8	7	15
<i>Eriphia smithi</i> (Iboiwa-ougi-gani)	G	6	7	13
<i>Actaea hirsutissima</i>	O	8	4	12
<i>Leptodius gracilis</i>	Q	9	3	12
<i>Leptodius sanguineus</i> (Mutsuha-ougi-gani)	G, P, Q	8	4	12
<i>Atergatis subdentatus</i> (Aka-manjū-gani)	H, I, O	6	3	9
<i>Ozius rugulosus</i> (Iso-ougi-gani)	Q	4	2	6
<i>Pilumnus tomentosus</i> (Ōkebuka-gani)	G, H	5	1	6
<i>Liomera cinctimana</i> (Ōbeni-ougi-gani)	P	3	1	4
<i>Etisus anaglyptus</i> (Togari-hizume-gani)	G	2	1	3
<i>Etisus utilis</i> (Nokogiri-hizume-gani)	P	3	0	3
<i>Etisus splendidus</i> (Ōaka-hizume-gani)	M, N	2	1	3
<i>Etisus deflexus</i>	O	1	1	2
<i>Chlorodiella nigra</i> (Kurotenaga-ougi-gani)	P	2	0	2
<i>Atergatopsis lucasi</i>	L	1	1	2
<i>Pilodius areolatus</i> (Keashi-awatsubu-gani)	P	0	1	1
<i>Pseudoliomera granosimana</i>	P	1	0	1
<i>Liomera ruguta</i>	P	0	1	1
<i>Lachnopodus tahitensis</i>	P	1	0	1
<i>Hypothalassia armata</i> (Matsuba-gani)	L	1	0	1

* See Fig. 1.

** The number of toxic specimens is given in parenthesis. When either of the appendages or cephalothorax was toxic, the specimen was regarded as toxic.

Table 1. Results of screening test for toxic crabs (continued).

Scientific name (Japanese name)	Place of catch*	Number of specimens tested**		
		♂	♀	Total
<i>Hypocolpus abotti</i>	L	1	0	1
<i>Lophozozymus pictor</i>	P	0	1	1
<i>Lophozozymus</i> sp.	L	1	0	1
<i>Paraxanthias notatus</i> (Toge-hizume-ougi-gani)	P	0	1	1
<i>Xanthias lamarcki</i>	Q	1	0	1
<i>Neoxanthias impressus</i>	P	0	1	1
<i>Xantho truncatus</i> (Togari-ougi-gani)	G	1	0	1
Grapsidae:				
<i>Metopograpsus thukuhar</i>	N	11	9	20
<i>Pachygrapsus crassipes</i> (Iwa-gani)	G	10	10	20
<i>Hemigrapsus penicillatus</i> (Kefusaiso-gani)	N	13	7	20
<i>Goetice depressus</i> (Hiraiso-gani)	G, Q	9	4	13
<i>Metopograpsus messor</i>	Q	1	3	4
<i>Grapsus tenuicrustatus</i> (Ōiwa-gani)	O, P, Q	0	4	4
<i>Grapsus strigosus</i> (Minami-iwa-gani)	O	2	2	4
<i>Percnon planissimum</i> (Togeashi-gani)	G, P	2	2	4
<i>Plagusia dentipes</i> (Shōjin-gani)	G	1	0	1
<i>Plagusia depressa tuberculata</i> (Ibo-shōjin-gani)	G	1	0	1
Majidae:				
<i>Camposcia retusa</i> (Mokuzushoi)	H, L	12	11	23
<i>Tiarinia cornigera</i> (Isokuzu-gani)	N, O	15	6	21
<i>Schizophrys aspera</i> (Nokogiri-gani)	P	1	1	2
<i>Picrocerus armatus</i> (Onitsuno-gani)	L	2	0	2
<i>Leptomithrax edwardsi</i> (Koshima-gani)	N	0	1	1
<i>Zewa okamotoi</i>	G	1	0	1
<i>Maja spinigera</i> (Keashi-gani)	H	0	1	1
Portunidae:				
<i>Thalamita prymna</i> (Benitsuke-gani)	L, P, Q	6	8	14
<i>Thalamita sima</i> (Futaba-benitsuke-gani)	L	6	5	11
<i>Thalamita coeruleipes</i>	O	5	1	6
<i>Thalamita picta</i> (Hime-benitsuke-gani)	P	3	1	4
<i>Charybdis erythrodactyla</i>	N	1	1	2
Parthenopidae:				
<i>Parthenope horrida</i> (Karuishi-gani)	L, O	10	10	20
<i>Zalasia horii</i> (Parao-doro-gani)	O	1	0	1
Ocypodidae:				
<i>Ocypode cordimana</i> (Minami-suna-gani)	L	6	4	10
<i>Ocypode ceratophthalma</i> (Tsunome-gani)	P, Q	2	0	2
Calappidae:				
<i>Calappa hepatica</i> (Sode-karappa)	O, P, Q	4	4	8
<i>Calappa lophos</i> (Torafu-karappa)	H	1	0	1
Dromiidae:				
<i>Dromiopsis dormia</i> (Ōkaikamuri)	L	3	0	3

dividual and local variations of toxicity, as will be reported in the following paper. No species other than the above three was found to be toxic. It is worthy to note that their closely related species in the family Xanthidae were non-toxic, even though caught at the same time at the same place. Such a strict species-specificity may serve as a clue to search for the origin of toxin.

COOPER⁴⁾ described that a xanthid crab, *Carpilius convexus*, is generally considered to be poisonous in the Gilbert Islands. It is also reputed to be toxic in some areas of the Amami Islands. Therefore, a total of 38 specimens of the species were collected from Amami-Oshima, Tokunoshima and Miyako Islands and from Minabe, but none of them were toxic. Although a large xanthid crab, *Etisus splendidus*, had been believed to be as strongly toxic as *Z. aeneus* by some inhabitants in the Amami Islands, two specimens from Tokunoshima Island and one from Kikai Island did not show any ill effect on mice. A further examination, however, may be necessary to obtain a conclusion on the toxicity of the species, on which only a few specimens were tested.

From the standpoint of public health, any other toxic species, if present, may be far less important than the above three as the cause of poisoning, since they were found frequently among the abundant non-toxic species at the place where the poisonings occurred.

Summary

A screening test for toxic crabs was carried out on a total of about 1,000 specimens covering 72 species and 8 families. The presence of toxin in the three species, *Zosimus aeneus*, *Platypodia granulosa* and *Atergatis floridus* was confirmed. The last species collected in various places around Japan was also found to be toxic. No other species was toxic.

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