

Morphological description of *Actaeodes sp.* in the intertidal shore of Initao, Misamis Oriental, Philippines

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Abstract: *Actaeodes sp.* has reports of toxicity in Initao, Misamis Oriental and Philippines but there is difficulty in identifying the organism because no comprehensive description has done yet. Thus, this study presents a detailed morphological description of *Actaeodes sp.* which served as baseline information on the identification and characterization of this species found in the Philippines. Sexual size dimorphism in size is evident of this species. There is also visible distinct pattern of coloration between male and female sexes. Taxonomic account and detailed morphological description is one avenue in public dissemination to avoid further poisoning events.

Key words: Red-eyed crab; Morphological identification; Coral reefs; Sexual dimorphism

1. Introduction

Five species of toxic crabs in the Philippine Island have once intensively collected by Garth and Alcalá in 1977. These are *Atergatis floridus*, *Zosimus aeneus*, *Platypodia granulosa*, *Lophozozymus pictor* and *Eriphia sebana*. The different species of this organism are found to inhabit the archipelago. The five species have found to have records of poisoning and fatalities identified on Negros Island, Camotes Island, Cebu, Palawan, Leyte and even recent report in Pangasinan (Yasumura et al., 1986b, Asakawa et al., 2014; Garth and Alcalá, 1977; Yasumoto et al., 1986b).

There is still scant information of other species of toxic crabs in the Philippines. There is still the existence of diverse species that remain to be described considering their biological and chemical significance.

In connection, a species was found to inhabit in the intertidal shore of Initao, Misamis Oriental, Philippines. This species is commonly named the hitch hiker or red-eyed crab locally known as “kong-kong” by the local inhabitants. The crabs had caused human poisoning when eaten by some local people of the coastal village. This crab is initially identified to be *Actaeodes sp.* (Corsini-Fokaand Kondylatos, 2015), a toxic crab species from the family xanthidae (Ping-Ho et al., 2006). Individuals were found burrowing on the dead intertidal coral reefs. Detailed descriptions of the external morphology of *Actaeodes sp.* was therefore done to provide sufficient information on its formal species status as a species.

2. Materials and methods

The sampling area was at the coastal village of Gimangpang of the municipality of Initao, Philippines having a long stretch of intertidal shore with a vast area of corals in that serves as habitats for crustaceans, gastropods and mollusk (Fig. 1).

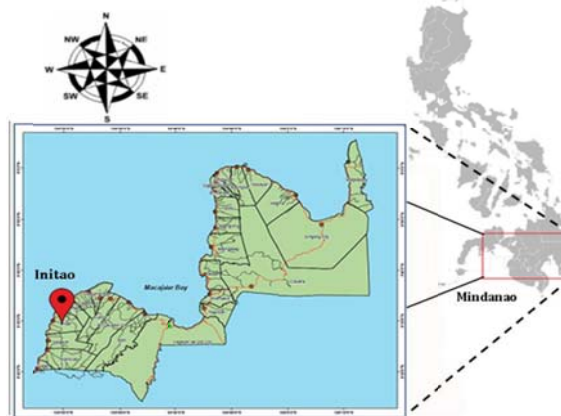


Fig. 1: Study site (red square) in Northern Mindanao, Philippines. Zoom in map of Misamis Oriental showing the position of Initao (red mark) where sampling location, Barangay Gimangpang is located.

Sampling was carried out based on the information provided by the local people on the existence of toxic crabs in the intertidal shore of the village. Collection was done on a low tide on March 6, 2016 at around 7A.M. Hand-collecting and baited traps were used since these organisms were found to be dwelling in the deep holes of dead coral reefs (Spiridonov and Neumann, 2008). Image acquisition of the morphological structure was done using Nikon DSLR D7000. Dissection of the 1st pereopod, ambulatory legs, abdomen and sternum was made possible by using dissecting forceps and needles. Crabs were sexed by revising the shape of the

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pleopods where males can be identified having a pair of long, thin pleopods on the ventral surface and females have four pairs of short pleopods (Peiró et al., 2011). The characteristics used for the description of the morphological characters of the crab are shown in Fig. 2.

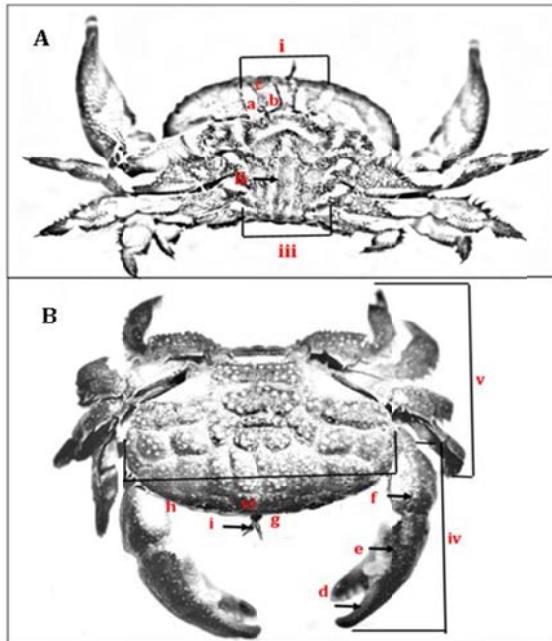


Fig. 2: Morphological terms describing the *Actaeodes sp.* (A) ventral portion: i. 3rd maxilliped with three divisions (a-c), ii. Abdomen, iii. Thoracic sternum. (B) Dorsal portion: iv. 1st pereiopod: d. dactylus (movable finger), e. Manus, f. carpus, v. Ambulatory legs (2nd to 5th pereiopod), vi. Carapace: g. frontal portion, h. antero-lateral teeth portion in the carapace, i. Antennae.

Description of the general morphology of the carapace, frontal and antero-lateral portion, 1st pereiopod, ambulatory legs, abdomen and thoracic sternum of the *Actaeodes sp.* include the general morphology of the dorsal and ventral part of the male and female crab is presented in digital photographs and linear sketch.

3. Results and discussion

Actaeodes sp. exhibit great diversity of form, structure and size of different parts for both male and female. In order to evaluate asymmetry attributes to size on individual organisms and between sexes, measurement of the chela both left and right, and carapace length and width was done (Table 1). Most species of crabs undergo sexual size dimorphism (Ng et al., 2008) and *Actaeodes sp.* is of no exception. Male crab was observed to be larger than the female (Fig. 3). Males have this attribute as a result of sexual selection that confers competitive advantages to success in mating (Barria et al., 2015; Abello et al., 1990). Within the Brachyuran, males are usually larger than females and this pattern is also frequently related to the investment in reproduction over growth by females (Garth and Alcalá, 1977; Hartnoll, 1982; Taddei and Herrera,

2010; da Silva et al., 2014). Sexual dimorphism was also observed based on the shape of the abdomen or the size of the chelae (Poupin and Juncker, 2010).

Sexual dimorphism was also observed based on color morphism. Females show dimorphism ranging from yellowish to orange features while male was observed to be whitish (Fig. 3C, F). Coloration of the male was completely opposite to that of the specimen found in Rhodes Island (Corsini-Foka and Kondylatos, 2015) identified as *Actaeodes tomentosus*. The coloration attributes is equivalent to that of female specimen found here in the Philippines having the orange coloration in the ventral portion of the body. This observation may indicate the species collected is a new species or it is *A. tomentosus* since this species are prone to polychromatism which the difference in the coloration is due to geographic variation in distribution of organism (Trivedi and Vachhrajani, 2013).

Table 1: Measurement of the chela both left (ChL) and right (ChR), and carapace length (CL) and width (CW)

| | CL | CW | ChL | ChR |
|--------|------|--------|--------|--------|
| Male | 2 cm | 2.5 cm | 1.7 cm | 1.8 cm |
| Female | 1 cm | 1.8 cm | 0.9 cm | 0.8 cm |

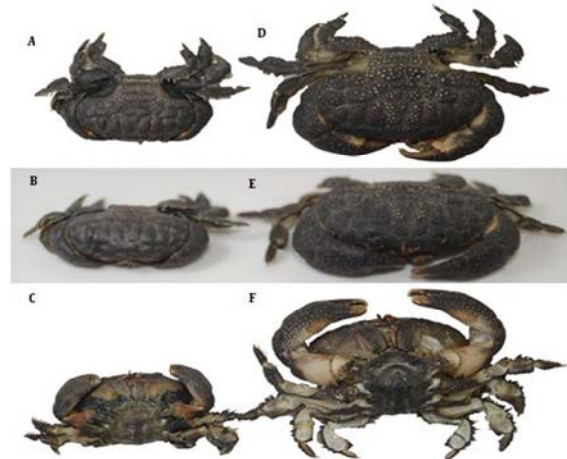


Fig. 3: Photographs of the dorsal (A), frontal (B) and ventral (C) view of a female *Actaeodes sp.*; dorsal (D), frontal (E) and ventral (F) view of a male *Actaeodes sp.*

CARAPACE: Male has broader and larger carapace than female. Color ranges from dark grey to reddish brown, and both sexes have apparent depression along different areas in the carapace divisible into several regions such as gastric, cardiac, intestinal and branchial. Texture of the carapace is noticeably bumpy due to the grooves. Carapace is also hairy in the antero-lateral and posterior portion. There are patches of small spots all over the carapace. Female spots are more dark red to red orange in the frontal portion and have a mixed white in the posterior concave edge. On the other hand, male has scattered whitish spots especially at the posterior portion (Fig. 4 and Table 1).

The observations made on the collected specimens showed distinct difference with *Actaeodes tomentosus* in intensity of white spots which are

clustering in the anterior to its posterior portion. The shape of the carapace of the collected species is ovate; however, the male has more vertically elongate ovate carapace than female. Examination of the posterior portion revealed that the female carapace is wider than the male. The larger posterior attributes is argued to be principally from reproductive processes, whereas males invert more energy to somatic growth (da Silva et al., 2014). It is also visible that female has pronounced concave insertion for the walking legs. Frontal and anterolateral portion is most likely repand and fine fissures margin. Inclusively, carapace has irregularly asymmetrical shape.

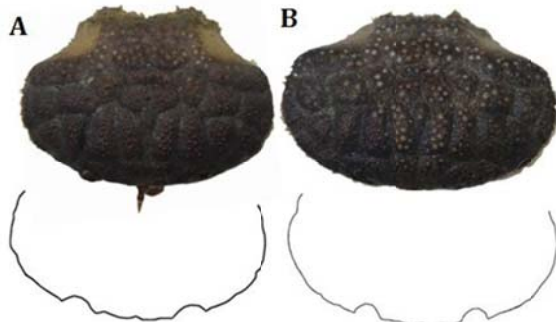


Fig. 4: Photograph of the carapace of *Actaeodes* sp. (A) female and (B) male. Below shows the comparison presented in a line drawing of the Orbito-frontal and antero-lateral margins of the sexes.

As with the Subfamily Actaeinae where the collected species belong, depressions and grooves along different areas is evident in the carapace divisible into several regions such as gastric, cardiac, intestinal and branchial which results to the texture of the carapace to be noticeably bumpy (Ho et al., 2006; Iwasa-Arai et al., 2015; Lee et al., 2010). Parallel observations with edible crabs where the antero-lateral region has the presence of sharp teeth, the collected *Actaeodes* sp. has most likely repand or wavy margin and fine fissures margin carapace (Tharmin et al., 2014).

1ST PEREIOPOD: This morphological character of the collected toxic crab consists of dactylus (movable finger), pollex, propodus, carpus and merus. The Chelipeds (dactylus-pollex-propodus) roughly has equal in size in both male and female (Table 1). Its spoon-tip-like end dactylus is evident that *Actaeodes* sp. feeds on algae (Wispongpan, 2011). Ventral portion of dactylus has dirty white to brown which includes the pollex until half of the lower portion of the propodus (Fig. 5. c-d & g-h). Male has whitish color and female on the other hand has orange to red orange shade. Moreover, dorsal portion (Fig. 5. a-b & e-f) has evident dark coloration with whitish patches of granules from half part of the dactylus and pollex to the carpus for both sexes. Merus for male has a patch of white pigment and female has orange color (Fig. 5. a-b & e-f). Setae adorned the merus part especially in female and some could also be found in the lower pollex teeth and upper part of dactylus.



Fig. 5: Showing the 1st pereopod and symmetry of chela: (a-b) dorsal and (c-d) ventral of male, (e-f) dorsal and (g-h) ventral of female crab.

The chelipeds of this crab conforms to those in the subfamily which are symmetrical (Lee et al., 2010) (Fig. 5 and Table 1). This is in contrast with those observed on edible marine crabs showing an apparent chela dimorphism and even handedness (Pynn, 1998).

AMBULATORY LEGS: The 2nd to 5th pereopods have a setaceous margin and crooked assembly in the flexor to easily conceal it during burrowing in holes of dead corals and rocks. Dorsal aspect of the 2nd ambulatory legs has evident uniform dark coloration for both male and female sexes (Fig. 6. a, d) with scatter tiny white speckle from the dactylus to the coxa. Male ventral (Fig. 6. b) 2nd walking leg has white coloration and female has light orange patches (Fig. 6. c).



Fig. 6: Photographs of the 2nd walking legs: (a) dorsal and (b) ventral of male *Actaeodes* sp., (c) ventral and (d) dorsal for the female. Representative of 3rd to 4th walking legs: (e) dorsal and (f) ventral for male, (c) ventral and (d) dorsal for female.

Representative photographs for the 3rd and 5th pereopod is shown since, parts has roughly similar attributes. Merus of the dorsal view of male has pronounced white patch (Fig. 6. e) with tiny protrusion. Female has orange patches at the merus

(Fig. 6. h) as well as scattered spots on the ventral view (Fig. 6. g).

THORACIC STERNUM AND ABDOMEN: Thoracic sternum of *Actaeodes* sp. has of the same structure as any "true crabs". Female (Fig. 7.A) has deformed and asymmetrical left and right appearance with a yellowish coloration. Each sternite is not well defined. The pubescence of female in the abdomen (Fig. 8. A-B) is soft and dense while male has no observable setae (Fig. 8.C-D). Abdomen has depression resulting to uneven surface and not just typically divided into different segments. Line drawing (Fig. 7.B) of the male crabs has striking rough symmetrical thoracic sternum with the express segment but, margin is asymmetrically lobate with crevice. Abdomen has triangular shape and whitish characteristic. The 3rd maxilliped (Fig. 7.D) has a setaceous margin which is dense, short and has observable spine-like setae. Antennule or first antenna is small, thick, paired and retractile appendages usually remain folded sidewise and placed within sockets. It has segment at the mid portion and pointed tip.

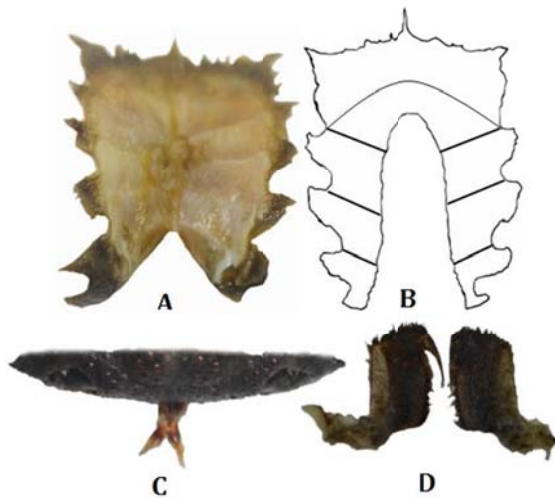


Fig. 7: Proximate angle of the (C) antennule and (D) 3rd maxilliped of *Actaeodes* sp.. Digital image of (A) female thoracic sternum and (B) line drawing for male



Fig. 8: (A) Dorsal and (B) Ventral portion of the female abdomen. (C) Dorsal and (D) Ventral portion of the male abdomen

4. Conclusion

The morphological attributes described of the collected Philippine toxic crab indicates the species belongs to the genus *Actaeodes* and has all the characteristics similar to that of the described

Actaeodes tomentosus, a species of toxic crab described from Rhodes Island. The observed polychromatism present in this species however from the Philippines indicates that this could be a different species thus named *Actaeodes* sp.

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