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Huenia brevifrons WARD (Decapoda, Majidae) Attached to Calcareous Green Alga, *Halimeda*, from the Ryukyu Islands

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Kuroshima is a small island situated at the latitude 24°03′–25°52′ N, longitude 122°56′–124°20′ E, the southwest of Ishigaki Island in the Yaeyama Group, Ryukyu Islands, being surrounded by barrier reef with many patch reefs along the south coast. The junior authors, the staff members of the Marine Park Research Station at this island, are extensively surveying on the corals and associated animals in the intertidal and shallow water bottom. During the survey in the last summer, a curious crab attached to the calcareous green alga, *Halimeda opuntia* (LINNAEUS) [Jap. name: Saboten-gusa] was unexpectedly found and kept for some time in the aquarium for observation of its behaviour. On November 25, another specimen was collected also on the alga, but no additional specimen was found in spite of the subsequent extensive observation in the field.[1)]

The similarity of the crabs to the algae in color and shape was really surprising, typically representing the case of the so-called mimicry. They were tentatively identified with *Huenia proteus* (DE HAAN) of the Majidae, which is well known by the extremely variable shape of the carapace and the dissimilarity in both sexes. They agree rather well with the figures of *H. proteus* represented by BORRADAILE (1903) and subsequently reproduced by BARNARD (1950) and BALSS (1956), but apparently differ from the figures given by some other authors and the materials from Japan. Consulting with literature on *Huenia* and its related genera, we learned that the males at hand accord well with *H. brevifrons* WARD based on a female from the Gulf of Davao, Philippines. The original description of this species is insufficient in some respects and the photographs are only poorly produced, but it may be rightly named as *brevifrons* on the wide and flattened rostrum. The inclusion in this genus, however, may be controversial, as mentioned in the following lines.

Two males (NSMT–Cr. 5078, 5079) with 5.8 and 5.2 mm in carapace width were decidedly identified with *Huenia brevifrons* WARD, 1941 [New Jap. name: Hime-

1) The third specimen was obtained on February 7, 1976, from the same habitat at the depth of 5m.

konoha-gani]. They are ill-calcified and may attain larger size, but there is little doubt in referring them to WARD's species from the Philippines. Judging from one of the photographs, it is probable that the type-female with 10 mm in width is also not fully developed. The original description is, as mentioned already, not thorough, so that only the contour of the carapace based on the photographs is surely available for definite identification. In the type-female the lateral lobe of the carapace is more distinctly petaloid with the convex anterolateral border. This feature may, however, be slightly variable with developmental stages, since the anterolateral border is distinctly convex in the larger male at hand as in the type-female and nearly oblique in the smaller one. The following is the diagnostic description taken from the two young males at hand.

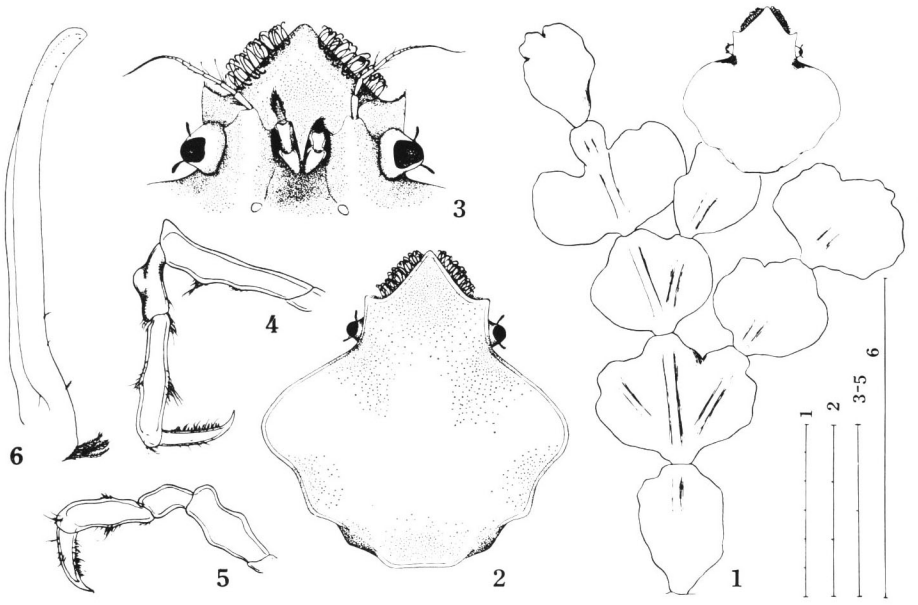
Carapace with rostrum nearly as long as wide, flattened dorsally, with slight indication of mesogastric and cardiac regions in median line. Lateral border produced into a wing-like projection which is weakly upturned; its anterolateral border strongly arched in larger male and nearly oblique for its most part in smaller male; posterolateral border of this projection more or less concave and ends in a round or angulated lobe. Behind it true posterolateral part of carapace rather concave dorsally. Posterior border of carapace narrow, with weakly raised rim.

Rostrum triangular, not long. Preocular angle produced into a small tooth directed forward. Supraorbital border nearly as long as the length of rostrum proper, being almost longitudinal. Frontal region, therefore, markedly prominent as a whole due to wide supraorbital region and triangular rostrum. In lateral view, rostrum with certain depth, and in ventral view surface for its most part flattened or rather concave, with lateral parts obliquely truncated; thick fringes of curled hairs arise from these parts, being directed upward and downward.

Chelipeds not heavy, and nearly hidden under carapace in natural position. Upper border of cheliped merus with three equidistant low mounds. Upper border of palm rather thin and also equipped with three convexities. Borders of ambulatory legs crested. Merus with a median and terminal convexities. Each of carpi and propodi also medially convex strongly in first two pairs and only weakly in last two. Several spinules in two rows on lower border of dactylus.

In dealing with *Huenia proteus* (DE HAAN), BORRADAILE (1903) mentioned and figured that the males are usually triangular with a long, sharp rostrum, and the females and some of the true males have the carapace widened into a leaf-like shape by outgrowths of the hepatic and branchial regions. According to these figures which were, as already mentioned elsewhere, reproduced by BARNARD (1950) and BALSS (1956) as the examples of variability and crustacean mimicry, the border of the lateral expansion of the carapace is medially rather angulated, the rostrum is small, and the preorbital angle is obtusely rounded. Although he also described that the intermediates are found in both sexes, it is highly probable that some of the leaf-like type living on *Halimeda* are really referable to the present or kindred undescribed species.

The present species referred with a slight hesitation to *Huenia* DE HAAN is peculiar



Figs. 1–6. *Huenia brevifrons* WARD. —— 1. *Halimeda* and carapace of male (NSMT–Cr. 5078). —— 2–6. Male (NSMT–Cr. 5079). Carapace, frontal region in abdominal view, first and third ambulatory legs, and left first pleopod in abdominal view, respectively. (Scale 1 mm)

in the formation of the rostral region. The lower surface of the rostrum is for its most part flattened, not compressed unlike the case of *H. proteus*, in which the rostrum is deep and sharply crested on the lower surface in both sexes, and the small area in front of the antennal fossae is sunken together with the epistomial region. It must be mentioned that the flattened rostrum of the species at hand is in reality obliquely truncated at the marginal part of the ventral surface, presenting the probable prototypic feature of the rostrum of *H. proteus*. On the other hand, the flattened rostrum is also seen in *Cyclonyx* MIERS which is monotypically represented by *C. frontalis* (WHITE) known only by a female in bad condition from an unknown locality. In this species, however, the rostrum is transversely oval in shape, and the eyes are situated in the narrow angle between the base of the rostrum and front of the carapace. In the species at hand, otherwise, the antennular fossae are shallow posteriorly and not distinctly delimited from the epistome. While this feature may be referred to the immaturity of the specimens, in *H. proteus* the antennular fossae are very distinct.

The genus *Huenia* as well as some related genera is well known by the peculiar feature that the formation of the carapace is different in both sexes. The similarity in both sexes of the species dealt with here is therefore noteworthy to be recorded, suggesting, together with the external features already mentioned, that this species may exceed, even if very close, the generic category of *Huenia*. In due time the estab-

lishment of the genus or at least subgenus may be justified for accomodation of this characteristic species. Besides the type-species, *H. proteus*, which is widely distributed in the Indo-West Pacific waters, the valid species from Australia, *H. bifurcata* STREET, was finely photographed by GRIFFIN (1966), while *H. platyrostrata* PILLAI from Travancore must be considered at present as a species of *Simocarcinus* MIERS due to the absence of the preocular tooth and the rostrum characteristic of the genus.

The carapace, chelipeds and ambulatory legs are uniformly light green. The similarity of the shape of the carapace as well as this color to *Halimeda* is, as figured in this paper and by BORRADAILE (*l.c.*) really surprising. In course of field collection the crab readily fell to the bottom and mimicked death when the alga was swinged in the water. In the aquarium, however, it is very difficult to detach the crab from the leaves without the aid of a pair of forceps, since the crab's holding by the ambulatory legs is, as usually seen in the majid crabs, unexpectedly tight itself and also the series of spinules on the dactyli may be of some use for this. During the observation in the aquarium the crab held on fast to the borders of leaf-like segments of the alga, being nearly in close contact with them and sometimes raising the carapace obliquely by straddling the ambulatory legs. The crab paused throughout there as it is, but only occasionally moved slowly straight or obliquely forward, or turned to the other direction at its resting place. Furthermore it was observed that the crabs was usually staying at the surface of the algal mass, but very rarely got in it from behind. During the observation the position and direction for the pause are not always constant, and this is probably true also in the field. Even if the relation of the crab to the alga may be generally considered as a typical case of the mimicry for protection, in considering the crab's behaviour it must be mentioned to be inappropriate to overestimate its adaptation.

In the Ryukyu Islands some species of *Halimeda* such as *H. opuntia* (LINNAEUS) [Saboten-gusa], *H. discoida* DECAISNE [Uchiwa-saboten-gusa], *H. macroloba* DECAISNE [Hiroha-saboten-gusa] and *H. incrassata* (ELLIS) [Mitsude-saboten-gusa] are rather commonly found. In his excellent monograph on *Halimeda*, HILLIS (1959) recorded *H. cylindracea* DECAISNE from the Ryukyu Islands, and otherwise *H. gracilis* HARVEY et J. AGARDH and *H. tuna* (ELLIS et SOLANDER) are also known reputedly. Some of the previous records may be attributed to misidentification due to the difficulty in the identification of them, *H. opuntia* representing the most confused case. HILLIS (*op. cit.*) reduced several formae to the synonyms of *H. opuntia opuntia* and made only *H. opuntia hederacea* BARTON valid. In the Ryukyu Islands *H. opuntia* is seemingly represented by two types with somewhat different habitat. The definite identification of them is too difficult for us, but it is highly probable that they are the two defined by the above author. The smaller type with much variable shape of the leaves may represent *H. opuntia* s.s., to which the crabs attached, and another one with larger and regular shape may be referable to *H. opuntia hederacea*. Around Kuroshima Island the latter is rather rare and almost restricted to the outside of patch reefs washed by the violent waves, while the former in question is also rarely found on the dead

coral at similar places, but mostly attaches to the lower dead part of the *Acropora* blocks growing in the lagoon. Both types are usually found at the depth of 1 to 10 m, mostly 1.5 to 5 m, below the average surface level. It is interesting to note that in spite of the extensive collection the crabs were never found on the *Halimeda* species living on the sandy bottom other than one of the forms of *H. opuntia*, to the leaves of which the shape of the carapace is surprisingly close.

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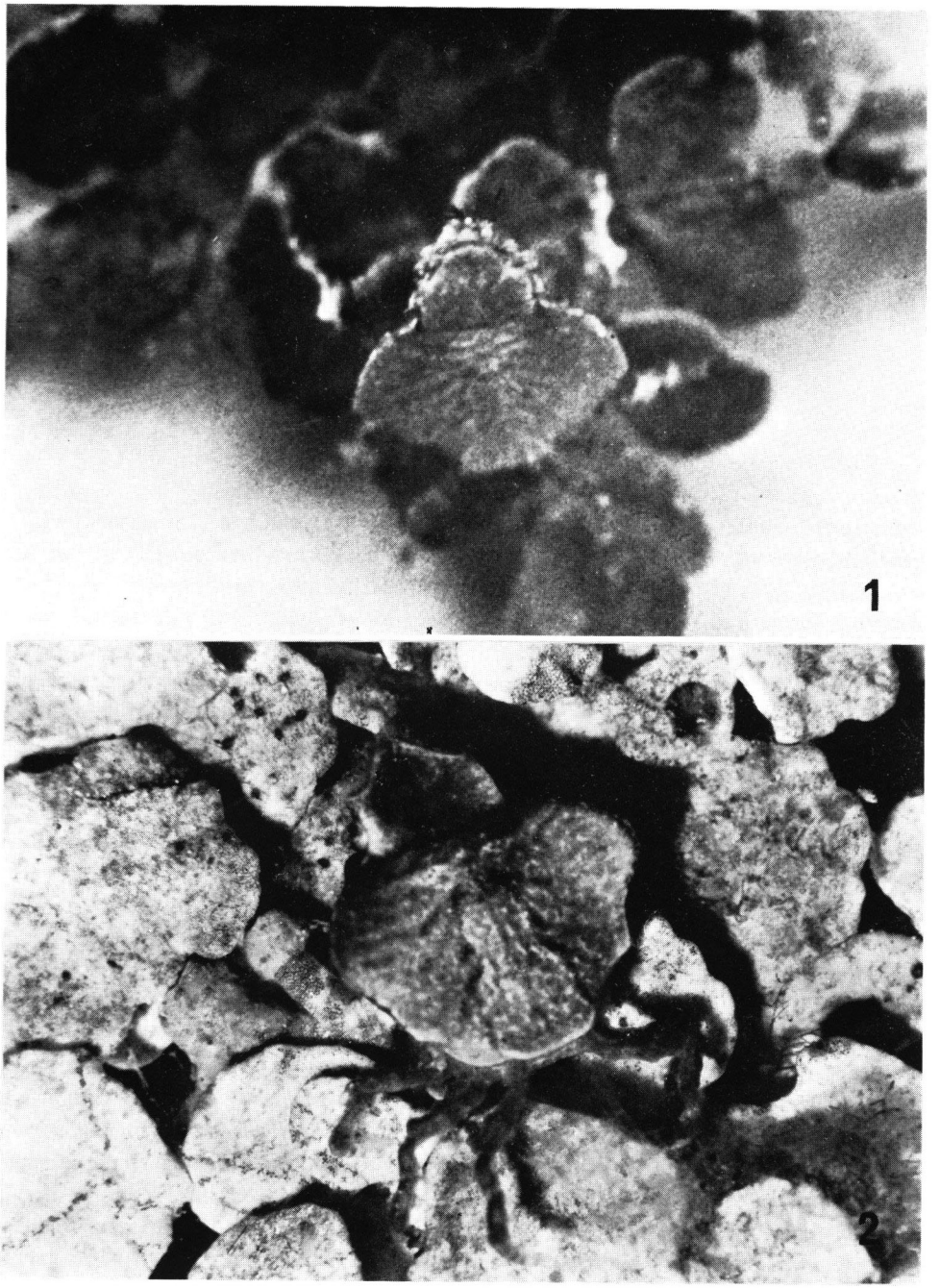
Explanation of Plate 1

Figs. 1–2. *Huenia brevifrons* WARD, staying at home of *Halimeda*. —— 1. Male (NSMT–Cr. 5078), with 5.8 mm in carapace width. —— 2. Male (NSMT–Cr. 5079), with 5.2 mm in carapace width.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