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ON THE *HETEROCARPUS* SHRIMPS (CRUSTACEA : DECAPODA : PANDALIDAE) FROM TAIWAN*

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Tin-Yam Chan and Hsiang-Ping Yu (1987). On the *Heterocarpus* shrimps (Crustacea : Decapoda : Pandalidae) from Taiwan. *Bull. Inst. Zool., Academia Sinica* **26**(1): 53-60. Four *Heterocarpus* shrimps are identified from the coastal deep-sea prawn fisheries at depth of 150-400 m off north-east and southern Taiwan. They are *H. gibbosus* Bate, 1888, *H. woodmasoni* Alcock, 1901, *H. ensifer parvispina* De Man 1917 and *H. sibogae* De Man 1917, the former three are new additions to the marine fauna list of Taiwan. *H. gibbosus* and *H. sibogae* have long been used as sea-food and with moderate price although their catches are not large nor stable. This report describes and illustrates these four Taiwanese *Heterocarpus* species. A key for their identification is provided. The morphological differences between the sexes in these species are also mentioned.

A survey on the Taiwanese decapod crustaceans supported by the National Science Council, R. O. C. has been started since 1984. The present paper reports the shrimps of the genus *Heterocarpus* of the family Pandalidae, as some of them are rather common and of moderate commercial value. Four *Heterocarpus* species have been identified, namely *H. gibbosus* Bate, 1888, *H. woodmasoni* Alcock, 1901, *H. ensifer parvispina* De Man 1917 and *Heterocarpus sibogae* De Man, 1917, the former three species are new additions to the marine fauna list of Taiwan. The local name of all these shrimps is the "Mother Shrimp", for always carrying eggs, or the "Big-Head Shrimp". *H. gibbosus* and *H. sibogae* are common by catches of coastal deep-sea prawn trawling and used as sea-food. The coloration of these four species is illustrated and a key is provides for their identification. The morphological differences between the sexes, which are mainly focus on the anterior three abdominal somites, are also mentioned.

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MATERIALS AND METHODS

All the specimens were obtained from local fish markets which are inside fishing harbours. They were caught by "baby" shrimp trawlers at 150–400 m depth on sandy and muddy bottoms off northeast and southern coasts of Taiwan. All are deposited at the Fisheries Department of National Taiwan College of Marine Science and Technology and with their specimen code number corresponding to its labeled species name and colllection date, eg. *Heterocarpus gibbosus* NTCMST 1983 02 03-01, *Heterocarpus gibbosus* NTCMST 1983 02 03-01, etc. The stated measurements are body lengths which were measured from the post-orbital margin to the posterior margin of the telson with the specimen fully stretched.

Key to the Taiwanese *Heterocarpus* species:

1. Strong spine(s) present at abdominal tergites.....2
   Strong spine absent at abdominal tergites .....*H. gibbosus*
2. Strong spine developed from mid-dorsum of abdominal tergite III..*H. woodmasoni*
   Overhanging spine developed from dorso-posterior of abdominal tergites III and IV 3
3. Dorsal carina nearly absent on abdominal tergites I and II; postero-median overhanging spine at abdominal tergite IV very short..... *H. ensifer parvispina*
   Dorsal carina well-developed on abdominal tergites I and II; postero-median overhanging spine at abdominal tergite IV nearly as long as that of III..... .....*H. sibogae*

SYSTEMATIC ACCOUNT

Heterocarpus gibbosus Bate, 1888

(Pl. 1 A, B, C)

Heterocarpus gibbosus Bate, 1888—Bate, 1888: 633. pl. 57-fig. 2; Alcock, 1901: 103; Kemp & Swell, 1912: 20; De Man, 1920: 135, pl. 14-fig. 40; Balss, 1925: 287, fig. 67; George & Rao, 1966: 331; Holthuis, 1980: 135; Miyake, 1982: 65, pl. 22-fig. 3.

Heterocarpus ? *gibbosus*—Wood-Mason & Alcock, 1892: 369, fig. 6. (?) (in part) (not) *Heterocarpus tricarinatus* Alcock & Anderson, 1894—Calman, 1939: 204.

Materials: 2 ♂♂, 2 ovigerous ♀♀, 1 ♀, 85–92 mm, 3 Feb 1983; 1 ♀, 88 mm, 14 Oct 1984; 2 ♂♂, 3 ovigerous ♀♀, 1, 65–99 mm, 16 Jun 1985; Ta-Chi, I-Lan County.

1 ♂, 40.5 mm, 20 Apr 1985; Su-Aou, I-Lan County.

2 ♂♂, 62 & 73 mm, 31 Oct 1985; 2 ♂♂, 1 ovigerous ♀, 2 ♀♀, 42–77 mm, 23 Mar 1985; Tong-Kang, Ping-Tong County.

Diagnosis: Rostrum with 3–5 dorsal teeth (one placed just above orbital margin) and 10–15 ventral teeth. Post-rostral carina slightly elevated and usually provided with 4–5 large teeth (five variety specimens with post-rostral carina elevated into high dorsal crest that bearing 6–7 large teeth, with 4–5 of them behind orbital margin whereas rest of rostrum with 4–6 dorsal teeth and 9–10 ventral teeth). Dactyli of posterior three pereiopods slender and about one-thirds to two-fifths (youngs) of propodi. Strong spines absent on abdominal tergites. Eggs numerous and spherical, about 0.7 mm in diameter.

Coloration: Eye black-brown. Dorsal surfaces orange-pink, ventral surfaces pink-red. Some specimens with deeper coloration. Pereiopods pink-red at proximal half but nearly white at distal half. Subdistal of meri at posterior three pereiopods with conspicuous red bands. Dactyli pink-red. Internal organs inside carapace visible as vermilion, yellow-white and somes also dark green. Teeth on dorsal crest of variety rather whitish. Eggs dark green.

Distribution: Indo-West-Pacific, depth about 200–1280 m: Eastern Africa, Arabian Sea, Indonesia, Taiwan, Philippines and Japan.

Remarks: 5 similar size specimens have an unusual high dorsal crest on the anterior

carapace whereas the post-rostral carina of all other specimens are only slightly elevated and no intermediate form has been found. Moreover, no other principle morphological difference is present between these two forms except the meri of the posterior three pereiopods in the variety are always more spinous. Dr. Chace kindly informed us that 354 of his *H. gibbosus* specimens of the *Albatross* materials from Philippines are with a series of elevation at the post-rostral carina. *H. gibbosus* close resembles *H. tricarinatus* (see Calman 1939 and De Man 1920) and the short dactyli *H. lepidus* (see De Man 1920). The *H. gibbosus* reported by Alcock (1901) and George & Rao (1966) are with very short dactyli (?=*H. lepidus*) and also seemed to be have a high dorsal crest. May be short dactyli is also a variety of *H. gibbosus*. A well-developed appendix masculina is always present at the endopod of the pleopod II in males. Moreover, Pairs of submedian projections are present at the abdominal sternites I to III except in ovigerous females; with the II pair strong, acute and curved inwards in males but weak and not curved in females (this difference is more distinct with specimens exceeded 65 mm but not well defined in the variety specimens). Furthermore, the rostrum in mature males is moderate upturned whereas in females and youngs it is remarkably upturned. *H. gibbosus* is common and always accompanied with the more numerous but usually smaller *H. sibogae*. The common form is caught at 200–400 m depth along north-east and southern coasts, whereas the high crest form is rather rare and only collected at 300–400 m depth off north-east Taiwan.

Heterocarpus woodmasoni Alcock, 1901

(Pl. I D)

Heterocarpus Wood-masoni Alcock, 1901—Alcock, 1901: 108, pl. 51-fig. 2; De Man, 1920: 156, pl. 13-fig. 36; Balss, 1925: 286.

Heterocarpus Wood-Masoni Calman, 1939: 204.

Heterocarpus woodmasoni—George & Rao, 1966: 331; Kensley, 1972: 50, fig. 23d (key and figure only); Holthuis, 1980: 137; Davis & Ward, 1984: fig. 6 (figure only).

Materials: 2 ♀♀, 62 & 64 mm, 31 Oct 1984; Tong-Kang, Ping-Tong County.

Diagnosis: Two well-developed longitudinal carinae, post-antennal (=post-antennular in De Man 1920), present along lateral carapace. Mid-dorsum of abdominal tergite III produced into strong hooked spine, directed posteriorly and sharp.

Coloration: Evenly-pink-red all over. Eyes brown-black and with minute golden reflections.

Distribution: Tropical Indo-West-Pacific, 291–640 m depth: Andaman Sea, Kei Islands, Arabian Sea, Eastern Africa, north-west Australia, Indonesia and Taiwan.

Remarks: With respect to the number of dorso-lateral spines present on the telson in this species; De Man (1920) stated as 4 pairs, Calman (1939) described as 2 pairs whereas George & Rao (1966) reported as 5 pairs. On the telson of our two specimens, one bears 4 pairs while the other bears 4 on the left but 5 on the right. Moreover, the telson also bears two distal movable spines and they are rather easily to shed off. Although this species is rather numerous in Madagascar and Australia (Holthuis 1980, Davis & Ward 1984), *H. woodmasoni* is rare in Taiwanese waters and only collected off southern Taiwan at about 300–400 m depth of sandy and muddy bottoms.

Heterocarpusensifer parvispina De Man, 1917

(Pl. II A, B)

(?) (not) *Heterocarpus ensifer* A. Milne-Edwards, 1881—Balss, 1914: 37; Yokoya, 1933: 20.

Heterocarpus ensifer A. M.-Edw. var. *parvispina* De Man, 1917—De Man, 1917: 282; De Man, 1920: 167, pl. 14-fig. 41.

(not) *H. ensifer* A. Milne-Edwards, 1881—Hayashi & Miyake, 1969: 74, fig. 6.

Plate I

A. *Heterocarpus gibbosus*, male 74 mm.
B. *Heterocarpus gibbosus*, ovigerous female 93 mm.
C. *Heterocarous gibbosus*, femlae 75 mm with high dorsal crest.
D. *Heterocarpus woodmasoni*, 64 mm female.

Plate II

A. *Heterocarpus ensifer parvispina*, male 79 mm.
B. *Heterocarpus ensifer parvispina*, ovigerous female 74 mm.
C. *Heterocarpus sibogae*, male 64 mm with red spot situated at branchio-cardiac region.
D. *Heterocarpus sibogae*, ovigerous female 96 mm with red spot situated at lateral of III abdominal somite.

Materials: 1 ♂, 2 ♀♀, 49–79 mm, 27 Mar 1985; 1 ♂, 2 ovigerous ♀♀, 81.5–90 mm, 8 May 1985; 3 ♂♂, 2 ovigerous ♀♀, 66–81 mm, 5 Aug 1985; Ta-Chi, I-Lan County.

1 ♀, 62 mm, 20 Apr 1985; Su-Aou, I-Lan County.

Diagnosis: Rostrum with 10–13 dorsal teeth and 5–9 (mostly 7–8) ventral teeth. Number of post-rostral teeth from 4 to 6, with first tooth rather small and always placed anterior to middle of post-rostral carina. Dorso-median areas of abdominal tergites I and II only rudimentary elevated. Mid-dorsum of abdominal tergites III and IV carinate (but also not highly elevated) and produced into overhanging spine posteriorly, with that of IV very short; about one-third (youngs) to one-fourth (adults) of that of III and not attained one-fourth of following somite when abdomen fully stretched. Eggs numerous and spherical, about 0.4–0.5 mm in diameter.

Coloration: Body color rather constant; somewhat transparent and stained with orange-pink. Pereiopods, pleopods and ventro-lateral surfaces deeper in color. Mouth parts pink-red. Lateral surfaces of abdomen with transparent yellow-green patches. Yellowish spots present at hinges between abdominal somites. Internal organs inside carapace visible as vermilion, yellow-white and sometimes also dark green or dark blue. Large red spots present at branchio-cardiac region, sometimes very prominent. Eyes black-brown and with golden reflections. Eggs dark green and becoming brown when eye spot present.

Distribution: Indian Archipelago, eastern Indian Ocean, Taiwan and ? Japan (see Remarks); about 150–521 m depth.

Remarks: The present subspecies differs from the typical form in having the postero-median overhanging spine at the abdominal tergite IV very short (about half as long as that of the III in the typical form as illustrated by Rathbun 1906 and Figueira 1957). The distribution of *H. ensifer* in Indo-West-Pacific is questionable, Crosnier & Forest (1973) and Holthuis (1980) proposed that specimens identified as *H. ensifer* from this region before should be referred to different forms. The specimens of Bate (1888), Alcock (1901) and the illustration of Miyake (1982) were actually *H. sibogae*, while the identity of the specimens of Balss (1914) and Yokoya (1933) from Japan are not sure but they are properly belonged to *H. sibogae*, too. The *H. ensifer* reported from eastern Indian Ocean by Hayashi & Miyake (1969) are with the postero-median overhanging spine at the abdominal tergite IV very short and therefore it should be assigned to the species. The sexing of the present species is similar to *H. sibogae*. *H. ensifer parvispina* is usually associated with *H. sibogae* but is uncommon and only collected off north-east coast at about 150–250 m depth on sand and muddy bottoms.

Heterocarpus sibogae De Man, 1917

(Pl. II C, D)

(not) *Heterocarpus ensifer* A. Milne-Edwards, 1881—Bate, 1888: 638, pl. 12-fig. 4; Alcock, 1901: 107; Miyake, 1982: 65, pl. 22-fig. 2.

(not) *Heterocarpus carinatus* (Smith, 1882)—Wood-Mason & Alcock, 1892: 369.

(?) (not) *Heterocarpus ensifer* A. Milne-Enwards, 1881—Balss, 1914: 37; Yokoya, 1933: 20.

Heterocarpus Sibogae De Man, 1917—De Man, 1917: 283; De Man, 1920: 169. pl. 14-fig. 42; Calman, 1939: 204.

Heterocarpus sibogae—Balss, 1925: 286; Chang, 1965: 16, fig. 26; Hanamura, 1979: 176; Holthuis, 1980: 136; Miyake, 1982: 165, pl. 22-fig. 4; Davis & Ward, 1984: fig. 6 (figure only).

Materials: 6 ♂♂, 8 ovigerous ♀♀, 2 ♀♀, 62–100 mm, 3 Feb 1983; 2 ♂♂, 4 ovigerous ♀♀, 74–102 mm, 10 Jan 1984; 1 ♂, 7 ovigerous ♀♀, 64–100 mm, 8 May 1985; 2 ovigerous ♀♀, 1 ♀, 65–74 mm, 16 Jun 1985; Ta-Chi, I-Lan County.

17 ♂♂, 1 ovigerous ♀, 16 ♀♀, 40–86 mm, 20 Apr 1985; Su-Aou, I-Lan County.

2 ♂♂, ovigerous ♀, 76.5–86 mm, 31 Oct 1984; Tong-Kang, Ping-Tong County.

Diagnosis: Close resembled *H. ensifer parvispina* but different in: First post-rostral tooth generally but not always placed behind middle of post-rostral carina. Number of ventral teeth up to 11. Mid-dorsum of abdominal tergites I and II with high and sharp dorsal carina, especially elevated at II. Dorsal carina at abdominal tergites III and IV well-marked and produced into long overhanging spine posteriorly, with that of IV slightly shorter than that of III and usually extending to middle of following somite (sometimes even reaching somite VI) when abdomen fully stretched. Eggs numerous and spherical, about 0.4–0.6 mm in diameter.

Coloration: Usually similar to *H. ensifer parvispina* but with variation in position of lateral red spot, which either occupied branchio-cardiac region or lateral surfaces of abdominal somite III (later more common in ovigerous females). Subapecial region of rostrum sometimes reddish. Ovigerous females with three different color patterns: 1) body almost white; 2) body color as usual, i. e. orange-pink; 3) body color deep, near to red. Eggs pale green to beatiful blue (more common) and such color usually also visible inside carapace.

Distribution: Indo-West-Pacific, depth 150–560 m: Maldives, Indonesia, north-west Australia, Taiwan, Philippines and Japan.

Remarks: Several specimens also with a deformed rostrum as reported by De Man (1920). *H. sibogae* is always confused with *H. ensifer* although *H. sibogae* is with marked dorsal carina at the abdominal tergites I and II and further separated from *H. ensifer parvispina* by the postero-median overhanging spine at the abdominal tergite IV is very long. Besides bearing a well-developed appendix masculina at the endopod of the pleopod II, the pair of submedian projections at the abdominal sternite I is well-developed and curved inwards in males (more apparent with the increase of size) whereas this pair is rather weak in females (nearly absent when exceeded 60 mm). Furthermore, in slight degree the sex can also be judged from the outline of the ventral margins of the anterior three abdominal pleura as in *Oplophorus* species (Chace 1940, 1947, Hayashi & Miyake 1969, Chan & Yu in press). *H. sibogae* has been used as a sea-food in Taiwan for at least 20 years (Chang 1965). As in N. W. Australia (Davis & Ward 1984), *H. sibogae* is a usual by-catch of the deep-sea penaeoid prawn and *Metanephrops* lobsters trawling along the north-east and southern coasts. The occurrence of the present species is from 150–400 m depth but usually at 150–250 m depth but usually at 150–250 m depth. The largest specimen observed was an ovigerous females of about 130 mm body length, and some specimens were found with bopyrid parasite in the branchial chamber. This species is not as welcome as *H. gibbosus* in the market for its spinous outline and the hard integument, and therefore has a lower price than *H. gibbosus*.

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臺灣近海產長額蝦科異腕蝦屬蝦類之研究

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本報告報導四種屬於長額蝦科 (Pandalidae) 異腕蝦屬 (*Heterocarpus*) 之蝦類。分別爲；隆額異腕蝦 *H. gibbosus* Bate, 1888，鈎棘異腕蝦 *H. woodmasoni* Alcock, 1901，細刺異腕蝦 *H. ensifer parvispine* De Man, 1917，東方異腕蝦 *H. sibogae* De Man, 1917。此四種蝦均爲近海蝦拖網漁船常見之蝦類，體長在 7～10 公分之間。雖然，產量不多，却經常混獲於 150～400 公尺水深之蝦拖網漁獲物中，頗具經濟價值。上述四種中，*H. sibogae* 曾爲張 (1965) 報告外，其餘三種則未曾報導。

本文除討論此四種蝦之外部形態、雌雄性徵及體色等特徵外，並附檢索表供爲查定種之依據。