Taxonomic studies on the crabs of the Nagai Collection preserved in the Wakayama Prefectural Museum of Natural History IV. Six rare species of the family Parthenopidae

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Abstract

Six species of the family Parthenopidae from the Nagai Collection in the Wakayama Prefectural Museum of Natural History are recorded, with diagnoses, taxonomic comments and photographs. Those species are *Daldorfia leprosa* (Nobili, 1905), *Aulacolambrus hystricosus* Tan & Ng, 2003, *Cryptopodia contracta* Stimpson, 1857, *Furtipodia petrosa* (Klunzinger, 1906), *Garthambrus lacunosus* (Rathbun, 1906) and *Rhinolambrus lamelliger* (White, 1847). Of them, the latter five species are officially recorded from Japanese waters for the first time.

Keywords：Crabs, Brachyura, Parthenopidae, Nagai Collection in the Wakayama Prefectural Museum of Natural History, West Pacific, Japanese carcinological fauna.

和歌山県立自然博物館所蔵のカニ類標本（永井コレクション）の分類学的研究．IV．ヒシガニ科の６稀種

摘要

和歌山県立自然博物館所蔵のカニ類標本（永井コレクション）の分類学的研究の第４報として、下記のヒシガニ科６種を記録した。ヒメカルイシガニ*Daldorfia leprosa*（Nobili, 1905）；コオキナガニ（新称）*Aulacolambrus hystricosus* Tan & Ng, 2003；サンカクカワリヒシガニ*Cryptopodia contracta* Stimpson, 1857；ツバサカワリヒシガニ（新称）*Furtipodia petrosa*（Klunzinger, 1906）；アバタハナヒシガニ*Garthambrus lacunosus*（Rathbun, 1906）；ツノダシヒシガニモドキ*Rhinolambrus lamelliger*（White, 1847）。これらはMarumura & Kosaka（2003）[1] により永井コレクションの標本目録に学名と和名、標本の記録のみが記されているが、本報文で学名の変更と誤同定の修正を行い、ヒメカルイシガニ以外の５種を正式に日本新記録種とした。

Introduction

The late Mr. Seiji Nagai donated a large collection of crab specimens to the Wakayama Prefectural Museum of Natural History, the list of which was published by Marumura and Kosaka (2003)[1]. Then, this so-called Nagai Collection has been taxonomically studied by Marumura and Takeda (2004, 2009, 2012, 2015)[2–5], and Takeda & Marumura (2010, 2014)[6, 7], with some notes on the rare species and descriptions of the new species. Most of the specimens were dry and preserved in compact plastic cases, but at present some were softened and transferred in glass vials with 70% ethanol for better preservation.

In this paper, the fourth of serial studies by Marumura and Takeda on the Nagai Collection, six species of the family Parthenopidae were taxonomically studied, and five of them were officially recorded as new to the carcinological fauna of Japan. The specimens are preserved in the Wakayama Prefectural Museum of Natural History (WMNH), Wakayama, Japan. In the following records of the species, the breadth and length of the carapace are abbreviated as cb and cl, respectively.

Taxonomic Records of the Species

Family PARTHENOPIDAE MacLeay, 1838
Genus ***Daldorfia*** Rathbun, 1904
Daldorfia leprosa (Nobili, 1905)
[Japanese name: Hime–karuishigani]
(Figs. 1A, B)

Lambrus (*Thyrolambrus*) *leprosus* Nobili, 1905[8]: 399. — 1906[9]: 179, pl. 9 fig. 7.
Parthenope acuta Klunzinger, 1906[10]: 55, pl. 2 fig. 10.
Daldorfia acuta, Chen and Xu, 1991[11]: 79, fig. 24.
Parthenope semicircularis Flipse, 1930[12]: 58, 60, fig.

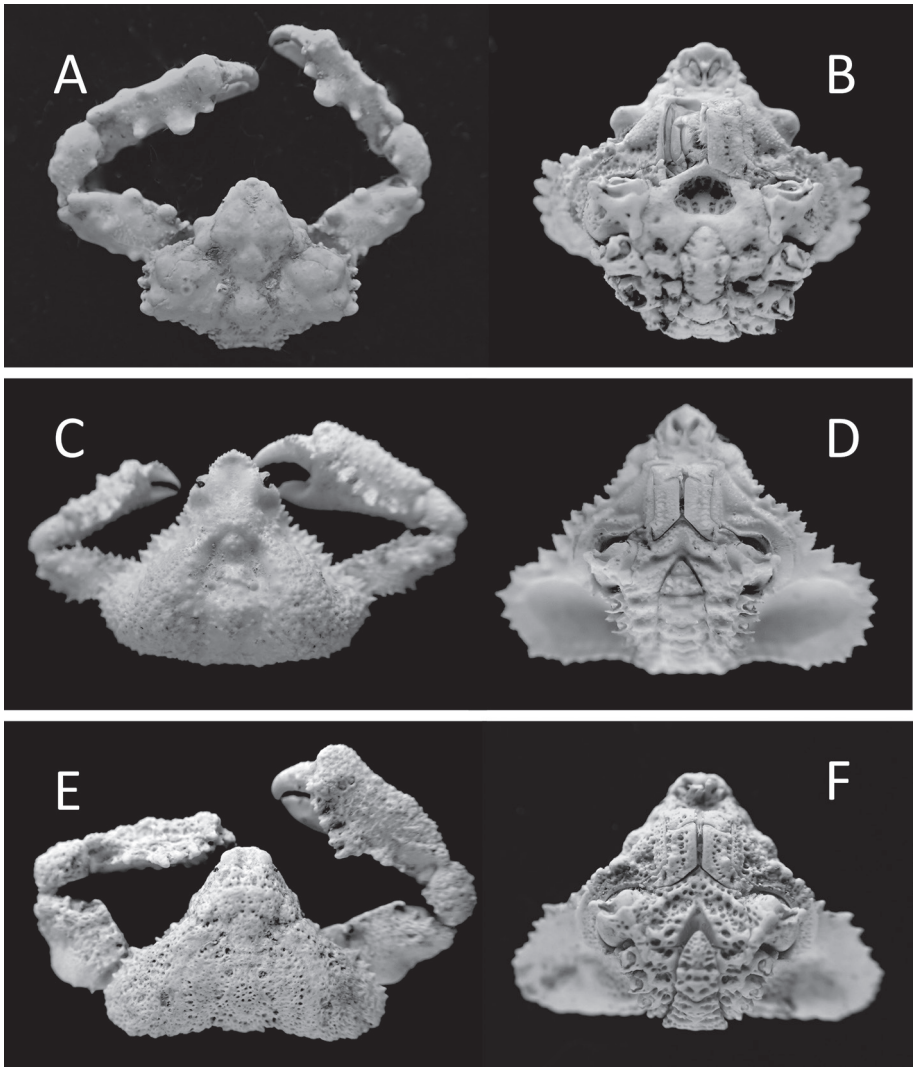

Fig. 1. A, B: *Daldorfia leprosa* (Nobili, 1905). Male (22.7 mm in carapace breadth, 16.2 mm in carapace length), WMNH–Na–Cr 462, off Kushimoto, Kii Penin., 10–15 m deep. C, D: *Cryptopodia contracta* Stimpson, 1857. Male (19.8 mm in carapace breadth, 14.6 mm in carapace length), WMNH–Na–Cr 468, south of Oshima Psssage, Amami–oshima I., Ryukyu Is., 200 m deep. E, F: *Furtipodia petrosa* (Klunzinger, 1906). Male (21.5 mm in carapace breadth, 13.8 mm in carapace length), WMNH–Na–Cr 469, Kuroshima I., Ryukyu Is., intertidal zone.

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Daldorfia semicircularis, Buitendijk, 1939[13]: 266. — Sakai, 1976[14]: 285, fig. 159. — Marumura and Kosaka, 2003[1]: 38.

Daldorfia sp., Marumura and Kosaka, 2003[1]: 38.

Daldorfia leprosa, Tan and Ng, 2007[15]: 146, figs. 18, 19.

Material examined. Off Kamiura, Kushimoto, Wakayama Pref., 10–15 m deep, 1980, 1 ♂ (cb 22.7 mm, cl 16.2 mm), WMNH–Na–Cr 462, recorded as *Daldorfia semicircularis* (Flipse) by Marumura and Kosaka (2003)[1]; Same locality, 70 m deep, 1979, 1 ♂ (cb 23.2 mm, cl 17.6 mm), WMNH–Na–Cr 463, recorded as *Daldorfia* sp. by Marumura and Kosaka (2003)[1].

Diagnosis. Carapace subpentagonal in outline; main part including metagastric, cardiac and branchial regions transversely rectangular, anterior part including protogastric, hepatic and frontal regions subtriangular as a whole, protruded forward; dorsal surface of carapace uneven, with knobbed gastric, cardiac and branchial regions separated by deep furrows; lateral margin of branchial region longitudinal, distinctly cut into five more or less serrate obtuse teeth.

Both chelipeds heavy, long, with thickened margins of meri and palms; each merus with two tu-

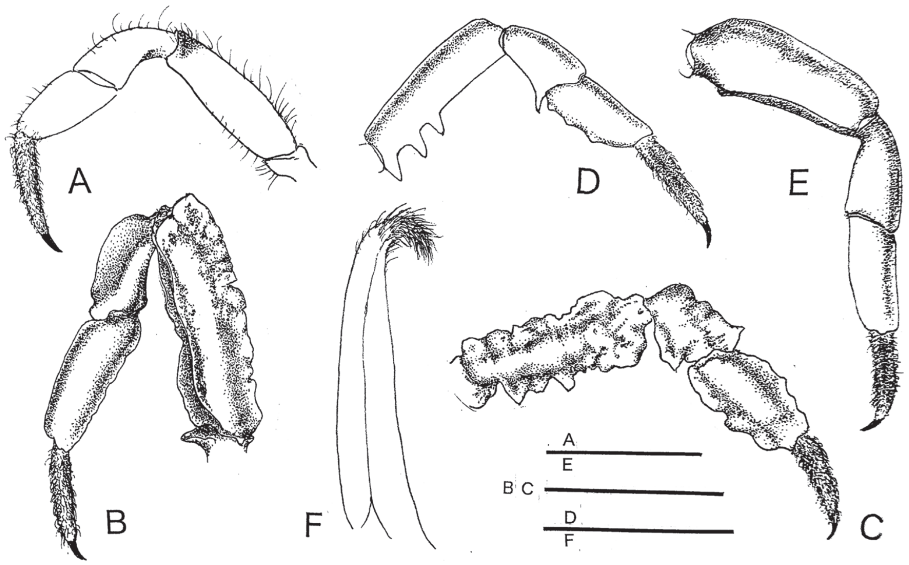

Fig. 2. A, F: *Aulacolambrus hystricosus* Tan & Ng, 2003. Male (7.3 mm in carapace breadth, 6.6 mm in carapace length), WMNH–Na–Cr 563. Anterior ambulatory leg in dorsal view (A), and left first male gonopod in ventral view (F). B, C: *Garthambrus lacunosus* (Rathbun, 1906). Ovigerous female (24.7 mm in carapace breadth, 18.2 mm in carapace length), WMNH–Na–Cr 432. Anterior and last ambulatory legs in dorsal view. D: *Cryptopodia contracta* Stimpson, 1857. Male (19.8 mm in carapace breadth, 14.6 mm in carapace length), WMNH–Na–Cr 468. Anterior ambulatory leg in dorsal view. E: *Furtipodia petrosa* (Klunzinger, 1906). Male (21.5 mm in carapace breadth, 13.8 mm in carapace length), WMNH–Na–Cr 469. Anterior ambulatory leg in dorsal view. [Scales] A = 2 mm; B C = 6 mm; D = 4 mm; E = 1 mm; F = 1 mm

bercles of good size at inner margin, each carpus with one tubercle at inner margin; palm rather compressed, with irregularly tuberculate on thick upper margin; three prominent tubercles arranged in a longitudinal line along whole length of inner surface of palm, weakly depressed, rounded at tip, median one remarkably larger than others. Inner margin of cheliped merus armed with a row of four or five large teeth continuous with adjacent teeth at bases. Ambulatory meri armed each with a rounded smooth tooth at distal part of upper margin.

Remarks. Tan and Ng (2007)[15], who examined the type specimens of *Dardorfia semicircularis*, synonymized *D. semicicularis* with *D. leprosa*[8]. *Daldorfia leprosa* superficially resembles *D. dimorpha* Tan & Ng, 2007 because of the similarly-shaped carapace and the presence of a dorsal hepatic ridge. In male and female of *D. leprosa*, the inner margin of each cheliped merus has a row of four or five relatively large teeth, which are slightly flattened and the bases of which are continuous with adjacent teeth. This particular arrangement can be found only in females of *D. dimorpha* but not in males.

According to Tan and Ng (2007)[15], the most useful features to distinguish *D. leprosa* from *D. dimorpha* are the spade-shaped meral teeth on the upper margins of the ambulatory legs, and the short and stubby meral teeth on the last leg. In *D. dimorpha*, the meral teeth are either r– or T–shaped. Most importantly, the distalmost ambulatory meral tooth in *D. leprosa* is rounded and smooth, but is a recurved r–shape in *D. dimorpha*. Considering such distinguishing characters, two male specimens at hand, which agree well with the photograph of *D. semicircularis* given by Sakai (1976)[14] in the general outline and dorsal sculpture of the carapace and the armature of the chelipeds and ambulatory legs, are certainly identified as *D. leprosa*.

Distribution. Widely distributed in the Indo–West Pacific from the Red Sea and the Aldabra Islands in the western Indian Ocean eastward to the Tuamotu Archipelago and the Society Islands in the South Pacific, and then northward to Japan through Indonesia, Guam and the Nansha Islands in the West Pacific. In Japan, this species has been

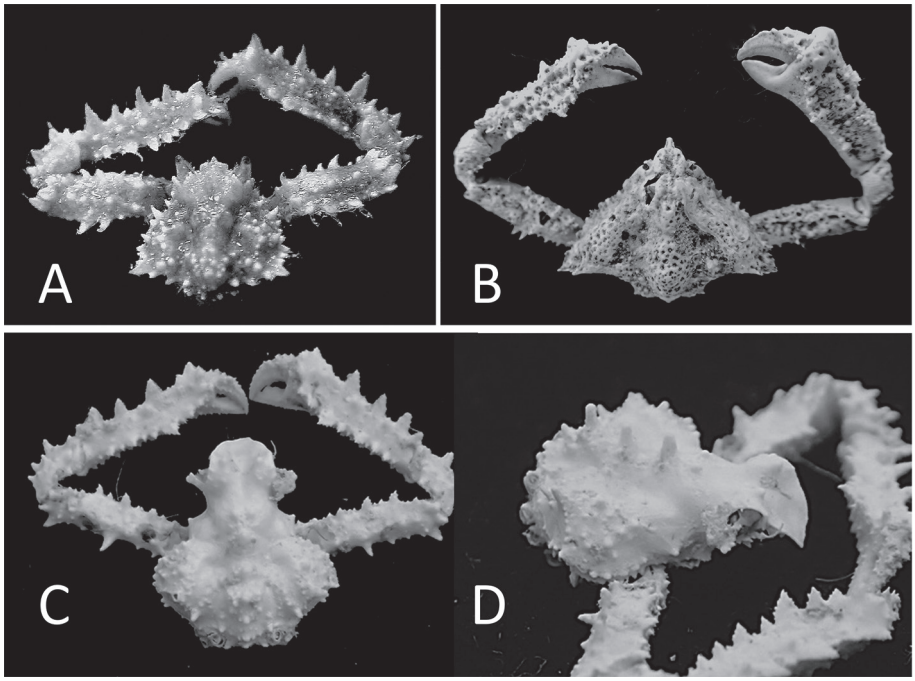

Fig. 3. A: *Aulacolambrus hystricosus* Tan & Ng, 2003. Male (7.3 mm in carapace breadth, 6.6 mm in carapace length), WMNH–Na–Cr 563, Kuroshima I., Ryukyu Is., lower tidal zone. B: *Garthambrus lacunosus* (Rathbun, 1906). Ovigerous female (24.7 mm in carapace breadth, 18.2 mm in carapace length), WMNH–Na–Cr 432, off Ogasawara Is., 250 m deep, coral fishing net. C, D: *Rhinolambrus lamelliger* (White, 1847). Male (15.3 mm in carapace breadth, 11.6 mm in carapace length), WMNH–Na–Cr 437, off Shionomisaki, Kii Penin., 70 m deep.

known as *Dardorfia semicircularis* (Flipse).

Genus ***Aulacolambrus*** Paul'son, 1875
Aulacolambrus hystricosus Tan & Ng, 2003
[New Japanese name: Ko–okinagani]
(Figs. 2A, F, 3A)

Aulacolambrus hystricosus Tan and Ng, 2003[16]: 389, figs. 1b, 2.
Aulacolambrus sp., Marumura and Kosaka, 2003[1]: 38.

Material examined. Nakamoto, Kuroshima I., Ryukyu Is., lower tidal zone, 1993, 1 ♂ (cb 7.3 mm, cl 6.6 mm), WMNH–Na–Cr 456, recorded as *Aulacolambrus* sp. by Marumura and Kosaka (2003)[1].

Diagnosis. Small species, with less than 1 cm in carapace width. Carapace subtriangular, slightly wider than long; last epibranchial tooth acute, but not tuberculate; protogastric, cardiac and intestinal regions convex dorsally, confluent with each other, covered with tubercles of good size; branchial region isolated from other regions by surrounding deep depressions, with tubercles. Supraorbital region raised, separated from protogastric region by wide gastro–orbital groove. Front projected forward, subtruncated, with a median triangular tooth. Anterolateral margin of carapace weakly convex outward, armed with several, obtuse tubercles of irregular size, separated into two parts, anterior one third, or hepatic margin and posterior two thirds, or branchial margin; a tubercle at anterior end of branchial margin slightly larger than others, and subequal to or slightly narrower than lateral tubercle at posterior end of branchial margin; posterolateral margin nearly transverse, weakly concave, armed with two tubercles; posterior margin of carapace convex, armed with prominent tubercle at each side and four small equidistant tubercles.

Chelipeds long, with thick margins fringed with strong, well-spaced sharp teeth of irregular sizes; merus with two large and some anteriorly curved teeth on inner margin, two large spiniform teeth on median part of posterior margin, a line of several small teeth on upper surface; palm triangular in

cross-section; outer margin lined with some depressed teeth alternating in size; upper margin rather crested, serrated with flattened teeth of different sizes. Ambulatory legs slender, with margins entire.

Remarks. The specimen at hand agrees in general with the original description and figures by Tan and Ng (2003)[16] in the shape, areolation and armature of the carapace, but the marginal teeth of the chelipeds are well-spaced in the specimen at hand, but close-set in the holotype specimen from Guam. The teeth of the cheliped margins appear more prominent in the holotype, though the numbers are not much different in both specimens.

This species is unexpectedly close to *Certolambrus pugilator*[17], the monotypic representative of the genus *Certolambrus* Tan & Ng, 2003[16] in the size and general formation of the carapace. In *C. pugilator*, however, the hepatic, anterolateral and posterolateral margins of the carapace are prominently and regularly armed with triangular teeth of subequal sizes. Tan & Ng (2003)[16] recorded *C. pugilator* from Japan (Kume–jima I.), Guam, Singapore, Western Samoa and New Caledonia, and Maenosono (2016)[18] reported this species from Okinawa–jima Island. It is interesting that in both of Guam and the Ryukyu Islands, two small parthenopid crabs of seemingly close, but generically different species are found on and in sand at the tidal or subtidal zone.

Distribution. Originally reported on a male (3.0 by 3.1 mm) and two females (4.7 by 4.1 mm; 6.1 by 4.9 mm) from Guam, on and in sand, 0.6–10 m deep.

Genus ***Cryptopodia*** H. Milne Edwards, 1834
Cryptopodia contracta Stimpson, 1857
[Japanese name: Sankaku–kawarihishigani]
(Figs. 1C, D, 2D)

Cryptopodia contracta Stimpson, 1857[19]: 220. — 1907[20]: 30, pl. 4 fig. 6.
Heterocrypta investigatoris Alcock, 1895[21]: 284. — Alcock and Anderson, 1896[22]: pl. 23 fig. 3. — Monod, 1938[23]: 108, fig. 6. — Shen *et al.,* 1982[24]: 144, figs. 3–7, pl. 2 fig. 10. — Dai *et al.,* 1986[25]: 161, fig. 93, pl. 22 fig. 2. — Chen and Xu, 1991[11]: 84, fig. 28. — Dai and Yang, 1991[26]: 178, fig. 93, pl. 22 fig. 2.
Heterocrypta bivallata Flipse, 1930[12]: 69, fig. 43. — Marumura and Kosaka, 2003[1]: 38.

Material examined. South of Oshima Psssage, Amami–oshima I., Ryukyu Is., 200 m deep, 1 ♂ (cb 19.8 mm, cl 14.6 mm), WMNH–Na–Cr 468, May 30, 1989, recorded as *Heterocrypta bivallata* Flipse by Marumura and Kosaka (2003)[1].

Diagnosis. Carapace rounded triangular in outline, with dorsally convex gastric and branchial regions; no strong tubercles, but wholly covered with conical granules; protogastric region completely confluent with inner part of branchial region; median gastric region distinguished as a low prominence in a prominent depression like crater between protogastric regions of both sides; cardiac region continuous anteriorly with median gastric prominence and posteriorly with intestinal region. Front broad, triangular in shape, depressed dorsally, smooth. Anterolateral margin of carapace in front of branchial margin sharply separated with triangular teeth; hepatic margin continuous with external orbital angle, serrated from anterior branchial margin by a narrow U–shaped notch; branchial posterolateral margin weakly retreats to posterior margin, with small sharp tubercles; branchial posterior margin and intestinal posterior margin almost transverse, shallowly concave close to weakly angulated lateral ends of intestinal region.

Chelipeds short, heavy, distinctly different in size; both of anterior and posterior margins of merus armed with sharp laciniate teeth of various sizes; upper margin of palm rather sharp, with some prominent teeth; in smaller chela, outer upper margin of palm armed with a prominent conical tooth at median part, while in larger chela, palm inflated, without strong teeth. Ambulatory legs comparatively long, with three high equidistant, subtruncated teeth along basal half of inner margin of each merus; the posterior distal end of carpus with a spiniform tooth, propodus with three protuberances on posterior margin.

Remarks. Tan and Ng (2003)[16], who examined the holotype of *Cryptopodia bivallata* Flipse from

Indonesia, the photographs of *Heterocrypta ivestigatoris* Alcock from India, some specimens referable to *C. contracta* Stimpson from the South China Sea, and the specimens from some localities in the Indian Ocean, concluded that these three species are without doubt synonymous to each other and *C. contracta* has the priority over the other two species.

Distribution. Widely distributed in the Indo–West Pacific from Japan (Amami–oshima I.) through the South China Sea (ca 23° N of the equator, Nansha Is. and Gulf of Tongking) to the Indian Ocean (India, Gulf of Aden, Kenya, Mozambique). In Japan, the specimen from Amami–oshima in the Nagai Collection has been recorded, without comments, as *Heterocrypta bivallata* by Marumura and Kosaka (2003)[1].

Genus ***Furtipodia*** Tan & Ng, 2003

Furtipodia petrosa (Klunzinger, 1906)

[New Japanese name: Tsubasa–kawarihishigani]

(Figs. 1E, F, 2E)

Heterocrypta petrosa Klunzinger, 1906[10]: 53, pl. 2 fig. 9. — Lenz, 1910[27]: 543.

Furtipodia petrosa, Tan and Ng, 2003[16]: 403, figs. 4b, 5c, d.

Heterocrypta sp., Marumura and Kosaka, 2003[1]: 38.

Material examined. Kuroshima I., Ryukyu Is., intertidal zone, June 1980, 1 ♂ (cb 21.5 mm, cl 13.8 mm), WMNH–Na–Cr 469, recorded as *Heterocrypta* sp. by Marumura and Kosaka (2003)[1].

Diagnosis. Carapace much broader than long, with 1.56 in ratio of breadth to length, but seemingly triangular, with rounded corners; dorsal surface not at all tuberculate, but eroded with small pits and depressions of variable shape and size; gastric region and branchial regions convex dorsally, similar in height; cardiac region distinct, lower than gastric and branchial regions, being separated anteriorly from gastric region by a transverse wide depression and laterally by longitudinal narrow depression from each branchial region. Front obtuse in dorsal view, but perpendicularly deflexed downward, sharply pointed at tip. Hepatic margin of carapace obtusely developed. Marginal part of anterior half of branchial margin, together with dorsal part of hepatic margin, truncated laterally, roughened with some small tubercles of irregular size and shape; posterior half of branchial margin somewhat wing–like; some small, marginal tubercles directed laterally, becoming smaller posteriorly; branchial posterior margin and posterior margin of intestinal region nearly transverse, forming posterior margin of carapace.

Chelipeds short, heavy, different in size; outer margin of merus crested for whole length; inner upper margin of merus roughened with some irregular tubercles, with distal part excavated to receive carpus when folded; outer half of upper margin of palm sharply crested, with some eroded tall tubercles; outer and outer upper surfaces of palm roughened with small pits and depressions, but not tuberculate; in larger chela, palm widening distally, with stout short fingers. Ambulatory legs thin, without tubercles.

Remarks. Another representative of *Furtipodia*, *F. gemma* Tan & Ng, 2003 from Guam and Hawaii is, as fully illustrated and described by Tan and Ng (2003)[16], readily distinguished from *F. petrosa* recorded in this paper. In *F. petrosa*, the surface of the carapace is generally smooth, without prominent tubercles on the protogastric and branchial regions of the carapace.

Distribution. The records of occurrence are few, but the known localities are within the wide distributional range from the Pacific Ocean (Hawaii, Guam, New Caledonia and Australia) to the Indian Ocean (Sri Lanka, Yemen, Red Sea, Sokotra I. and Seychelles).

Genus ***Garthambrus*** Ng, 1996

Garthambrus lacunosus (Rathbun, 1906)

[Japanese name: Abata–hanahishigani]

(Figs. 2B, C, 3B)

Parthenope (Platylambrus) stellata lacunosa Rathbun, 1906[28]: 884, pl. 15 fig. 7. — Garth, 1993[29]: 788.

Parthenope lacunosa, Garth and Davie, 1995[30]: 226, fig. 3A.

Garthambrus lacunosa, Ng, 1996[31]: 156, 158. — Ng

and Tan, 1999[32]: 122, 126, figs. 2A, B, 3A–C, 6D–F.
Garthambrus stellata Marumura and Kosaka, 2003[1]: 38.
Garthambrus lacunosus, McLay and Tan, 2009[33]: 16, figs. 6C, D, 12A, B.

Material examined. Off Ogasawara Is., 250 m deep, coral fishing net, 1 ovig. ♀ (cb 24.7 mm, cl including rostrum 18.2 mm), WMNH–Na–Cr 432, recorded as *G. stellata* (Rathbun) by Marumura and Kosaka (2003)[1].

Diagnosis. Carapace roughly triangular in dorsal view, with strongly convex gastric, cardiac and branchial regions; surface roughened with many small, irregular depressions and pits; median gastric and cardiac regions weakly tuberculate at tips, but not sharp. Front produced forward, with inflated sides and depressed dorsal median part; distal proboscis narrow, protruded forward, weakly curved dorsally. Posterior extension of external orbital angle short, smooth, nearly confluent with hepatic margin; anterolateral margin of carapace fringed with about ten serrated teeth; epibranchial tooth sharp; posterolateral margin nearly transverse, with an angle to epibranchial tooth; a tooth close to epibranchial tooth as an extension of anterolateral marginal fringe of teeth; posterior margin of carapace, with an obtuse tubercle at each lateral end and an callus on median part.

In the ovigerous female examined, both chelipeds subequal to each other in length, but right palm and chela stronger; surfaces rough, eroded, with somewhat reticulated depressions of various size; merus with several small tubercles on anterior margin, some laciniate teeth on basal half of posterior margin, with a sharp tubercle at middle of upper surface close to posterior margin; larger palm widened gradually to bases of fingers; in both fingers, lower surface smooth, upper surface heavily roughened, reticulated, with a low of several tubercles to base of movable finger; outer margin of upper surface nearly unarmed in larger chela, but with some distant tubercles of different size in smaller chela; in larger chela, immovable finger curved, leaving a space between both fingers. Ambulatory legs stout, anterior margin and posterior upper and lower margins of each merus, and both anterior and posterior margins of each carpus and propodus distinctly crested; margins weakly waved or irregularly and obtusely dentate.

Remarks. Marumura and Kosaka (2003)[1] recorded the Ogasawaran specimen examined in this study as *Garthambrus stellatus*, without comment, and provided with a new Japanese name. The specimen is here reidentified as *G. lacunosus*.

Ng (1996)[31] placed nine species in the genus *Garthambrus* Ng, 1996. Later, McLay and Tan (2009)[33] fully revised the genus and recognized 11 nominal species; 1) two new species were described, 2) *Lambrus (Parthenopoides) pteromerus* Ortmann which has been known as the *Tutankahmen* species after Sakai (1938)[34] was transferred to *Garthambrus*, and 3) *Asterolambrus mironovi* Zarenkov became monotypic representative of their new genus *Hispidolambrus*. Some variations of *G. lacunosus* have been mentioned by Ng and Tan (1999)[32], and as mentioned by McLay and Tan (2009)[33], this species is somewhat similar to *G. poupini*[29], *G. allisoni*[29] and *G. cidaris*[30] in the general shape of the carapace. *Garthambrus lacunosus* has, however, the reticulated, not tuberculate, dorsal surface of the carapace, and the deeply and heavily engraved chelipeds with reticulation, and the strongly crested, not tuberculate, anterior and posterior margins of the ambulatory legs.

Distribution. This species is known from the Hawaiian Islands (west coast of Hawaii I., south coast of Molokai I., between Maui and Molokai Is, northwest coast of Oahu I., 238–362 m deep) and the Kai Islands, Indonesia (170–206 m in deep), and off the Ogasawara Islands, Japan (250 m in deep).

Genus ***Rhinolambrus*** A. Milne–Edwareds, 1878
Rhinolambrus lamelliger (White, 1847)
[Japanese name: Tsunodashi–hishiganimodoki]
(Figs. 3C, D)

Lambrus lamelliger White, 1847a[35]: 12 (nomen nudum).— 1847b[36]: 63. — 1847c[37]: 58. — Miers, 1880[38] : 230. — 1886[39]: 93.
Lambrus lamellifrons Adams and White, 1848[40]: 26, pl. 5 fig. 1.

Parthenope (Rhinolambrus) lamelligera, Rathbun, 1906[28]: 885, pl. 17 fig. 1.

Parthenope (Rhinolambus) lamellifrons, Dai *et al.,* 1986[25]: 152, fig. 85, pl. 21 fig. 2. — Dai and Yang, 1991[26]: 169, fig. 85 (3), pl. 21 fig. 2. — Tan *et al.,* 1999[41]: 201.

Rhinolambrus naso, Marumura and Kosaka, 2003[1] : 37.

Material examined. Off Shionomisaki, Kii Penin., Wakayama, 70 m deep, 2 ♂♂ (cb 15.3 mm, cl 11.6 mm; cb 7.8 mm, cl 10.0 mm), WMNH–Na–Cr 437, recorded as *Rhinolambrus naso* (Flipse) by Marumura and Kosaka (2003)[1].

Diagnosis. Carapace with strongly developed lamellar front; branchial region inflated margin with a line of obtuse granules of good size; hepatic margin with an obtuse tubercle, separated posteriorly from branchial margin, and anteriorly and dorsally from front–orbital margin; gastric region weakly concave dorsally, with a pair of tuberculate granules arranged side by side at anterior part of protogastric margin; a tall tubercle at median posterior part of mesogtrastric region; cardiac region prominent, strongly convex as long as gastric region, being separated to three parts by two transverse furrows, each part armed with a tall, erect tuberculate subregion armed with small granules of variable size, otherwise, with an oblique line of three granules at anterior part, a prominent erect tubercle at posterior outer part, and a shorter, but distinct tubercle at further posterior part; posterior margin of carapace with three tubercles at median part and lateral end. Front strongly developed as a broad plate, obliquely deflexed, narrowing distally; dorsal surface longitudinally depressed so as to be a shallower groove between supraorbital margins of both sides; a rounded tubercle just inside of each supraorbital margin; outer orbital margin developed outward to receive eyestalk; its posterior margin curved, continuous with anterior margins of hepatic tubercle to form a neck.

Both chelipeds long, subequal to each other, tuberculate along margins; tubercles unequal, sharp, more or less flattened; some of the tubercles prominent, median and subterminal tubercles of posterior margin of merus; palm with three tubercles on outer margin, one or two on inner margin.

Remarks. The lobate front is characteristic of the specimens at hand, but may be exposed to variation. In the smaller male examined, the distal part of the front is apparently narrower than the larger male. In both specimens, the arrangement of tall tubercles is close to each other, but in the smaller male, the tubercles are comparatively shorter.

Distribution. Indian Ocean (Andamans, Sri Lanka, India, Seychelles, Zanzibar), the Red Sea, and the Pacific Ocean (Australia, Samoa, and New Caledonia, Philippines, China, Korea, Japan).

General Discussion

In the fourth report of this serial studies on the Nagai Collection in the Wakayama Prefectural Museum of Natural History, six species of the family Parthenopidae were recorded. Of the six species, *Daldorfia leprosa*[8] belongs to the subfamily Daldorfiinae, and the other five species, *Aulacolambrus hystricosus* Tan & Ng, 2003, *Cryptopodia contracta* Stimpson, 1857, *Furtipodia petrosa* (Klunzinger, 1906), *Garthambrus lacunosus* (Rathbun, 1906), and *Rhinolambrus lamelliger* (White, 1847) belong to the subfamily Parthenopinae. In Japan, *D. leprosa* has been known as *D. semicircularis* Flipse, 1930 since Sakai (1976)[14], but the latter was synonymized under the former by Tan and Ng (2007)[15]. Similarly, *C. contracta* has been recorded by Marumura and Kosaka (2003)[1] as *Heterocrypta bivallata* Flipse, 1930. The remaining three species, *F. petrosa*, *G. lacunosus* and *R. lamelliger* were listed as *Heterocrypta* sp., *G. stellatus*[28] and *R. naso*[12], respectively, by Marumura and Kosaka (2003)[1]. In the present report, these five species of the subfamily Parthenopinae were recorded with diagnoses and photographs, and thus officially added to the carcinological fauna of Japan. In general, the parthenopid crabs are surprisingly variable according to the individual and developmental conditions as for rough and eroded dorsal surface of the carapace, convexity of the dorsal regions of the carapace, sharpness of teeth

or tubercles of the carapace anterolateral margin, shape of the front, and armature of the meri and palms of the chelipeds. It may be difficult to identify the species based on the schematic figures which are usual in the old literature.

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Literature cited

1) M. Marumura and A. Kosaka: *Catalogue of the Brachyuran and Anomuran Crabs Collection donated by the late Mr. Seiji Nagai to the Wakayama Prefectural Museum of Natural History*. Wakayama Pref. Mus. Nat. Hist., 73 pp. 2003. (In Japanese)
2) M. Marumura and M. Takeda: Taxonomic studies on the crabs of the Nagai Collection preserved in the Wakayama Prefectural Museum of Natural History. I. Species new to Japan (1). *Nankiseibutu*, 46: 93–99. 2004. (In Japanese with English summary)
3) M. Marumura and M. Takeda: Taxonomic studies on the crabs of the Nagai Collection preserved in the Wakayama Prefectural Museum of Natural History. II. Species new to Japan (2). *Nankiseibutu*, 51: 75–80. 2009. (In Japanese with English summary)
4) M. Marumura and M. Takeda: Taxonomic studies on the crabs of the Nagai Collection preserved in the Wakayama Prefectural Museum of Natural History. III. Species new to Japan (3). *J. Teikyo Heisei Univ*., 23: 189–197. 2012. (In Japanese with English abstract)
5) M. Marumura and M. Takeda: Taxonomic notes on two species of xanthid crabs of the genera *Hepatoporus* Serène, 1984 and *Gaillardiellus* Guinot, 1976 from the Ryukyu Islands. *Fauna Ryukyuana*, 27: 1–11. 2015.
6) M. Takeda and M. Marumura: Spider crabs of the genus *Huenia* De Haan, 1837 (Crustacea, Decapoda, Brachyura) from Japan, with descriptions of two new species. *Bull. Natl. Mus. Nat. Sci*., Tokyo, (A), 36: 39–48. 2010.
7) M. Takeda and M. Marumura: A new species of the spider crab genus *Rochinia* (Decapoda, Brachyura, Epialtidae) from the Izu Islands, central Japan. *Bull. Natl. Mus. Nat. Sci*., Tokyo, (A), 40: 207–213. 2014.
8) G. Nobili: Diagnoses préliminaires de 34 espèces et variétés nouvelles, et de 2 genres nouveaux de décapodes de la Mer Rouge. *Bull. Mus. Hist. Nat*., Paris, 11 : 393–411. 1905.
9) G. Nobili: Faune carcinologique de la Mer Rouge. Décapodes et stomatopodes. *Ann. Sci. Nat*., Zool., Paris, (9) 4 : 1–347, pls. 1–11. 1906.
10) C. B. Klunzinger: *Die Spitz– und Spitzmundkrabben (Oxyrhyncha und Oxystomata) des Roten Meeres*. Verlag von Ferdinand Enke, Stuttgart, vii + 91 pp., 2 pls. 1906.
11) H. Chen and Z. Xu: Study on the crabs of the Nansha Islands, China. *Studies on the Marine Organisms of the Nansha Islands and Surrounding Seas*, 3: 48–106. 1991. (In Chinese with English abstract)
12) H. J. Flipse: Oxyrhyncha: Parthenopidae. Die Decapoda Brachyura der Siboga–Expedition, VI. *Siboga–Exp*., 39c2: 1–96. 1930.
13) A. M. Buitendijk: Biological results of the Snellius Expedition. V. The Dromiacea, Oxystomata and Oxyrhynca of the Snellius Expedition. *Temminckia*, 4: 223–276, pls. 7–11. 1939.
14) T. Sakai: *Crabs of Japan and the Adjacent Seas*. Kodansha Ltd., Tokyo, xxix + 773 pp. (English text)/461 pp. (Japanese text)/16 pp. + 251 pls. (Plates). 1976.
15) S. H. Tan and P. K. L. Ng: Review of the subfamily Daldorfiinae Ng & Rodríguez, 1986 (Crustacea: Decapoda: Brachyura: Parthenopidae). *The Raffles Bulletin of Zoology*, Supplement, 16: 121–167. 2007.
16) S. H. Tan and P. K. L. Ng: The Parthenopidae of Guam. (Crustacea: Decapoda: Brachyura: Parthenopidae). *Micronesica*, 35–36: 385–416.

2003.

17) A. Milne–Edwards: Description de quelques Crustacés. nouveaux ou peu connus provenant du Musée de M. C. Godeffroy. *J. Mus. Godeffroy*, 1 : 77–88, pls. 12–13. 1873.

18) T. Maenosono: New records of two parthenopid crabs (Decapoda: Brachyura) from the Ryukyu Archipelago, Japan, with additional record of a rare species. *Cancer*, 25: 33–39. 2016. (In Japanese)

19) W. Stimpson: Prodromus animalium evertebratorum, quae in expeditione ad Oceanum Pacificum Septentrionalem, a Republica Federeata missa, Cadwaladaro Ringgold et Johanne Rodgers Ducibus, observavit et descripsit. Pars III. Crustacea Maioidea. *Proc. Acad. Nat. Sci. Philadelphia*, 9: 216–221. 1857.

20) W. Stimpson: Report on the Crustacea (Brachyura and Anomura) collected by the North Pacific Exploring Expedition, 1853–1856. *Smiths. Misc. Coll*., 49: 1–240, pls. 1–26. 1907.

21) A. Alcock: Materials for a carcinological fauna of India. No. 1. The Brachyura Oxyrhyncha. *J. Asiatic Soc. Bengal*, (II), 64: 158–291, pls. 3–5. 1895.

22) A. Alcock and A. R. J. Anderson: *Illustrations of the Zoology of the Royal Indian Marine Survey Ship Investigator, under the Command of Commander T. H. Heming, R.N. Published under the Authority of Captain W. S. Goodridge, R.N., C.I.E. Director of the Royal Indian Marine*. Crustacea, pls. 16–27. 1896.

23) T. Monod: Mission Robert Ph. Dollfus en Égypte. VIII. Decapoda Brachyura. *Mém. Inst. Égypte*, 37: 91–162. 1938.

24) C.–J. Shen, A.–Y. Dai and H.–L. Chen: New and rare species of Parthenopide (Crustacea: Brachyura) from China Seas. *Acta Zootax. Sinica*, 7: 139–149, pls. 1–2. 1982. (In Chinese with English summary)

25) A.–I. Dai, S.–L. Yang, Y.–Z. Song and G.–X. Chen: [*Crabs of the China Seas*]. China Ocean Press, 642 pp. 1986. (In Chinese)

26) A.–I. Dai and S.–L. Yang : *Crabs of the China Seas*. China Ocean Press, 682 pp. 1991.

27) H. Lenz: *Crustaceen von Madagaskar, Ostafrika und Ceylon. Reise in Ostafrika in den Jahren 1903–1905, mit Mittlen der Hermann und Else geb. Heckmann Wentzel–Stiftung ausgeführt von Professor Dr. Alfred Voeltzkow*. Wiss. Ergeb., Zweiter Band, Systematische Arbeiten. Stuttgart, pp. 539–576. 1910.

28) M. J. Rathbun: The Brachyura and Macrura of the Hawaiian Islands. *Bull. U. S. Fish. Comm*., 23: 827–930, pls. 1–24. 1906.

29) J. S. Garth: Some deep–water Parthenopidae (Crustacea, Brachyura) from French Polynesia and nearby eastern Pacific ridges and seamounts. *Bull. Mus. Nat. Hist. Nat*., Paris, (4), (A), 14: 781–795. 1993.

30) J. S. Garth and P. J. F. Davie: A new species of *Parthenope* (Ctustacea: Decapoda: Brachyura) from deep–water off northern Queensland. *Mem. Qld Mus*., 18: 223–227. 1995.

31) P. K. L. Ng: *Garthambrus*, a new genus of deep water parthenopid crabs (Crustacea: Decapoda: Brachyura) from the Indo–Pacific, with description of a new species from the Seychelles. *Zool. Meded., Leiden*, 70: 155–168. 1996.

32) P. K. L. Ng and S. H. Tan: The Hawaiian parthenopid crabs of the genera *Garthambrus* Ng, 1996, and *Dairoides* Stebbing, 1920 (Crustacea: Decapoda: Brachyura). *Proc. Biol. Soc. Washington*, 112: 120–132. 1999.

33) C. L. McLay and S. H. Tan: Revision of the crab genus *Garthambrus* Ng, 1996, with the description of two new genera and discussion of the status of *Tutankhamen* Rathbun, 1925 (Crustacea: Brachyura: Parthenopidae). *Zootaxa*, 2122: 1-50. 2009.

34) T. Sakai: *Studies on the Crabs of Japan. III. Brachygnatha, Oxyrhyncha*. Tokyo, 193–364 pp., 20–41 pls. 1938.

35) A. White: *List of the Specimens of Crustacea in the Collection of the British Museum*. London, viii + 143 pp. 1847a.

36) A. White: Descriptions of new Crustacea from the Eastern Seas. *Ann. Mag. Nat. Hist*., 20: 61–63. 1847b.

37) A. White: Descriptions of new Crustacea from the Eastern Seas. *Proc. Zool. Soc. London*,

1847: 56–58. 1847c.

38) E. J. Miers: On a collection of Crustacea from the Malaysian region. Part I. Crustacea Oxyrhyncha and Cyclometopa, except Telphusidea. *Ann. Mag. Nat. Hist*., 5: 226–239, pl. 13. 1880.

39) E. J. Miers: *Report on the Brachyura collected by H.M.S. Challenger during the years 1873-76. Report on the Scientific Results of the Voyage of H.M.S. Challenger during the Years 1873–1876 under the Command of Captain George S. Nares, N.R., F.R.S. and the late Captain Frank Tourle Thomson, R.N. prepared under the Superintendence of the late Sir C. Wyville Thomson, Knt., F.R.S. &c. Regius Professor of Natural History in the University of Edinburgh of the Civilian Scientific Staff on Board and now of John Murray one of the Naturalists of the Expedition*. Zoology, published by Order of Her Majesty's Government. London, Edinburgh and Dublin, HMSO, 17: i–L, 1–362, pls. 1–29. 1886.

40) A. Adams and A. White: Crustacea. In: Adams, A. (ed.), *The Zoology of the Voyage of H. M. S. Samarang, under the Command of Captain Sir Edward Belcher, C.B., F.R.A.S., F.G.S. during the Years 1843–1846*. Reeve, Benham, and Reeve, London, 66 pp., 13 pls. 1848.

41) S. H. Tan, J. F. Huang and P. K. L. Ng: Crabs of the family Parthenopidae of Taiwan (Crustacea: Decapoda). *Zool. Sci*., 38: 196–206. 1999.