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CRUSTACEAN FAUNA OF TAIWAN:
CRAB-LIKE ANOMURANS

T. Y. CHAN

國立臺灣海洋大學

臺灣蟹型異尾類誌 (蟬蟹、石蟹及瓷蟹)

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(HIPPOIDEA, LITHODOIDEA AND PORCELLANIDAE)

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序

甲殼十足類是常見的海洋生物，一般分為三大類；腹部發達的長尾類—蝦類，腹部退化的短尾類—蟹類，和型態介於蝦、蟹之間的異尾類。異尾類中最具代表性的是寄居蟹，但其中亦包括很多其他型態截然不同的類群。臺灣的異尾類中種類較多的寄居蟹和鎧甲蝦已在近年出版的「臺灣寄居蟹類誌」及「臺灣鎧甲蝦類誌」中有詳細的記載。本誌是將臺灣其它的異尾類一併整理，包括型態十分接近蟹類的蟬蟹、石蟹和瓷蟹。其中瓷蟹常見於海邊的岩岸和珊瑚礁，但直至十多年前才開始有積極的調查研究。石蟹即一般所謂的“帝王蟹”或“雪場蟹”，是寒帶海域高經濟價值的海產，在臺灣則僅分佈於深海，以致遲至近年才有被發現。蟬蟹有潛沙的習性，很容易被忽略，故臺灣的蟬蟹也是近幾年才有積極的調查，但最近在東部的沙灘有大量俗稱“倒退嚕”的蟬蟹被捕捉，使其族群受到很大的威脅。本誌由行政院國家科學委員會補助的研究計劃『臺灣大型甲殼類誌編撰及十足目高階分類系統之審定』，邀請國際著名的甲殼異尾類分類專家共同深入研究整理出臺澎金馬的蟬蟹2科4屬12種，石蟹1科3屬6種，瓷蟹1科11屬40種，包含有臺灣新記錄的8種蟬蟹和6種瓷蟹，並有1種臺灣特有的石蟹，但有兩種瓷蟹目前僅記錄於金馬而仍未在臺灣本島發現。本誌中每種皆提供有型態描述、重要特徵線繪圖和檢索等，大部分種類（9種蟬蟹、全部石蟹和37種瓷蟹）亦附有彩色標本照以利參考鑑別。本誌之編輯及印刷為行政院國家科學委員會補助（NSC 98-2321-B-019-013），由國立臺灣海洋大學海洋生物科技及環境生態中心協助出版，僅致上由衷謝意，並感謝林芝君及李瑞怡小姐在編輯上的協助。甲殼十足類三大類中的異尾類已經由臺灣甲殼類誌系列整理完成，共記錄有307種，為全世界異尾類的八分之一，再次彰顯臺灣具有十分豐富的海洋生物多樣性。

GENERAL INTRODUCTION

Amongst the decapod crustaceans, anomurans have the highest diversity of morphological forms. Although the best known anomurans are hermit crabs, some members of this group are lobster-like (e.g. the squat lobsters) or crab-like (e.g. the king crabs and porcelain crabs). In older classification schemes the mud shrimps (thalassinideans) were also considered as anomurans (Borradaile, 1903; Glaessner, 1969) but they are now considered as a distinct group of their own (Thalassinidea), or as two distinct infraorder groupings (Gebiidea and Axiidea) (Robles *et al.*, 2009). Whether the various anomuran forms represent natural groups or merely convergence of morphological characters under similar selective pressures has been a major focus of recent phylogenetic studies on decapods crustaceans (see Ah Yong *et al.*, 2009). The anomurans of Taiwan consist of five main morphological groups, namely the hermit crabs, king crabs, squat lobsters, porcelain crabs and mole crabs. The most recent classification scheme (De Grave *et al.*, 2009) of these groups places them at different taxonomic ranks. The hermit crabs are of the superfamily Paguroidea Latreille, 1802. The king crabs are also in their own superfamily Lithodoidea Samouelle, 1819 but there are strong debates as to whether or not they are derived from within the Paguroidea (e.g. Morrison *et al.*, 2002 vs. McLaughlin *et al.*, 2007). Two families of squat lobsters, Chirostylidae Ortmann, 1892 and Galatheidae Samouelle, 1819, are grouped with the porcelain crabs of the family Porcellanidae Haworth, 1825 in the superfamily Galatheoidea Samouelle, 1819. The mole crabs are treated as the superfamily Hippoidea Latreille, 1825. The series of Taiwan crustacean catalogs have already reported the two most diverse anomuran groups, the hermit crabs (McLaughlin *et al.*, 2007) and squat lobsters (Baba *et al.*, 2009). The remaining crab-like anomurans are now dealt with in the present catalog.

These three crab-like anomuran groups have only received significant attention in Taiwan during the last decade or so. The porcelain crabs, although rather common and inhabiting intertidal and shallow subtidal zones of rocky and coral reefs, have only been extensively surveyed since 1997. Off Taiwan, the king crabs are only found from deep-waters and hence are only known from the island since the start of intensive deep-sea surveys in 1998. Mole crabs are uncommonly encountered because of their cryptic behavior (*i.e.* buried in sand), and have rarely been reported from Taiwan prior to 2002. Recently, very large quantities of mole crabs have been collected commercially from beaches in the eastern coast of Taiwan for food and bait use.

Through projects supported by the Taiwan National Science Council, Taiwan, R.O.C., the present work compiles a catalog of all the crab-like anomurans known from Taiwan and the Taiwan Strait (excluding those reported from the coast of Fujian in mainland China). Although the midline of the Taiwan Strait generally divides the territories of Taiwan and mainland China, Kinmen and Matsu are situated close to mainland China but under the jurisdiction of Taiwan. The catalog is divided into three chapters according to the different groups and by different authors. In total, 12 species in four genera of hippoids, six species in three genera of lithodoids, and 40 species in 11 genera of porcellanids are included in this catalog. Two porcellanid species are still only known from the Taiwan Strait and not yet from Taiwan proper. On the other hand, the species in this catalog include 14 new Taiwan records (eight for hippoids and six for porcellanids). The numbers of porcellanid and hippoid species now found in Taiwan are about 1/6 and 1/7 of the world's species, respectively. However, the lithodoid fauna of Taiwan comprises only about 5% of the world's species. Nevertheless, one lithodoid is

presently known only from Taiwan and there are no Taiwanese endemics among porcellanids or hippoids. It is likely that more species of these three anomuran groups will be discovered from Taiwan with more extensive collecting efforts. A total of 307 species of anomurans are now known from Taiwan (McLaughlin *et al.*, 2007; Osawa & Chan, 2008, 2009; Baba *et al.*, 2009; present catalog), which comprises about 1/8 of the 2470 species reported worldwide (De Grave *et al.*, 2009).

For each species in the catalog, restricted synonymies that cover the original citation, primary synonyms, major works, and references relevant to Taiwan and the Taiwan Strait are given. Each species, genus, family and superfamily is diagnosed. Line drawings illustrating distinguishing characters are given for all the species. Color photographs of fresh specimens are provided for all the lithodoids, nine species of hippoids and 37 species of porcellanids. The coloration is often very useful in distinguishing species of decapods and stomatopods in general. The majority of specimens reported in this catalog are deposited in the collection of the National Taiwan Ocean University, Keelung (NTOU). Some specimens studied are housed in the National Museum of Natural Science, Taichung (NMNS), the Raffles Museum of Biodiversity Research, National University of Singapore (ZRC) and the Zoological Museum, University of Copenhagen (ZMUC). For comparative purposes, the materials from the following museums were also examined: the Allan Hancock Foundation, University of Southern California (AHF) (now in deposited in the Natural History Museum of Los Angeles County; LACM); the Australian Museum, Sydney (AM); the Natural History Museum and Institute, Chiba (CBM); the Natural History Museum, Wien (NHMW), the Swedish Museum of Natural History, Stockholm (SMNH); and the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM). All specimen measurements are in millimeters (mm). Size measures are given as carapace length (cl), which is measured from the apex of the rostrum or the midpoint of the anterior margin to the median posterior margin of the carapace; postorbital carapace length (pcl), measured from the posterior margin of the orbit to the median posterior margin of the carapace; and carapace width (cw), which is the greatest width of the carapace, excluding spines. General morphology is illustrated under **Morphological Terms** in the various chapters. For specimens collected by the "TAIWAN" cruises, gear types are abbreviated as follows: otter trawl le Drezen type Solo Hard Botton 12.4 m (CD), 4 m French beam trawl (CP), and 2.5 m French beam trawl (PCP).

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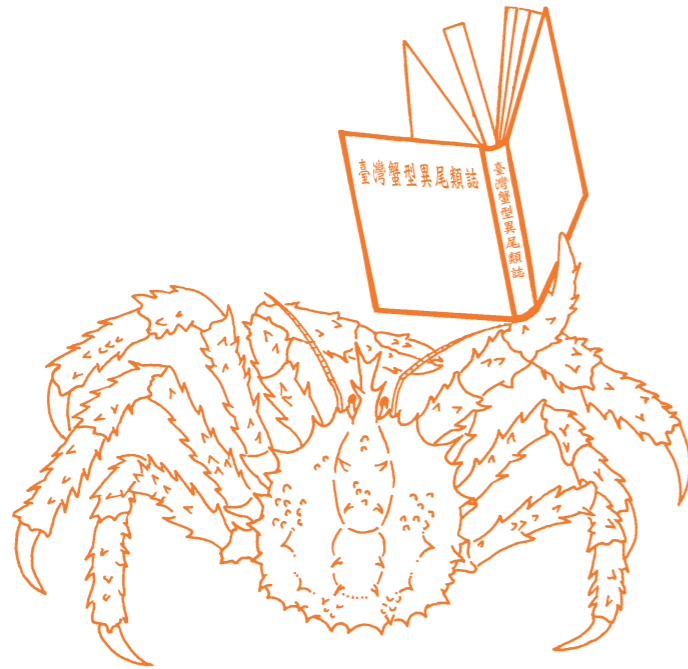
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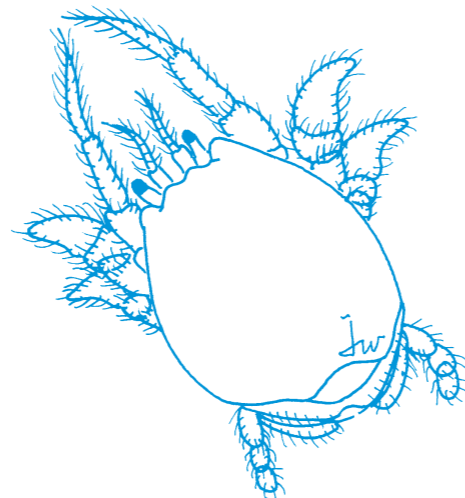
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Part I. Hippoidea (Mole crabs)

By

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INTRODUCTION

The superfamily Hippoidea Latreille, 1825 is one of the crab-like groups of the Anomura and commonly called mole or sand crabs. Most hippoids are relatively small in size and specialized to live buried in sandy substrate or fine sediments from the intertidal to offshore, predominantly in tropical and subtropical regions. Because of their preferred habitat, they are uncommonly encountered unless specifically targeted for collection, and thus have been poorly studied in general. However, *Emerita* species of the North and South American coastlines are relatively well studied, including aspects of population structure, life history, and reproduction (Dugan *et al.*, 1991, 2000; Delgado & Defeo, 2006; also see references therein).

The Hippoidea includes three families, 14 Recent genera, and 82 Recent species worldwide (De Grave *et al.*, 2009). Boyko & Harvey (1999) gave an annotated list of the Indo-West Pacific species of the superfamily and a key to those species. Since this publication, one new genus (*Squillalbunea* Boyko, 2002) and six new species of *Albunea* Weber, 1795 have been added to the Indo-West Pacific fauna (Boyko, 1999, 2000, 2002; Osawa & Fujita, 2007).

Balss (1914) reported the first hippoid from Taiwan: *Hippa adactyla* Fabricius, 1787 (as *Remipes testudinarius* var. *denticulatifrons*). However, there were no other reports on hippoids from Taiwan until the worldwide revision of the recent and fossil species of the families Albuneidae and Blepharipodidae by Boyko (2002), in which three species of *Albunea* (*A. bulla* Boyko, 2002, *A. groeningi* Boyko, 2002, and *A. occulta* Boyko, 2002) were reported from Taiwan. Although the hippoid fauna of Taiwan is still poorly known, very large quantities of *Hippa* species have been recently collected commercially from beaches on the eastern coast of Taiwan for food and bait use.

A total 12 species in four genera and two families are reported in the present catalog. All these 12 species are found in Taiwan and eight of them are new records for the island. Two species, *Albunea occulta* and *Hippa truncatifrons* (Miers, 1878), are also found from Matu in the western part of the Taiwan Strait. No endemic species of hippoids are known from Taiwan. The currently known Taiwanese hippoid fauna is about 1/7 of the total world's species in this superfamily. It is likely that more species will be discovered from Taiwan if more extensive collecting efforts are made because other species are known from the region between southern Japan and southeast Asia but not, so far, from Taiwan (e.g. De Man, 1896; Boyko, 2002; Osawa & Fujita, 2007). The morphological terminology used in this chapter follows that of Boyko & Harvey (1999) and Boyko (2002), and is illustrated under **Morphological Terms** in the next pages.

Morphological Terms

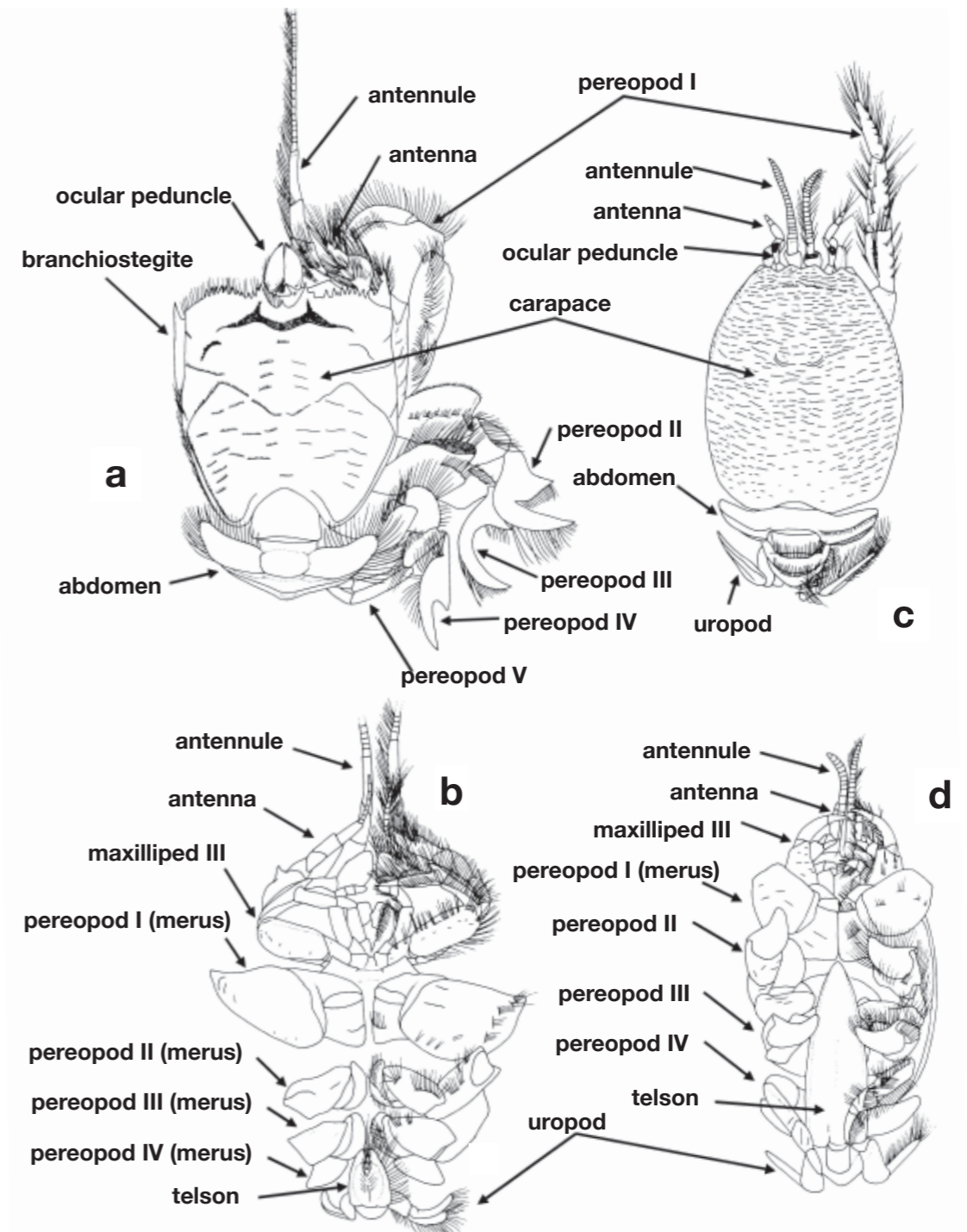


Fig. 1. a–b, Albuneidae, *Albunea*; c–d, Hippidae, *Hippa*. a, carapace, right appendages, and anterior part of abdomen, dorsal view (setae omitted from left side); b, cephalic appendages, mouthparts, basal segments of pereopods, and posterior part of abdomen, ventral view (setae omitted from right side); c, carapace, cephalic appendages, right pereopods, and anterior part of abdomen, dorsal view (setae omitted from left side); d, cephalic appendages, mouthparts, basal segments of pereopod I, pereopods II–IV, and posterior part of abdomen, ventral view (setae omitted from right side).

Morphological Terms

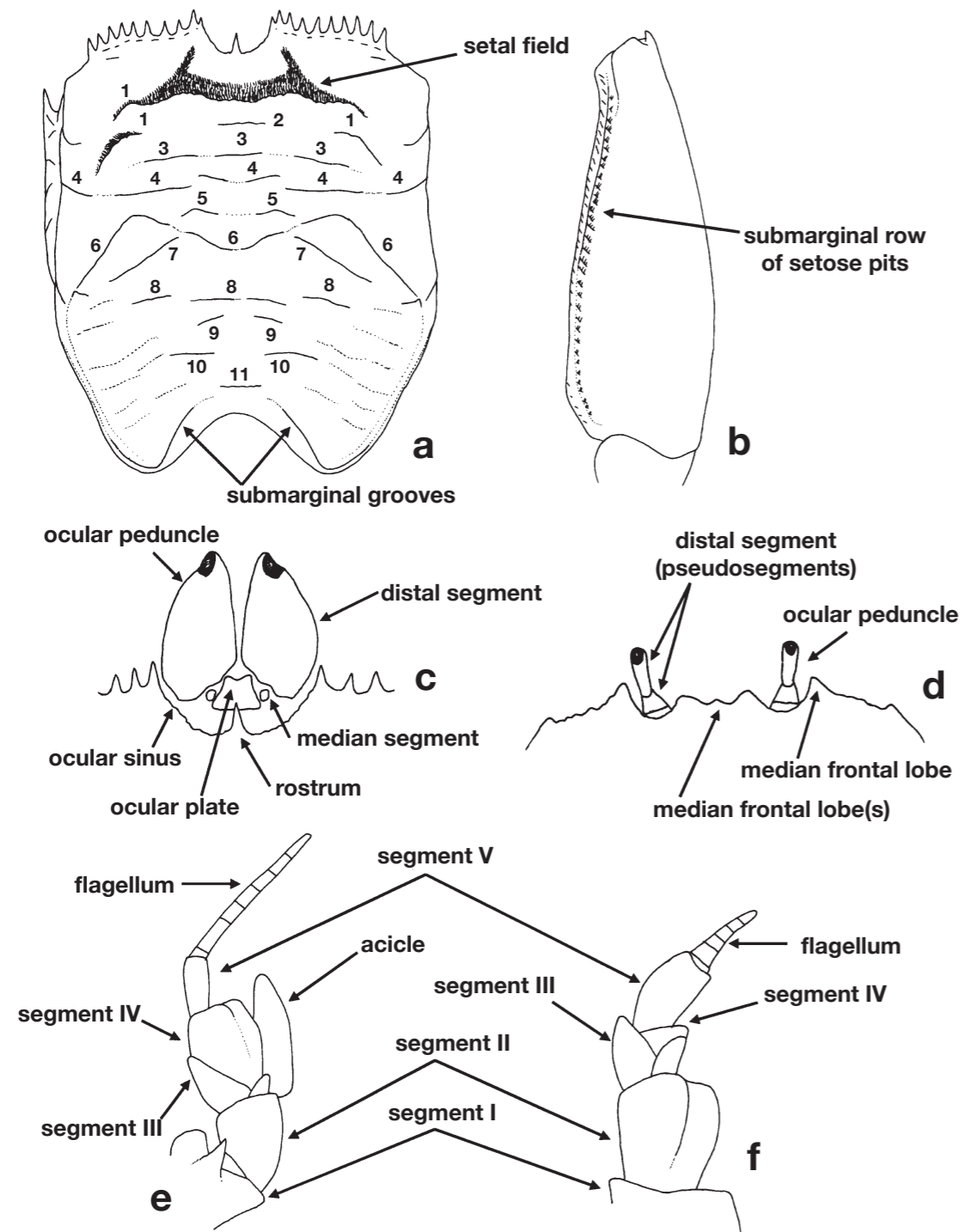


Fig. 2. a, c, e, Albuneidae, *Albunea*; b, d, f, Hippidae, *Hippa*: a, carapace, showing setal field, setose carapace grooves (CG1-11), and submarginal posterior grooves, dorsal view; b, carapace, showing submarginal row of setose pits, lateral view; c-d, ocular peduncles and anterior part of carapace, dorsal view; e-f, left antenna, lateral view (setae omitted).

Morphological Terms

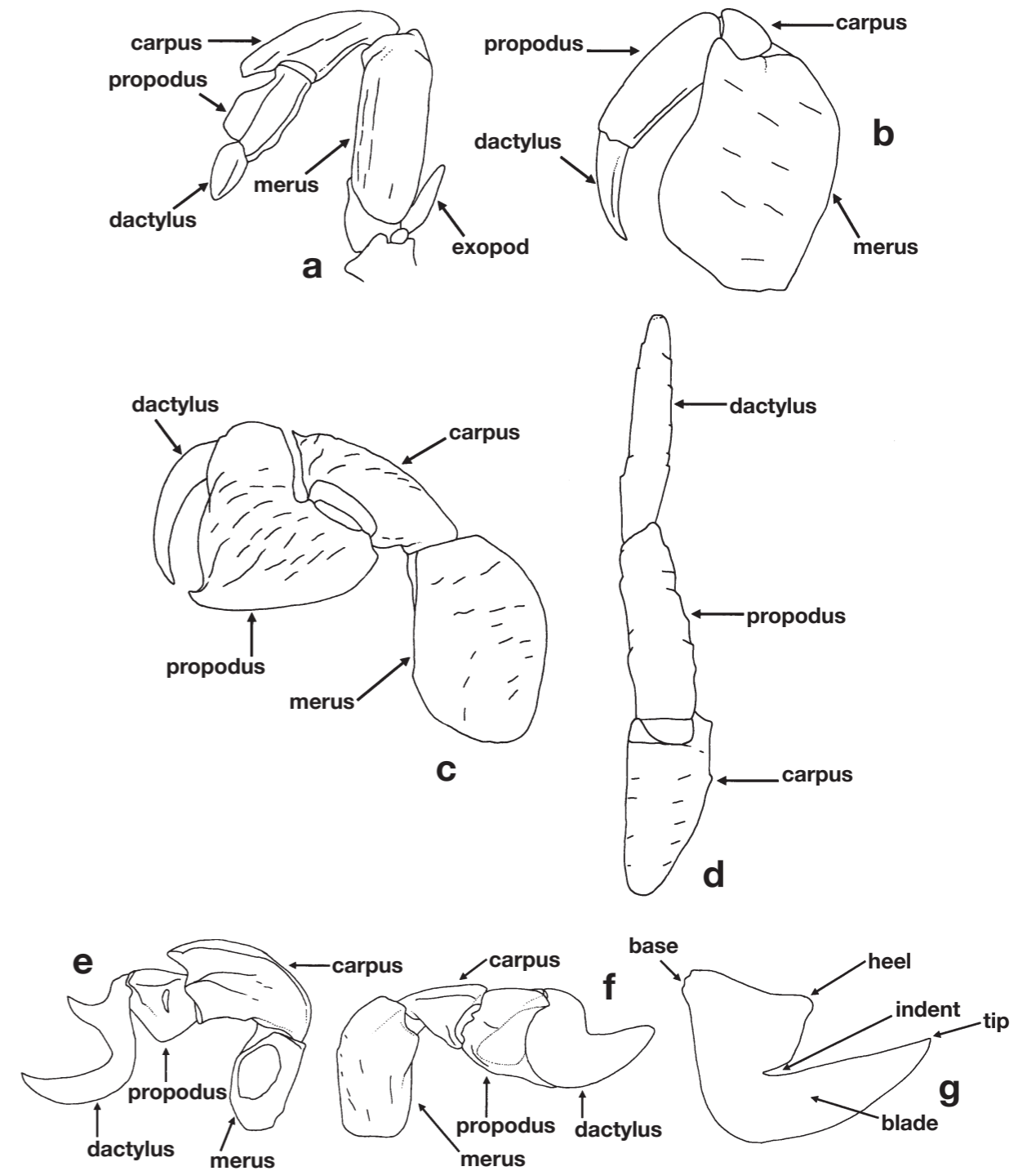


Fig. 3. a, c, e, g, Albuneidae, *Albunea*; b, d, f, Hippidae, *Hippa*: a-b, left third maxilliped, lateral view (setae omitted); c, left pereopod I, lateral view (setae omitted); d, same, dorsal view (setae omitted); e, left pereopod III, lateral view (setae omitted); f, right pereopod III, lateral view (setae omitted); g, right pereopod II, dactylus, lateral view (setae omitted).

SYSTEMATICS

Infraorder Anomura MacLeay, 1838

異尾下目

Superfamily Hippoidea Latreille, 1825

蟬蟹總科

Diagnosis.—Carapace ovate or subrectangular. Pereopod I subchelate or non-chelate. Pereopods II–IV dactyli flattened, generally similar in shape on pereopods II and III. Telson entire. Uropodal rami not forming tail-fan. Males without pleopods, except in some Albuneidae where pleopods present but much reduced.

Remarks.—The superfamily Hippoidea includes three families: Albuneidae Stimpson, 1858, Blepharipodidae Boyko, 2002, and Hippidae Latreille, 1825 (Boyko, 2002). Hippidae is readily distinguishable from the other two families by the pereopod I being simple (non-chelate) instead of subchelate. Albuneidae differs from Blepharipodidae in having phyllobranchiate (also found in Hippidae) instead of trichobranchiate gills and no distinct spines on the anterior half of the branchial margin of the carapace and the ventral margin of the pereopod I merus, and in the absence of a decalcified part on the median dorsal surface of the abdominal somite I.

Hippoidea is monophyletic and sister to the remaining anomurans based on the phylogenetic analyses inferred from the morphological and molecular data (e.g. Martin & Abele, 1986; Ah Yong & O’Meally, 2004; Tsang, *et al.*, 2008; Ah Yong, *et al.*, 2009). Additionally, the phylogenetic trees by Ah Yong & O’Meally, (2004) and Ah Yong, *et al.* (2009) show that Blepharipodidae is sister to a clade of Albuneidae and Hippidae. The monophyly of each of the three hippoid families is also supported by Boyko & Harvey (2009) in phylogenetic analyses based on morphological characters.

Albuneidae and Hippidae are known from Taiwan. Blepharipodidae is exclusively antitropical and is not distributed in Taiwan. Albuneidae and Hippidae include nine and three recent genera, respectively, and Blepharipodidae contains two genera: *Blepharipoda* Randall, 1840 and *Lophomastix* Benedict, 1904.

Key to families of Hippoidea from Taiwan

1. Carapace subrectangular, without lateral expansions covering pereopods; pereopod I subchelate ···· **Albuneidae**
- Carapace ovate, with lateral expansions covering pereopods II–IV; pereopod I simple, non-chelate ······
- **Hippidae**

Family Albuneidae Stimpson, 1858

管須蟹科

Albuneidae Stimpson, 1858: 230 [correction by Miers (1878), of the original spelling Alburnidae Stimpson, 1858

(ICZN, 1958: Opinion 522); type genus: *Albunea* Weber, 1795].

Diagnosis.—Carapace subrectangular, moderately convex on dorsal surface, without lateral expansions covering pereopods; branchial margin without spines. Distal segment of ocular peduncle entire. Antennular peduncle 3-segmented; dorsal flagellum much longer than carapace; ventral flagellum absent or composed of 1–7 articles. Antennal peduncle 5-segmented; acicle present; flagellum composed of 1–9 articles. Mandible well-developed, with 3-segmented palp. Maxilliped III with merus elongate but not broadened; crista dentata absent or weak; exopod slender or lamellar, usually without flagellum. Pereopod I subchelate; dactylus smooth or crenulate on dorsal margin; propodus smooth or with blunt teeth on cutting edge; merus without strong spine ventrally. Pereopods II–IV dactyli laterally compressed and dorsoventrally expanded. Pereopod V reduced, chelate. Abdomen with pleura on somites II–IV or II–V; somite I without decalcified region on median dorsal surface. Telson ovate, spatulate, or subtriangular in shape. Females with uniramous, paired pleopods on abdominal somites II–V; males with or without reduced pleopods. Gills phyllobranchiate.

Remarks.—Boyko (2002) divided the family Albuneidae into two subfamilies: Albuneinae Stimpson, 1858 and Lepidopinae Boyko, 2002. Albuneinae is distinguished from Lepidopinae by the abdominal somite V without pleura and long antennal acicle (greater than or equal to the length of the antennal segment III). In Lepidopinae, the abdominal somite V has pleura and the antennal acicle is short (less than the length of the antennal segment III). Boyko (2002) considered Albuneinae to contain five Recent genera: *Albunea* Weber, 1795; *Zygopa* Holthuis, 1961; *Stemonopa* Efford & Haig, 1968; *Paralbunea* Serène, 1977; *Squillalbunea* Boyko, 2002; whereas Lepidopinae includes four recent genera: *Austrolepidopa* Efford & Haig, 1968; *Lepidopa* Stimpson, 1858; *Leucolepidopa* Efford, 1969; and *Paraleucolepidopa* Calado, 1996. All the five albuneine genera include Indo-West Pacific species, while only two lepidopine genera, *Austrolepidopa* and *Leucolepidopa*, contain Indo-West Pacific species. Boyko & Harvey (2009) later excluded *Squillalbunea* and *Zygopa* from Albuneinae and treated them as unplaced genera in the monophyletic Albuneidae based on phylogenetic analyses inferred from morphological characters. The phylogenetic trees of Boyko & Harvey (2009) also show that *Paralbunea* is a basal lepidopine, rather than a basal albuneine as suggested by Boyko (2002), and the genus may not be monophyletic as currently conceived. Although further studies are needed to clarify the exact phylogenetic relationships in Albuneidae, the definitions of the albuneid subfamilies and genera by Boyko (2002) are followed in this work.

Only *Austrolepidopa caledonica* Boyko & Harvey, 1999 and *A. trigonops* Efford & Haig, 1968 have a long flagellum consisting of a single article on the exopod of the maxilliped III. Other known albuneid species completely lack this flagellum.

Albuneids, often called sand crabs, can burrow deeply in sand and are therefore rather difficult to collect. They are mostly found in relatively shallow coastal waters, although they can be distributed down to 225 m deep (the deepest record for *Austrolepidopa caledonica*).

Only two genera, *Albunea* and *Paralbunea*, are known from Taiwan, the latter is new record for the island. The two genera are readily distinguished by the armature of the segment I of the antennal peduncle and pereopod I carpus, as shown below in the key to the Taiwanese genera.

Key to genera of Albuneidae from Taiwan

1. Antennal peduncular segment I with lateral spine; pereopod I carpus with dorsodistal spine ······ *Albunea*
- Antennal peduncular segment I without lateral spine; pereopod I carpus without dorsodistal spine ······
- *Paralbunea*

Genus *Albunea* Weber, 1795

管須蟹屬

Albunea Weber, 1795: 94 (in part) [type species: *Cancer symmysta* Linnaeus, 1758, by subsequent designation of Holthuis (1956). Gender: feminine].

Mioranina Müller, 1979: 278 [type species: *Mioranina asymmetrica* Müller, 1979, by monotypy. Gender: feminine. Fossil].

Diagnosis.—Carapace front broad, anterior margin with row of spines; hepatic anterolateral spine absent; branchiostegite with anterior submarginal spine. Rostrum present, acute. Distal segment of ocular peduncle flattened, cornea present. Antennule with ventral flagellum composed of 1–5 articles. Antennal peduncular segment I armed with spine on lateral surface; flagellum composed of 5–8 articles. Maxilliped III carpus with short dorsodistal projection. Pereopod I dactylus smooth on dorsal margin; carpus with dorsodistal spine. Telson exhibiting strong sexual dimorphism.

Remarks.—Boyko (2002) recognized four species groups in Recent species of the genus *Albunea*; namely the *carabus* group (*A. bulla* Boyko, 2002, *A. carabus* (Linnaeus, 1758) and *A. danai* Boyko, 1999), the *holthuisi* group (*A. groeningi* Boyko, 2002, *A. holthuisi* Boyko & Harvey, 1999 and *A. marquisiana* Boyko, 2000), the *microps* group (*A. elioti* Benedict, 1904, *A. galapagensis* Boyko, 2002 and *A. microps* Miers, 1878), and the *paretii* group (*A. catherinae* Boyko, 2002, *A. elegans* A. Milne-Edwards & Bouvier, 1898, *A. lucasia* de Saussure, 1853, *A. paretii* Guérin Mèneville, 1853 and *A. steinitzi* Holthuis, 1958). The groups to which the five remaining Recent species belong were not specified by Boyko (2002). Boyko (2002) suggested that *A. speciosa* Dana, 1852 is linked to two fossil species, *A. cuisiana* Beschin & De Angeli, 1984 and *A. hahnae* Blow & Manning, 1996, in having fused elements of the CG1; a character otherwise unknown in *Albunea* but found in other albuneid genera of two subfamilies (e.g. *Lepidopa*, *Stemonopa*). These three species appeared to form a clade that is sister to all the other species of *Albunea*. Boyko (2002) also indicated that *A. occulta* is closely related to *A. symmysta* (Linnaeus, 1758) and they appear to be intermediate between the *holthuisi* and *paretii* groups. For *A. gibbesii* Stimpson, 1859 and *A. thurstoni* Henderson, 1893, they are likely sister species according to Boyko (2002), but their relationships to the other species of the genus are unknown. *Albunea okinawaensis* Osawa & Fujita, 2007 was described after Boyko (2002), but appeared closest to *A. symmysta*.

The morphology-based phylogenetic analysis of Boyko & Harvey (2009) on the Recent and fossil species of Albuneidae and Blepharipodidae showed that the genus *Albunea* is monophyletic but the *microps* and *paretii* groups of Boyko (2002) are not monophyletic. Further discrepancies from the relationships suggested by Boyko (2002) are: *A. galapagensis* is not sister to the clade containing *A. elioti* and *A. microps*; there are some support that *A. bulla* belongs to the *microps* group; *A. symmysta* belongs to the *holthuisi* clade which is sister to the *paretii* clade; and *A. speciosa* is not sister to all the other species of the genus. Further analyses, likely using molecular datasets, are required to better resolve the species relationships in this genus.

It has been suggested that species of the genus *Albunea* are filter feeders, collecting suspended food particles with long antennular flagella, but Boyko (2002) discredited this and proposed that they are scavengers or predators.

Albunea includes 20 Recent species with 13 of them recorded from the Indo-West Pacific region (Boyko & Harvey, 2009). Five species are now known from Taiwan, with two of them new to the Taiwanese fauna.

Key to species of *Albunea* from Taiwan

1. Pereopod III dactylus heel rounded *A. bulla*

– Pereopod III dactylus heel distinctly produced, acute 2
 2. CG11 present *A. occulta*
 – CG11 absent 3
 3. Telson ovate, indented on median distal margin *A. groeningi*
 – Telson spatulate, rounded on distal margin 4
 4. Distal segment of ocular peduncle stout, strongly convex on lateral margin *A. symmysta*
 – Distal segment of ocular peduncle comparatively slender, weakly convex on lateral margin
 *A. okinawaensis*

Albunea bulla Boyko, 2002

鈕扣管須蟹

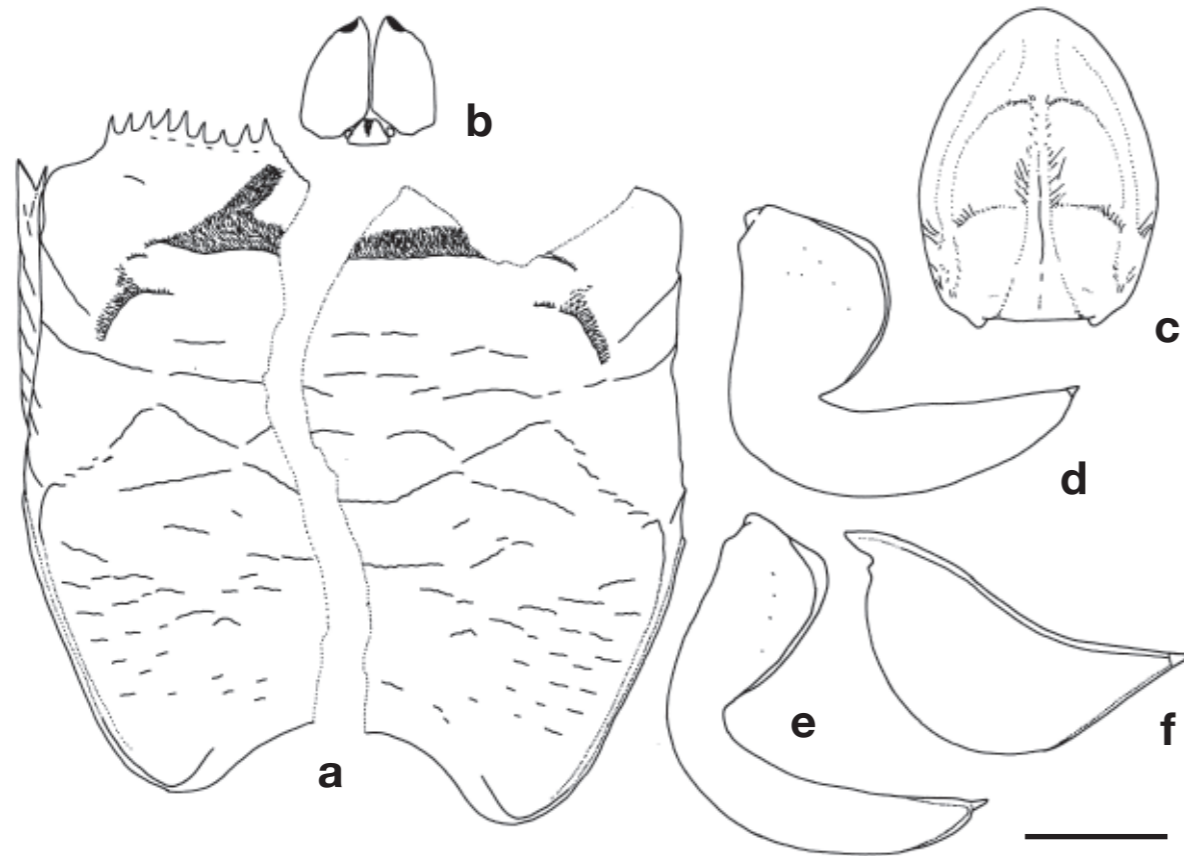


Fig. 4. Paratype female (cl 17.4 mm), Magong fishing port, Penghu County, 15 Sep 1996: **a**, carapace (broken) and left branchiostegite, dorsal view (setae omitted, except setal field); **b**, ocular peduncles and ocular plate, dorsal view (setae omitted); **c**, telson, extensor view (marginal setae omitted); **d**, right pereopod II, dactylus, lateral view (setae omitted); **e**, right pereopod III, dactylus, lateral view (setae omitted); **f**, right pereopod IV, dactylus, lateral view (setae omitted). Scale: a–b = 4.3 mm; c = 2.6 mm; d–f = 3.2 mm.

Albunea symnista.—Gordon, 1938: 187 (in part). [not *Albunea symmysta* (Linnaeus, 1758)]

Albunea bulla Boyko, 2002: 260, figs. 85–86 [type locality: Off Richmond River mouth, off Ballina, New South Wales, Australia].

Material examined.—Nanliao fishing port, Mituo, Kaohsiung County, 25 Nov 1992: 1 female (cl 10.8 mm) (NTOU A00122). Magong fishing port, Penghu County, 15 Sep 1996: 1 female paratype (cl 17.4 mm) (NTOU A00115).

Diagnosis.—Carapace with CG1 separated into anterior and posterior elements; CG3 separated into 3–6 short and relatively long elements between posterior lateral elements of CG1; CG4 with lateral element reaching level of mesial end of CG1 posterior element; CG5 widely separated into 2 relatively long, anteriorly convex elements; CG8 present as 1 long or 2–4 interrupted median elements; CG11 composed of 2 or 3 short elements

or absent; hepatic region with short groove; posterior submarginal grooves short, reaching one-third to two-fifths length of posterior concavity. Rostrum reaching proximal margin of ocular plate. Ocular plate subquadrate. Distal segment of ocular peduncle oblong in shape, tapering distally; lateral margin convex, without distinct notch on median lateral margin; mesial margin straight. Dactylus of pereopod II with heel broadly rounded; indent broad. Dactylus of pereopod III with heel broadly rounded. Dactylus of pereopod IV evenly sinuous from base to tip, with low obtuse heel and shallow indent. Telson of male inflated on proximal part and distinctly tapering on distal part; distal margin rounded. Telson of female ovate, somewhat tapering on distal part.

Size.—Males to cl 15.4 mm, females to cl 19.4 mm (Boyko, 2002).

Coloration.—Not known.

Habitat.—Sandy bottoms, intertidal to 29.3 m deep (Boyko, 2002).

Distribution.—Known from Taiwan, Queensland in Australia, New Caledonia and Fiji, probably also found in Pitcairn Island at depths of 47.6–54.9 m (Boyko, 2002).

Remarks.—Boyko (2002) described this species based on material including a paratype from Taiwan. The paratype is now damaged as shown in the present illustration. Only one more specimen of this species has been collected from Nanliao, and it differs from the original description of *A. bulla* in the absence of the CG11, although the Nanliao specimen agrees well with the species in the other characters. The presence or absence of the CG11 has been considered as a diagnostic character for *Albunea* species (see Boyko, 2002), but should also be considered in the context of other important characters. More material from Taiwan is necessary to determine if the Nanliao specimen truly belongs to *A. bulla*.

The phylogenetic analysis of Boyko & Harvey (2009) shows that *A. bulla* is likely sister to a clade composed of *A. carabus* and *A. danai* rather than to the clade consisted of *A. elioti* and *A. microps*. *Albunea bulla* is distinguished from *A. carabus* and *A. danai* by the distal segment of the ocular peduncle being stouter and more strongly convex on the distal half of the lateral margin, and the “button-like” morphology of the male telson. *Albunea carabus* further differs from *A. bulla* and *A. danai* in the dactylus of pereopod II with the heel being subquadrate instead of rounded on the ventral margin and with a much narrower indent.

Albunea bulla also show some resemblance to *A. microps* in the separation of the CG1 into anterior and posterior elements, the subquadrate shape of the ocular plate, the lack of a distinct notch on the median lateral margin of the distal segment of the ocular peduncle, the broad indent of the pereopod II dactylus, and the rounded heel of the pereopod III dactylus. However, the two species can be separated by the nature of the setose grooves on the carapace and structure of the male telson (Boyko, 2002; Osawa & Fujita, 2007).

Boyko (2002) suggested that the “Albuneidae sp.” reported by DiSalvo *et al.* (1988) from Easter Island may be *A. bulla*, but no material is yet available to verify this idea.

Albunea groeningi Boyko, 2002
葛氏管須蟹



Fig. 5. Male (cl 10.6 mm), Nanliao fishing port, Mituo, Kaohsiung County, 10 May 1991.

Albunea symnista.—Gordon, 1938: 187 (in part). [not *Albunea symmysta* (Linnaeus, 1758)]

Albunea symmysta.—Miyake *et al.*, 1962: 125 (in part). [not *Albunea symmysta* (Linnaeus, 1758)]

Albunea steinitzi.—Serène & Umali, 1965: 97–102, pl. 1–fig. 2, pl. 2–fig. 2, pl. 3–figs. 3, 4b, pl. 4–fig. 2, text-figs. 1b, 2b, 4b, 5c, 6c, 7a, 9b–c. [not *Albunea steinitzi* Holthuis, 1958]

Albunea groeningi Boyko, 2002: 296, figs. 96–97 [type locality: Mikawa-Isshiki, Aichi Prefecture, Honshu, Japan].

Material examined.—Danshuei, Taipei County, 20 Jun 1999: 1 damaged specimen (NTOU A00149). Nanliao fishing port, Hsinchu City, 7 Jan 1993: 2 females (cl 9.3, 11.3 mm) (NTOU A00139). Tongsiao, Miaoli County, 25 Nov 1991: 1 male (cl 9.4 mm), 1 female (cl 9.1 mm) (NTOU A00147). Cijin fishing port, Kaohsiung County, 22 Oct 1991: 1 female (cl 9.3 mm) (NTOU A00138). Nanliao fishing port, Mituo, Kaohsiung County, 10 May 1991: 1 male (cl 10.6 mm) (NTOU A00148).—1 Jan 1992: 1 male paratype (cl 9.2 mm), 1 female paratype (cl 9.6 mm) (NTOU A00118).—25 Nov 1992: 1 male (cl 7.5 mm), 1 female (cl 7.2 mm) (NTOU A00130). Kaohsiung County, 7 Jun 1992: 2 male paratypes (cl 9.2, 9.8 mm), 1 female paratype (cl 11.2 mm)

(NTOU A00970). Dasi fishing port, Yilan County, 20 Jun 1999: 1 male (cl 4.1 mm) (NTOU A00361). No specific locality: 1 male (cl 7.4 mm) (NTOU A01120).

Diagnosis.—Carapace with CG1 separated into anterior and posterior elements; CG3 broken into 3 or 4 widely separated short elements between posterior lateral elements of CG1; CG4 with lateral element reaching approximate level of mesial end of CG1 posterior element; CG5 widely separated into 2 short elements; CG8 present as 2–4 short median elements; CG11 absent; hepatic region without short groove; posterior submarginal grooves moderately long, reaching two-thirds length of posterior concavity. Rostrum reaching proximal margin of ocular plate. Ocular plate subtriangular or subquadrate. Distal segment of ocular peduncle elongate subtriangular in shape, tapering distally; lateral margins moderately convex; mesial margins straight. Dactylus of pereopod II with heel acute; indent relatively broad. Dactylus of pereopod III with heel elongate and acute. Dactylus of pereopod IV with produced, subtriangular heel; indent broad. Telson of male elongate, ovate; extensor surface with 2 rows of thick setae along midline; distal margin with median concavity; lateral margins generally straight except for distal convex part. Telson of female generally similar to male.

Size.—Males to cl 14.4 mm and females to cl 17.0 mm (Boyko, 2002).

Coloration.—Carapace, abdomen, pereopods, and distal segments of ocular peduncles entirely pale brown on dorsal and lateral surfaces. Antennular flagella with dark blue bands.

Habitat.—Sandy bottoms, intertidal down to 45.7 m deep (Boyko, 2002).

Distribution.—From Japan (north to Toyama Bay) southward to Western Australia and Victoria, Australia (Boyko, 2002).

Remarks.—Boyko (2002) described this species based on the material including some paratypes from Taiwan. As indicated by Osawa & Fujita (2007) for specimens from the Ryukyu Islands, the shape of the male telson somewhat varies in the Taiwanese material. The telson of a paratype male (cl 9.8 mm, NTOU A00362) tapers more strongly than that of the illustration by Boyko (2002, fig. 97F). All the Taiwanese paratypes also have the heel of the pereopod IV dactylus being more strongly produced than that illustrated in Boyko (2002, fig. 97D).

From the key given by Boyko (2002), *A. groeningi* is similar to *A. steinitzi* from the western Indian Ocean in having the CG1 separated into anterior and posterior elements, the absence of CG11, the acute heel of the pereopod III dactylus, and the ovate male telson with a distomedian concavity. Nevertheless, *A. groeningi* differs from *A. steinitzi* in the more strongly produced heel of the pereopod IV dactylus and the male telson almost straight instead of distinctly convex on the lateral margins.

Albunea groeningi belongs to the “*A. holthuisi* group” of Boyko (2002) in having the distinctly produced heel and narrow indent of the pereopod II dactylus, the acute heel of the pereopod III dactylus, and the distinctive median rows of thick setae on the male telson. *Albunea groeningi* differs from the other two species of the group, namely *A. holthuisi* and *A. marquisiana*, in lacking the CG11, the presence of a distomedian concavity on the telson in both males and females, and the more strongly developed heels of the pereopods II–IV dactyli. *Albunea holthuisi* further differs from *A. groeningi* and *A. marquisiana* in having the CG8 as one long median element instead of two to four short elements and the relatively narrower proximal part of the blade of the pereopod III dactylus.

Boyko (2002) mentioned that *A. groeningi* is the sister species of *A. holthuisi*. However, the phylogenetic analyses of Boyko & Harvey (2009) show that the closest relative of *A. groeningi* is *A. symmysta*. *Albunea groeningi* differs from *A. symmysta* by the more strongly developed heels of the pereopods II–IV dactyli, the relatively narrower proximal part of the blade of each pereopods II and III dactyli and the shape of the telsons of male and female.

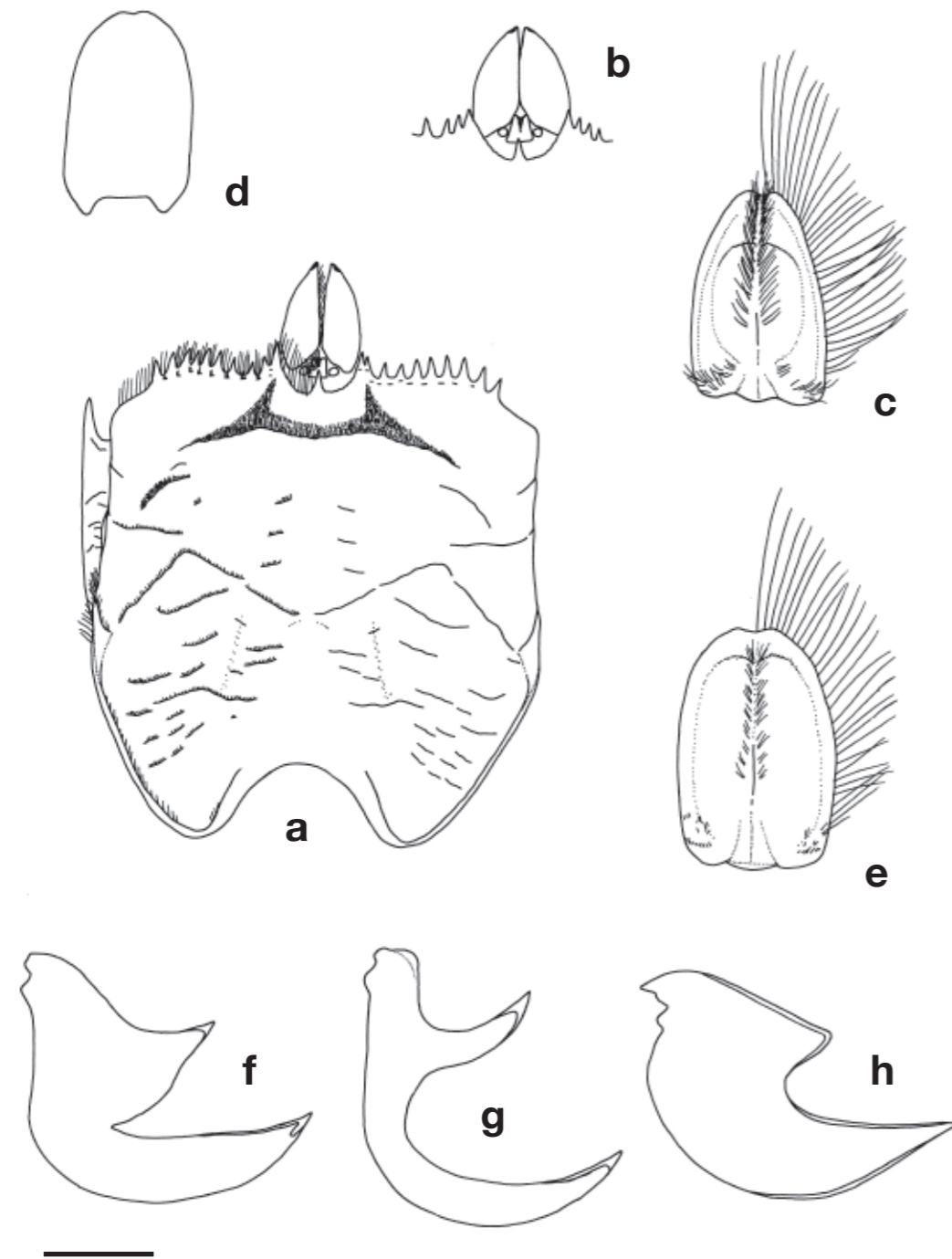


Fig. 6. Paratype male (cl 9.8 mm), Kaohsiung County, 7 Jun 1992, a, c, f–h; paratype female (cl 11.2 mm), same locality and date, b, e; paratype male (cl 9.2 mm), same locality and date, d: **a**, carapace, ocular peduncles, and left branchiostegite, dorsal view (setae omitted from right side); **b**, ocular peduncles and ocular plate, dorsal view (setae omitted); **c–e**, telson, extensor view (c, e: marginal setae omitted from right side; d: setae omitted); **f**, right pereopod II, dactylus, lateral view (setae omitted); **g**, right pereopod III, dactylus, lateral view (setae omitted); **h**, right pereopod IV, dactylus, lateral view (setae omitted). Scale: a–b = 2.7 mm; c–e = 1.7 mm; f–h = 1.8 mm.

Albunea occulta Boyko, 2002
隱匿管須蟹



Fig. 7. Female (24.9 mm), Mituo, Kaohsiung County, 2004.

Albunea symmista.—Gordon, 1938: 187 (in part). [not *Albunea symmista* (Linnaeus, 1758)]

Albunea symmista.—Miyake, 1965: 651. [not *Albunea symmista* (Linnaeus, 1758)]

Albunea occultus Boyko, 2002: 313, figs. 100–101 [type locality: Sand bar no. 1, Darwin, Northern Territory, Australia].

Albunea occulta.—Sakai & Sawada, 2006: 1358 [emendation of specific name].

Material examined.—Danshuei, Taipei County, May 1995: 1 male (cl 16.2 mm) (NTOU A00092).—5 Mar 2000: 1 female (cl 16.0 mm) (NTOU A00131). Tongsiao, Miaoli County, 30 Aug 1992: 1 male (cl 14.3 mm) (NTOU A00126). Cijin fishing port, Kaohsiung County, 24 Jan 1992: 1 male paratype (cl 19.7 mm) (NTOU A00093). Ezailiao, Kaohsiung County, 13 May 2000: 3 males (cl 16.1–23.5 mm), 1 female (cl 17.0 mm) (NTOU A00133).—17 Jan 2001: 3 males (cl 14.6–17.7 mm), 3 females (cl 20.2–24.0 mm) (NTOU A00127). Gushan, Kaohsiung City, 1 Apr 1995: 2 females (cl 19.6, 20.6 mm) (NTOU A00091). Mituo, Kaohsiung County, 2004: 2 females (cl 23.3, 24.9 mm) (NTOU A01112). Nanliao fishing port, Mituo, Kaohsiung County, 3 Apr 1988: 1 female paratype (cl 25.3 mm) (NTOU A00134).—24 Nov 1990: 2 males (cl 17.6, 18.3 mm) (NTOU

A01114).—10 May 1991: 1 female (cl 23.7 mm) (NTOU A00116). Singda Harbor, Kaohsiung County, 23 Mar 1985: 3 males (cl 18.3–20.4 mm) (NTOU A00091). Gengfang fishing port, Yilan County, 30 Jul 1999: 1 female (cl 22.7 mm) (NTOU A00129). Gengsin fishing port, Yilan County, 21 May 1991: 1 female (cl 25.9 mm) (NTOU A00128). Matsu, Lienchiang County, 9 May 2001: 2 males (cl 6.6, 10.2 mm) (NTOU A00459).

Diagnosis.—Carapace with CG1 separated into anterior and posterior elements; CG3 broken into 4–7 short elements between posterior lateral elements of CG1; CG4 with lateral element only reaching or distinctly overreaching level of mesial end of CG1 posterior element; CG5 widely separated into 2 short, anteriorly convex elements; CG8 present as 2 long elements; CG11 present as 1 long or 2 short median elements; hepatic region without short groove; posterior submarginal grooves long, reaching nearly to entire length of posterior concavity. Rostrum reaching proximal margin of ocular plate. Ocular plate subquadrate. Distal segment of ocular peduncle elongate subtriangular in shape, tapering distally; lateral margins slightly convex; mesial margins straight. Dactylus of pereopod II with heel produced and rounded; indent narrow. Dactylus of pereopod III with heel elongate and subacute. Dactylus of pereopod IV sinuous from base to tip, with low obtuse heel and shallow indent. Telson of male spatulate; distal margin with narrowly rounded median projection; lateral margins strongly convex. Telson of female ovate; distal margin slightly produced medially.

Size.—Males to cl 23.5 mm (present study) and females to cl 26.7 mm (Boyko, 2002).

Coloration.—Carapace, abdomen, and pereopods entirely whitish or bluish, brown on dorsal and lateral surfaces; mesial surface of pereopod I whitish. Distal segments of ocular peduncles bluish brown, each with narrow white band at base of cornea. Antennular peduncles and flagella also bluish brown; flagella with narrow white bands. Sometimes, body and pereopods entirely reddish brown (see Miyake, 1998: pl. 53–fig 2; as *A. symmista*).

Habitat.—Sandy bottoms, intertidal down to 82 m deep (Boyko, 2002).

Distribution.—From southern Japan (north to Tosa Bay) southward to the eastern and western coasts of Australia (Boyko, 2002).

Remarks.—This species was originally named *A. occultus* by Boyko (2002) but, as first noted by Sakai & Sawada (2006), it must be emended to *A. occulta* because the genus is of feminine gender. Boyko (2002) described this species based on the material including some paratypes from Taiwan. The males of the Taiwanese material show some variations in the shape of the telson with sizes. The telson is narrower in small specimens than in large specimens, and its distomedian margin is not so abruptly narrowed in small specimens unlike in large individuals. The telson of the largest female paratype examined (cl 25.3 mm, NTOU A00134) has the distomedian margin being more weakly produced than that of the illustration given by Boyko (2002, fig 101G).

Albunea occulta is characterized by the separation of the CG1 into anterior and posterior elements, the presence of the CG11, the acute heel of the pereopod III dactylus, and the spatulate-shaped male telson (see Boyko, 2002). Although *A. catherinae*, *A. elegans*, *A. holthuisi*, *A. lucasia*, *A. marquisiana*, and *A. paretii* all have the same characters of the CG1, CG11 and pereopod III dactylus, they differ from *A. occulta* in the male telson being ovate instead of spatulate.

Although Boyko (2002) mentioned that *A. occulta* is most closely related to *A. symmista*, the phylogenetic analyses by Boyko & Harvey (2009) do not support this relationship. Nevertheless, *A. occulta* does superficially resemble *A. symmista* and *A. okinawaensis*. These three species are similar in having the separation of the CG1 into anterior and posterior elements, the roundly produced heel and narrow indent of the pereopod II dactylus, the acute heel of the pereopod III dactylus, and the spatulate-shaped male telson. *Albunea occulta* is further allied to *A. okinawaensis* in having the relatively long, submarginal grooves along the posterior margin of the carapace and the weakly concave, lateral margin of the distal segment of ocular peduncle. However, *A. occulta* differs from both *A. okinawaensis* and *A. symmista* in the presence of the CG11, the much more weakly concave

indent of the pereopod IV dactylus, and the distomedian margin of the male telson being narrowed abruptly rather than gently. The photographs of “*A. symmista*” given by Asakura (1995) and Miyake (1998) likely depict *A. occulta* instead, based on the appearance of the setose grooves on the carapace.

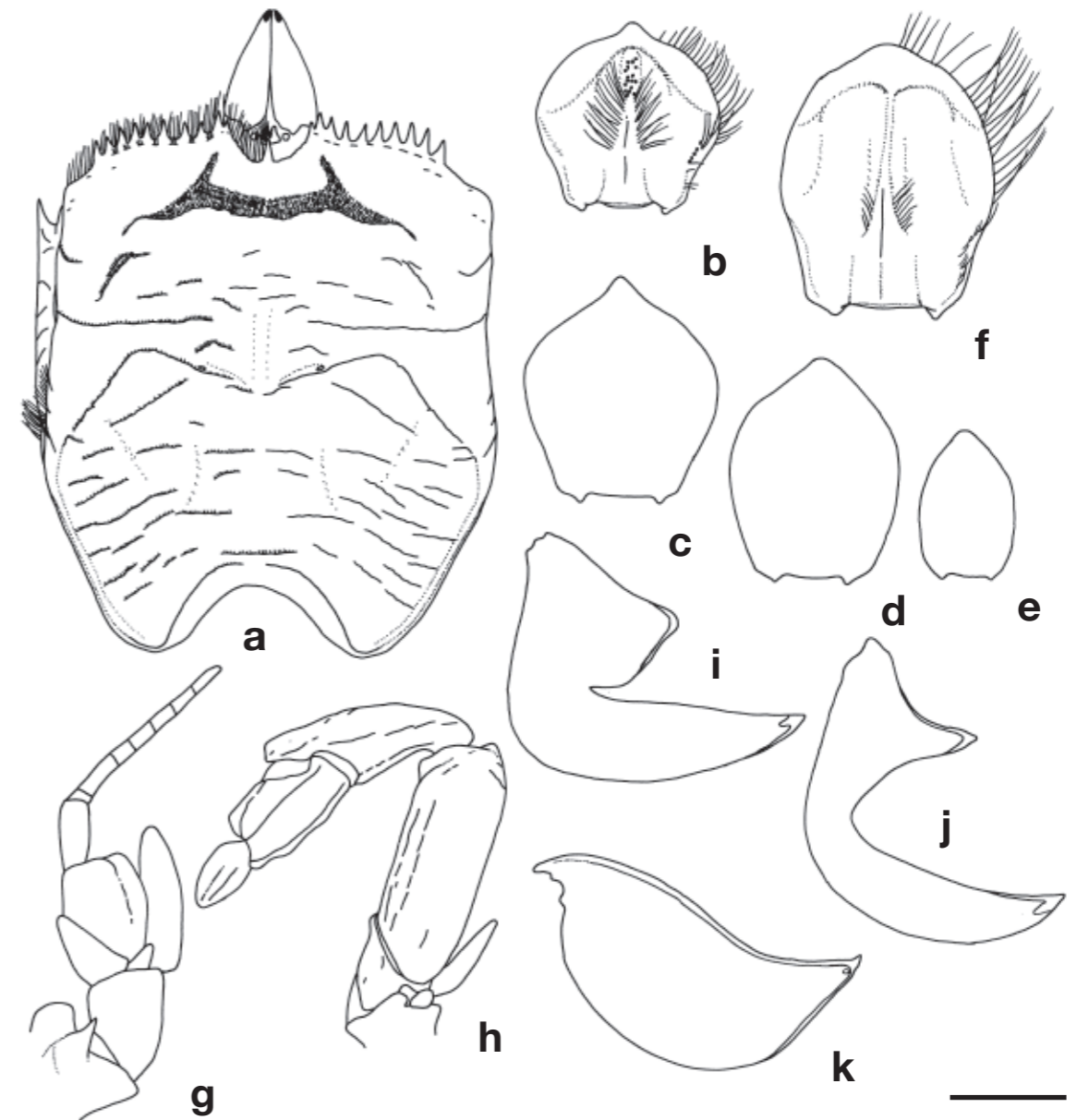


Fig. 8. Paratype male (cl 19.7 mm), Cijin fishing port, Kaohsiung County, 24 Jan 1992, a–b, g–k; male (cl 16.2 mm), Danshuei, Taipei County, May 1995, c; male (cl 10.2 mm), Matsu, Lienchiang County, 9 May 2001, d; male (cl 6.6 mm), same locality and date, e; paratype female (cl 25.3 mm), Nanliao fishing port, Mituo, Kaohsiung County, 3 Apr 1988, f; a, carapace, ocular peduncles, and left branchiostegite, dorsal view (setae omitted from right side); b–f, telson, extensor view (b, f: marginal setae omitted from right side; c–e: setae omitted); g, left antenna, lateral view (setae omitted); h, left maxilliped III, lateral view (setae omitted); i, right pereopod II, dactylus, lateral view (setae omitted); j, right pereopod III, dactylus, lateral view (setae omitted); k, right pereopod IV, dactylus, lateral view (setae omitted). Scale: a = 5.1 mm; b, f–k = 3.5 mm; c = 2.8 mm; d–e = 1.7 mm.

Albunea okinawaensis Osawa & Fujita, 2007

琉球管須蟹



Fig. 9. Male (cl 17.2 mm), Ezailiao, Kaohsiung County, 17 Jan 2000.

Albunea okinawaensis Osawa & Fujita, 2007: 128, figs. 1–4, 6A–B [type locality: Gushikawa, Kin Bay, Okinawa Island, Ryukyu Islands].

Material examined.—Ezailiao, Kaohsiung County, 17 Jan 2000: 1 male (cl 17.2 mm) (NTOU A00140).—13 May 2000: 1 female (cl 23.8 mm) (NTOU A00137).

Diagnosis.—Carapace with CG1 separated into anterior and posterior elements; CG3 broken into 6–8 short or relatively long elements (lateral elements oblique) between posterior lateral elements of CG1; CG4 with lateral element reaching or nearly reaching level of mesial end of CG1 posterior element; CG5 widely separated into 2 short, transverse or anteriorly convex elements; CG8 present as 2–4 short or long median elements; CG11 absent; hepatic region without short groove; posterior submarginal grooves long, reaching more than two thirds length of posterior concavity. Rostrum not reaching proximal margin of ocular plate. Ocular plate subtriangular or subquadrate. Distal segment of ocular peduncle elongate subtriangular in shape, tapering distally; lateral margins slightly or moderately convex; mesial margins straight. Dactylus of pereopod II with heel produced and rounded; indent narrow. Dactylus of pereopod III with heel elongate and acute or subacute. Dactylus of

pereopod IV sinuous from base to tip, with broadly rounded heel and broad indent. Telson of male spatulate or roundly rhomboid; distal margin roundly produced; lateral margins strongly convex on median part. Telson of female ovate; distal margin slightly produced medially.

Size.—Males to cl 17.2 mm, females to cl 23.8 mm (present study).

Coloration.—Carapace, abdomen, pereopods, and distal segments of ocular peduncles entirely brown on dorsal and lateral surfaces. Ocular peduncles each with narrow white band at base of cornea. Antennular peduncles and flagella also brown; flagella with narrow white bands. Osawa & Fujita (2007) mentioned the coloration of the type material as “The carapace, abdomen, ocular peduncles, and pereopods are entirely bluish brown in the holotype, whereas they are yellowish brown in the paratype”.

Habitat.—Sandy bottoms, intertidal to 40 m deep (Osawa & Fujita, 2007; present study).

Distribution.—Previously known only from the Okinawa Island, Ryukyu Islands, now from Taiwan.

Remarks.—*Albunea okinawaensis* closely resembles *A. occulta* and *A. symmysta*. Their differences are given under the “Remarks” of *A. occulta*. This species is recorded for the first time in Taiwan. The Taiwanese material also contains a female which is previously unknown for this species. The female specimen differs from the males in having longer submarginal grooves along the posterior margin of the carapace and the shallower indent of the pereopod IV dactylus. The shape of the female telson is generally similar among *A. occulta*, *A. okinawaensis*, and *A. symmysta*.

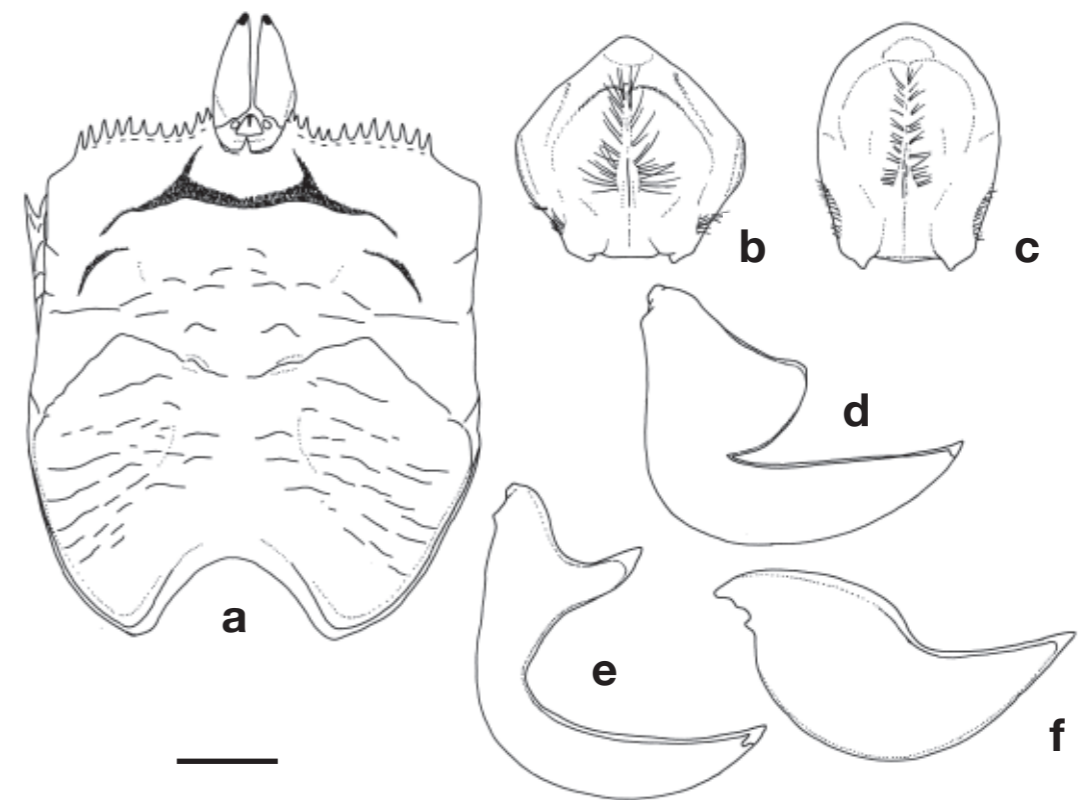


Fig. 10. Male (cl 17.2 mm), Ezailiao, Kaohsiung County, 17 Jan 2000, a–b, d–f; female (cl 23.8 mm), same locality and date, c: a, carapace, ocular peduncles, and left branchiostegite, dorsal view (setae omitted, except setal field); b–c, telson, extensor view (marginal setae omitted); d, right pereopod II, dactylus, lateral view (setae omitted); e, right pereopod III, dactylus, lateral view (setae omitted); f, right pereopod IV, dactylus, lateral view (setae omitted). Scale: a = 4.1 mm; b, d–f = 2.6 mm; c = 3.2 mm.

Albunea symmysta (Linnaeus, 1758)
東方管須蟹

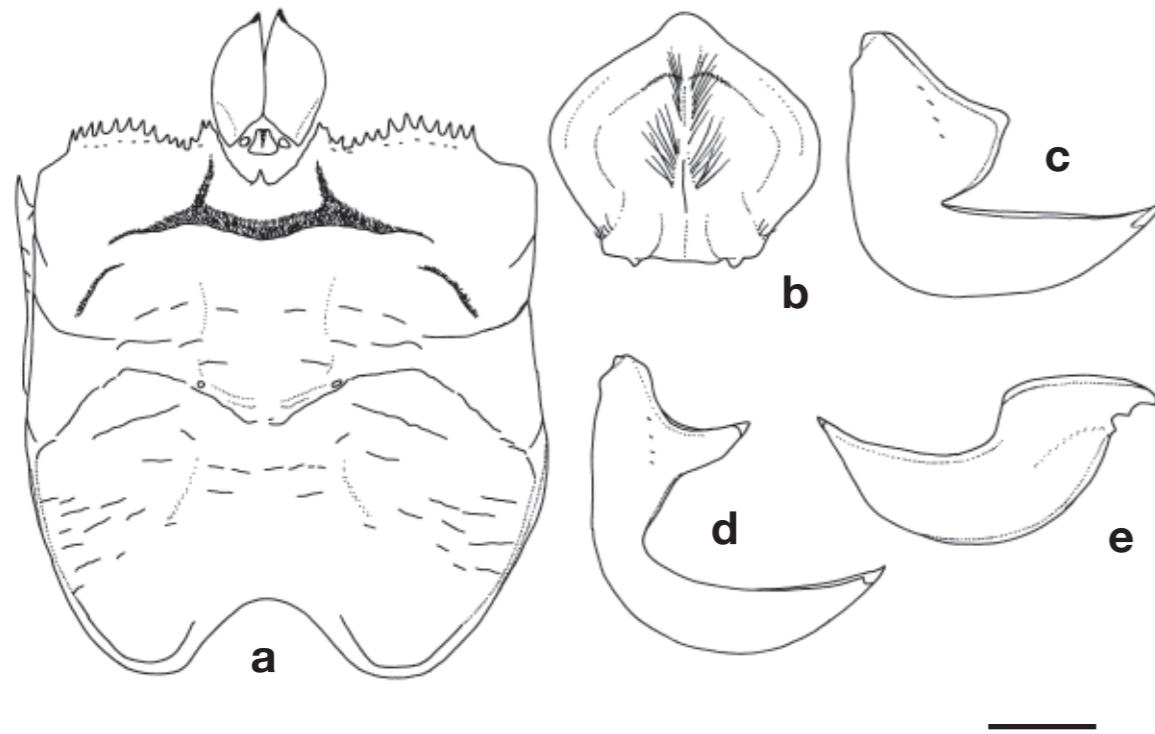


Fig. 11. Male (cl 15.3 mm), Dalinpu, Kaohsiung City, 30 April 1992: **a**, carapace, ocular peduncles, and left branchiostegite, dorsal view (setae omitted, except setal field); **b**, telson, extensor view (marginal setae omitted); **c**, right pereopod II, dactylus, lateral view (setae omitted); **d**, right pereopod III, dactylus, lateral view (setae omitted); **e**, left pereopod IV, dactylus, lateral view (setae omitted). Scale: a = 3.8 mm; b = 2.3 mm; c–e = 2.6 mm.

Cancer Symmysta Linnaeus, 1758: 630 [type locality: “Asia” was the only locality information given by Linnaeus (1758) for *A. symmysta*; the neotype (Zoologisk Museum, Oslo: ZMO F17538) designated by Boyko (2002) was collected from Madras, India, which became the type locality of *A. symmysta*].

Albunea edsoni Calado, 1997: 18, figs. 1–2 [type locality: Lord Howe Island, New South Wales, Australia].

Albunea symmysta.—Boyko, 2002: 303, figs. 98–99.

Material examined.—Dalinpu, Kaohsiung City, 30 Apr 1992: 1 male (cl 15.3 mm) (NTOU A00132).

Diagnosis.—Carapace with CG1 separated into anterior and posterior elements; CG3 broken into 5 or 6 short elements between posterior lateral elements of CG1; CG4 with lateral element reaching level of mesial end of CG1 posterior element; CG5 widely separated into 2 short, transverse or anteriorly convex elements; CG8 present as 2–6 short median elements; CG11 absent; hepatic region without short groove; posterior submarginal

grooves moderately long, reaching two thirds length of posterior concavity. Rostrum not reaching proximal margin of ocular plate. Ocular plate subtriangular or subquadrate. Distal segment of ocular peduncle elongate oval in shape, tapering distally; lateral margins strongly convex; mesial margins straight. Dactylus of pereopod II with heel produced and narrowly rounded; indent narrow. Dactylus of pereopod III with heel elongate and acute. Dactylus of pereopod IV sinuous from base to tip, with bluntly produced heel and broad indent. Telson of male roundly rhomboid; distal margin roundly produced; lateral margins strongly convex on median part. Telson of female ovate; distal margin slightly produced medially.

Size.—Males to 17.4 mm cl, females to 21.9 mm cl (Boyko, 2002).

Coloration.—Not known.

Habitat.—Sandy bottoms, intertidal to 151.5 m deep (Boyko, 2002).

Distribution.—From east coast of India to throughout southeast Asia as far as southern Taiwan (new record of the present study), the Philippines, Java in Indonesia, Queensland and Lord Howe Island in Australia (Boyko, 2002).

Remarks.—The taxonomy and complete synonymy of this species can be found in Boyko (2002). The misspelling of the species name “*symnista*” was introduced by Linnaeus (1767) and had been used by most authors until the study of Boyko (2002). *Albunea symmysta* is widely distributed in Asia but is here recorded for the first time from Taiwan. The distinguishing characters of *A. symmysta* are discussed under the “Remarks” of its allied species, *A. groeningi* and *A. occulta*.

Genus *Paralbunea* Serène, 1977

仿管須蟹屬

Paralbunea Serène, 1977: 54 [type species: *Paralbunea manihinei* Serène 1977, by monotypy. Gender: feminine].

Diagnosis.—Carapace wider than long, front broad, anterior margin weakly spinose or unarmed; hepatic anterolateral spine absent; branchiostegite with anterior submarginal spine. Distal segment of ocular peduncle flattened, short, cornea absent or greatly reduced. Antennule with ventral flagellum composed of 2 or 3 articles. Antennal peduncular segment I unarmed on lateral surface; flagellum composed of 6–8 articles. Pereopod I dactylus smooth on dorsal margin; carpus without dorsodistal spine. Telson with weak sexual dimorphism, fully calcified in male.

Remarks.—The genus *Paralbunea* should be considered as originally described by Serène (1977) instead of Serène (1979), as pointed out by Boyko (2002). Boyko & Harvey (2009) suggested that the genus is not monophyletic and is a basal lepidopine rather than a basal albuneine. *Paralbunea* includes four extant species; of which three are recorded from the Indo-West Pacific (Boyko, 2002). This genus is recorded for the first time from Taiwan with a new record of *P. dayriti* (Serène & Umali, 1965).

Paralbunea dayriti (Serène & Umali, 1965)

長鞭仿管須蟹



Fig. 12. Male (cl 9.0 mm), Dasi fishing port, Yilan County, Dec 1998.

Albunea dayriti Serène & Umali, 1965: 103, pl. 1–fig. 4, pl. 2–fig. 4, pl. 3–fig. 6, 6a, pl. 4–fig. 4, pl. 5–fig. 2, 2a, text-figs. 1d, 2b, 4c, 7b, 10a, 12a [type locality: Batangas Bay, Batangas Province, Philippines].

Paralbunea dayriti.—Serène, 1979: 97, fig. 2.—Boyko, 2002: 197, figs. 64–65.

Material examined.—Dasi fishing port, Yilan County, Dec 1998: 1 male (cl 9.0 mm) (NTOU A00161).

Diagnosis.—Carapace anterior margin with row of small spines on either lateral side of ocular sinus; CG1 separated into anterior and posterior elements; CG4 and CG5 with short median elements; CG8 present as 2–4 short or long median elements; posterior submarginal grooves short. Rostrum reaching proximal margin of ocular plate. Ocular plate subtriangular. Ocular peduncle apparently lacking median segment; distal segment subtriangular in shape, tapering distally; lateral margins strongly convex; mesial margins slightly convex; cornea reduced, faint. Dactylus of pereopod II with heel produced and narrowly rounded; indent broad. Dactylus of pereopod III with heel somewhat elongate and narrowly rounded. Dactylus of pereopod IV sinuous from base to tip, with broadly rounded heel and broad indent. Telsons of male and female pear-shaped; distal margin rounded.

Size.—Males to cl 14.8 mm and females to cl 11.3 mm (Boyko, 2002).

Coloration.—Carapace, abdomen, antennular peduncles and flagella, pereopods, and distal segments of ocular peduncles entirely pale brown on dorsal and lateral surfaces.

Habitat.—Sandy bottoms in depths of 6.1–45.5 m (Boyko, 2002).

Distribution.—Known from southern Japan (north to Chiba Prefecture) southward to Western Australia, and eastward to New Caledonia, the Marshall Islands, and Tahiti (Boyko, 2002).

Remarks.—This species is a new record for Taiwan. The single Taiwanese specimen has the pereopod III dactylus partly broken and lacks the entire pereopod IV dactylus. The characters of these pereopods given in the “Diagnosis” are based on the concepts of Boyko (2002). *Paralbunea dayriti* is most similar to *P. paradoxa* (Gordon, 1938) from Singapore and the Philippines in having a subtriangular ocular plate, short distodorsal projection of the maxilliped III carpus, distinctly produced heel of the pereopod III dactylus, and the strongly concave indent of the pereopod IV dactylus. These two species are sister species (Boyko, 2002; Boyko & Harvey, 2009). Nevertheless, *P. dayriti* can be readily separated from *P. paradoxa* by the carapace with a row of small spines on each side of the anterior margin (unarmed in *P. paradoxa*), the presence of the CG8 (absent in *P. paradoxa*), the distal segment of the ocular peduncle being subtriangular (subquadrate in *P. paradoxa*), and the heels of pereopods III and IV being much less elongate and with rounded tips (acute tips of pereopods III and IV dactyli in *P. paradoxa*).

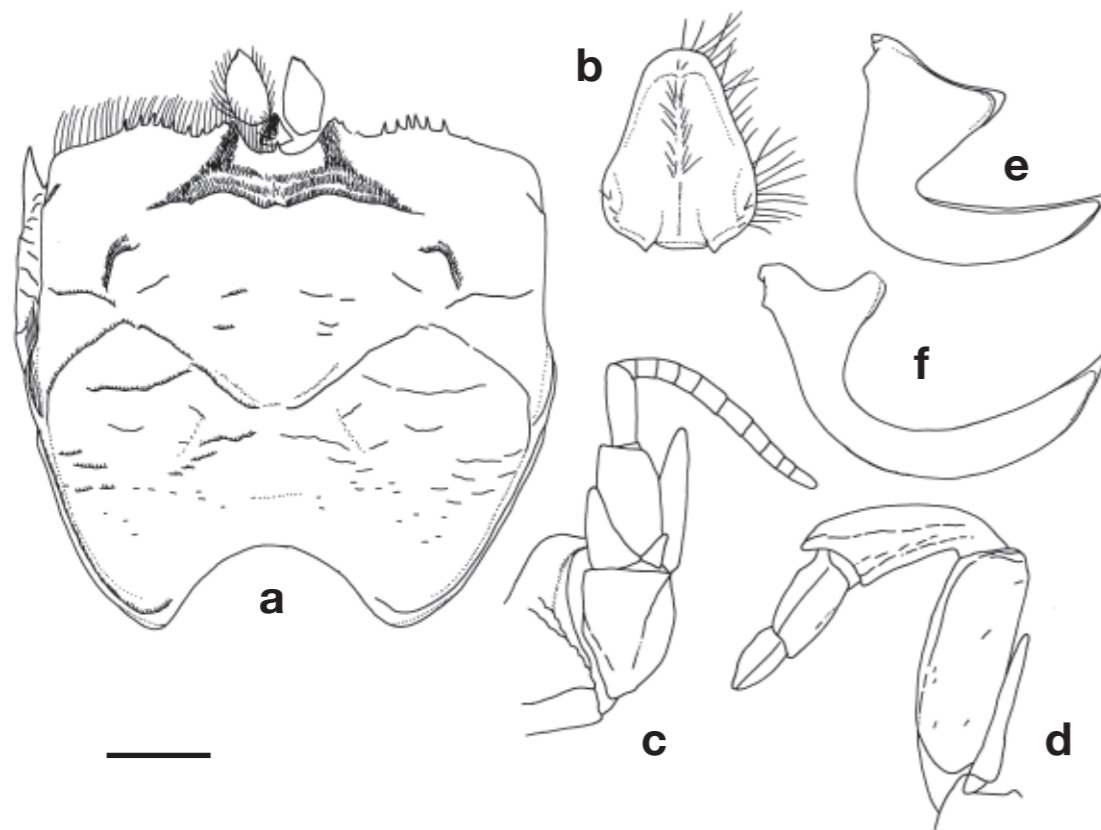


Fig. 13. Male (cl 9.0 mm), Dasi fishing port, Yilan County, Dec 1998: **a**, carapace, ocular peduncles, and left branchiostegite, dorsal view (setae omitted from right side); **b**, telson, extensor view (marginal setae omitted from right side); **c**, left antenna, lateral view (setae omitted); **d**, left maxilliped III, lateral view (setae omitted); **e**, right pereopod II, dactylus, lateral view (setae omitted); **f**, right pereopod III, dactylus, lateral view (setae omitted). Scale: a = 2.3 mm; b, e–f = 1.8 mm; c–d = 1.5 mm.

Family Hippidae Latreille, 1825

蟬蟹科

Hippidae Latreille, 1825: 275 [correction of the original spelling Hippides Latreille, 1825 (ICZN, 1963: Opinion 643); type genus: *Hippa* Fabricius, 1787].

Diagnosis.—Carapace ovate, strongly convex on dorsal surface, with lateral expansions covering pereopods II–IV. Ocular peduncle slender; distal segment subdivided into 2 pseudosegments; cornea distinct. Antennule with dorsal flagellum being much shorter than carapace. Antennal flagellum short or long; acicle absent. Mandible reduced. Maxilliped III merus enlarged; exopod absent. Pereopod I non-chelate; dactylus subcylindrical or lamellate. Pereopods II and III dactyli laterally compressed and dorsoventrally expanded. Pereopod IV dactylus much shorter than pereopods II and III dactyli, subtriangular. Telson elongate, lanceolate. Abdominal somite II with well developed pleura, much larger than following somites. Females with uiramous, paired pleopods on abdominal somites II–IV; males without pleopods.

Remarks.—This family contains three genera: *Emerita* Scopoli, 1777, *Hippa* Fabricius, 1787, and *Mastigochirus* Miers, 1878. *Emerita* is distinguished from the other two genera by the antennal flagellum being at least as long as the carapace and densely covered ventrally with long plumose setae, and the pereopod I dactylus being lamellate and broad. *Hippa* and *Mastigochirus* both have the antennal flagellum being considerably shorter than the carapace and the pereopod I dactylus being subcylindrical and slender. These two genera are separated from each other by the length and structure of the pereopod I dactylus, as shown below in the key to the Taiwanese genera.

The hippid species from Taiwan all have a subdivision on the distal segment of the ocular peduncle. A similar structure is also known in *Emerita* of Hippidae and *Blepharipoda* Randall, 1840 of Blepharipodidae; it is not a true segmentation, but is only a weak calcification separating the distal segment into two pseudosegments (cf. Powar, 1969, for “*Hippa*” = *Emerita*; Boyko, 2002).

Hippids, commonly called mole crabs, live buried in sandy substrate or fine sediments in the intertidal to subtidal zones. McNeill (1958) referred to the tropical species collectively, under the name *Hippa adactyla*, as “turtle crab”. This common name, however, is more often applied to species in the genus *Cryptolithodes* Brandt, 1848 (Lithodidae), although they are also known as “butterfly” and “umbrella” crabs.

Only the genera *Hippa* and *Mastigochirus* are known from Taiwan, with the latter being a new record for the island.

Key to genera of Hippidae from Taiwan

1. Pereopod I dactylus less than one-third length of carapace, non-articulated *Hippa*
– Pereopod I dactylus greatly elongate, nearly as long as carapace, multi-articulated *Mastigochirus*

Genus *Hippa* Fabricius, 1787

蟬蟹屬

Hippa Fabricius, 1787: 329 [type species: *Hippa adactyla* Fabricius, 1787, by subsequent designation of Rathbun (1900). Gender: feminine].

Remipes Latreille, 1806: 45 [type species: *Remipes testudinarius* Latreille, 1806 (= *Hippa adactyla* Fabricius, 1787), by subsequent monotypy of Latreille (1806). Gender: masculine].

Diagnosis.—Antennal flagellum considerably shorter than carapace. Maxilliped III merus broadened, subovate. Pereopod I subcylindrical; dactylus less than one-third length of carapace, styliform, non-articulated.

Remarks.—The genus *Hippa* has not been fully revised since the work of De Man (1896, 1898; as *Remipes*), although lists of species of this genus are given in Haig *et al.* (1986) and Boyko & Harvey (1999).

Although De Grave *et al.* (2009) listed 14 as the number of species in this genus, Boyko & Harvey (1999) listed 13 species known from the Indo-West Pacific region and an additional three species known from the eastern Pacific and Atlantic. Among these 16 species, *H. alcimede* (De Man, 1902) and *H. granulata* (Borradaile, 1904) are considered to be possible synonyms of *H. hirtipes* (Dana, 1852) (Haig *et al.*, 1986; Boyko & Harvey, 1999), but their types have not been carefully compared yet and both are still considered valid species. *Hippa marmorata* (Hombron & Jacquinot, 1846) is now officially treated as the senior synonym of *H. pacifica* (Dana, 1852) (ICZN, 2004, Opinion 2063; see Remarks of *H. marmorata*). Thus, there are currently 15 species of *Hippa* known worldwide, with 12 known from the Indo-West Pacific, including *H. alcimede* and *H. granulata*.

Haig (1974) and Haig *et al.* (1986) divided the species of *Hippa* into two informal groups based on the development of the frontal lobes and the presence or absence of a submarginal row of slightly elongate, setose pits on the lateral surfaces of the carapace. One group is characterized by the presence or absence of a broad triangular, median frontal lobe; the lateral frontal lobes being usually poorly developed; and no distinct submarginal row of setose pits on the lateral surface of the carapace (this row is usually replaced by a series of oblique striations or oblique rows of pits). This group includes three species in the Indo-West Pacific: *H. australis* Hale, 1927, *H. indica* Haig, Murugan & Nair, 1986, and *H. truncatifrons* (Miers, 1878). Another group is characterized by two or three median frontal lobes, the lateral frontal lobes being well developed, and a distinct submarginal row of setose pits on the lateral surface of the carapace. This group contains the other nine Indo-West Pacific species.

Five species are presently recorded from Taiwan. Only *Hippa adactyla* has been reported from Taiwan before, the other four species are new records for the island.

Key to species of *Hippa* from Taiwan

1. Frontal margin of carapace with 1 broad median lobe, lateral frontal lobes weakly developed; lateral surface of carapace with series of short oblique ridges *H. truncatifrons*
- Frontal margin of carapace with 2 or 3 median lobes, lateral frontal lobes well developed; lateral surface of carapace with submarginal row of slightly elongate, setose pits 2
2. Lateral frontal lobes of carapace greatly exceeding median lobes 3
- All frontal lobes of carapace about equally projecting 4
3. Pereopods II and III dactyli each with distinct indent cut into right angle on dorsal margin; antennal flagellum composed of 3–7 (usually 5) articles *H. adactyla*
- Pereopods II and III dactyli each with obtuse indent on dorsal margin; antennal flagellum composed of 1 or 2 articles *H. admirabilis*
4. Lateral surface of carapace with submarginal row of 30–40 setose pits; antennal flagellum composed of usually 2 articles; median frontal lobes separated by shallow sinus, rarely with minute median denticle *H. marmorata*
- Lateral surface of carapace with submarginal row of 43–55 setose pits; antennal flagellum composed of usually 3 articles; median frontal lobes usually separated by low, rounded lobe *H. ovalis*

Hippa adactyla Fabricius, 1787

側指蟬蟹



Fig. 14. Male (cl 15.4 mm), Nan-ao, Yilan County, 18 Aug 2009.



Fig. 15. Female (cl 28.0 mm), Nan-ao, Yilan County, 10 Sep 2009.



Fig. 16. Kending, Pingtung County, Aug 1999.

Hippa adactyla Fabricius, 1787: 329 [type locality: McCauley's Beach, Coff's Harbour jetty, New South Wales, Australia, by subsequent designation of a neotype by Haig (1970)].—Haig, 1970: 293; 1974: 179, fig. 2, pl. 6.—Bauchau, 1985: 310, pls. 1, 3A, C.

Remipes testudinarius Latreille, 1806: 45 [type locality: "in Oceano Australasiae"].—De Man, 1896: 463; 1898: pl. 33—fig. 50, 50a–c.

Remipes [*testudinarius*].—Latreille, 1817: 28 [type locality restricted to "Nouvelle-Hollande"].

Remipes denticulatifrons White, 1847: 57 [nomen nudum; type locality: Philippine Islands].

Remipes testudinarius var. *denticulatifrons*.—Miers, 1878: 318 (in part), pl. 5—fig. 2.—Balss, 1914: 92, text-fig. 50.

Material examined.—Ezailiao, Kaohsiung County, 13 May 2000: 1 female (cl 40.7 mm) (NTOU A00029). Kending, Pingtung County, 29 Sep 1999: 1 female (cl 27.0 mm) (NTOU A00030). Nan-ao, Yilan County, 18 Aug 2009: 1 male (cl 15.4 mm) (NTOU A01116).—10 Sep 2009: 1 female (cl 28.0 mm) (NTOU A01119). Tungching Bay, Lanyu, Taitung County, 10 Jul 1997: 1 female (cl 25.2 mm), 2 ovigerous females (cl 28.0, 30.4 mm) (NTOU A00121).—24 Jul 2000: 3 males (cl 26.8–27.7 mm), 2 females (cl 31.6, 33.7 mm), 3 ovigerous females (cl 28.8–33.7 mm) (NTOU A00031). No specific locality: 1 damaged specimen (NTOU A01115).

Diagnosis.—Carapace covered with numerous short, transverse ridges anteriorly bearing small rounded denticles; frontal margin with 2 median lobes separated by small rounded lobe, lateral lobes greatly exceeding tips of median lobes; frontal lateral margin broad; anterior lateral angle terminating in small projection; lateral surface with submarginal row of 48–55 slightly elongate, setose pits. Antennal flagellum composed of 3–7 (usually 5) articles. Pereopod I dactylus flattish. Pereopods II and III dactyli each with distinct indent cut into right angle on dorsal margin. Telson with lateral margins nearly straight; apex narrowly rounded.

Size.—Males to cl 27.7 mm and females to cl 40.7 mm (present study).

Coloration.—Carapace and abdomen generally bluish gray, margins and ridges on carapace and anterior margins of abdominal somites reddish brown; or bluish brown with numerous irregular-shaped, white or pale brown marks. Distal segments of ocular peduncles white, with brown marks. Antennular peduncles and flagella gray or bluish brown. Pereopod I generally bluish brown, sometimes with irregular-shaped white marks, margins of segments sometimes reddish brown. Pereopods II and III dactyli white.

Habitat.—Sandy bottoms of low intertidal to shallow subtidal.

Distribution.—From Madagascar eastward to the Marquesas Islands, northward to Japan (Misaki, Sagami Bay), and southward to Queensland, Australia (Haig, 1974; Miyake, 1978).

Remarks.—The antennal flagellum of *H. adactyla* was diagnosed as consisting of three to six articles (Haig, 1974; Boyko & Harvey, 1999). The present specimens from Taiwan have five to seven, usually five, articles in the antennal flagellum. *Hippa adactyla* is most similar to *H. admirabilis* (Thallwitz, 1892). The common features of these two species are: the frontal margin of the carapace having three median lobes and lateral lobes greatly exceeding the median lobes; the dorsal surface covered with short transverse ridges; and the lateral surfaces bearing a submarginal row of slightly elongate, setose pits. *Hippa adactyla* can be separated from *H. admirabilis* in the numbers of the articles of the antennal flagellum, and the shape of the pereopods II and III dactyli as given in the key to the Taiwanese species. These two species further differ in the structures of the dorsal surface and anterior lateral angle of the carapace, and the shape of the pereopod I dactylus. The short transverse ridges on the dorsal surface of the carapace have small rounded denticles on the anterior margins in *H. adactyla*, whereas they are rather smooth in *H. admirabilis*. The anterior lateral angle of the carapace terminates in a small but distinct projection in *H. adactyla*, but it is rounded in *H. admirabilis*. The pereopod I dactylus is flattish in *H. adactyla*, rather than subcylindrical in *H. admirabilis*.

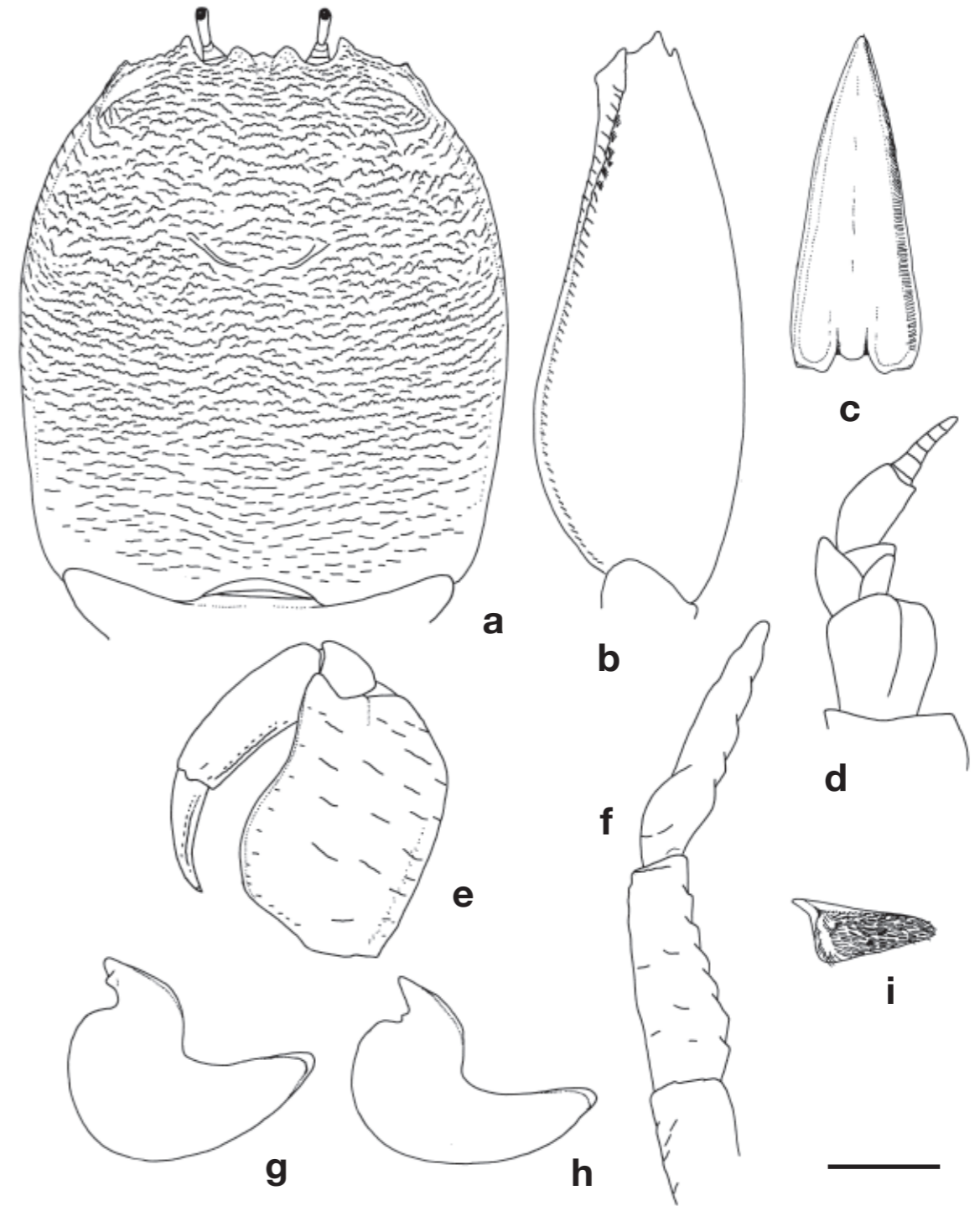


Fig. 17. Male (cl 27.7 mm), Tungching Bay, Lanyu, Taitung County, 24 Jul 2000, a–c, e–h; female (cl 31.6 mm), same locality and date, d; ovigerous female (cl 31.2 mm), same locality and date, i: **a**, carapace and ocular peduncles, dorsal view; **b**, carapace, lateral view (most setae on pits omitted); **c**, telson, extensor view (setae omitted from right side); **d**, left antenna, lateral view (setae omitted); **e**, left maxilliped III, lateral view (setae omitted); **f**, left pereopod I, dorsal view (setae omitted); **g**, right pereopod II, dactylus, lateral view (setae omitted); **h**, right pereopod III, dactylus, lateral view (setae omitted); **i**, right pereopod IV, dactylus, lateral view. Scale: a–b = 5.8 mm; c = 7.1 mm; d = 2.8 mm; e, g–i = 3.6 mm; f = 4.5 mm.

Hippa admirabilis (Thallwitz, 1892)

神奇蟬蟹

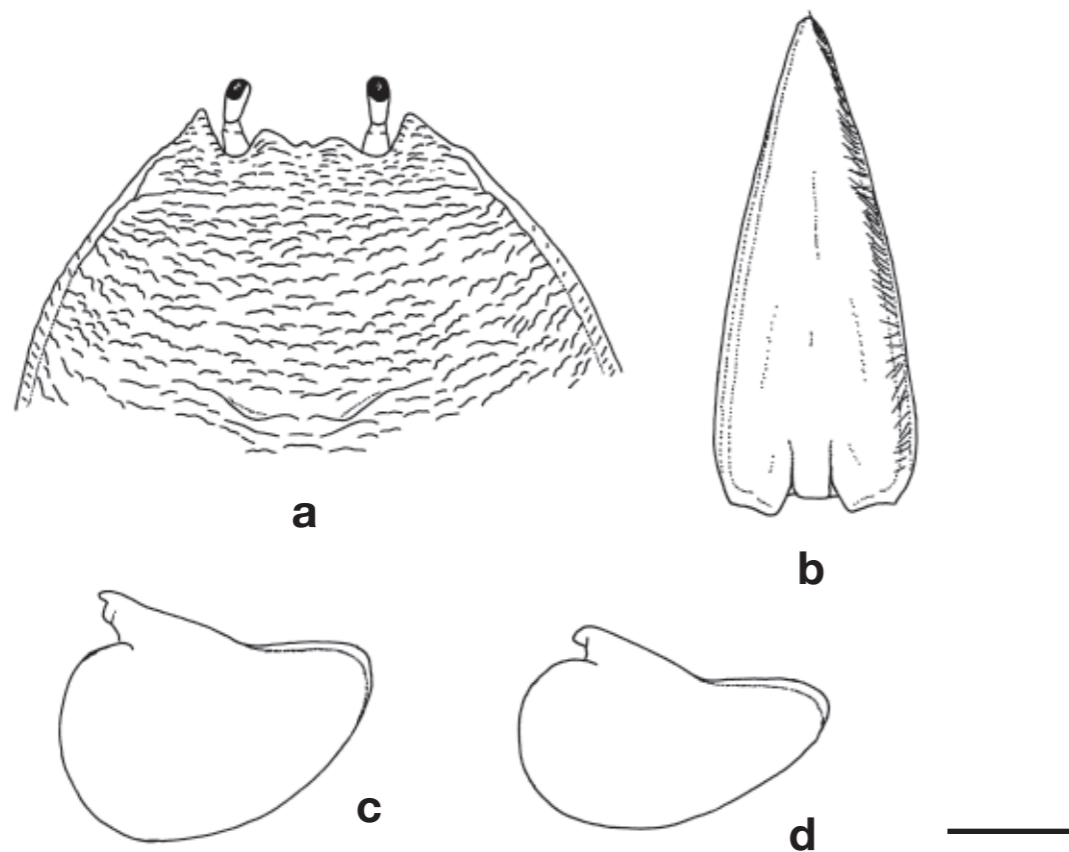


Fig. 18. Female (cl 20.0 mm), Hongtou Villiage, Lanyu, Taitung County, 24 Jul 2000: **a**, anterior part of carapace and ocular peduncles, dorsal view; **b**, telson, extensor view (marginal setae omitted from right side); **c**, right pereopod II, dactylus, lateral view (setae omitted); **d**, right pereopod III, dactylus, lateral view (setae omitted). Scale: a–b = 3.6 mm; c–d = 1.8 mm.

Remipes admirabilis Thallwitz, 1892: 36 [type locality: northwest of New Guinea].—De Man, 1896: 466; 1898: 705, pl. 33–fig. 51, 51a–d.

Material examined.—Hongtou Village, Lanyu, Taitung County, 24 Jul 2000: 1 female (cl 20.0 mm) (NTOU A00123).

Diagnosis.—Carapace covered with numerous short, transverse ridges; frontal margin with 2 median lobes separated by small rounded lobe, lateral lobes greatly exceeding tips of median lobes; anterior lateral angle rounded, not produced; lateral surface with submarginal row of 49–51 slightly elongate, setose pits. Antennal flagellum composed of 1 or 2 articles. Pereopod I dactylus subcylindrical. Pereopods II and III dactyli shallowly concave on dorsal margin. Telson with lateral margins nearly straight; apex narrowly rounded.

Size.—Males to cl 13.2 mm, females to cl 25.0 mm (De Man, 1896).

Coloration.—Not known.

Habitat.—Sandy bottoms and intertidal.

Distribution.—Previously known only from Papua New Guinea and Indonesia (De Man, 1896) and now from Taiwan.

Remarks.—This species is a new record for Taiwan. The Taiwanese specimen is composed of a soft body and its molted shell being partly broken. The illustrations given are based on the molted shell. *Hippa admirabilis* most closely resembles *H. adactyla*. As mentioned under the “Remarks” of *H. adactyla*, the two species differ in the characters of the antennal flagellum and the pereopods II and III dactyli.

Hippa marmorata (Hombron & Jacquinot, 1846)
大理石蟬蟹



Fig. 19. Ovigerous female (cl 12.6 mm), Houbihu, Kending, Pingtung County, 26 Jul 2009.



Fig. 20. Ovigerous female (cl 16.1 mm), Houbihu, Kending, Pingtung County, 27 Jul 2009.

(NTOU A00158). No specific locality, 24 Jul 2000: 1 female (cl 22.1 mm) (NTOU A00971).

Diagnosis.—Carapace covered with numerous short, transverse ridges; frontal margin with 2 median lobes separated by very broad, shallow sinus, lateral lobes reaching tips of median frontal lobes; anterior lateral angle



Fig. 21. Ovigerous female (cl 14.1 mm), Houbihu, Kending, Pingtung County, 26 Jul 2009.

rounded, not produced; lateral surface with submarginal row of 30–40 slightly elongate, setose pits. Antennal flagellum usually composed of 2 articles. Pereopod I dactylus subcylindrical. Pereopods II and III dactyli concave on dorsal margin. Telson with lateral margins slightly convex or nearly straight; apex narrowly rounded.

Size.—Males to cl 17.7 mm and females to cl 27.5 mm (Haig, 1974).

Coloration.—Body and pereopods generally milky white or pale brown. Carapace with irregular-shaped, dark brown marks. Abdominal somites also with few to numerous dark brown marks. Telson white. Distal segments of ocular peduncles white. Antennular peduncles white; proximal parts of segment I orange; flagella brown or bluish. Pereopod I with dark brown band on median part of each merus, carpus, and dactylus. Pereopods II–IV white. Eggs orange. Experiments in the laboratory and observations in the field have shown that individuals of *H. marmorata* can adapt to the color of local substrates as they grow (Wenner, 1972, as *H. pacifica*).

Habitat.—Sandy bottom and intertidal.

Distribution.—In the Indo-West Pacific, from Tanzania eastward to the Hawaiian Islands, southward to New South Wales, Australia, and northward to mainland China and southern Japan (Haig, 1974; Miyake, 1978; Sun & Wang, 1996). It is also found in the eastern Pacific from the upper Gulf of California south to Panama as well as Socorro, Clipperton, Cocos, and Galapagos Islands (Efford, 1972).

Remarks.—This species is recorded for the first time from Taiwan. The Taiwanese material has the antennal flagellum composed of two articles, except for a male specimen from Houbihu that has two or three articles on each side. Boyko & Harvey (2002) showed that the extant syntypes of *H. marmorata* belong to the same species as *H. pacifica* but proposed that the latter name should take precedence over the former because “*H. pacifica*” has been cited numerous times in taxonomic works and it is also an important experimental animal that is used in studies of intraspecific competition and intertidal zonation, color change, various aspects of population biology, and reproductive biology. However, Holthuis (2002a) subsequently commented that the rule of priority should not be suspended to give precedence to *H. pacifica* over *H. marmorata*. The International Commission of the Zoological Nomenclature (ICZN, 2004, Opinion 2063) ruled that the priority should be maintained for *H. marmorata*, and noted that the actual year when the original illustrations of *H. marmorata* were published is cited in Clark & Crosnier (2000). The correct authorship for this species was emended by Holthuis (2002b) to “Hombron & Jacquinot”.

Remipes marmoratus Hombron & Jacquinot, 1846: pl. 8—figs. 22–26 [type locality: Raffles Bay, Northern Territory, Australia].—Jacquinot & Lucas, 1854: 97.

Remipes pacificus Dana, 1852: 407 [type localities of syntypes: Hawaiian Islands (as Sandwich Islands) and Fiji Islands. Lectotype designated by Boyko & Harvey (2002) for a specimen from the Hawaiian Islands (MCZ 1406, deposited in the Museum of Comparative Zoology, Harvard University)]; 1855: pl. 25—fig. 7a–g.—De Man, 1896: 476; 1898: 705, pl. 33—fig. 53, 53a–c.

Remipes testudinarius.—Miers, 1878: 316 (in part), pl. 5—fig. 1. [not *Remipes testudinarius* Latreille, 1806=*Hippa adactyla* Fabricius, 1787]

Hippa adactyla.—McNeill, 1968: 39 (in part, Murray Island, Torres Strait). [not *Hippa adactyla* Fabricius, 1787]

Hippa pacificus.—Thomassin, 1969: 157, text—figs. 7c, 8c, 10, pl. 7.

Hippa pacifica.—Haig, 1974: 181, fig. 3.—Bauchau, 1985: 313, pls. 4, 5B–C.—Boyko & Harvey, 1999: 396, fig. 10.

Hippa pacific [sic].—Sun & Wang, 1996: 28, fig. 2.

Material examined.—Houbihu, Kending, Pingtung County, 26 Jul 2009: 3 ovigerous females (cl 12.6–14.1 mm) (NTOU A01124).—27 Jul 2009: 1 male (cl 10.8 mm), 2 ovigerous females (cl 16.1, 16.9 mm)

Hippa marmorata is most similar to *H. ovalis* in the characters of the carapace and antennal flagellum. The carapaces of these two species have the frontal margin with two or three median lobes and a lateral lobe on each side being extended to about the same level of the median lobes, the dorsal surface covered with short transverse ridges, and the lateral surface with a submarginal row of 30 or more slightly elongated setose pits. The antennal flagella of *H. marmorata* and *H. ovalis* are composed of two or three articles. However, the two species differ in the numbers of the setose pits on the lateral surfaces and the shape of the median frontal lobes of the carapace, as indicated in the key to the Taiwanese species.

Hippa marmorata also resembles *H. celaeno* (De Man, 1896) and *H. picta* (Heller, 1861) in the general shape of the frontal lobes of the carapace, but differs from them in having the lateral surfaces of the carapace with a submarginal row of more than 30 slightly elongated setose pits (less than 30 setose pits in *H. celaeno* and *H. picta*), the median frontal lobes of the carapace separated by a much shallower sinus, and the antennal flagellum usually composed of two articles (one article in *H. celaeno* and *H. picta*).

It has been suggested that this species is a scavenger or predator, and some are known to feed on the Portuguese man-of-war, *Physalia physalis* (Haig, 1974; Wenner, 1977, as *H. pacifica*). The burrowing and swash behavior of *H. marmorata* were reported by Lastra et al. (2002, as *H. pacifica*).

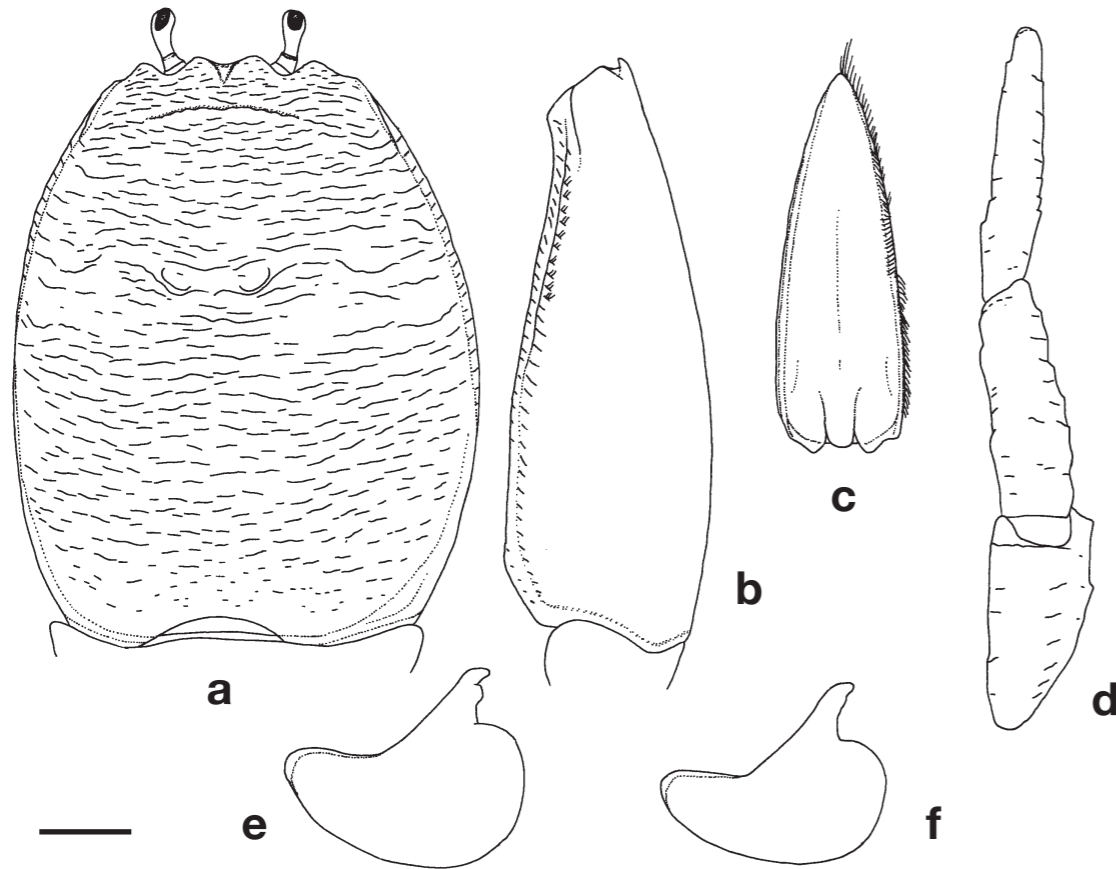


Fig. 22. Male (cl 10.8 mm), Houbihu, Kending, Pingtung County, 27 July 2009: **a**, carapace and ocular peduncles, dorsal view; **b**, carapace, lateral view (most setae on pits omitted); **c**, telson, extensor view (setae omitted from right side); **d**, left pereopod I, dorsal view (setae omitted); **e**, left pereopod II, dactylus, lateral view (setae omitted); **f**, left pereopod III, dactylus, lateral view (setae omitted). Scale: a–b = 1.8 mm; c = 2.0 mm; d = 1.2 mm; e–f = 0.9 mm.

Hippa ovalis (A. Milne-Edwards, 1862)

橢圓蟬蟹



Fig. 23. Male (cl 20.8 mm), Nan-ao, Yilan County, 17 Oct 2009.



Fig. 24. Female (cl 25.2 mm), Nan-ao, Yilan County, 10 Sep 2009.

Remipes ovalis A. Milne-Edwards, 1862: 12, fig. 5 [type locality: R union].—De Man, 1896: 471; 1898: 705, pl. 33–fig. 52, 51a–c.

Hippa ovalis.—Bauchau, 1985: 312, pls. 2, 3B, 5A.

Material examined.—Dalinpu, Kaohsiung City, 30 Dec 1991: 1 female (cl 28.2 mm) (NTOU A00025). Northeast Taiwan, 5 Feb 1992: 1 female (cl 30.6 mm) (NTOU A00028). Nan-ao, Yilan County, 18 Aug 2009: 1 female (cl 20.7 mm) (NTOU A00125).—10 Sep 2009: 2 females (cl 25.2, 27.2 mm) (NTOU A01118).—17 Oct 2009: 2 males (cl 19.6, 20.8 mm), 2 females (cl 19.8, 23.9 mm) (NTOU A01117). Meilun River, Hualien County, 4 Apr 1992: 1 female (cl 24.6 mm) (NTOU A00024). Hongtou Village, Lanyu, Taitung County, 24 Jul 2000: 2 males (cl 22.0, 27.5 mm), 9 ovigerous females (cl 24.5–31.8 mm), 3 females (cl 29.9–31.2 mm) (NTOU A00027).—no date: 1 female (cl 28.7 mm) (NTOU A01125). Lanyu, Taitung County, 10 Jul 1997: 2 ovigerous females (cl 25.7, 26.2 mm) (NTOU A00026).

Diagnosis.—Carapace covered with numerous short, transverse ridges; frontal margin with 2 median lobes separated by low, rounded lobe (low lobe sometimes indistinct or absent), lateral lobes usually slightly exceeding tips of median frontal lobes; anterior lateral angle rounded, not produced; lateral surface with submarginal row of 43–49 slightly elongate, setose pits. Antennal flagellum composed of 2–4 (usually 3) articles. Pereopod I dactylus subcylindrical. Pereopods II and III dactyli shallowly concave on dorsal margin.

Telson with lateral margins nearly straight; apex narrowly rounded.

Size.—Males to cl 27.5 mm (present study) and females to cl 36.0 mm (De Man, 1896).

Coloration.—Carapace and abdomen entirely gray or bluish brown, sometimes with large patches of irregular-shaped white marks. Abdominal somites brown on margins. Distal segments of ocular peduncles white or pale brown, with brown marks. Antennular peduncles and flagella bluish brown. Pereopod I generally bluish brown; proximal and distal parts of propodus blue. Pereopods II and III dactyli white.

Habitat.—Sandy bottoms and intertidal.

Distribution.—Widely distributed from the east coast of Africa eastward to Papua New Guinea (Bauchau, 1985), and now from Taiwan.

Remarks.—This species is reported for the first time in Taiwan. The carapace of a female specimen (cl 20.7 mm) from Nan-ao is narrower than those of the other specimens examined. This difference is probably due to the small size of the specimen (cl 20.7 mm vs. cl 24.5–31.8 mm in the other female specimens). According to Haig (1974) and Boyko & Harvey (1999), *H. ovalis* is characterized by the lateral surface of carapace with a submarginal row of 45–55 setose pits. The present Taiwanese specimens have 43–49 setose pits, a number on the lower end of the known range and slightly extending it downward. *Hippa ovalis* most closely resembles *H. marmorata*, but differs in the characters of the carapace and antennal flagellum (see “Remarks” under *H. marmorata*).

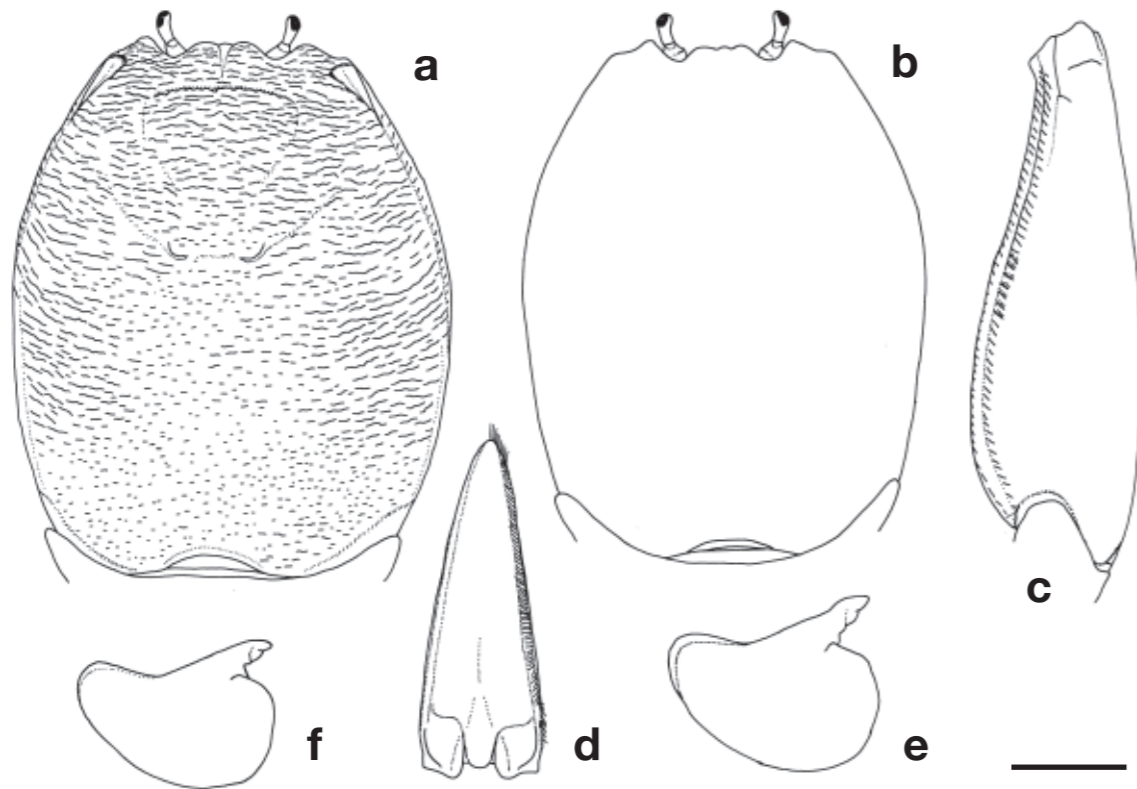


Fig. 25. Male (cl 22.0 mm), Hongtou Village, Lanyu, Taitung County, 24 Jul 2000, a, c–f; female (cl 20.7 mm), Nan-ao, Yilan County, 18 Aug 2009, b: **a**, carapace and ocular peduncles, dorsal view; **b**, same, dorsal view (surface structure omitted); **c**, carapace, lateral view (most setae on pits omitted); **d**, telson, extensor view (setae omitted from right side); **e**, left pereopod II, dactylus, lateral view (setae omitted); **f**, left pereopod III, dactylus, lateral view (setae omitted). Scale: a–c = 4.8 mm; d = 5.5 mm; e, f = 2.6 mm.

Hippa truncatifrons (Miers, 1878)

截額蟬蟹

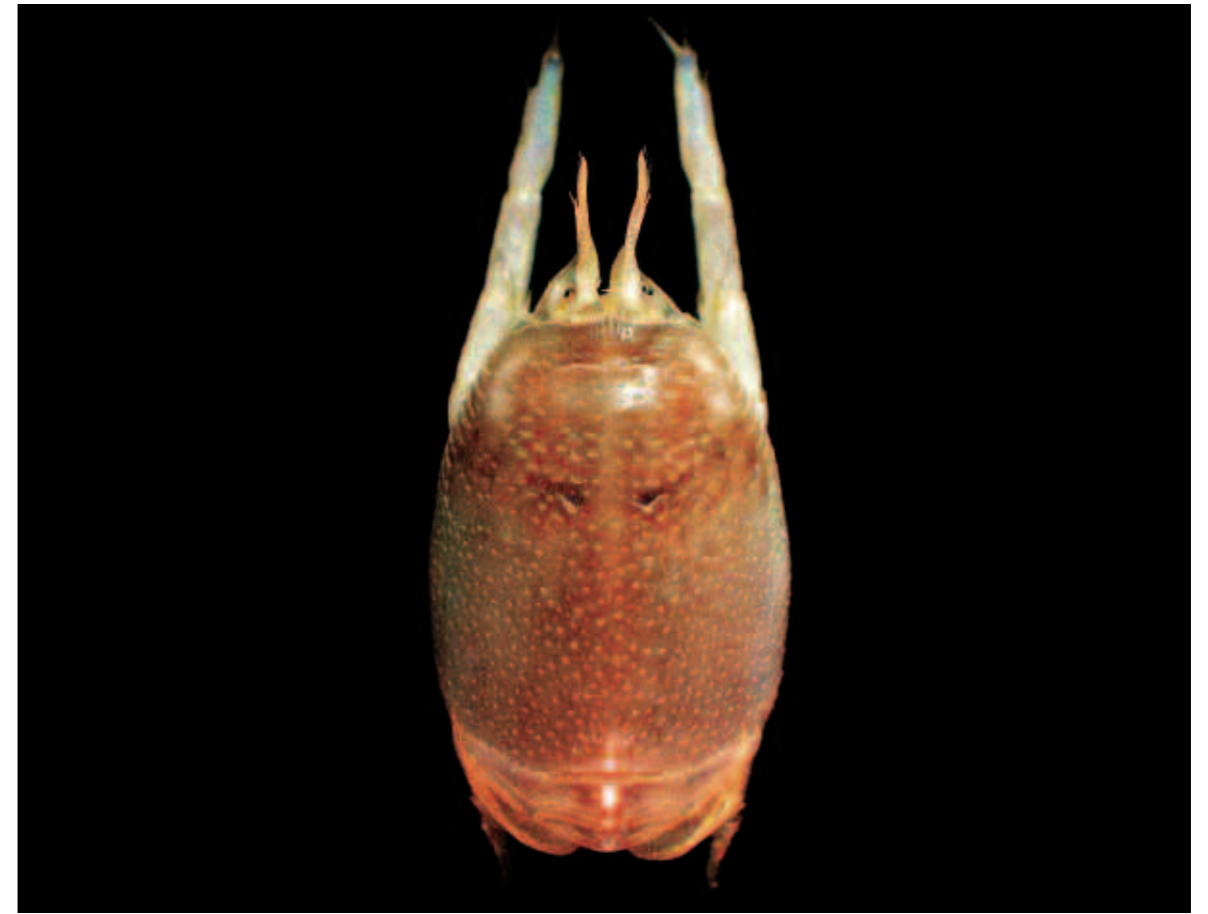


Fig. 26. Ovigerous female (cl 11.3 mm), Beigan, Matsu, Lienchiang County, 30 May 2009.

Remipes truncatifrons Miers, 1878: 321, pl. 5–figs. 5–6 [type locality: China].

Hippa truncatifrons.—Haig, 1974: 186, fig. 5G–I.

Material examined.—Southern Taiwan, 30 Apr 1992: 1 ovigerous female (cl 9.4 mm) (NTOU A00074). Beigan, Matsu, Lienchiang County, 22 Apr 1992: 1 female (cl 12.3 mm) (NTOU A00124).—30 May 2009: 1 male (cl 6.8 mm), 1 ovigerous female (cl 11.3 mm) (NTOU A01176).

Diagnosis.—Carapace covered with very short, transverse ridges; frontal margin with low, subtriangular median lobe, lateral lobes obtuse; anterior lateral angle rounded, not produced; lateral surface with series of short, oblique ridges. Antennal flagellum composed of 3 or 4 articles. Pereopod I dactylus flattish. Pereopods II and III dactyli concave on dorsal margin. Telson with lateral margins slightly convex; apex narrowly rounded.

Size.—Males to cl 10.0 mm, females to cl 17.3 mm (Kato & Suzuki, 1992).

Coloration.—Carapace and abdomen generally brown, with white transverse ridges. Antennular peduncles white, with pale brown flagella. Pereopod I whitish, with pale brown marks. Kato & Suzuki (1992) reported that the body of this species varies from dark gray (most often) to pale gray, brown, blue, white, and even rarely

red; generally similar to the sand color of their inhabited beaches. Asakura (1995: pl. 100–fig. 8) and Minemizu (2002: 177, unnumbered fig.) provided photographs of fresh specimens of *H. truncatifrons*; showing the body and pereopods generally pale brown or pale blue, and the carapace with a brown transverse band on the anterior region. The Taiwanese specimens are generally pale brown, with ventral surface and the pereopods pale white. Eggs orange.

Habitat.—Sandy bottoms and intertidal.

Distribution.—Previously known only from mainland China and Japan (north to Sakata, Yamagata Prefecture and south to Nagasaki-bana, Kagoshima Prefecture), (Miyake, 1978). Now from Taiwan.

Remarks.—*Hippa truncatifrons* is a new record for Taiwan. This species is closely related to *H. australis* from South and Western Australia. The carapaces of these two species have the frontal margin with a low, subtriangular median lobe and weakly developed lateral lobes, and the lateral surfaces with a series of short oblique ridges. However, *H. truncatifrons* differs from *H. australis* in the absence of lobes flanked on each side of the median frontal lobe of the carapace (the submedian lobes are weakly developed and rounded in *H. australis*) and the dorsal flagellum of the antennule being much shorter and less tapering (see Haig, 1974). It has been reported that *H. truncatifrons* feed on annelids and small crustaceans, including amphipods, in sands by using the third maxillipeds (Kato & Suzuki, 1992).

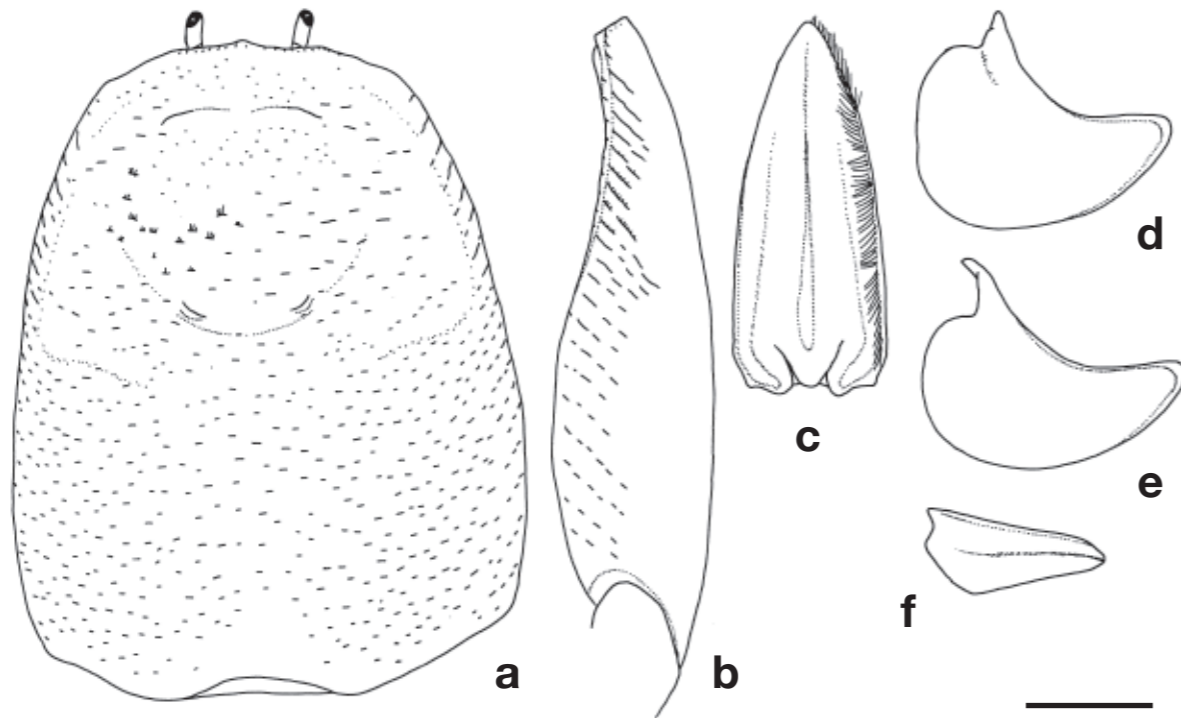


Fig. 27. Female (cl 12.3 mm), Beigan, Matsu, Lienchiang County, 22 Apr 1992: **a**, carapace and ocular peduncles, dorsal view (most short setae omitted); **b**, carapace, lateral view; **c**, telson, extensor view (most setae omitted); **d**, right pereopod II, dactylus, lateral view (setae omitted); **e**, right pereopod III, dactylus, lateral view (setae omitted); **f**, left pereopod III, dactylus, lateral view (setae omitted). Scale: a–b = 2.4 mm; c = 1.9 mm; d–f = 1.3 mm.

Genus *Mastigochirus* Miers, 1878

鞭足蟹屬

Mastigopus Stimpson, 1858: 230 [type species: *Mastigopus gracilis* Stimpson, 1858, by original designation.

Gender: masculine. Junior homonym of *Mastigopus* Leuckart, 1853].

Mastigochirus Miers, 1878: 321 [type species: *Mastigopus gracilis* Stimpson, 1858. Gender: masculine. New name for *Mastigopus* Stimpson, 1858].

Diagnosis.—Antennal flagellum considerably shorter than carapace. Maxilliped III merus elongate, subrectangular. Pereopod I subcylindrical, slender; dactylus greatly elongate, nearly as long as carapace, multi-articulated.

Remarks.—*Mastigochirus* includes only two species and both are known in the Indo-West Pacific (Boyko & Harvey, 1999). *Mastigochirus quadrilobatus* Miers, 1878 is found in India, the Philippines, and Western Australia and Queensland in Australia. *Mastigochirus gracilis* (Stimpson, 1858) was previously only recorded from Fujian and Hainan Provinces in mainland China (Haig, 1974; Sun & Wang, 1996). This genus is recorded for the first time from Taiwan with the species *M. gracilis*.

Mastigochirus gracilis (Stimpson, 1858)
細鞭足蟹

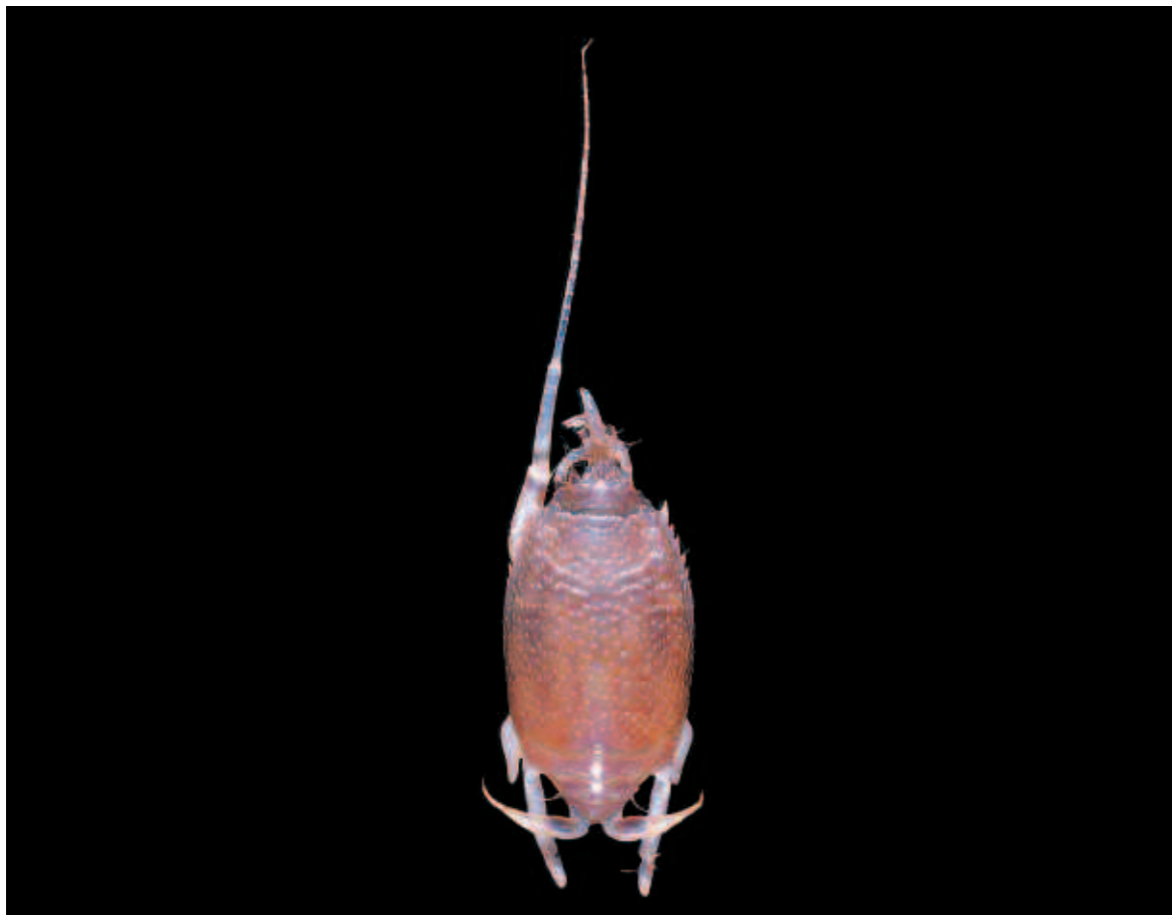


Fig. 28. Male (cl 8.1 mm), Danshuei, Taipei County, 28 Aug 2000.

Mastigopus gracilis Stimpson, 1858: 244 [type locality: China Sea, 23°N]; 1907: 196, pl. 21—fig. 1.—Sun & Wang, 1996: 29, fig. 3.

Mastigochirus gracilis.—Miers, 1878: 322, pl. 5—fig. 7.

Material examined.—Danshuei, Taipei County, 28 Aug 2000: 2 males (cl 7.9, 8.1 mm) (NTOU A00155).

Diagnosis.—Carapace covered with short transverse ridges, ridges on anterior half bearing minute, rounded denticles; frontal margin with triangular median lobe, lateral lobes acute and reaching to tip of median lobe; anterior half of lateral margin with row of 6–10 spines decreasing in size posteriorly; lateral surface with series of very short oblique ridges or pits. Antennal flagellum composed of 3 or 4 articles. Pereopod I dactylus subcylindrical, composed of 12–14 (14 in remaining dactylus of one of the present specimens) elongate articles, proximal article much longer than following articles. Pereopods II and III dactyli shallowly concave on dorsal margin. Telson with lateral margins subparallel, nearly straight; apex narrowly rounded.

Size.—Males to cl 13.2 mm (Stimpson, 1907). Female size is unknown, although the material of Sun & Wang (1996) included both males and females.

Coloration.—Carapace and abdomen pale brown to bluish brown. Distal segments of ocular peduncles pale brown. Antennular peduncles and flagella also pale brown to bluish brown. Pereopods II and III dactyli white. Stimpson (1907) gave color description for this species as “Carapax dark olive, becoming paler at the middle, and brownish at the margins. Front often reddish. A white band crosses the carapax at its posterior extremity. Abdomen bluish, with transverse lead-colored bands at the middle segments. Members all white, with the exception of the external antennae, which are pale blue. Body beneath, white”.

Habitat.—Sandy bottoms, shallow subtidal to 20 fathoms (= 36.6 m) (Stimpson, 1907).

Distribution.—Previously known only from Fujian and Hainan Provinces in mainland China (Stimpson, 1907; Sun & Wang, 1996). Now from Taiwan.

Remarks.—This species is distinguished from the sole congener *M. quadrilobatus* by the configuration of the median frontal lobe and the lateral margin of the carapace. The median frontal lobe is triangular in *M. gracilis*, whereas it is composed of two rounded or triangular lobes separated by a shallow sinus in *M. quadrilobatus*. The anterior lateral margin of the carapace has a row of distinct spines in *M. gracilis*, but it is unarmed in *M. quadrilobatus*. *Mastigochirus gracilis* is recorded for the first time from Taiwan.

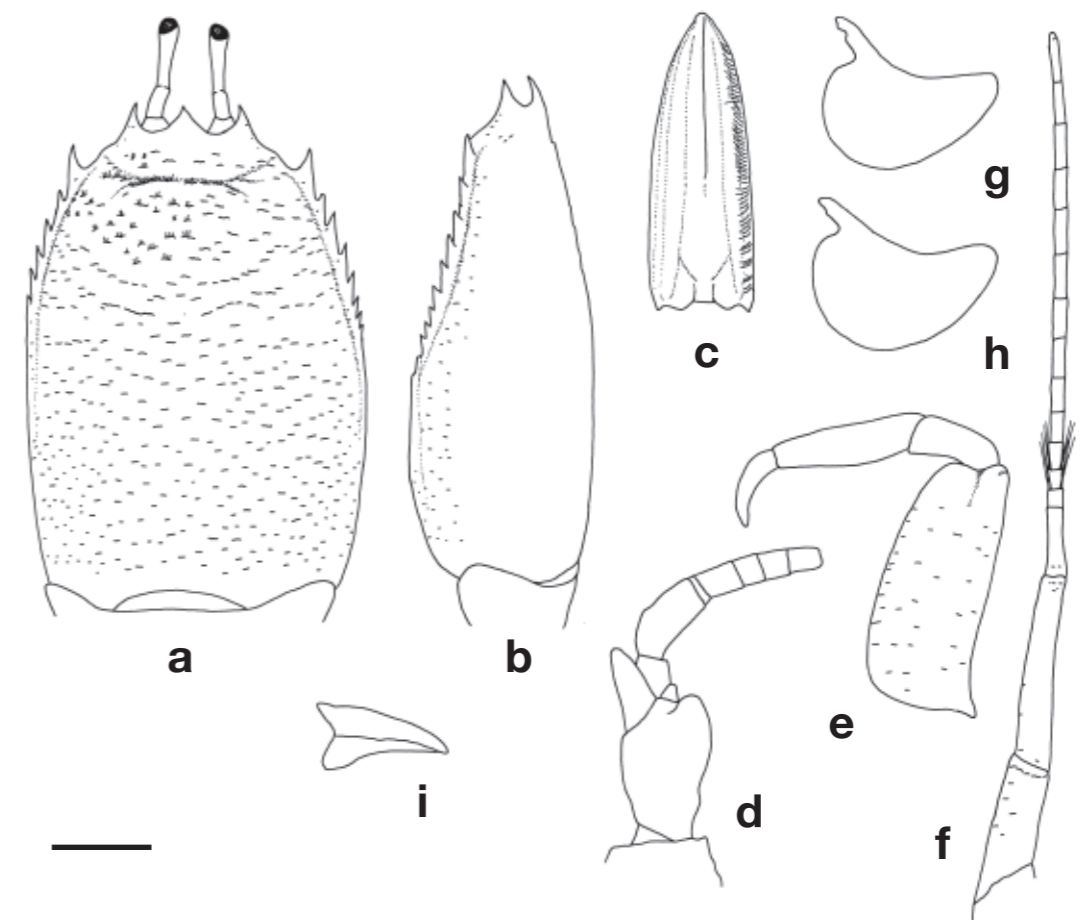


Fig. 29. Male (cl 8.1 mm), Danshuei, Taipei County, 28 Aug 2000: **a**, carapace and ocular peduncles, dorsal view (most short setae omitted); **b**, carapace, lateral view; **c**, telson, extensor view (most setae omitted); **d**, left antenna, lateral view (setae omitted); **e**, left maxilliped III, lateral view (setae omitted); **f**, left pereopod I, dorsal view (most setae omitted); **g**, right pereopod II, dactylus, lateral view (setae omitted); **h**, right pereopod III, dactylus, lateral view (setae omitted); **i**, right pereopod IV, dactylus, lateral view (setae omitted). Scale: a–b, f = 1.7 mm; c = 2.2 mm; d–e, g–i = 1.0 mm.

Part II. Lithodoidea (King crabs)

By

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INTRODUCTION

Lithodoids, popularly known as king crabs, are among the largest and most conspicuous deepwater crustaceans, and are the only reptant decapods to have colonized the polar regions. Several species support significant commercial fisheries, such as *Paralithodes camtschaticus* (Tilesius, 1815) (red king crab) and *Lithodes aequispinus* (Benedict, 1895) (golden king crab) in the northern hemisphere, and *Lithodes santolla* (Molina, 1782) (southern king crab) in the southern hemisphere. Lithodoids appear to favour cool water temperatures, and although they are distributed worldwide, most occur in deep-water, from the outer shelf down to abyssal depths. Some lithodoids, however, especially hapalogastrids, may be found at littoral or shallow sublittoral depths at high latitudes. At present, two families, 15 genera and more than 100 species of king crab are known, with the majority of species contained in three genera: *Lithodes* Latreille, 1806, *Neolithodes* A. Milne-Edwards & Bouvier, 1894, and *Paralomis* White, 1856 (De Grave *et al.*, 2009; Hall & Thatje, 2009; Ahyong & Chan, 2010).

The lithodoids have a more crab-like body form than any other anomuran and, according to the majority of phylogenetic studies, are derived from asymmetrical hermit crabs (e.g. Cunningham *et al.*, 1992; Morrison *et al.*, 2002; Tsang *et al.*, 2008; Ahyong *et al.*, 2009; Bracken *et al.*, 2009; but for a contrary position see McLaughlin & Lemaitre, 1997; McLaughlin *et al.*, 2004, 2007). Thus, the lithodoids represent the most striking example of carcinization, the derivation of a crab-like form from a non-crab-like ancestor. Carcinization is achieved by widening of the carapace and sternum, and reduction of the abdomen, which is held fully folded under the body as in a typical brachyuran crab. Although king crabs are now morphologically very different from other hermit crabs, they appear to retain clear traces of their paguroid ancestry in the asymmetrical female abdomen. Thus, they have been classified as members of the Paguroidea Latreille, 1802, or in their own superfamily, Lithodoidea Samouelle, 1819. Debates over the position of king crabs have been a major focus of recent phylogenetic studies on decapods crustaceans (see Ahyong *et al.* 2009; Lemaitre & McLaughlin, 2009).

Although lithodoids have been known from the northwestern Pacific, including Japan, for centuries, they have been recorded from Taiwan only since the 1990s with the development of deepwater trawl fisheries (Wu *et al.*, 1998). As such, the Taiwanese lithodoid fauna is known from only a very few studies. Specimens of the first lithodoid species to be recorded from Taiwan, *Lithodes turritus* Ortmann, 1892, were collected by deep-water fishing trawlers off the northeastern coast in 1996 (Wu *et al.*, 1998). Subsequent collections made by deep-water fishermen and scientific expeditions around Taiwan resulted in records of *Paralomis arae* Macpherson, 2001, *P. dofleini* Balss, 1911, *P. truncatispinosa* Takeda & Miyake, 1980, and *Neolithodes nipponensis* Sakai, 1971 (Macpherson & Chan, 2008). Most recently, Ahyong & Chan (2010) described *Lithodes formosae* from northeastern Taiwan, the first lithodoid to be described as new from Taiwan. In total, six species in three genera of Lithodidae are presently known from Taiwan and all of them are included in the present catalog. Most species of Taiwanese lithodoids are regionally restricted. *Neolithodes nipponensis* and *P. dofleini* are known only from Japan and Taiwan. *Paralomis truncatispinosa* is known only from Japan, northern China (East China Sea) and Taiwan, and *Lithodes formosae* is presently known only from Taiwan. Two species range more widely, however, with *Paralomis arae* known also from Fiji and *L. turritus* ranging from Japan to the Philippines. In Taiwan, all of these lithodoid species occur at depths exceeding 400 m. Although *L. turritus* reaches a very large size and

commands high market prices, it is rather uncommon in Taiwan. The other five Taiwanese species are even rarer, and in Taiwan some are still only known from a single specimen. The lithodoid fauna of Taiwan comprises only about 5% of the world's species, a proportion that is much lower than other major decapod crustacean groups. Twenty-one species of lithodoids (almost 18% of the world's species) are presently known from neighbouring Japan. Thus, it is likely that more species of lithodoids will be found in Taiwanese waters when further deep-water sampling is conducted.

The terminology used in this chapter generally follows Ahyong & Chan (2010), and the general morphology of lithodoids is illustrated under **Morphological Terms** in the next pages. It is important to note that the length of the rostrum and spines of the body and pereopods vary greatly with size, usually being extremely long in very small specimens, becoming progressively shorter with increasing body size, some even becoming reduced to sharp tubercles in large adults of some species. Therefore, juveniles are often very difficult to identify to species level.

Morphological Terms

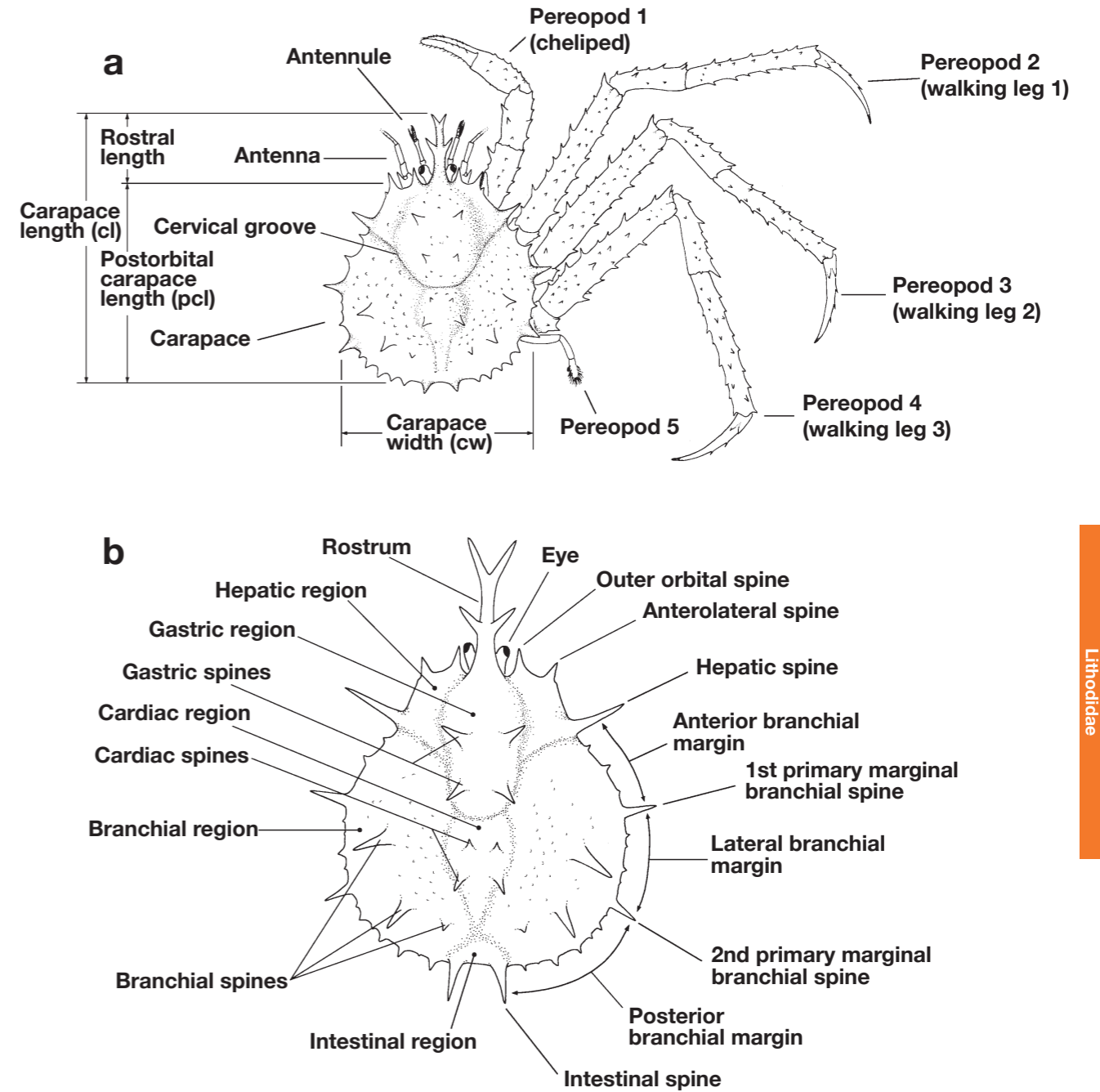


Fig. 30. Lithodidae. a, general morphology; b, carapace regions and spines.

Morphological Terms

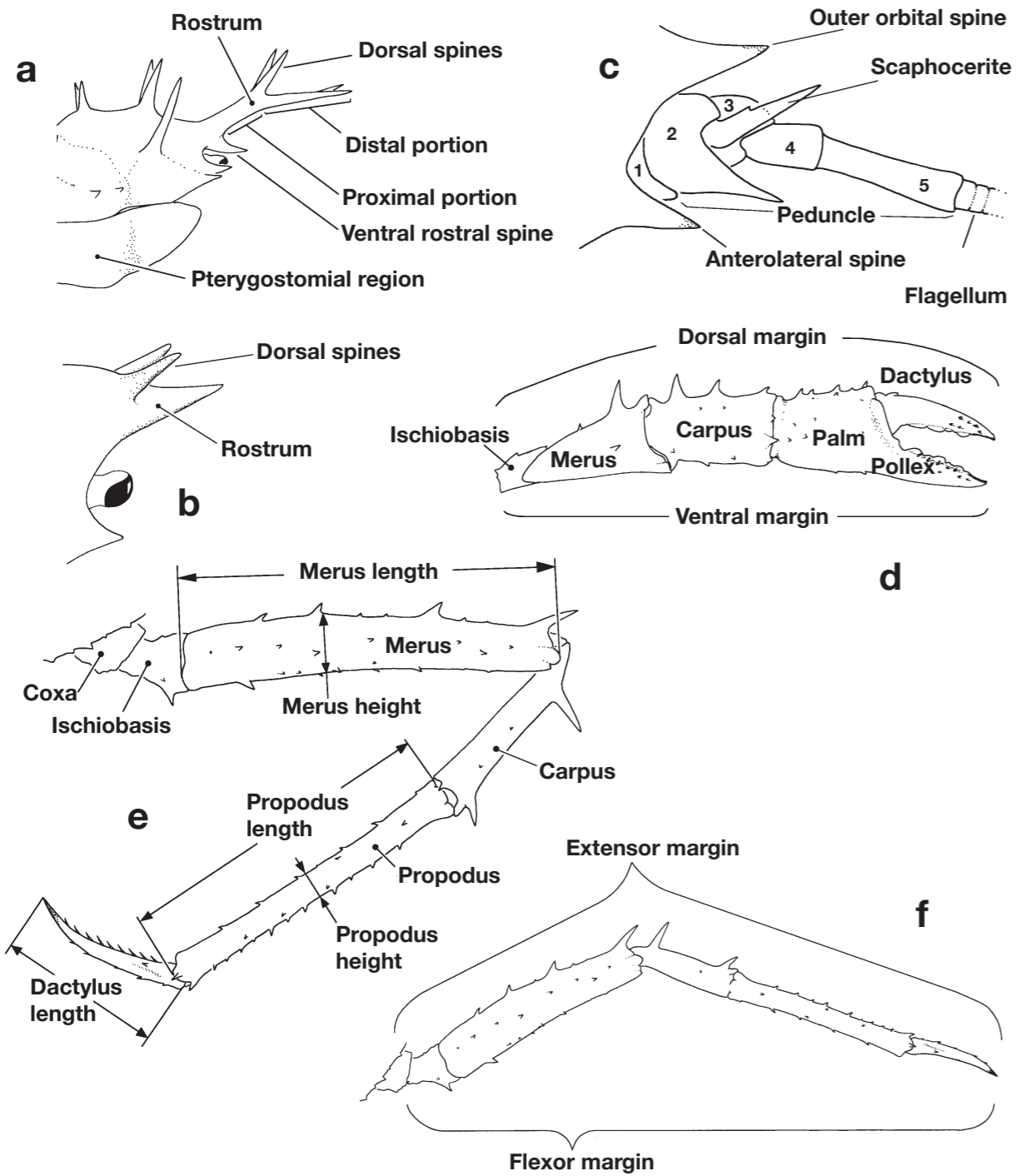


Fig. 31. Lithodidae. **a**, anterior carapace including rostrum, *Lithodes* form; **b**, rostrum, *Neolithodes* and *Paralomis* forms; **c**, right antenna, with peduncle segments numbered; **d**, cheliped; **e-f**, walking legs.

Morphological Terms

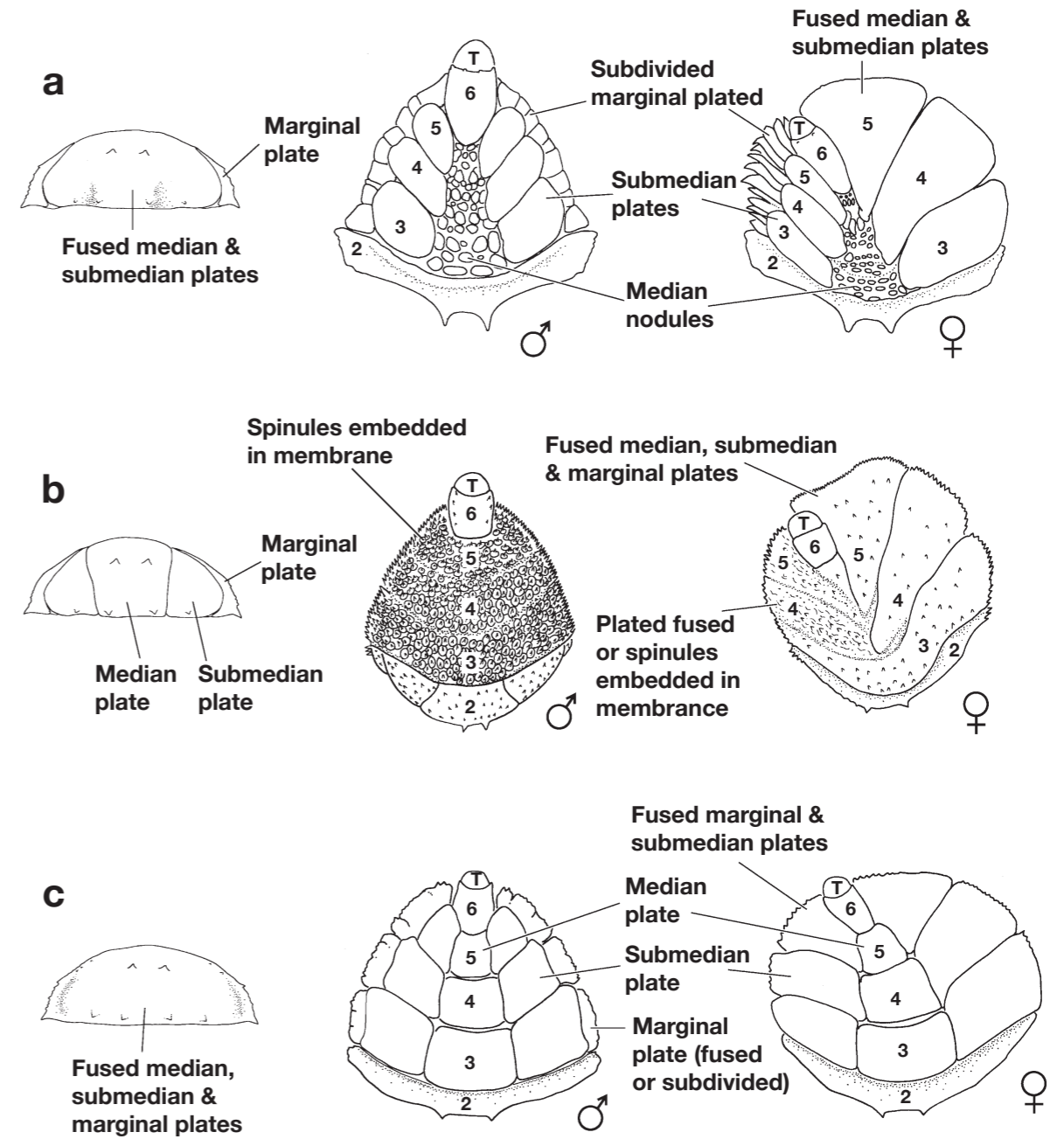


Fig. 32. Abdomen of lithodid genera known from Taiwan. **a**, *Lithodes*; **b**, *Neolithodes*; **c**, *Paralomis*. From left to right: abdominal somite 2, male abdomen, female abdomen. Somite number indicated. Abbreviations: T, telson.

SYSTEMATICS

Infraorder Anomura MacLeay, 1838

異尾下目

Superfamily Lithodoidea Samouelle, 1819

石蟹總科

Diagnosis.—Crab-like. Carapace subtriangular to transversely ovate; rostrum present. Eyes with pigmented cornea; cornea distoventral on stalk. Maxilliped 3 with crista dentata and accessory tooth. Pereopod 1 chelate, subequal or right larger and more robust than left. Pereopods 2–4 developed as walking legs. Pereopod 5 subchelate, reduced, usually folded beneath carapace margin. Abdomen short, broad, held folded against thoracic sternum; composed of calcified plates or nodules embedded in arthrodial membrane; somite 1 concealed by carapace; abdominal plates more strongly developed on left side in females, producing asymmetry. Pleopods absent in males; females with paired pleopods on somite 1 and single uniramous pleopod on left side of somites 2–5. Uropods absent.

Remarks.—Until recently, Lithodidae comprised two subfamilies, Hapalogastrinae Brandt, 1850, and Lithodinae Samouelle, 1819. McLaughlin *et al.* (2007) raised Hapalogastrinae and Lithodinae each to family level, within a superfamily Lithodoidea. Lithodidae currently includes 10 genera and more than 100 species, of which more than 60 species occur in the Pacific Ocean. Six species in three genera (*Lithodes* Latreille, 1806, *Neolithodes* A. Milne-Edwards & Bouvier, 1894, and *Paralomis* White, 1856) are currently known from Taiwan. Hapalogastrids also occur in the northwestern Pacific, but none is currently known from south of Japan.

Key to families of Lithodoidea

1. Rostrum well-developed, spiniform or truncate, extending anteriorly beyond cornea. Abdominal somites 3–5 usually well calcified; sometimes with membranous areas medially with nodules or small spinules **Lithodidae**
- Rostrum short, broad, usually not extending anteriorly beyond cornea. Abdominal somites 3–5 weakly calcified, in form of a membranous sac; usually covered by small, thin plates **Hapalogastridae**

Family Lithodidae Samouelle, 1819

石蟹科

Lithodiadae Samouelle, 1819: 90 [incorrect original spelling for Lithodidae Samouelle, 1819 (ICZN Opinion 511); type genus: *Lithodes* Latreille, 1806].

Lithodinae.—Macpherson, 1988a: 17.

Lithodidae.—McLaughlin *et al.*, 2007: 108.—De Grave *et al.*, 2009: 25.

Diagnosis.—Rostrum well-developed, spiniform or truncate, extending anteriorly beyond cornea. Abdominal somites 3–5 usually well calcified; composed entirely of calcified plates or of nodules or spinules embedded in arthrodial membrane

Remarks.—Currently, three of 10 lithodid genera are represented in Taiwan.

Key to genera of the Lithodidae from Taiwan

1. Abdominal somite 2 divided into 5 plates (median, paired submedian, and paired marginals) *Neolithodes*
- Abdominal somite 2 either a single undivided plate or subdivided into 3 plates (paired marginals and single plate comprising fused median and submedian plates) 2
2. Rostrum distally bifurcated. Abdominal somite 2 usually composed of 3 plates (rarely fused into single plate). Abdominal somites 3–5 with median nodules or membranous areas. Sternite 5 (between pereopods 2) with deep median fissure *Lithodes*
- Rostrum terminating in a single point, not distally bifurcated. Abdominal somite 2 always a single plate. Abdominal somites 3–5 comprised of calcified plates, without median nodules or membranous areas. Sternite 5 (between pereopods 2) without deep median fissure *Paralomis*

Genus *Lithodes* Latreille, 1806

石蟹屬

Lithodes Latreille, 1806: 39 [type species: *Cancer maja* Linnaeus, 1758: 269. Gender: masculine].

Pseudolithodes Birstein & Vinogradov, 1972: 356 [type species: *Pseudolithodes zenkevitchi* Birstein & Vinogradov, 1972= *Lithodes santolla* (Molina, 1782). Gender: masculine].

Diagnosis.—Carapace pyriform, not covering bases of walking legs; regions indicated; gastric region elevated above other regions; cardiac region triangular, separated from gastric region by deep groove; cervical groove shallow, indistinct. Rostrum comprised of median spine (usually distally bifid) and one or two pairs of dorsal spines; prominent subrostral spine present. Abdominal somite 2 comprising 3 plates (a wide median plate and a pair of narrow marginal plates) or single plate in adults of some species (all plates fused). Abdominal somites 3–5 with median regions composed of calcareous nodules joined by arthrodial membrane; submedian and marginal plates well demarcated in both sexes; submedian plates in females better developed on left side and fused with marginal plates; marginal plates usually subdivided. Sternite 5 (between pereopods 2) with deep median fissure. Scaphocerite absent or reduced to small spine. Walking legs (pereopods 2–4) similar in form, third walking leg longest, always longer than carapace length; dactyli of adults with or without corneous spines along flexor margin.

Remarks.—*Lithodes* currently includes 22 species. Macpherson (1988a) listed 15 species of *Lithodes* worldwide of which seven occur in the Atlantic Ocean and eight in the Indo-Pacific. Since then, seven species of *Lithodes* have been described, one from the Indian Ocean and six from the Pacific Ocean: *L. mamillifer* Macpherson, 1988b (southwestern Indian Ocean), *L. richeri* Macpherson, 1990 (New Caledonia), *L. megacantha* Macpherson, 1991 (French Polynesia), *L. ceramensis* Takeda & Nagai, 2004 (Indonesia), *L. paulayi* Macpherson & Chan, 2008 (Guam), *L. galapagensis* Hall & Thatje, 2009 (Galapagos Islands), and *L. formosae* Ah Yong & Chan, 2010 (Taiwan). Two species of *Lithodes* are currently known from Taiwan, *L. turritus* and *L. formosae*.

Key to the Taiwanese species of *Lithodes*

1. Rostrum distinctly directed upward in proximal half. Adults with long dorsal spines on carapace and walking

- legs; 2 cardiac spines present *L. formosae*
- Rostrum almost horizontal over entire length. Adults with short dorsal spines on carapace and walking legs; 4 cardiac spines in juveniles, anterior pair becoming reduced to a short tubercle in large adults *L. turritus*

Lithodes formosae Ah Yong & Chan, 2010
臺灣石蟹



Fig. 33. Ovigerous female holotype (cl 78 mm, pcl 56 mm, cw 55 mm), Dasi fishing port, Yilan county, 6 Jun 1998 (after Ah Yong & Chan 2010).

Lithodes sp.—Macpherson & Chan, 2008: 47.

Lithodes formosae Ah Yong & Chan, 2010: 62, figs 1–4 [type locality: off Dasi, Yilan County, northeastern Taiwan].

Material examined.—Dasi fishing port, Yilan County, 6 Jun 1998: 1 ovigerous female holotype (cl 78 mm, pcl 56 mm, cw 55 mm) (NTOU A01090).

Diagnosis.—Carapace dorsal surface with long, slender spines; gastric region with 4 upright spines, anterior pair longer than half length of hepatic spine, posterior pair half length of hepatic spine; cardiac and intestinal regions each with 2 long upright spines; branchial surface with 2 long upright spines. Branchial margins spinose; 1st primary marginal branchial spine 1/3 length of hepatic spine, 2nd primary marginal branchial spine 1/6 length of hepatic spine; anterior and lateral branchial margins each with 2 low prominences; posterior branchial margin with 5 protrusions of which 2 or 3 are developed as short spines. Adult rostrum shorter than half pcl; proximal half strongly upraised by about 45°. Abdominal somite 2 comprising 3 separate

plates in adults. Antennal peduncle segment 2 with slender outer spine reaching midlength of segment 4. Chelipeds unequal; palms generally smooth, with low tubercles on dorsal surface. Walking legs spinose; surface between major spines smooth or with very few, scattered spines. Pereopod 4 merus about as long as pcl, length less than 7 times height; propodus length 11–12 times height; dactylus half length of propodus, flexor margin with 6 or 7 minute, widely spaced corneous spines.

Size.—Only known from the female holotype of pcl 56 mm.

Coloration.—Body red. Cornea dark brown. Eggs orange.

Habitat.—Deep-sea, sandy mud substrates; 500–600 m.

Distribution.—Presently known only off northeastern Taiwan.

Remarks.—*Lithodes formosae* resembles other long-spined species of the genus in which the carapace and walking legs bear long spines even as early adults: *L. longispina* Sakai, 1971, *L. megacantha*, and *L. paulayi*. It is readily distinguished from *L. longispina* and *L. megacantha* by having two dorsal branchial spines instead of one; the first primary marginal branchial spine is considerably shorter than, rather than subequal to the hepatic spine; the second primary marginal branchial spine is considerably shorter than the first, rather than subequal; and the distolateral spine of the basal antennal segment reaches the midlength rather than end of the second segment. *Lithodes formosae* is most similar to *L. paulayi* in sharing two dorsal branchial carapace spines, proportionally short primary marginal branchial spines, and similar basal antennal segment ornamentation. The two species differ in the number of posterior branchial marginal spines (5 protrusions of which 2 or 3 are developed as short spines in *L. formosae*; 6–8 spines in *L. paulayi*), proportional length of the rostrum and dorsal spines (markedly longer in *L. paulayi*), and spination of the chelipeds (a few dorsal tubercles on the palms in *L. formosae*; dorsal spines and lateral tubercles in *L. paulayi*). Ahyong & Chan (2010) reported pairwise nucleotide divergences in COI at 6.2% between *L. formosae* and *L. paulayi*, 6.3–6.8% (mean 6.5%) between *L. formosae* and *L. longispina*, and 6.3–6.6% (mean 6.4%) between *L. paulayi* and *L. longispina*. The interspecific divergences between the three species contrasts strongly with the intraspecific divergence of 0.2–0.8% (mean 0.4%) within *L. longispina*.

Lithodes formosae is readily distinguished from the only other *Lithodes* known from Taiwan, *L. turritus* (when comparing specimens of similar size to the holotype of *L. formosae*) by the strongly upraised proximal half of the rostrum (45° versus almost horizontal); the length of the primary marginal branchial spines, which are considerably shorter than half the length of the hepatic spine, compared to 2/3 to as long as the hepatic spine; the presence of two instead of four cardiac spines, and the armature of the posterior branchial margin, which bears only low tubercles or very short conical spines compared to long slender spines in *L. turritus*.

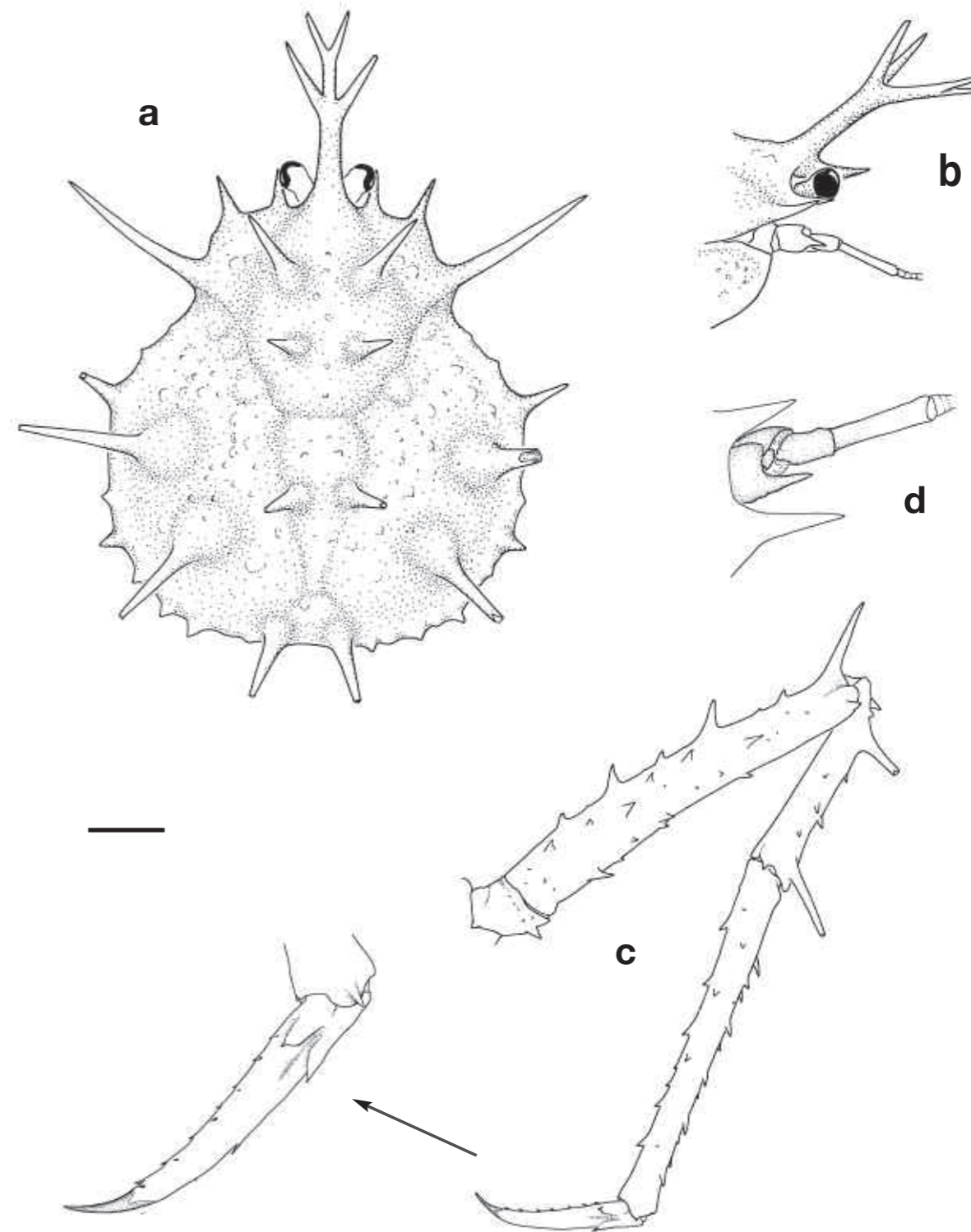


Fig. 34. Ovigerous female holotype (cl 78 mm, pcl 56 mm, cw 55 mm), Dasi fishing port, Yilan County, 6 Jun 1998: **a**, carapace, dorsal view; **b**, anterior carapace, right lateral view; **c**, right pereopod 4 (walking leg 3); **d**, right antenna. Scale: a–c = 10 mm, d = 5 mm (after Ahyong & Chan, 2010).

Lithodes turritus Ortmann, 1892

塔形石蟹



Fig. 35. Male (cl 194 mm, pcl 149 mm, cw 155 mm), Dasi fishing port, Yilan County, 9 Apr 1997.



Fig. 36. Young (cl ca. 80 mm), Dasi fishing port, Yilan County, Sep 1998.

Lithodes turritus Ortmann, 1892: 321, pl. 12—fig. 26 [type locality: Japan].—Balss, 1913: 73, figs. 42–45, pl. 11.—Sakai, 1971: 10, fig. 2a–b, pl. 4—fig. 1, pl. 11—fig. 1; 1976: 693, fig. 376a–b, pl. 240, pl. 243—fig. 1.—Baba, 1986: 211: fig. 156.—Tung *et al.*, 1988: 62, fig. 58.—Ikeda, 1998: 47, pl. 66.—Wu *et al.*, 1998: 119, figs. 1–2.—Macpherson & Chan, 2008: 44, fig. 5b.

Material examined.—Dasi fishing port, Yilan County, 31 May 1996: 1 male (cl 184 mm, pcl 137 mm, cw 143 mm) (NTOU A01155).—9 Apr 1997: 1 male (cl 194 mm, pcl 149 mm, cw 155 mm) (NTOU A01159), 1 female (cl damage, pcl 134 mm, cw 132 mm) (NTOU A01156).—13 May 1997: 1 male (pcl 143 mm, cw 143 mm) (ZRC 1997.914), 1 female (cl 163 mm, pcl 120 mm, cw 119 mm) (NTOU A01151).—18 Dec 1997: 1 ovigerous female (cl 167 mm, pcl 124 mm, cw 128 mm) (NTOU A01160).—Feb 1999: 1 male (cl 93 mm, pcl 65 mm, cw 67 mm) (NTOU A01107).—25 Apr 2003: 1 male (cl 235 mm, pcl 168 mm, cw 178 mm) (NTOU A01162).—no date: 1 male (cl 116 mm, pcl 86 mm, cw 87 mm) (NTOU A01153), 1 male (cl 175 mm, pcl 136 mm, cw 141 mm) (NTOU A01154), 1 male (cl 189 mm, pcl 141 mm, cw 159 mm) (NTOU A01161), 1 female (cl 108 mm, pcl 79 mm, cw 79 mm) (NTOU A01152).

Diagnosis.—Carapace dorsal surface with long slender spines in juveniles becoming short, stout, conical spines in adults; gastric regions with 4 spines; cardiac region with 4 spines or with anterior pair reduced to low tubercles; branchial regions each with 2 dorsal spines. Branchial margins spinose; anterior branchial margin with 2 spines, anterior spine shorter, often minute; lateral branchial margin with 1 spine, usually as long as 1st and 2nd primary marginal branchial spines; posterior branchial margin with 2 or 3 spines, one longer than half length of 2nd primary marginal branchial spine. Adult rostrum shorter than half pcl, almost horizontal; with bifurcate apex and short pair of dorsal spines near midlength; subrostral spine stout. Abdominal somite 2 comprising 3 separate plates in adults. Antennal peduncle segment 2 with slender outer spine reaching beyond midlength of segment 4; scaphocerite reduced to blunt sclerite. Chelipeds unequal; palms generally smooth, with low tubercles on surfaces. Walking legs sparsely spinose; surface between major spines smooth or with very few, scattered spines. Pereopod 4 merus longer than pcl in males, shorter in females, length about 8 times height; propodus length about 10 times height; dactylus about half length of propodus or less, flexor margin unarmed, smooth, at most with a few setae.

Size.—The pcl 168 mm male reported here is the largest known specimen of the species.

Coloration.—Overall body generally deep red, ventral surface paler in color. Chelipeds with outer surfaces whitish. Cornea black-brown.

Habitat.—Deep-sea, soft sandy-mud and mud substrates; 300–812 m.

Distribution.—Japan, East China Sea, Taiwan and the Philippines.

Remarks.—*Lithodes turritus* was first reported from Taiwan by Wu *et al.* (1998). The dorsal spines of *L. turritus* are proportionally longest in juveniles, becoming shorter with increasing size, being reduced to stout conical spines in adults. Thus, juveniles of *L. turritus* superficially resemble *L. formosae*, which retain long dorsal spines as adults. Features distinguishing the two species are given under the account of *L. formosae*. *Lithodes turritus* is occasionally collected by commercial trawlers and is highly esteemed as food.

Genus *Neolithodes* A. Milne-Edwards & Bouvier, 1894

新石蟹屬

Neolithodes A. Milne-Edwards & Bouvier, 1894b: 120 [type species: *Lithodes grimaldii* A. Milne-Edwards & Bouvier, 1894a, by monotypy. Gender: masculine].

Diagnosis.—Carapace pyriform, not covering bases of walking legs; regions indicated; gastric region elevated above other regions; cardiac region triangular, separated from gastric region by deep groove; cervical groove shallow, indistinct. Rostrum comprised of median spine and one pair of dorsal spines at base; subrostral spine absent. Abdominal somite 2 comprising 5 plates (median plate, paired submedian and paired marginal plates). Abdominal somites 3–5 of males composed of small spiniform nodules embedded in arthroal membrane; female abdominal somites composed either of well-developed plates or spiniform nodules and well-developed plates on left side. Sternite 5 (between pereopods 2) with deep median fissure. Scaphocerite absent or a simple spine. Walking legs (pereopods 2–4) similar in form, third walking leg longest, always longer than carapace length; dactyli of adults without row of corneous spines flexor spines.

Remarks.—Macpherson (1988a) listed eight valid species of *Neolithodes*. Since then, *N. duhameli* Macpherson, 2004, was described from the Crozet Islands, *N. yaldwyni* Ahyong & Dawson, 2006, from Antarctica, and *N. flindersi* Ahyong, 2010, from southeastern Australia (Macpherson, 2004; Ahyong & Dawson, 2006; Ahyong, 2010). Thus, 11 species of *Neolithodes* are currently recognized of which only one is presently known from Taiwan.

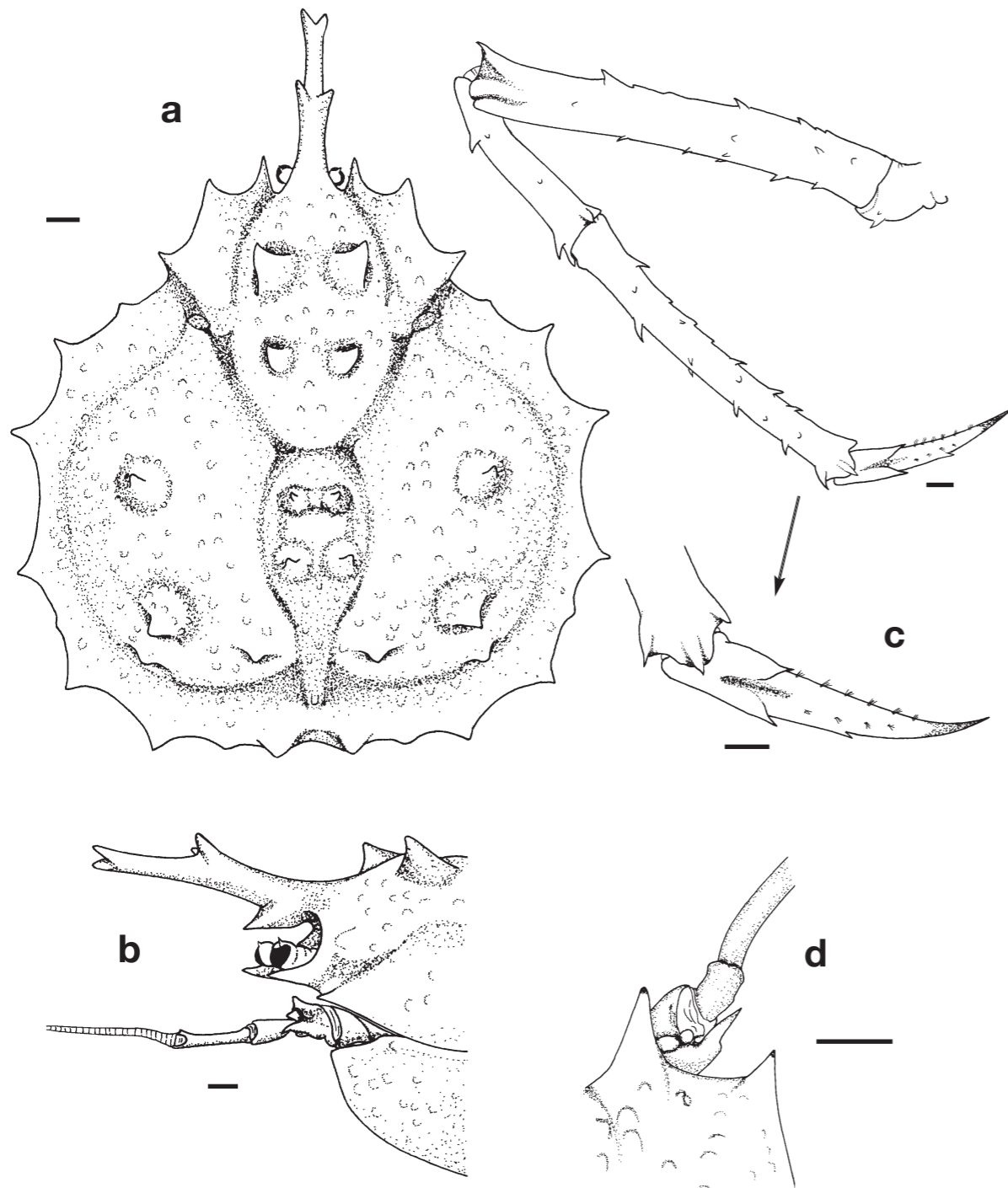


Fig. 37. Male (cl 235 mm, pcl 168 mm, cw 178 mm), Dasi fishing port, Yilan County, 25 Apr 2003: a, carapace, dorsal view; b, anterior carapace, left lateral view; c, left pereopod 4 (walking leg 3); d, right antenna, dorsal view. Scales = 10 mm.

Neolithodes nipponensis Sakai, 1971
日本新石蟹



Fig. 38. Male (cl 84 mm, pcl 73 mm, cw 65 mm), Stn CD228 (after Macpherson & Chan, 2008).

Neolithodes nipponensis Sakai, 1971: 7, fig. 1a–f, pl. 8 [type locality: off Mikawa Bay, Japan]; 1976: 697, fig. 378a–f, pl. 244.—Tung *et al.*, 1988: 63, fig. 59.—Ikeda, 1998: 47, pl. 65.—Macpherson & Chan, 2008: 44, fig. 5a.

Material examined.—CD129, 22°5.89'N, 121°5.21'E, 1271–1275 m, 21 Aug 2001: 1 ovigerous female (cl 148 mm, pcl 135 mm, cw 119 mm) (NTOU A01157), 1 female (cl 73 mm, pcl 68 mm, cw 61 mm) (NTOU A01170). CD134, 22°16.56'N, 120°6.11'E, 736–1040 m, 22 Nov 2001: 1 male (damaged, pcl ca. 24 mm) (NTOU A01166). CD199, 24°25.38'N, 122°12.41'E, 1138–1187m, 12 Sep 2002: 3 males (pcl 67–80 mm, cw 61–74 mm) (ZRC2005.0012). CD206, 22°5.67'N, 121°2.65'E, 1278–1298 m, 30 May 2003: 1 male (cl 60 mm, pcl 49 mm, cw 45 mm) (NTOU A01165). CD228, 22°8.7'N, 121°0.97'E, 1259–1383 m, 30 Aug 2003: 3 males (cl 70–84 mm, pcl 55–73 mm, cw 51–65 mm) (NTOU A01158), 1 male (cl 84 mm, pcl 73 mm, cw 65 mm) (NTOU A01171). CP366, 22°2.872'N, 121°10.079'E, 1302–1301 m, 25 Aug 2006: 1 male (cl 57 mm, pcl 47 mm, cw 41 mm) (NTOU A01164).

Diagnosis.—Carapace slightly longer than wide; dorsal surface densely covered with small spinules in

addition to longer primary spines; longest spine in adults not exceeding 0.2 times carapace length. Rostrum shorter than 0.2 times pcl; ventral surface minutely spinulate. Ocular peduncle with small spines. Posterior orbital margin concave, rounded; outer orbital spine slender, reaching to but not beyond cornea. Antennal peduncle prominently spinulate. Scaphocerite spinulate, rudimentary, shorter than antennal segment 4. Chelipeds prominently spinose; dactylus with convex dorsal margin. Walking legs densely covered with short, curved secondary spines in addition to longer, larger, widely spaced primary spines; primary spines along flexor margin of merus not distinctly protruding above secondary spines but curved and inclined towards margin; merus ovate in cross-section, shorter than carapace; propodus subcylindrical in cross-section; dactylus exceeding half propodus length, surface almost fully spinose on dactyli of pereopods 3–4. Merus of pereopod 4 shorter than propodus length.

Size.—Largest cl 191 mm (Ikeda, 1998).

Coloration.—Overall varying shades of red to reddish-brown. Cornea black-brown.

Habitat.—Deep-sea, mud and sandy-mud substrates; 200–1752 m.

Distribution.—Known with certainty from Japan and Taiwan. Records of *Neolithodes nipponensis* from Fiji and the Solomon Islands (Macpherson, 2001, 2003) require verification.

Remarks.—*Neolithodes nipponensis* closely resembles *N. brodiei* Dawson & Yaldwyn, 1970, from New Zealand, and *N. flindersi* Ah Yong, 2010, from southeastern Australia in sharing the dense covering of secondary spinules over the surfaces of the carapace and walking legs, with dactyli having a circular cross-section. The three species are best distinguished by the pattern of spination, principally on the meri of the walking legs. In *N. brodiei*, the dorsal margin of the meri of the walking legs has 5–7 major erect spines protruding above the level of the smaller secondary spines. In *N. nipponensis* and *N. flindersi*, however, the major spines of the dorsal margins of the meri of the walking legs are obliquely inclined towards the surface of the segment, not generally protruding above the level of the smaller secondary spines. *Neolithodes nipponensis* is distinguished from *N. flindersi* in being more prominently spinose, with the secondary spines covering the surfaces of the walking legs being distinctly longer and less upright, and the antennal peduncle being prominently spinulate, rather than sparsely granulate or only minutely spinulate as in *N. flindersi*. As is the case in *N. brodiei* and *N. flindersi*, juveniles of *N. nipponensis* have long dorsal spines, resembling adult *N. vinogradovi* Macpherson, 1988a.

Neolithodes nipponensis is known with certainty only from Japan and Taiwan. It has been reported also from Fiji and the Solomon Islands (Macpherson, 2001, 2003), but these records may be based on an undescribed species currently under study by P. Davie.

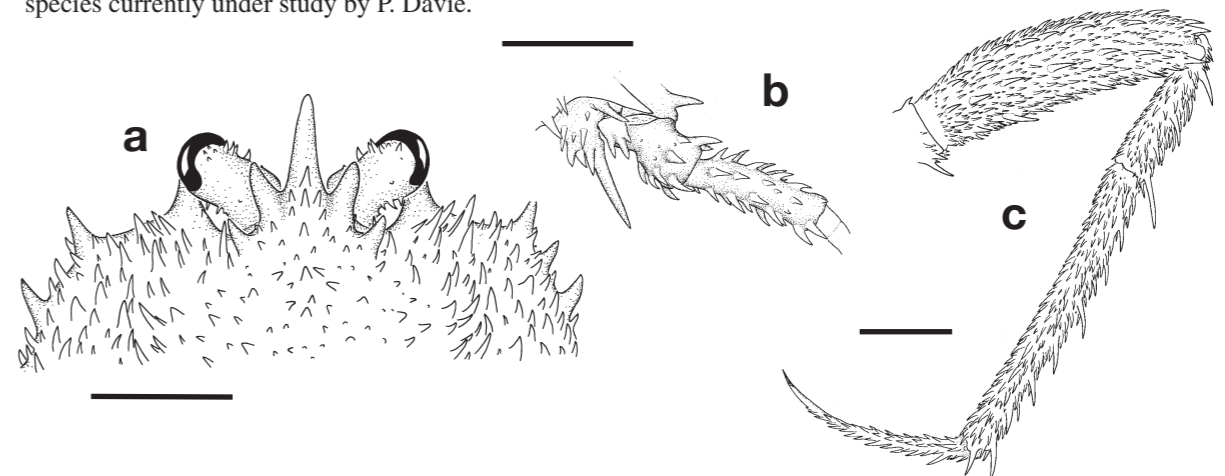


Fig. 39. Male (cl 90 mm, pcl 80 mm, cw 74 mm), CD199 (ZRC 2005.0012): a, anterior carapace; b, right antenna, dorsal view; c, right pereopod 4 (walking leg 3). Scale: a = 10 mm, b = 8 mm, c = 20 mm.

Genus *Paralomis* White, 1856

仿石蟹屬

Paralomis White, 1856: 134 [type species: *Lithodes granulosa* Hombron & Jacquinot, 1846. Gender feminine].

Acantholithus Stimpson, 1858: 69 [type species: *Lithodes histrix* De Haan, 1844. Gender masculine].

Leptolithodes Benedict, 1895: 484 [type species: *Paralomis aculeata* Henderson, 1888, by present designation. Gender masculine].

Pristopus Benedict, 1895: 486 [type species: *Pristopus verrilli* Benedict, 1895, by present designation. Gender masculine].

Diagnosis.—Carapace pentagonal or pyriform, not covering bases of walking legs; regions indicated; gastric region elevated above other regions; cardiac region triangular, separated from gastric region by deep groove; cervical groove shallow, indistinct. Rostrum comprised of median spine and at least one pair of dorsal spines near base. Abdominal somite 2 comprising a single plate. Abdominal somites 3–5 comprising well-calcified plates, without nodules and membranous areas; each somite comprising median, paired submedian and paired marginal plates (sometimes subdivided) or notched; marginal and submedian plates of somites 3 (and rarely 4) fused. Sternite 5 (between pereopods 2) without deep median fissure. Scaphocerite well-developed, usually spinose. Walking legs (pereopods 2–4) similar in form, second walking leg usually longest; third walking leg always longer than carapace length; dactyli of adults with corneous spines along flexor margin.

Remarks.—*Paralomis* is the largest and most morphologically diverse genus in the Lithodidae, presently containing 62 extant and one fossil species (De Grave *et al.*, 2009; Hall *et al.*, 2009). The taxonomic history of *Paralomis* has been rather unstable (see Macpherson, 1988a for full discussion), and three nominal genera are presently included in its synonymy, *Acantholithus* Stimpson, 1858 (type species: *Lithodes histrix* De Haan, 1844), *Leptolithodes* Benedict, 1895, and *Pristopus* Benedict, 1895. Benedict (1895) incorrectly regarded the type species of *Paralomis*, *Lithodes granulosa* Hombron & Jacquinot, 1846, as a species of *Echinocerus* White, 1848 (a junior synonym of *Lopholithodes* Brandt, 1848), effectively sinking *Paralomis*. As such, Benedict (1895) erected two new genera to accommodate other species of *Paralomis*: *Leptolithodes* and *Pristopus*. *Leptolithodes* was erected for *Paralomis aculeata* Henderson, 1888, *P. longipes* Faxon, 1893, and two new species described therein, *P. multispina* Benedict, 1895 and *P. papillata* Benedict, 1895. *Pristopus* was erected for two species, *Pristopus verrilli* Benedict, 1895, described therein as new, and *Paralomis formosa* Henderson, 1888. In both cases, a type species was not explicitly designated, nor was any indication given as to which species was considered to be the type species. Therefore, we herein select *Paralomis aculeata*, as the type species of *Leptolithodes*, and *Pristopus verrilli*, as the type species of *Pristopus*. The respective type species of *Leptolithodes* and *Pristopus* fit within the present concept of *Paralomis*. Three species of *Paralomis* are known from Taiwan.

Key to the Taiwanese species of *Paralomis*

1. Carapace margins unarmed *P. dofleini*
- Carapace margins with spines 2
2. Carapace surface rugose, evenly and densely covered with small coarse granules. Gastric region with 1 very prominent central spine or protuberance *P. arae*
- Carapace surface covered with hemispherical nodules and larger, rounded, flattened nodules. Gastric region without prominent central spine or protuberance *P. truncatispinosa*

Paralomis arae Macpherson, 2001

天壇仿石蟹



Fig. 40. Female (pcl 14 mm, cw 14 mm), CD191 (after Macpherson & Chan, 2008).

Paralomis arae Macpherson, 2001: 799, figs. 1–3 [type locality: Fiji].—Macpherson & Chan, 2008: 48, figs. 3, 5e.

Material examined.—CD191, 21°41.04'N, 118°21.95'E, 1630–1623 m, 28 Aug 2002: 1 female (rostrum broken, pcl 14 mm, cw 14 mm) (NTOU A00849).

Diagnosis.—Carapace subhexagonal, widest near midlength, lateral branchial margins subparallel; dorsal and lateral surfaces uniformly covered with small tubercles or granules; margins spinose; gastric region elevated, with distinct median spine anteriorly and pair of small low spines posteriorly; branchial surfaces each with small, low spine; outer orbital and anterolateral spines prominent. Rostrum descending, tapering to spiniform apex; with pair of short dorsal spines. Ocular peduncle granulate, with several distal spines. Basal segment of antennal peduncle with prominent dorsolateral and distomesial spines; acicle long, multispinose dorsally and laterally. Chelipeds unequal, surfaces strongly tuberculate; merus with several stout distomesial spines; carpus and propodus dorsally spinose. Walking legs densely covered with tubercles and granules; extensor and flexor margins of merus and propodus spinose; extensor margin of carpus spinose; extensor margin

of dactylus spinose on proximal half. Abdomen of both sexes densely and uniformly covered with small tubercles or granules.

Size.—Largest known specimen pcl 74.5 mm (Macpherson, 2001).

Coloration.—Pinkish. Cornea dark brown.

Habitat.—Deep-sea, mud, clay substrates; 1058–1630 m.

Distribution.—Fiji and Taiwan.

Remarks.—*Paralomis arae* is currently known only from the male holotype (pcl. 74.5 mm, cw. 72.0 mm) from Fiji (1058–1091 m) and the juvenile female from Taiwan, first reported by Macpherson & Chan (2008). The conspecific status of the two specimens was confirmed by analysis of cytochrome oxidase I sequences (Macpherson & Chan, 2008). The juvenile female is an early crab stage: asymmetry of the abdominal tergites is already evident, but pleopods are as yet undeveloped. The juvenile female from Taiwan differs chiefly from the adult male holotype of *P. arae*, as follows:

—The anterolateral spine of the carapace is much longer than the external orbital spine, rather than slightly shorter in the adult.

—The branchial margins of the carapace have six strong spines, whereas in the adult male, these spines are clearly smaller and more numerous (8 or 9).

—The scaphocerite is more spinose in the adult than in the juvenile. The dorsal side is unarmed in the Taiwanese juvenile, but has 3 or 4 spines in the holotype; and the lateral margin has 4 or 5 well developed spines in the adult, but only 3 in the juvenile.

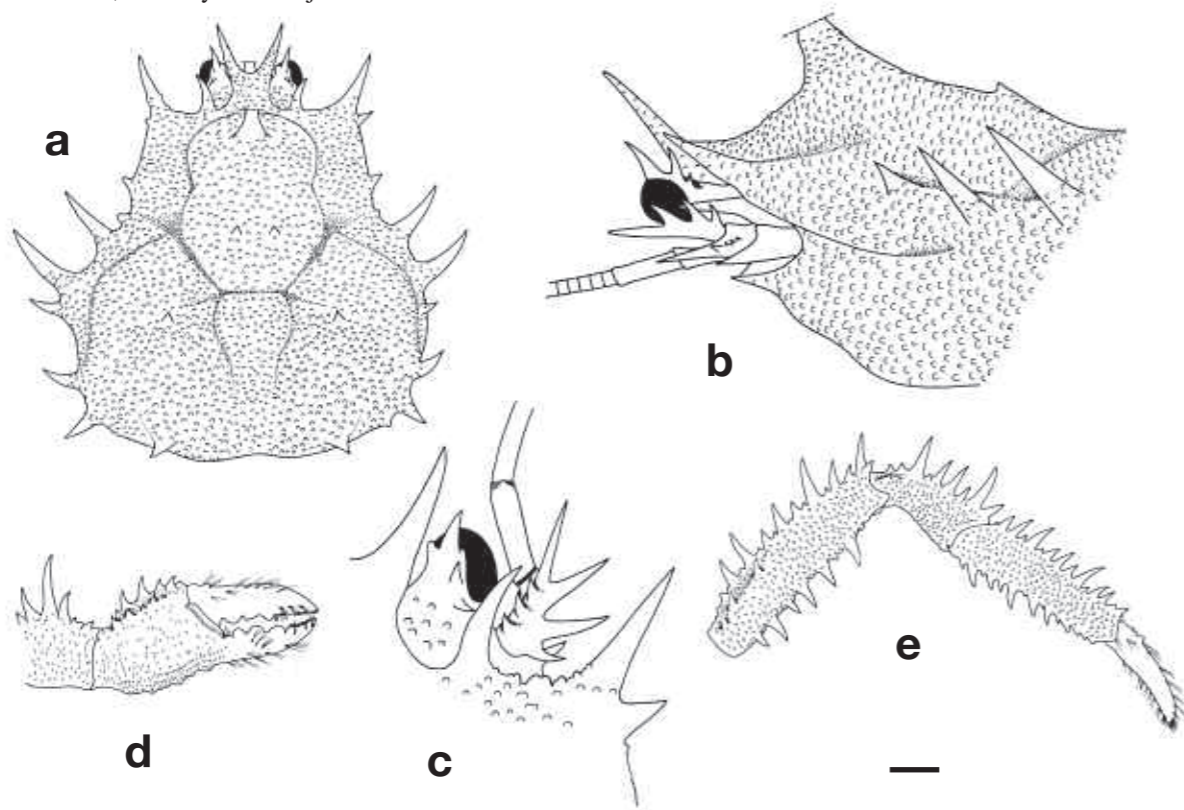


Fig. 41. Female (pcl 14 mm, cw 14 mm), CD191: **a**, carapace, dorsal view; **b**, anterior carapace, lateral view; **c**, dorsal view of right anterolateral carapace, eye and antenna; **d**, right chela and distal carpus, lateral view; **e**, right pereopod 4 (walking leg 3). Scale: a, d–e = 2 mm; b–c = 1 mm (after Macpherson & Chan, 2008).

Paralomis dofleini Balss, 1911

多突仿石蟹



Fig. 42. Male (cl 79 mm, pcl 72 mm, cw 76 mm), Dasi fishing port, Yilan County, Jul 2005 (after Macpherson & Chan, 2008).

Paralomis Dofleini Balss 1911: 8, figs. 16–17 [type locality: Japan]; 1913: 76, figs. 46–48, pl. 2–fig. 4.

Paralomis dofleini.—Sakai 1971: 39, pl. 7–fig. 1, pl. 17; 1976: 703, pl. 248.—Takeda, 1982: 78, fig. 227.—

Baba, 1986: 213, fig. 158.—Tung *et al.*, 1988: 65, fig. 61.—Macpherson, 1990: 223, figs 2e, 3c–d.—Ikeda, 1998: 164, pl. 72.—Macpherson & Chan, 2008: 48, fig. 5d.

Material examined.—Dasi fishing port, Yilan County, 26 Sep 1998: 1 female (cl 46 mm, pcl 40 mm, cw 42 mm) (NTOU A01167).—May 2000: 1 ovigerous female (cl 75 mm, pcl 66 mm, cw 64 mm) (NTOU A01168).—Jul 2005: 1 male (cl 79 mm, pcl 72 mm, cw 76 mm) (NTOU A01096).

Diagnosis.—Carapace subhexagonal, widest near midlength, lateral branchial margins subparallel; dorsal and lateral surfaces densely and uniformly covered with wart-like tubercles; surface and margins without spines. Rostrum broad, descending, tapering to point; with pair of blunt dorsal tubercles. Antennal acicle long, with 5–7 spines on lateral margin and 5 or 6 smaller spines on mesial margin. Chelipeds unequal, surfaces strongly tuberculate; merus with 1 strong and 2 or 3 smaller spines on inner margin; carpus with 4 spines on inner margin. Walking legs densely covered with tubercles and blunt spines on all surfaces of all segments. Abdomen

of both sexes densely and uniformly covered with blunt tubercles.

Size.—Ikeda (1998) reported specimens up to cl 102 mm.

Coloration.—Body and appendages totally dull red or purplish-brown.

Habitat.—Deep-sea soft substrates; 330–780 m.

Distribution.—Sagami Bay and off Kominato, Japan, and northeastern Taiwan.

Remarks.—The Taiwanese specimens agree well with recent accounts of *P. dofleini* from Japan (e.g. Baba, 1986; Ikeda, 1998).

Paralomis truncatispinosa Takeda & Miyake, 1980

截刺仿石蟹

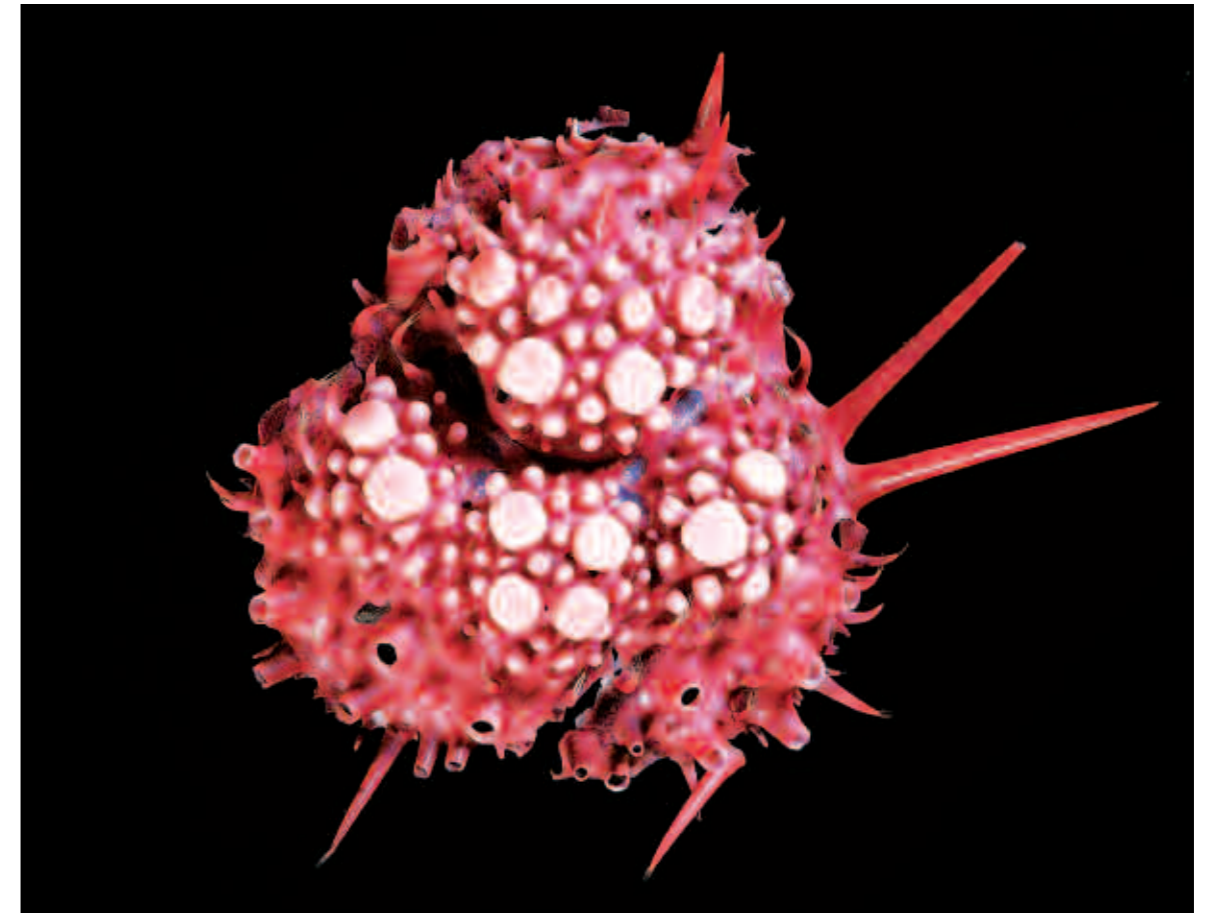


Fig. 44. Heavily damaged specimen (pcl ca. 35 mm), CD231 (after Macpherson & Chan, 2008).

Paralomis truncatispinosa Takeda & Miyake, 1980: 42, figs. 1–4 [type locality: East China Sea, 29°23.01–24.47'N, 127°30.92–31.99'E].—Macpherson, 2003: 416.—Macpherson & Chan, 2008: 49, fig. 5f. *Paralomis heterotuberculata* Tung, Wang & Li, 1984: 329 [type locality: East China Sea].—Tung *et al.*, 1988: 67, figs. 62–63, pl. 5–fig. 2.

Material examined.—CD231, 22°14.32'N, 119°58.78'E, 951–1062 m, 31 Aug 2008: 1 damaged specimen (pcl ca. 35 mm) (NTOU A01169).

Diagnosis.—Rostrum strongly trispinous. Carapace surface nodular and spinose: gastric region with upright spines anteriorly, 6 large flattened nodules, and about 20 smaller, hemispherical nodules; cardiac region with 4 large flattened nodules, and about 20 smaller, hemispherical modules; branchial regions with 3 upright spines posteriorly, 2 large flattened nodules, and more than 15 smaller, hemispherical modules. Carapace margin with strong anterolateral spine, overreaching eyes and outerorbital spine; hepatic margin with 2 long spines; branchial margins with about 6 long spines of similar length to hepatic spines. Chelipeds, walking legs and abdomen prominently spinose.

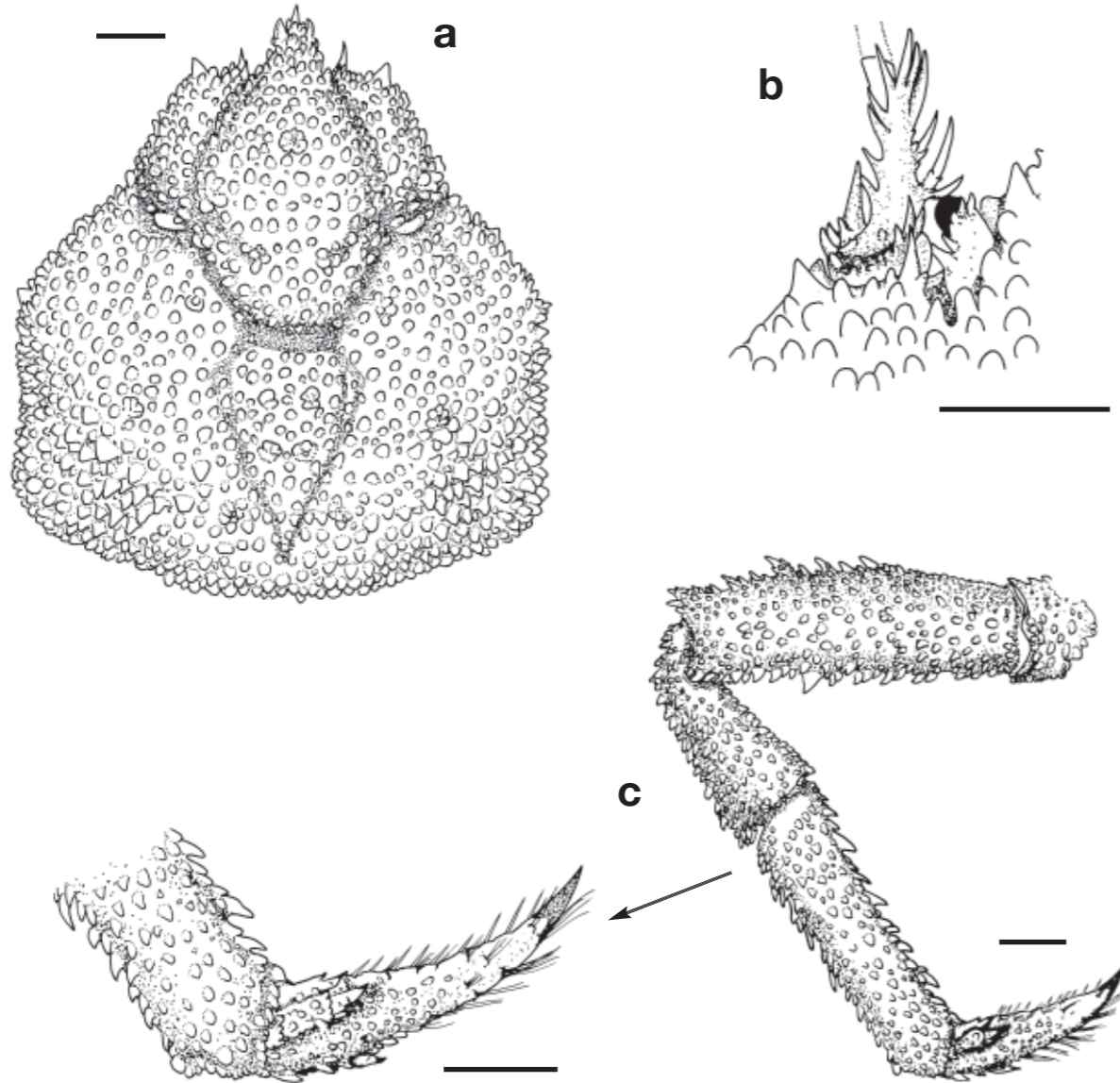


Fig. 43. Male (cl 79 mm, pcl 72 mm, cw 76 mm), Dasi fishing port, Yilan County, Jul 2005: a, carapace, dorsal view; b, left anterolateral carapace, eye and antenna, dorsal view; c, left pereopod 4 (walking leg 3). Scales = 10 mm.

Part III. Porcellanidae (Porcelain crabs)

By

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Size.—The largest known specimen measures pcl 45 mm and cw 40 mm (Takeda & Miyake, 1980).

Coloration.—Carapace pinkish red with pinkish-white tubercles.

Habitat.—Deep-sea soft substrates; 642–1062 m (Macpherson & Chan, 2008).

Distribution.—East China Sea and Taiwan.

Remarks.—*Paralomis truncatispinosa* is a distinctive species, readily recognized by the combination of long marginal carapace spines and large, flattened dorsal tubercles. Unfortunately, the only known Taiwanese specimen is badly damaged. Therefore, the description provided for some body parts follows Takeda & Miyake (1980). A habitus line drawing of the entire animal, based on Tung *et al.* (1988) is given to illustrate the characteristics of this unusual species.

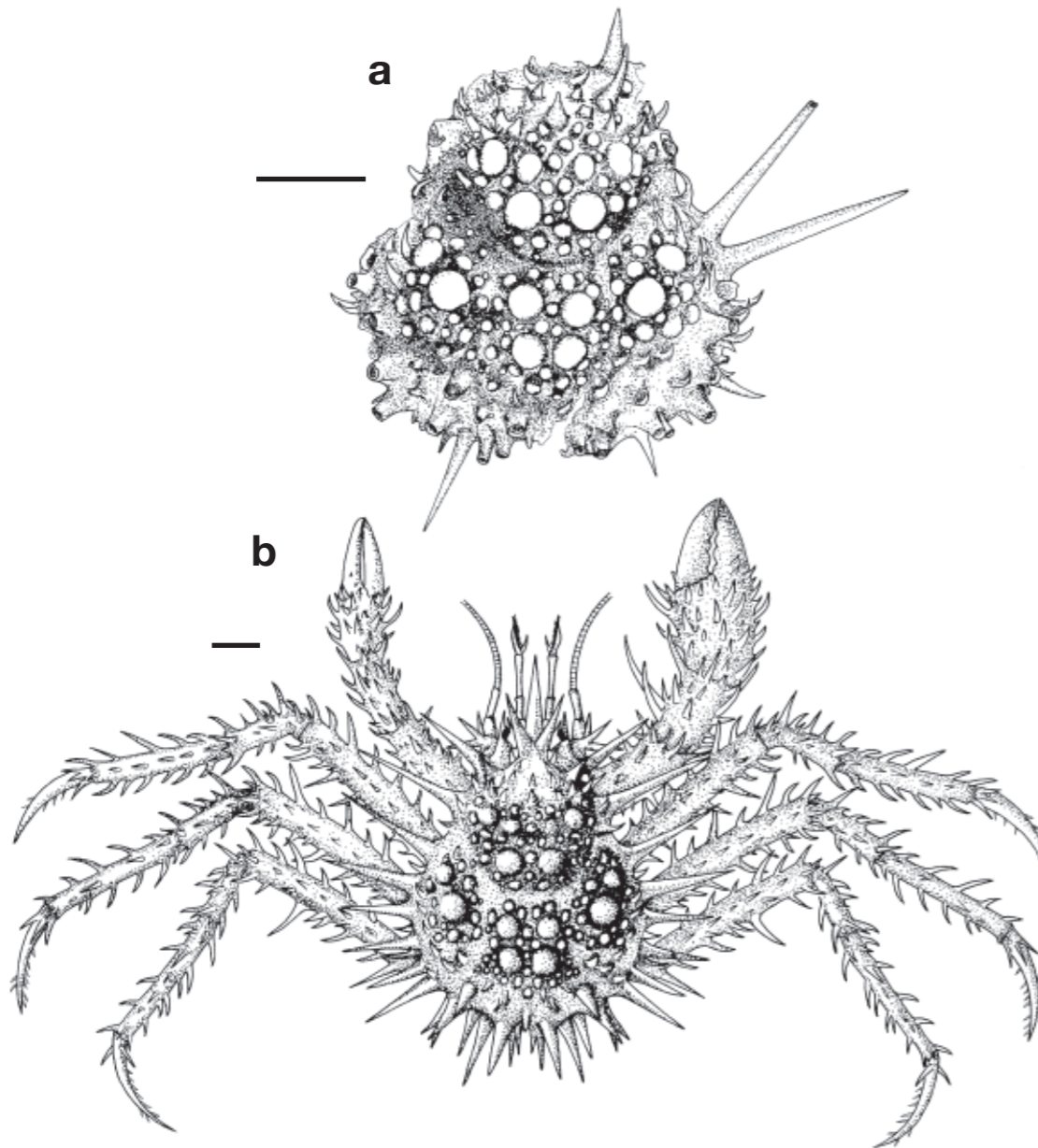


Fig. 45. **a**, carapace (damaged) (pcl ca. 35 mm), CD231; **b**, dorsal habitus, male (pcl 50 mm, cw 155 mm), East China Sea (after Tung *et al.*, 1988). Scales = 10 mm.

INTRODUCTION

The decapod crustacean family Porcellanidae Haworth, 1825, known as porcelain crabs or false crabs, is similar to true crabs (Brachyura) and generally distinguishable from other anomuran families by the crab-shaped body with a flattened abdomen. However, porcellanids differ from brachyuran crabs in having the fifth pereopod much reduced in size and often hidden under the carapace, the antennal peduncle with a long flagellum, and the abdomen not fitting closely to the underside of the thoracic sternum. In taxonomic classification, porcelain crabs are generally grouped with the squat lobsters (families Chirostylidae Ortmann, 1892 and Galatheidae Samouelle, 1819) in the superfamily Galatheaidea Samouelle, 1819. The Porcellanidae includes 29 extant genera and about 250 extant species around the world (De Grave *et al.*, 2009), distributed mainly in temperate to tropical waters. Only five genera, *Pachycheles* Stimpson, 1858, *Petrolisthes* Stimpson, 1858, *Pisidia* Leach, 1820, *Polyonyx* Stimpson, 1858, and *Porcellana* Lamarck, 1801, are distributed in the Pacific, Indian, and Atlantic Oceans. Thirteen genera are known only from the Indo-West Pacific: *Aliaporcellana* Nakasone & Miyake, 1969, *Ancylocheles* Haig, 1978, *Capilliporcellana* Haig, 1978, *Enosteoides* Johnson, 1970, *Euleniaios* Ng & Nakasone, 1993, *Heteropolyonyx* Osawa, 2001, *Lissoporcellana* Haig, 1978, *Neopetrolisthes* Miyake, 1937a, *Novorostrum* Osawa, 1998a, *Petrocheles* Miers, 1876, *Porcellanella* White, 1852, *Pseudoporcellanella* Sankarankutty, 1961, and *Raphidopus* Stimpson, 1858. Amongst them, six genera have rather restricted distributions: *Ancylocheles* is reported only from the western coast of India, Gulf of Manaar, and Australia; *Capilliporcellana* from Japan, Palau, Philippines, and the Gulf of Thailand; *Euleniaios* from Singapore and the Mergui Archipelago; *Heteropolyonyx* from Japan and New Caledonia; *Petrocheles* from Australia and New Zealand; and *Pseudoporcellanella* from the eastern Indian Ocean. Moreover, *Ancylocheles*, *Euleniaios*, *Heteropolyonyx*, and *Pseudoporcellanella* are still monotypic genera.

Species of the Porcellanidae occur from the shore to continental shelf depths (< 200 m), being common in the intertidal and shallow subtidal zones of rocky and coral reefs. Many intertidal species (e.g. of *Petrolisthes*, *Pachycheles*) inhabit narrow spaces between rocks or dead coral blocks, whereas subtidal species (e.g. of *Aliaporcellana*, *Lissoporcellana*, *Polyonyx*) occasionally live in association with sponges and a variety of soft corals. Some porcellanids are reported as the most abundant species among decapod crustaceans occurring under boulders in the intertidal region or on colonies of living corals in the subtidal region (Nakasone *et al.*, 1986; Asakura, 1991).

Porcellanids are known to be typically suspension feeders and catch food particles on long plumose setae as the elongate third maxillipeds are pulled through the water. In addition to their rapid sliding movement on rocks, “hair-trigger” autotomy of pereopods is well known as one of the distinctive habits for *Petrolisthes* species (see Wasson *et al.*, 2002).

Recent guidebooks on the marine crustaceans (e.g. Debelius, 1999; Minemizu, 2002; Kato & Okuno, 2001; Kawamoto & Okuno, 2003) show underwater photographs of numerous shallow-water species including porcellanids, and many of them have attractive coloration. Species of *Neopetrolisthes*, associates of large sea anemones, are well known in the aquarium trade for their colorful spots on a porcelain-white body. The beautiful body and the tendency of “porcelain” crabs to “break easily” (i.e. to shed the chelipeds when under stress) may account for the unusual common name (see Debelius, 1999: 245).

In Taiwan, *Petrolisthes hastatus* Stimpson, 1858, was reported as the first porcellanid by Maki & Tsuchiya (1923). After that, there were only scattered reports on the porcellanid crabs from the island (Miyake, 1943; Suzuki, 1985; Kropp, 1986; Dörjes & Cheng, 1986; Nakasone & Yu, 1987; Kropp & Haig, 1994) and only in the last decade has this group been extensively surveyed (Hsieh *et al.*, 1997; Hsueh & Huang, 1998; Osawa *et al.*, 2007). To date, 11 genera and 32 species of porcellanid crabs have been reported from Taiwan. *Polyonyx bella* Hsueh & Huang, 1998 was originally described from Taiwanese material, but the species is treated as a junior synonym of *P. sinensis* Stimpson, 1858 by Werding (2001). *Pachycheles stevensii* Stimpson, 1858 was listed from western Taiwan by Dörjes & Cheng (1986), but because *P. stevensii* is generally believed to have a northern distribution in Japan, Korean Strait and Vladivostok (Miyake, 1998), it is very likely that the material of Dörjes & Cheng (1986) belongs to the southern species *P. pectiniscarpus* Stimpson, 1858. Four species, *Lissoporcellana quadrilobata* (Miers, 1884), *L. streptochiroides* (Johnson, 1970), *Pisidia serratifrons* Stimpson, 1858, and *Polyonyx biunguiculatus* (Dana, 1852), have been recorded only from the eastern part of the Taiwan Strait and/or Matsu near to mainland China but not from Taiwan proper (Haig, 1964, 1981a; Hsieh *et al.*, 1997).

A total of 40 species in 11 genera are reported, including new Taiwan records for six species. One of the six newly recorded species is *Polyonyx obesulus* Miers, 1884. Although Haig (1964) recorded *Polyonyx biunguiculatus* from the Taiwan Strait, re-examination of that specimen has revealed that it actually belongs to *P. obesulus* and this species is now also found in Taiwan proper. The other five species newly recorded from Taiwan are *Aliaporcellana pygmaea* (De Man, 1902), *Lissoporcellana quadrilobata* (Miers, 1884), *Novorostrum securiger* (Melin, 1939), *Petrolisthes heterochrous* Kropp, 1986, and *P. obtusifrons* Miyake, 1937. Among the 40 species in this catalog, only *Lissoporcellana streptochiroides* and *Pisidia serratifrons* are still only known from the Taiwan Strait and have not been found from Taiwan proper. Although there are no endemic species of porcellanids in Taiwan, the number of species found in Taiwan is relatively high, with nearly one sixth of the world’s total species. It is likely that more species will be discovered from Taiwan with more extensive collecting efforts on coral reefs because other species are known from its adjacent regions such as the Xisha and Nansha Islands of China and the Ryukyu Islands of Japan (Yang, 1983; Yang & Xu, 1994; Osawa, 1996, 1997, 1998a, b, 2009; Osawa & Fujita, 2005).

The general morphology of porcellanids is illustrated under the **Morphological Terms** in the next pages. The diagnoses and line drawings are based on specimens from Taiwan and the Taiwan Strait, except for *Petrolisthes heterochrous* Kropp, 1986. Although there is a color photograph of a Taiwanese specimen of this species, it could not be located during the preparation of the catalog. Thus, a specimen from the Ryukyu Islands is used for the line drawings of *P. heterochrous*.

Morphological Terms

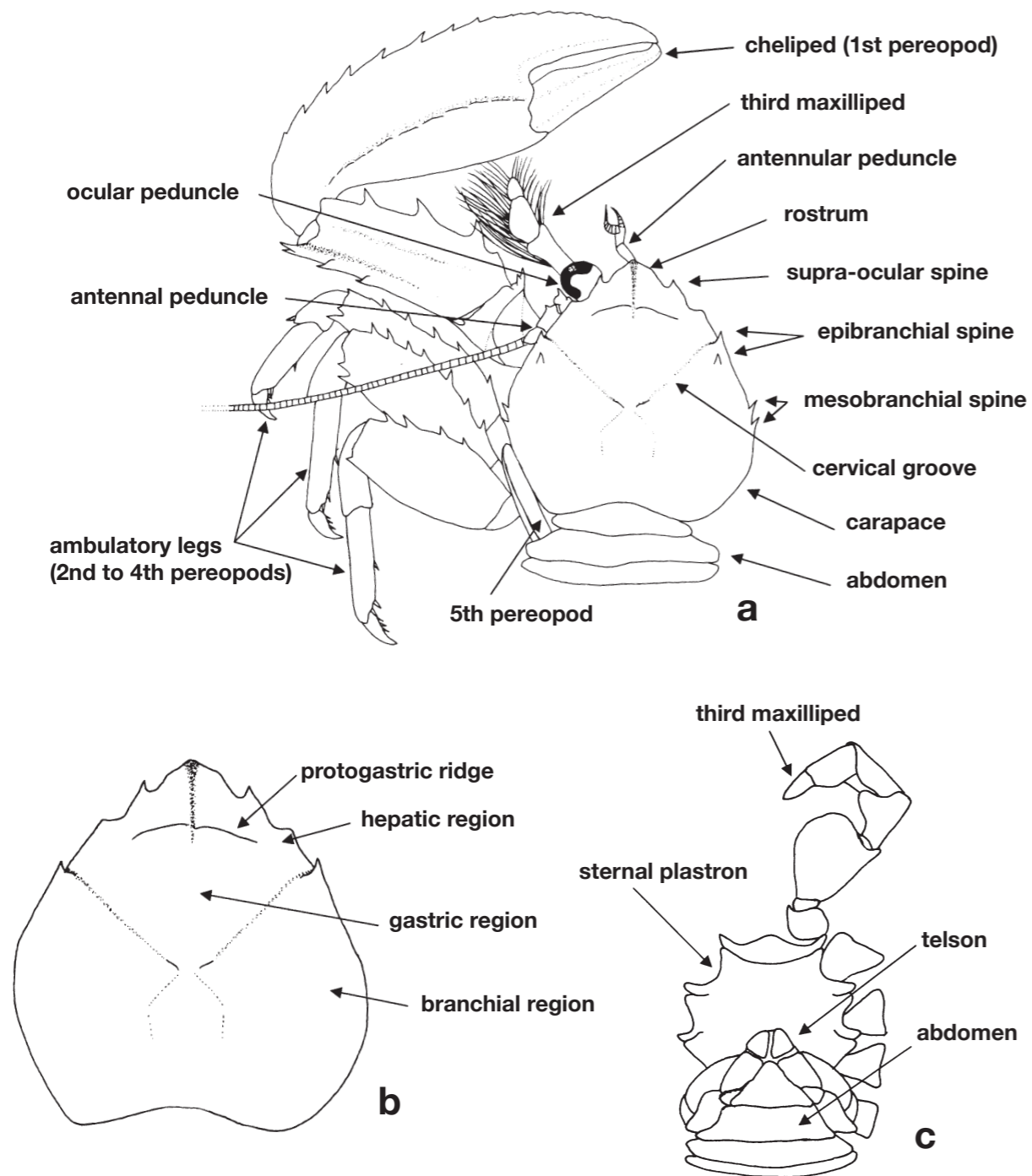


Fig. 46. *Petrolisthes*: a, carapace and left appendages, dorsal view; b, carapace, dorsal view; c, sternal plastron, abdomen, and third maxilliped, ventral view.

Morphological Terms

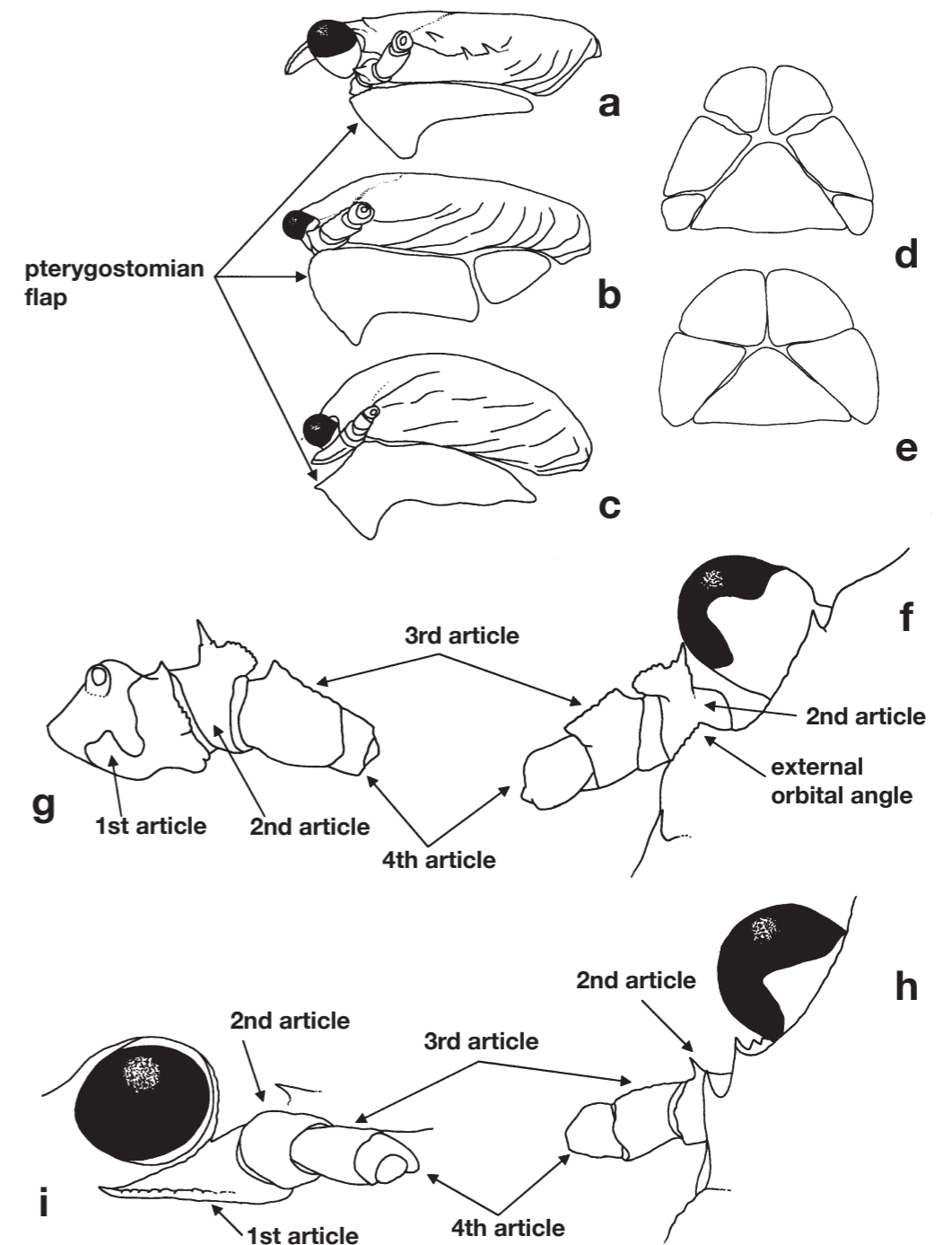


Fig. 47. a, d, f-g, *Petrolisthes*; b, e, *Pachycheles*; c, *Polyonyx*; h-i, *Lissoporcellana*: a-c, carapace, pterygostomian flap, and ocular and antennal peduncles, left lateral view; d-e, telson, extensor view; f, h, left ocular and antennal peduncles and anterolateral margin of carapace, dorsal view; g, left antennal peduncle, ventral view; i, left ocular and antennal peduncles and anterolateral margin of carapace, lateral view.

Morphological Terms

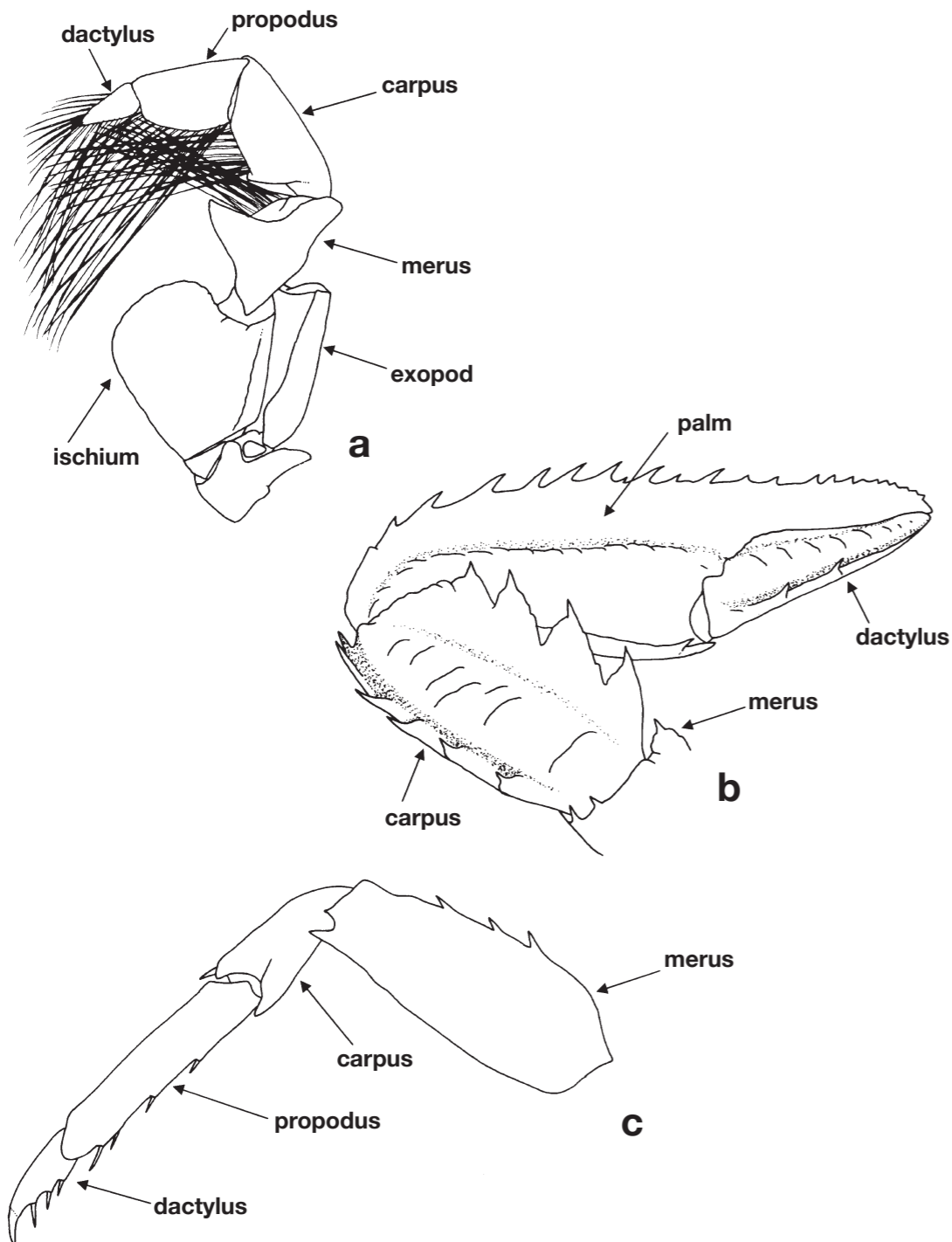


Fig. 48. *Petrolisthes*: a, left third maxilliped, lateral view; b, left cheliped, dorsal view; c, left ambulatory leg.

SYSTEMATICS

Infraorder Anomura MacLeay, 1838

異尾下目

Superfamily Galatheoidea Samouelle, 1819

鎧甲蝦總科

Diagnosis.—Body crab- or lobster-like. Ocular scales absent. Antennal peduncle composed of 4 or 5 articles. First pereopods elongate and chelate; second to fourth pereopods ambulatory, with claw-like dactyli; fifth pereopod reduced and slender, often hidden under carapace. Abdomen symmetrical, depressed, folded up against itself or thoracic sternum; tailfan composed of flattened telson and spatulate uropods. Male gonopods usually present on second abdominal segment (no gonopods in some porcellanids). Female pleopods absent on first abdominal segment.

Remarks.—In the present catalog, the classification within the superfamily Galatheoidea follows the most updated scheme of De Grave *et al.* (2009) which includes only three families instead of five, and we acknowledge that there is a wealth of divergent opinions on the classification within this group (e.g. McLaughlin *et al.*, 2007; Ahyong *et al.*, 2009). The three families included in Galatheoidea are Chirostylidae Ortmann, 1892, Galatheidae Samouelle, 1819, and Porcellanidae Haworth, 1825. Ahyong *et al.* (2009) demonstrated considerable polyphyly of some taxa included in the Anomura. Chirostylid squat lobsters are more closely related to an assemblage including aeglids, lomisooids, and parapagurids than to other galatheoids. Galatheidae may be paraphyletic on the basis of an internally nested Porcellanidae, and a similar situation is present with Chirostylidae and Kiwaidae Macpherson, Jones & Segonzac, 2005 (Ahyong *et al.*, 2009). Members of Chirostylidae, Galatheidae and Porcellanidae are all marine inhabitants, and all the three families are known from Taiwan. The Taiwanese species of the families Chirostylidae and Galatheidae have been reported in the recently published Taiwan squat lobster catalog (Baba *et al.*, 2009). A key to the three families given in Baba *et al.* (2009) is shown below.

Key to families of Galatheoidea in Taiwan

1. Abdomen folded against thorax. Body crab-like **Porcellanidae**
- Abdomen bent but not folded against thorax. Body lobster-like 2
2. Telson divided into anterior and posterior lobes by distinct or indistinct suture, folded beneath preceding abdominal somites. Sternal plate absent between last pereopods. Antennal peduncle of 5 segments **Chirostylidae**
- Telson distinctly or indistinctly divided into several plates, not folded beneath preceding abdominal somites. Sternal plate between last pereopods, separated from preceding sternal plastron. Antennal peduncle of 4 segments **Galatheidae**

Family Porcellanidae Haworth, 1825

瓷蟹科

Porcellanidae Haworth, 1825: 184 [type genus: *Porcellana* Lamarck, 1801 (see Holthuis, 1962; ICZN, 1964)].

Diagnosis.—Body more or less depressed, crab-like; carapace generally broadly ovate; frontal margin often forming broad triangular rostrum in dorsal view, occasionally bilobate, trilobate, or quadrilobate in anterior view. Antennular peduncle usually concealed. Antennal peduncle composed of 4 articles, usually directed laterally. Third maxilliped with ischium broad and subovate, anterior flexor margin strongly inflated; merus usually with broad, flattened lobe on flexor margin (no distinct lobe in *Petrocheles* Miers, 1876); merus to dactylus fringed with long plumose setae on flexor margin; exopod flattened, slender or inflated. First pereopod chelate, usually much stronger than ambulatory legs, flattened or inflated, often held more or less horizontally or obliquely, usually bent sharply at articulation between carpus and chela. Second to fourth pereopods as ambulatory legs subcylindrical or flattened laterally. Fifth pereopod markedly reduced in size, slender, folded in dorsolateral position. Third thoracic sternite often trilobate, with distinct or weakly developed median lobe. Abdomen broad, strongly flattened, folded up against thorax but not closely fitting sterno-abdominal cavity; telson forming well developed tailfan with uropods, divided into 5 or 7 plates; male usually with a single pair of well developed pleopods modified as gonopods on second segment (in *Petrocheles*, additional pair of short gonopods present on first segment; in some species of *Pachycheles* Stimpson, 1858 and *Polyonyx* Stimpson, 1858, gonopods completely absent); female usually with pairs of well developed, slender, uniramous pleopods on third to fifth segments, pair on third segment sometimes reduced or completely lacking (in *Petrocheles*, pair of short pleopods present on second segment).

Remarks.—Ahyong *et al.* (2009) suggest the possibility that porcellanids are derived from within the galatheids based on the analysis of the phylogenetic relationships of the Anomura. They also mention that this is morphologically plausible because chief characters separating galatheids from porcellanids, namely structures of the rostrum, cephalothorax, abdomen, and cheliped, are all plesiomorphic. In addition to the crab-like form as an example of carcinization within Anomura, Porcellanidae is distinguished from Galatheidae and Chirostylidae by a probable apomorphic character, the ischium of the third maxilliped being broad and subovate and strongly inflated on the anterior flexor margin, which may be correlated with feeding behavior. The article in the other two families is narrow and generally elongate subrectangular.

Of the 29 extant genera of porcelain crabs, 11 genera are found in Taiwan. Keys are presented below for the genera and species known from Taiwan. Keys to all the Indo-West Pacific genera and to the Indo-West Pacific species of some selected genera can be found in Osawa (2007b). The porcellanid genera are divided into two informal groups based on the structure of the antennal peduncle (the first dichotomy of the key shown below). This major division is supported by larval and sperm cell morphologies (Lebour, 1943; Sankolli, 1965; Gore, 1971; Tudge & Jameison, 1996a, b) and molecular data (Rodríguez, *et al.*, 2006).

Key to genera of Porcellanidae from Taiwan

1. Antennal peduncle with movable (second to fourth) articles freely accessible to orbit 2
 - Antennal peduncle with movable articles excluded from orbit by projection of immovable (first) article adpressed to anterior margin of carapace 5
2. Chelipeds flattened. Pterygostomian flap entire 3

- Chelipeds robust. Posterior part of pterygostomian flap composed of 1 or more pieces separated by membranous interspaces from anterior part *Pachycheles*
- 3. Carapace with gastric region strongly elevated. Ambulatory legs subcylindrical *Neopetrolisthes*
 - Carapace flattened or somewhat convex on dorsal surface. Ambulatory legs flattened laterally 4
 - 4. Carapace uneven on dorsal surface. Median lobe of rostrum with pair of lateral elevations *Novorostrum*
 - Carapace generally even on dorsal surface. Median lobe of rostrum without lateral elevations *Petrolisthes*
 - 5. Carapace broader than long 6
 - Carapace as long as or longer than broad 8
 - 6. Ambulatory legs with dactyli each terminating in a single claw (no corneous spines present on flexor margin) *Raphidopus*
 - Ambulatory legs with dactyli each bearing biunguiculate claw 7
 - 7. Branchial margins of carapace armed with spines, external orbital angle terminating in small spine *Aliaporcellana*
 - Branchial margins of carapace without spines, external orbital angle unarmed *Polyonyx*
 - 8. Carapace distinctly elongate. Dactyli of ambulatory legs each quadriunguiculate *Porcellanella*
 - Carapace not elongate. Dactyli of ambulatory legs each terminating in a single claw 9
 - 9. Carapace strongly areolate on dorsal surface *Enosteoides*
 - Carapace not uneven, nearly smooth or striate on dorsal surface 10
 - 10. Chelae inflated and subcylindrical, no distinct sexual dimorphism (median lobe usually with distinct median notch) *Lissoporcellana*
 - Chelae rather flattened, usually showing sexual dimorphism in spinulation and degree of distortion of fingers (median lobe without median notch) *Pisidia*

Genus *Aliaporcellana* Nakasone & Miyake, 1969

異瓷蟹屬

Aliaporcellana Nakasone & Miyake, 1969: 17 [type species: *Porcellana suluensis* Dana, 1852, by original designation. Gender: feminine].

Diagnosis.—Carapace as long as broad as or broader than long; dorsal surface convex, nearly smooth or somewhat uneven, regions moderately defined. Rostrum trilobate; median lobe exceeding lateral lobes, bent ventrally. External orbital angle terminating in spine. Hepatic margins each with spine(s). Branchial margin armed with spines. Pterygostomian flaps entire. Antennal peduncle with movable (second to fourth) articles excluded from orbit by projection of immovable (first) article adpressed to anterior margin of carapace. Chelipeds usually unequal in size and armature; chelae inflated; dactylus usually opening obliquely. Ambulatory legs with dactyli each bearing biunguiculate claw. Male with pair of gonopods on second abdominal segment. Telson divided into 7 plates.

Remarks.—This genus includes four Indo-West Pacific species, all inhabiting sponges and cnidarians including scleractinians, antipatharians, and alcyonaceans (Osawa, 2007b). Three species are known from Taiwan, with one of them being a new record of the island.

Key to species of *Aliaporcellana* from Taiwan

1. Rostrum with lateral lobes produced but usually not visible in dorsal view. Dactylus of smaller cheliped unarmed or crenulated on dorsoflexor (posterior) margin *A. suluensis*
- Rostrum with lateral lobes produced and visible in dorsal view. Dactylus of smaller cheliped with acute, slender spines on dorsoflexor margin 2
2. Lateral lobes of rostrum each terminating in small spine. Dactyli of ambulatory legs unarmed on flexor margin *A. kikuchii*
- Lateral lobes of rostrum serrated or tuberculated on anterior margin. Dactyli of ambulatory legs each with small corneous spine on flexor margin *A. pygmaea*

Aliaporcellana kikuchii Nakasone & Miyake, 1969

卡氏異瓷蟹



Fig. 49. Male (cl 3.6 mm), Dasi fishing port, Yilan County, 15 Apr 1993.

Aliaporcellana kikuchii Nakasone & Miyake, 1969: 27, fig. 4 [type locality: Amakusa, west Kyushu, Japan].—Asakura, 1995: 375, pl. 100–fig. 4.—Hsieh *et al.*, 1997: 343, figs. 32D, 37.

Material examined.—Dasi fishing port, Yilan County, 15 Apr 1993: 1 male (cl 3.6 mm) (NTOU A00694).

Diagnosis.—Carapace rounded; approximately as long as broad; dorsal surface with scattered stiff setae on short transverse ridges. Rostrum with median lobe tapering distally; lateral lobes each terminating in small spine. Smaller cheliped with stiff setae on dorsal surface; carpus armed with small spines on dorso-extensor margin; dactylus with acute, slender spines on dorsoflexor (posterior) margin. Ambulatory legs relatively slender; dactyli each with extensor claw more slender and longer than flexor claw, flexor margin without spines.

Size.—To cl 3.6 mm (present study).

Coloration.—Carapace and pereopods mottled light brown. Asakura (1995) shows a color photograph of this species from Japan, and it is pale brown on the entire body and has irregular brown marks on the pereopods.

Habitat.—The holotype was taken from the reef-building coral dredged at Amakusa, west Kyushu, Japan (Nakasone & Miyake, 1969). The collection depth was not recorded.

Distribution.—Only recorded from Taiwan and Japan.

Remarks.—This species closely resembles *A. pygmaea* (De Man, 1902), but the shape of the rostrum and armature and shape of the dactyli of the ambulatory legs distinguishes the two species (Osawa, 2007b).

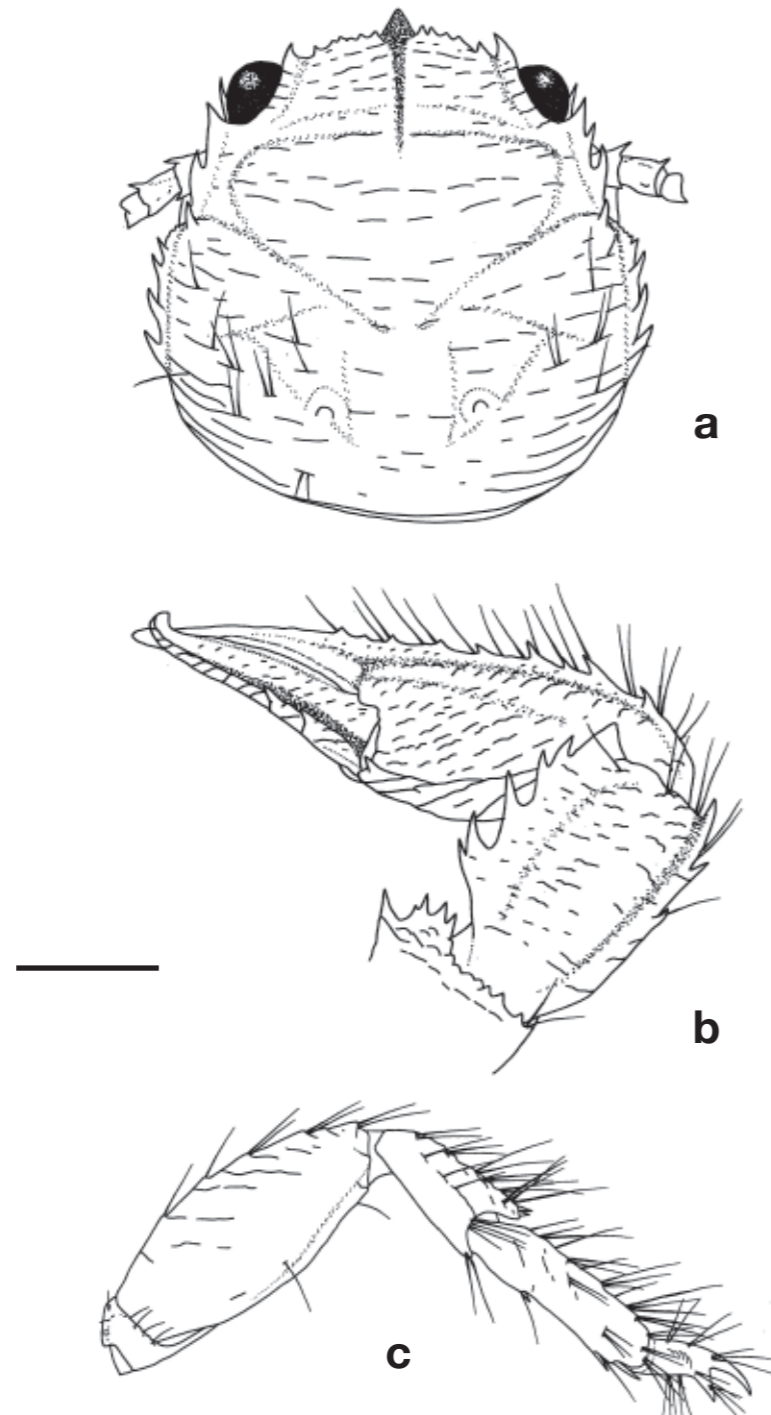


Fig. 50. Male (cl 3.6 mm), Dasi fishing port, Yilan County, 15 Apr 1993: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, larger right cheliped, dorsal view; **c**, right second pereopod, lateral view. Scale = 1.0 mm.

Aliaporcellana pygmaea (De Man, 1902)
微異瓷蟹

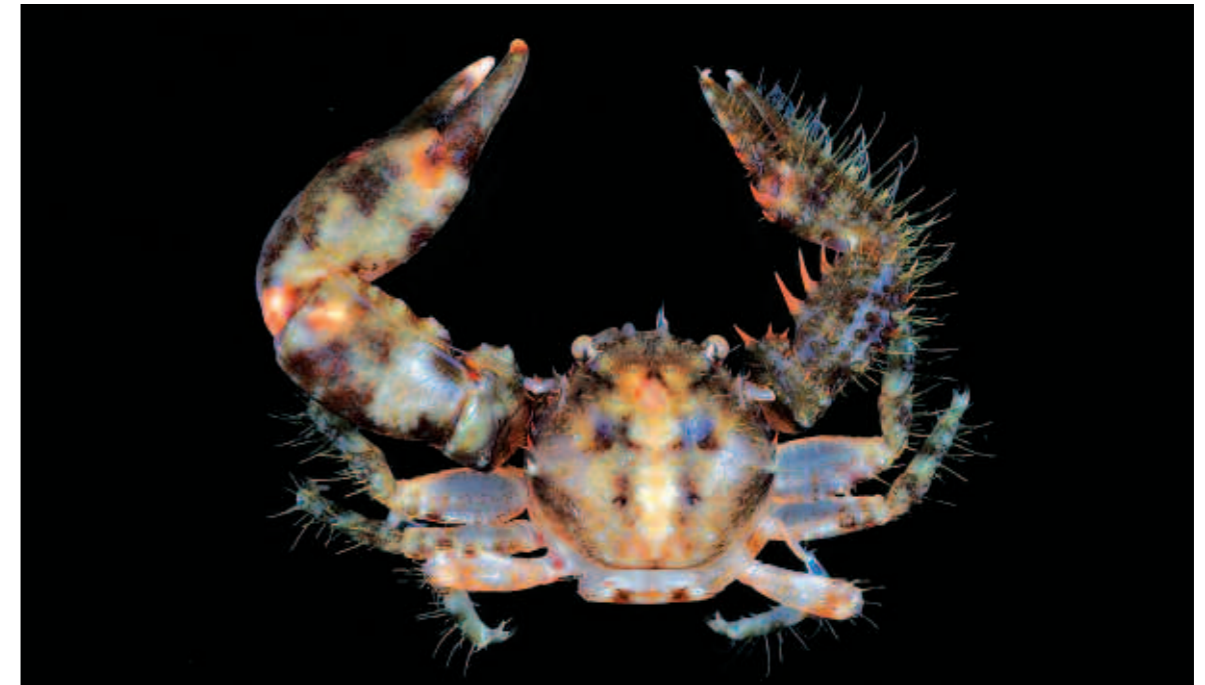


Fig. 51. Male (cl 4.1 mm), Gudanshih, Kending, Pingtung County, 8 Dec 2009.



Fig. 52. Ovigerous female (cl 4.0 mm), Gongguanbi, Lyudao, Taitung County, 22 Jul 2009.

Porcellana pygmaea De Man, 1902: 698, pl. 23—figs. 38, 38a–e [type locality: Ternate, Indonesia].

Polyonyx pugilator Nobili, 1906b: 161 [type locality: Persian Gulf].

Polyonyx pygmaeus.—Lewinsohn, 1969: 161, fig. 36.

Aliaporcellana pygmaea.—Nakasone & Miyake, 1969: 19.—Osawa, 2007b: 5, fig. 1.

Material examined.—Gudanshih, Kending, Pingtung County, 8 Dec 2009: 1 male (cl 4.1 mm) (NTOU A01113). Landong, Kending, Pingtung County, 9 Dec 2009: 2 males (cl 3.5, 4.3 mm), 1 ovigerous female (cl 4.0 mm) (NTOU A01173). Gongguanbi, Lyudao, Taitung County, 22 Jul 2009: 2 ovigerous females (cl 3.1, 4.0 mm) (NTOU A01127).

Diagnosis.—Carapace rounded; slightly broader than long; dorsal surface with scattered stiff setae on short transverse ridges. Rostrum with median lobe terminating subacutely; lateral lobes each serrated or tuberculated on anterior margin. Smaller cheliped with stiff setae on dorsal surface; carpus armed with small spines on dorso-extensor margin; dactylus with acute, slender spines on dorsoflexor (posterior) margin. Ambulatory legs relatively stout; dactyli each with extensor claw slightly more slender than but subequal in length to flexor claw, flexor margin with small corneous spine.

Size.—To cl 4.1 mm (Lewinsohn, 1969).

Coloration.—Carapace and chelipeds generally brown. Carapace light brown on median part, with dark brown marks laterally. Chelipeds with irregular dark brown marks. Ambulatory legs whitish or pale brown, with brown marks or bands. Setae pale brown.

Habitat.—Shallow water to 80 m deep; among sponges and antipatharians.

Distribution.—Red Sea, Gulf of Aden, Persian Gulf, Seychelles, Madagascar, Cargados Carajos (northeast of Mauritius), Gulf of Thailand, Java Sea, Moluccas, New Caledonia, and Loyalty Islands. Now from Taiwan.

Remarks.—*Aliaporcellana pygmaea* is here reported from Taiwan for the first time. Distinctions between this species and *A. kikuchii* are given under “Remarks” for the latter species.

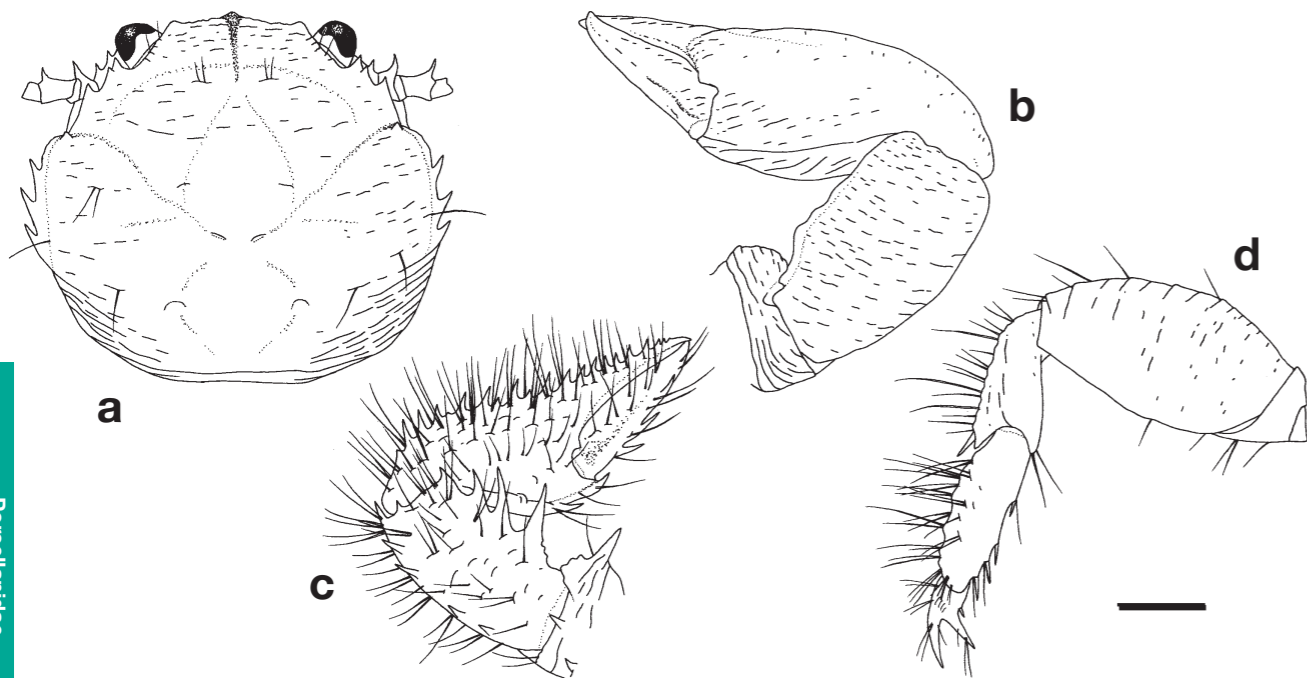


Fig. 53. Ovigerous female (cl 4.0 mm), Gongguanbi, Lyudao, Taitung County, 22 Jul 2009: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, larger right cheliped, dorsal view; **c**, smaller left cheliped, dorsal view; **d**, left second pereopod, lateral view. Scale: a = 1.0 mm; b–c = 1.1 mm; d = 0.8 mm.

Aliaporcellana suluensis (Dana, 1852)

蘇祿異瓷蟹



Fig. 54. Ovigerous female (cl 3.6 mm), Gongguanbi, Ludao, Taitung County, 22 Jul 2009.

Porcellana suluensis Dana, 1852: 414 [type locality: Sulu Sea].

Polyonyx denticulatus Paulson, 1875: 89, pl. 11—fig. 6 [type locality: Red Sea].

Polyonyx hexagonalis Zehntner, 1894: 187, pl. 8—figs. 18, 18a [type locality: Amboina, Moluccas, Indonesia].

Polyonyx suluensis.—Haig, 1964: 373, fig. 3.—Lewinsohn, 1969: 166, fig. 37.

Aliaporcellana suluensis.—Nakasone & Miyake, 1969: 21, fig. 1.—Haig, 1992: 304, fig. 1.—Hsieh, *et al.*, 1997: 345, figs. 32E, 38.—Osawa, 2007b: 7, fig. 2.

Material examined.—Gongguanbi, Ludao, Taitung County, 22 Jul 2009: 1 ovigerous female (cl 3.6 mm) (NTOU A00926). Taiwan Strait, 23°08'N, 117°30'E, 44 m, 23 Jan 1912: 6 males (cl 2.6–3.8 mm), 4 females (cl 3.1–5.4 mm) (ZMUC).

Diagnosis.—Carapace roughly hexagonal; as long as broad or slightly broader than long; dorsal surface usually with scattered stiff setae. Rostrum with median lobe terminating subacutely; lateral lobes produced but usually not visible in dorsal view. Smaller cheliped nearly smooth or with denticulate protuberances on dorsal surfaces of carpus and palm; carpus crenulated or with some small spines on dorso-extensor margin; dactylus

unarmed or crenulated on dorsoflexor (posterior) margin. Ambulatory legs relatively stout; dactyli each with extensor claw much slender than but subequal in length to flexor claw, flexor margin without rounded knob.

Size.—To cl 5.8 mm (Osawa, 2007b).

Coloration.—Carapace and pereopods generally pale brown with pale blue marks. Chelipeds with small dark brown marks on carpi and chelae. Ambulatory legs generally pale brown. Eggs reddish.

Habitat.—Littoral to 180 m deep; bottoms of shells and sand, or living and dead corals on reefs.

Distribution.—Widely distributed in the Indo-West Pacific; north to Kyushu, Japan, south to tropical Queensland and New Caledonia, and west to Red Sea and east coast of Africa.

Remarks.—Although the material reported by Hsieh *et al.* (1997) from southern Taiwan could not be located at the time of writing of this catalog, specimens from the Taiwan Strait reported by Haig (1964) and recently collected from Ludao were examined. *Aliaporcellana suluensis* has been known to have intraspecific variations on the degrees of convexity of the lateral margins of the carapace and armature on the chelipeds (Haig, 1964; Osawa, 2007b). This species is closely allied to *A. telestophila* (Johnson, 1958), but can be immediately distinguished from the latter by the shape of the dactyli of ambulatory legs.

Genus *Enosteoides* Johnson, 1970

擬豆瓷蟹屬

Porcellana (*Enosteoides*) Johnson, 1970: 32 [originally established as a subgenus of *Porcellana* Lamarck, 1801, and subsequently raised to generic rank by Haig (1978); type species: *Porcellana corallicola* Haswell, 1882, by original designation. This species is a junior subjective synonym of *Porcellana ornata* Stimpson, 1858 as discussed by Haig (1965). Gender: masculine].

Enosteoides.—Haig, 1978: 709.

Diagnosis.—Carapace approximately as long as broad; dorsal surface distinctly areolate, regions well defined. Rostrum trilobate; median lobe exceeding lateral lobes, bent ventrally near apex, with median notch in dorsal view. External orbital angle produced or not produced. Branchial margins ridged, with some small spines on median part. Pterygostomian flaps entire. Antennal peduncle with movable (second to fourth) articles excluded from orbit by projection of immovable (first) article adpressed to anterior margin of carapace. Chelipeds subequal; chelae broad, flattened; dactylus opening horizontally. Ambulatory legs with dactyli each terminating in a single claw. Male with pair of gonopods on second abdominal segment. Telson divided into 7 plates.

Remarks.—This genus contains four Indo-West Pacific species (Osawa, 2009), and only one species has been reported from Taiwan. The uneven carapace with well-defined regions is one of the major diagnostic characters of *Enosteoides*, although this character is also known in *Capilliporcellana* and *Novorostrum*.

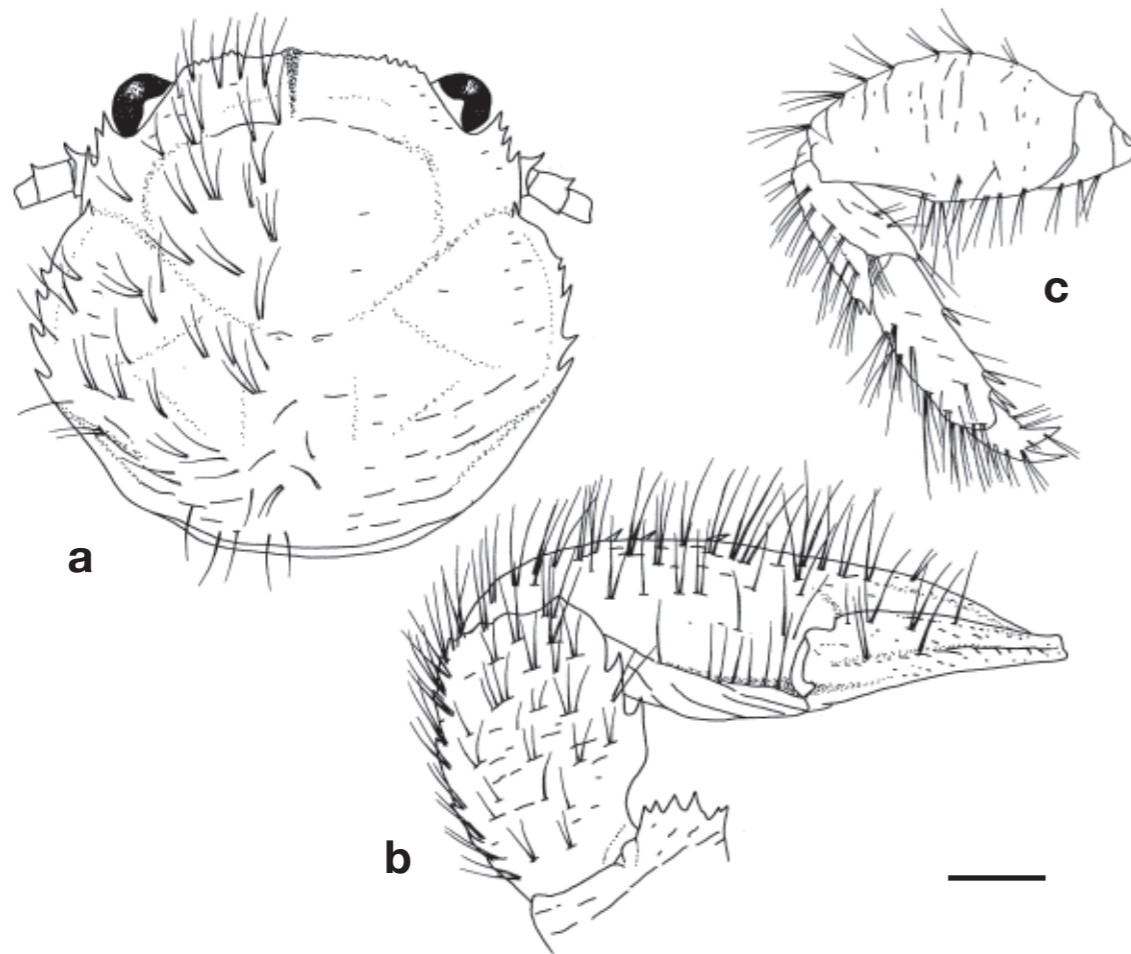


Fig. 55. Female (cl 5.4 mm), Taiwan Strait, 23°08'N, 117°30'E, 23 Jan 1912: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, larger left cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale = 1.0 mm.

Enosteoides ornatus (Stimpson, 1858)

裝飾擬豆瓷蟹



Fig. 56. Female (cl 4.5 mm), Danshuei, Taipei County, 20 Feb 1998.

Porcellana ornata Stimpson, 1858: 242 [type locality: Hong Kong].—Miyake, 1943: 118, figs. 42–43.

Porcellana corallicola Haswell, 1882: 759 [type locality: Port Molle, Queensland].

Porcellana (Enosteoides) corallicola.—Johnson, 1970: 32, figs. 3q–r.

Enosteoides ornatus.—Haig, 1978: 709.—Haig, 1992: 305, fig. 2.—Hsieh *et al.*, 1997: 335, figs. 32B, 33.

Material examined.—Danshuei, Taipei County, 20 Feb 1998: 2 females (cl 4.5, 4.7 mm) (NTOU A01128). Houlong, Miaoli County, 12 Sep 1992: 3 males (cl 2.9–3.9 mm), 3 juveniles (cl 2.0–2.1 mm) (NTOU A00689). Baisha, Penghu County, 4 Sep 1990: 2 males (cl 3.8, 4.2 mm), 1 female (cl 3.1 mm) (NTOU A00687). Lijhengjiao, Penghu County, 24 May 1992: 1 male (cl 3.9 mm) (NTOU A00688). No specific locality: 4 males (cl 4.7–3.0 mm), 2 females (cl 2.5, 3.3 mm), 2 juveniles (cl 2.0, 2.1 mm) (NTOU A00917).

Diagnosis.—Carapace with distinct acute or blunt spines on supra-orbital and hepatic margins. Rostrum with lateral lobes indistinctly produced in dorsal view. External orbital angle terminating in small blunt or subacute spine. Chelipeds with carpi bearing serrations and some proximal larger spines on dorsoflexor margin, dorso-extensor margin with row of small spines; chelae with tubercles or upstanding scaly ridges on extensor

side of dorsal surface, extensor margin with row of plumose setae. Ambulatory legs moderately slender; propodi relatively short; dactyli each with 4 or 5 corneous spines.

Size.—To cl 6.0 mm (Miyake, 1943).

Coloration.—Carapace and pereopods generally brown. Carapace with narrow pale brown stripe on midline. Chelipeds with scattered dark brown marks. Dactyli of ambulatory legs whitish.

Habitat.—Intertidal to 54 m deep; under rocks, from dead coral bases and sponge.

Distribution.—North to Honshu in Japan, south to tropical Australia and west to Pakistan.

Remarks.—*Enosteoides ornatus* can be readily distinguished from other congeners by the armature on the anterolateral margin of the carapace, basal article of the antennular peduncle, and palms of the chelipeds (Osawa, 2009).

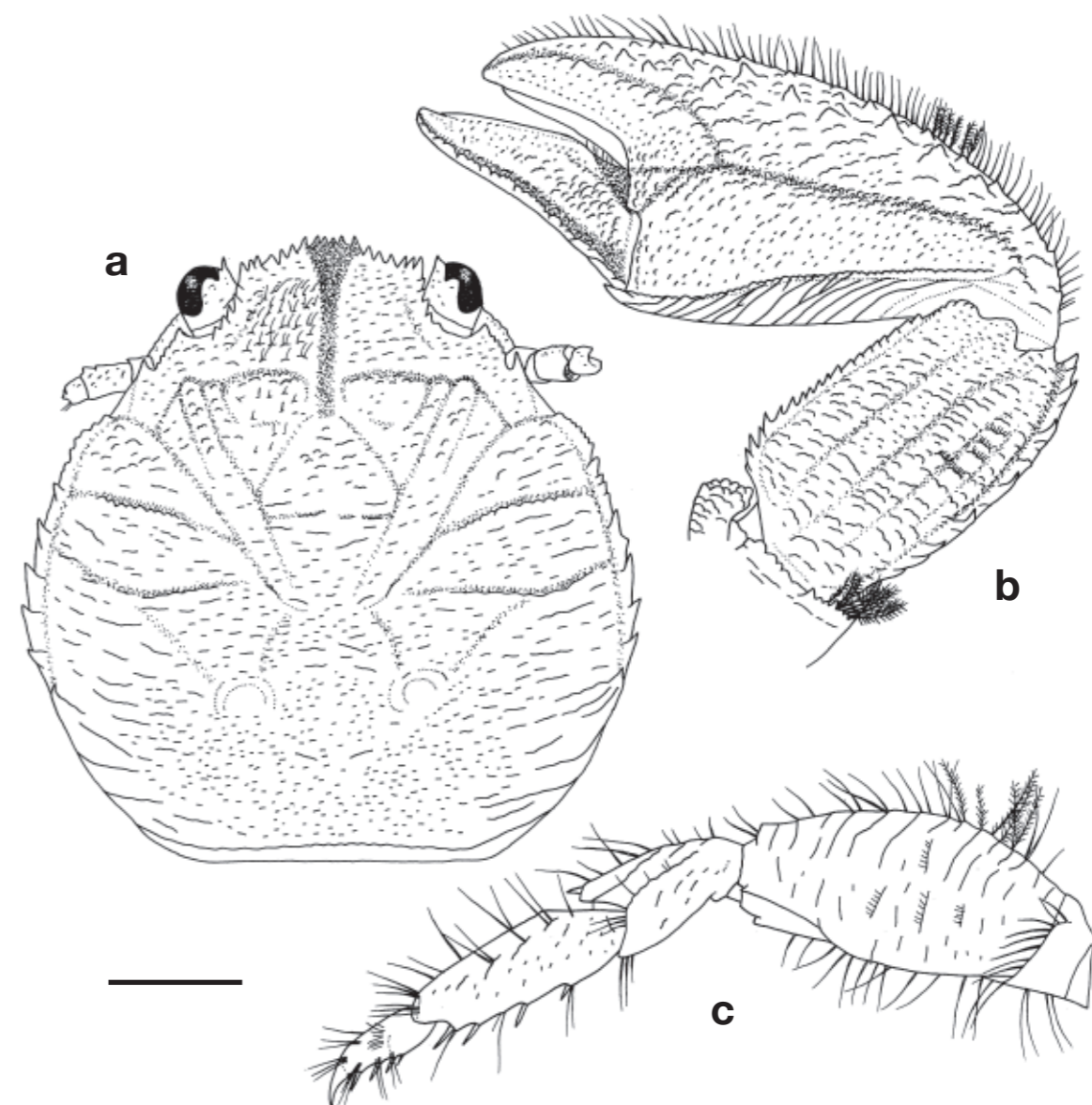


Fig. 57. Female (cl 4.7 mm), Danshuei, Taipei County, 20 Feb 1998: a, carapace and ocular and antennular peduncles, dorsal view; b, right cheliped, dorsal view; c, left second pereopod, lateral view. Scale: a, c = 1.0 mm; b = 1.3 mm.

Genus *Lissoporccellana* Haig, 1978
光滑瓷蟹屬

? *Porcellanides* Czerniavsky 1884: 109 [type species: *Porcellana kriczagini* Czerniavsky, 1884, by original designation. Gender: masculine].

Lissoporccellana Haig, 1978: 711 [type species: *Porcellana quadrilobata* Miers, 1884, by original designation. Gender: feminine].

Diagnosis.—Carapace as long as broad or longer than broad; dorsal surface somewhat convex, nearly smooth, regions weakly defined. Rostrum tridentate or trilobate, horizontal; median lobe usually with distinct median notch on frontal margin (in *L. furcillata* (Haig, 1965), with denticles, and with or without small notch; in *L. nitida* (Haswell, 1882), without notch and denticles; in *L. streptochiroides* (Johnson, 1970), with denticles, and with or without very shallow concavity). External orbital angle terminating in small spine. Hepatic spine present. Branchial margin usually armed with 1 or more spines (in *L. nitida*, unarmed). Pterygostomian flaps entire. Antennal peduncle with movable (second to fourth) articles excluded from orbit by projection of immovable (first) article addressed to anterior margin of carapace. Chelipeds usually unequal in size; chelae inflated, subcylindrical; dactylus usually opening obliquely; dactylus of smaller cheliped somewhat twisted, opening at more strongly oblique angle and with stronger armature than that of larger cheliped, not sexually dimorphic. Ambulatory legs with dactyli each usually terminating in a single claw (in *L. furcillata*, biunguiculate claw). Male with pair of gonopods on second abdominal segment. Telson divided into 7 plates.

Remarks.—This genus currently contains 10 species (Osawa, 2007b), all from the Indo-West Pacific. Most species are known to be associated with sponges, hydrozoans, or anthozoans such as scleractinians, antipatharians, and alcyonaceans. Two species are found from Taiwan, with one of them being a new record for the island. The third species, *L. streptochiroides* (Johnson, 1970), is still only known from the Taiwan Strait.

Lissoporccellana is closely allied to *Pisidia* in general appearances, but differs in the dissimilarity of the two chelae which is not due to sexual dimorphism. The males and females are alike in having one cheliped being larger than the other, and the degree of the distortion of the dactylus appears to be related to size rather than sex; and chelipeds are not more strongly spinulate in females than in males. In addition to these characters, *Lissoporccellana* also differs from *Pisidia* in having a relatively smoother carapace, rostrum usually with a distinct median notch on the frontal margin (no median notch in *Pisidia*), and inflated and subcylindrical chelae (in *Pisidia*, the chelae are rather flattened).

Haig (1978) pointed out that *Porcellanides* Czerniavsky, 1884 might be a senior synonym of *Lissoporccellana* because the type species, *P. kriczagini* Czerniavsky, 1884 from Singapore, is likely to be a member of *Lissoporccellana* judging from the diagnosis given by Czerniavsky (1884).

Key to species of *Lissoporccellana* from Taiwan

1. Median lobe of rostrum without distinct median notch *L. streptochiroides*
- Median lobe of rostrum with distinct median notch 2
2. Carpi of chelipeds each armed with 3 spines including distal spine on extensor margin *L. spinuligera*
- Carpi of chelipeds unarmed on extensor margin *L. quadrilobata*

***Lissoporccellana quadrilobata* (Miers, 1884)**
四葉光滑瓷蟹



Fig. 58. Ovigerous female (cl 4.0 mm), Gudanshih, Kending, Pingtung County, 7 Dec 2009.

Porcellana streptochirus White, 1847: 64 [*nomen nudum*].

Porcellana quadrilobata Miers, 1884: 276, pl. 30–fig. D [type locality: Port Denison, Queensland].

Porcellana streptochira Miers, 1884: 277 [type locality: Corregidor, Philippines].

Porcellana gaekwari Southwell, 1909: 112, figs. 1–3 of plate [type locality: Challai Paar, Gulf of Mannar].

Aliaporcellana quadrilobata.—Nakasone & Miyake, 1969: 24, figs. 2–3.

Lissoporccellana quadrilobata.—Haig, 1978: 712; 1981a: 279, fig. 2; 1992: 306, fig. 3.—Hsieh et al., 1997: 340, fig. 35.—Kato & Okuno, 2001: 92, unnumbered figs.

Lissoporccellana paraquadrilobata Yang & Sun, 1992: 205, figs. 11–12 [type locality: Guangxi Province, China].

Material examined.—Gudanshih, Kending, Pingtung County, 7 Dec 2009: 1 ovigerous female (cl 4.0 mm) (NTOU A01174). Penghu County, 21 Jul 2003: 1 ovigerous female (cl 8.7 mm) (NTOU A01129).

Diagnosis.—Carapace distinctly longer than broad; branchial margins each with 3 spines. Rostrum strongly produced anteriorly; median lobe with distinct notch on anterior margin. Carpi of chelipeds unarmed on

extensor margins. Propodi of ambulatory legs each with 3–5 corneous spines including distal paired spines on flexor margin; dactyli each with 2 corneous spines on flexor margin, excluding much larger, distal spine on elevated, broad base, and with long terminal claw.

Size.—To cl 8.7 mm (present study).

Coloration.—Carapace translucent pinkish white, with pale red oblique mark on each hepatic region. Chelipeds and ambulatory legs translucent pale red. Eggs translucent white when near hatching.

Habitat.—Shore to 128 m deep; sandy and muddy bottoms; found in association with soft coral (*Dendronephthya*) and gorgonians (*Chironephthya*, *Solenocaulon*).

Distribution.—Indo-West Pacific from the Persian Gulf, east coast of Africa and throughout the Indian Ocean to the Malay Peninsula, north to the Izu Islands, and south to Queensland, Australia.

Remarks.—*Lissoporcellana quadrilobata* was reported from the Taiwan Strait previously and is now also known from Taiwan proper. The relatively elongate carapace with a strongly produced rostrum are diagnostic characters distinguishing *L. quadrilobata* from the other congeners.

Lissoporcellana spinuligera (Dana, 1853)
刺額光滑瓷蟹



Fig. 60. Male, no specific locality.



Fig. 61. Male (cl 5.0 mm), no specific locality.

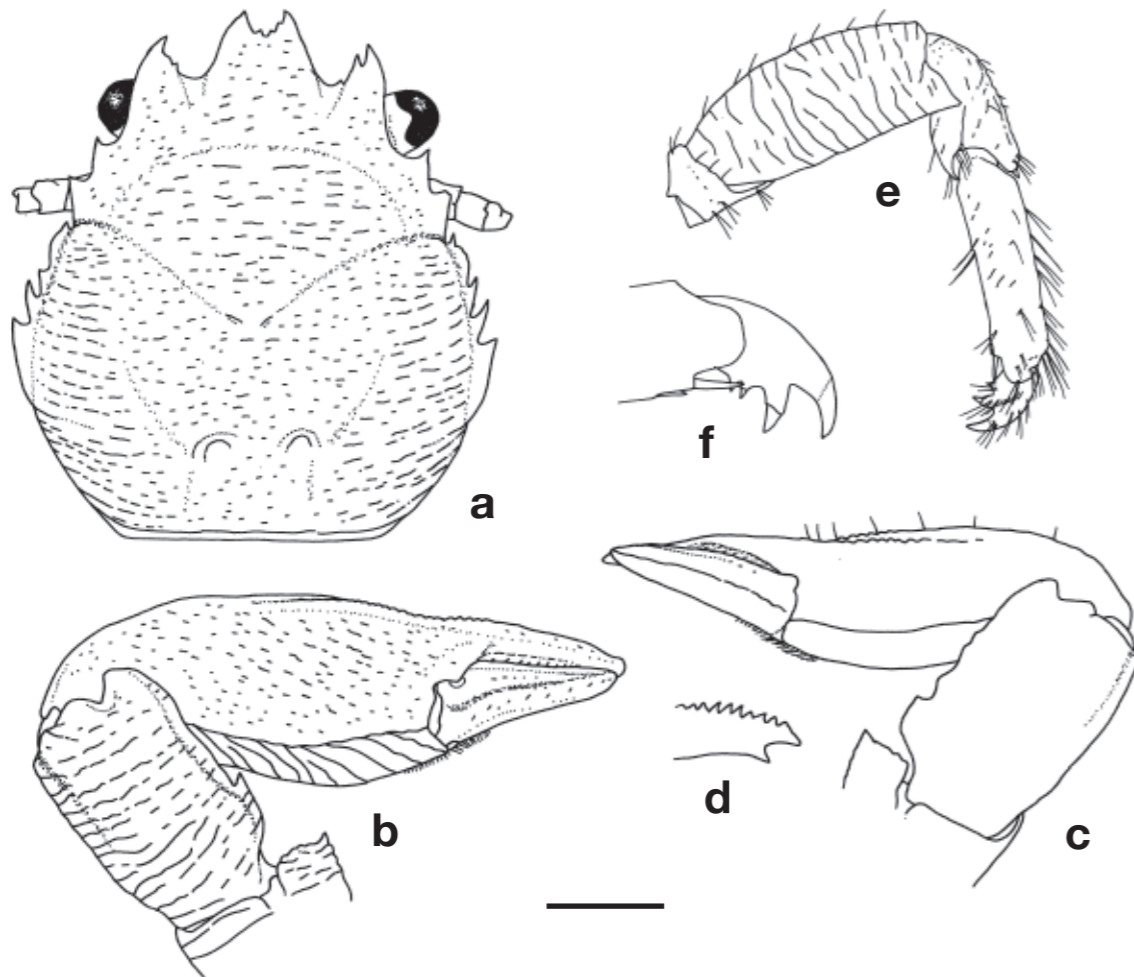


Fig. 59. Ovigerous female (cl 8.7 mm), Penghu County, 21 Jul 2003: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, larger cheliped, dorsal view; **c**, smaller cheliped, dorsal view; **d**, same, distal tip of fixed finger, ventral view; **e**, right second pereopod, lateral view; **f**, same, dactylus, lateral view. Scale: a–d = 2.0 mm; e = 2.6 mm; f = 0.8 mm.

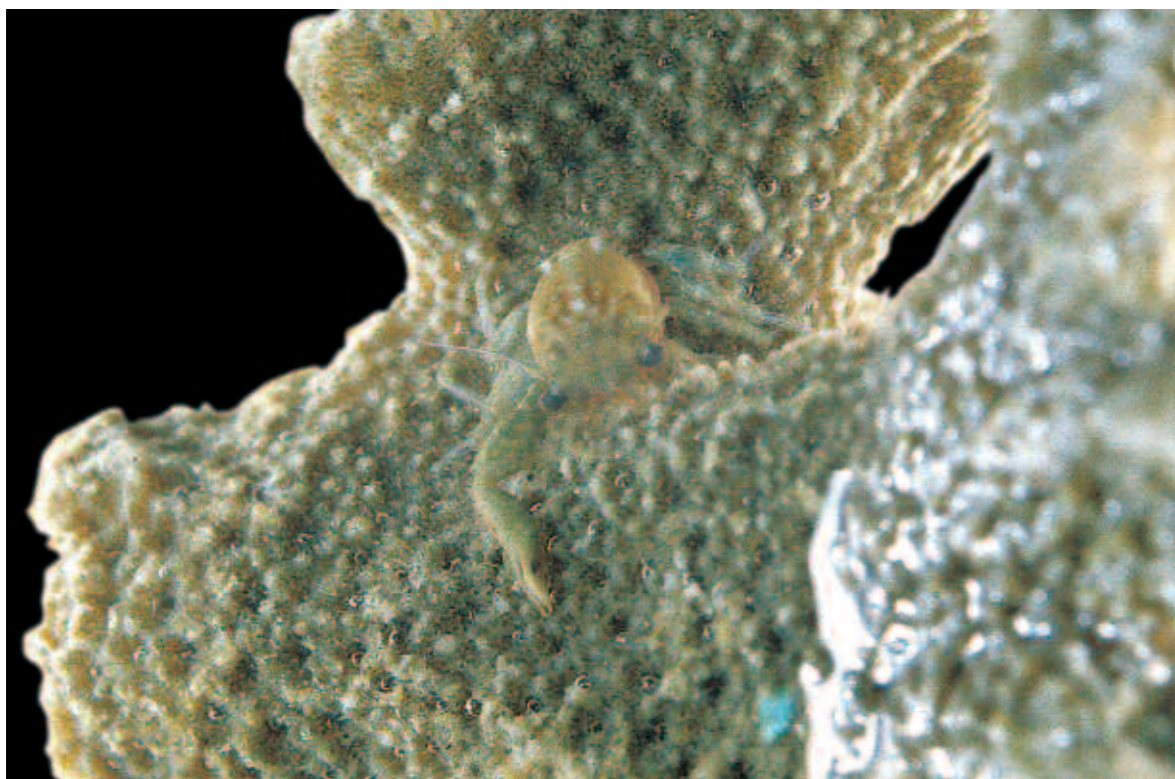


Fig. 62. No specific locality.

Porcellana armata Dana, 1852: 426 [type locality: Mangsi Island, Balabac Passage, north of Borneo; name preoccupied by *Porcellana armata* Gibbes, 1850]; 1855: pl. 26–fig. 14.—Miyake, 1942: 356, figs. 17–19.

Porcellana spinuligera Dana, 1853: 1595 [replacement name for *Porcellana armata* Dana, 1852].

Porcellana latifrons Stimpson, 1858: 229 [type localities: Hong Kong and Ousima Island, Ryukyu Islands]; 1907: 190, pl. 23–fig. 4.

Pisidia spinuligera.—Nakasone & Miyake, 1968b: 101, fig. 2.—Haig, 1979: 128, fig. 12.

Lissoporcellana spinuligera.—Haig, 1978: 712; 1992: 307, fig. 4.—Hsieh *et al.*, 1997: 337, figs. 32C, 34.

Material examined.—Baisha, Penghu County, 4 Sep 1990: 2 males (cl 4.3, 5.3 mm), 3 females (cl 3.3–4.8 mm) (NTOU A00692). Cingluo, Penghu County, 25 Apr 1992: 5 males (cl 4.8–5.4 mm), 2 ovigerous females (cl 4.5, 5.1 mm), 3 females (cl 4.5–5.1 mm) (NTOU A00690). Lintou, Penghu County, 22 May 1992: 1 male (cl 5.4 mm), 3 ovigerous females (cl 4.7–5.4 mm) (NTOU A00691). Penghu County, 15 Jul 1992: 1 ovigerous female (cl 4.7 mm) (NTOU A00912). No specific locality: 1 female (cl 4.6 mm) (NTOU A00908).—1 male (cl 4.2 mm) (NTOU A00909).—1 male (cl 4.3 mm) (NTOU A00911).—1 male (cl 5.0 mm), 1 ovigerous female (cl 5.2 mm) (NTOU A00913).

Diagnosis.—Carapace slightly longer than broad; branchial margins each with 3 spines. Rostrum strongly dentate on anterior margin; median lobe with distinct notch on anterior margin. Carpi of chelipeds each armed with 3 spines including distal spine on dorso-extensor margin. Dactyli of ambulatory legs each with 3 or 4 slender corneous spines on flexor margin, excluding much larger distal spine on elevated broad base, and with long terminal claw.

Size.—To cl 7.8 mm (Haig, 1965).

Coloration.—Carapace whitish or bluish green, with mottled, greenish brown pattern on anterior two thirds and numerous small white spots on remaining posterior part. Chelipeds generally whitish or bluish green; meri and carpi with mottled, greenish brown pattern; chelae brown on extensor margins; dactyli with black on median part of posterior surface. Ambulatory legs with mottled, brown or greenish brown pattern on meri and carpi; propodi bluish with 2 dark brown stripes on lateral surface.

Habitat.—Shore to 94 m deep, occurring most commonly on coral reefs in 24 m deep or less (Haig, 1981a, 1992); associated with corals, gorgonian octocoral (*Solenocaulon*), and sponge (*Sigmatocia symbiotica*).

Distribution.—Hong Kong, Gulf of Thailand, Singapore, and north to the Ryukyu Islands, south to tropical Australia and east to Palau.

Remarks.—Nakasone *et al.* (1986) reported on the species composition of decapod crustaceans associated with living corals in the Gulf of Thailand and the most abundant species on *Pavona frondifera* was this porcelain crab. *Lissoporcellana spinuligera* resembles *L. furcillata* (Haig, 1965) and *L. pectinata* Haig, 1981a in having the carapace with three or four spines on each branchial margin and a strongly dentate rostrum. However, *L. spinuligera* is readily distinguished from *L. furcillata* by the shape of the dactyli of the ambulatory legs, and from *L. pectinata* by the armature on the carpi of the chelipeds and propodi of the ambulatory legs.

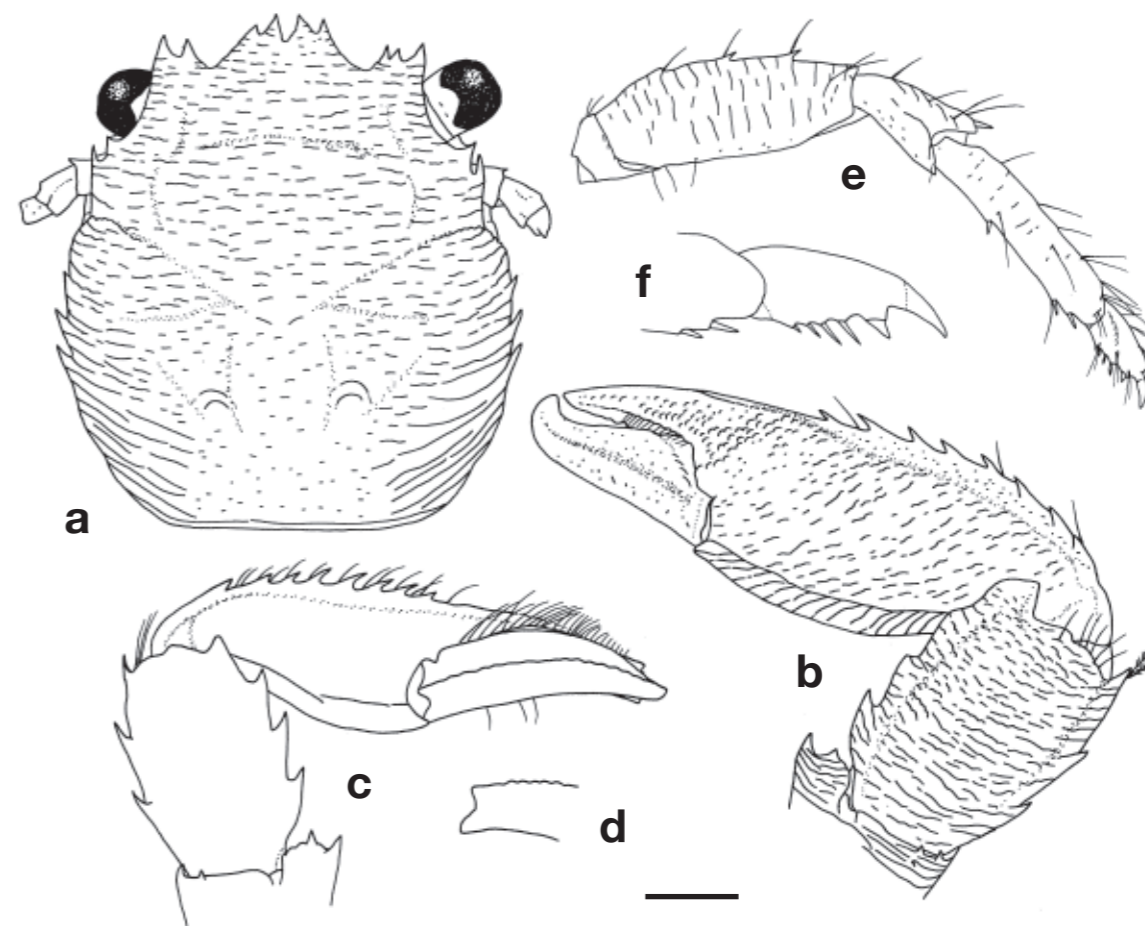


Fig. 63. Male (cl 5.4 mm), Lintou, Penghu County, 22 May 1992: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, larger cheliped, dorsal view; **c**, smaller cheliped, dorsal view; **d**, same, distal tip of fixed finger, ventral view; **e**, right second pereopod, lateral view; **f**, same, dactylus, lateral view. Scale: a, e = 1.0 mm; b–d = 1.3 mm; f = 0.5 mm.

Lissoporcellana streptochiroides (Johnson, 1970)

扭螯光滑瓷蟹

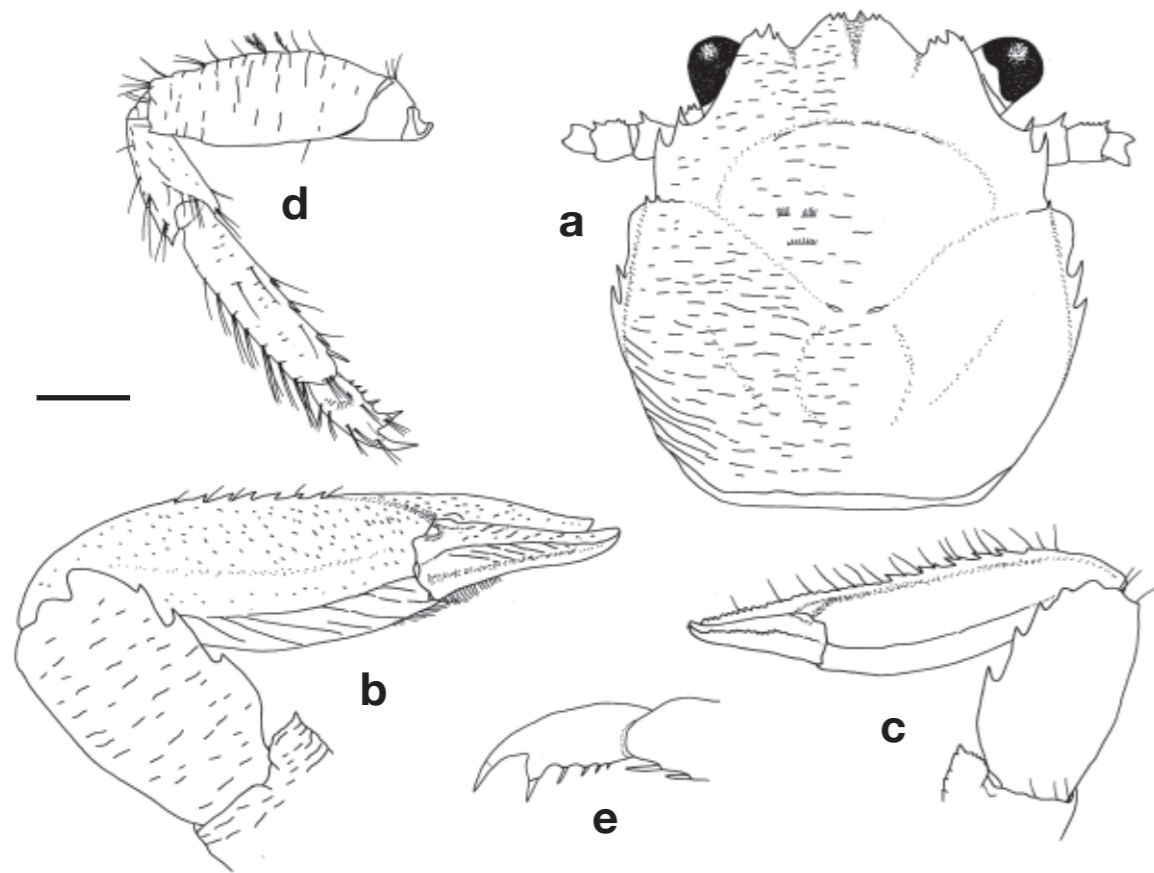


Fig. 64. Male (cl 5.2 mm), Taiwan Strait, 23°08'N, 117°30'E, 23 Jan 1912: a, carapace and ocular and antennal peduncles, dorsal view; b, larger cheliped, dorsal view; c, smaller cheliped, dorsal view; d, left second pereopod, lateral view; e, same, dactylus, lateral view. Scale: a, d = 1.0 mm; b–c = 1.3 mm; e = 0.6 mm.

Porcellana (*Porcellana*) *streptochira*.—De Man, 1888, 419, pl. 18–fig. 6. [not *Porcellana streptochira* Miers, 1884= *Lissoporcellana quadrilobata* (Miers, 1884)]

Porcellana (*Pisidia*) *streptochiroides* Johnson, 1970: 26, fig. 3j–l [type locality: Singapore].

Lissoporcellana streptochiroides.—Haig, 1978: 712; 1981a: 280; 1992: 308, fig. 5.—Hsieh *et al.*, 1997: 340, fig. 35.

Material examined.—Taiwan Strait, 25°28'N, 120°29'E, 66 m, Apr 1897: 1 ovigerous female (cl 6.1 mm) (ZMUC).—23°08'N, 117°30'E, 44 m, 23 Jan 1912: 13 males (cl 3.4–5.2 mm), 8 females (cl 3.6–4.3 mm), 29 ovigerous females (cl 4.0–6.3 mm) (ZMUC).—23°15'N, 117°40'E, 26 Jul 1912: 2 males (cl 3.3, 4.0 mm), 2 ovigerous females (cl 4.3, 4.9 mm) (ZMUC).—no specific locality, 46 m, 23 May 1897: 3 males (cl 3.2–4.4 mm), 1 ovigerous female (cl 6.0 mm) (ZMUC).

Diagnosis.—Carapace slightly longer than broad; branchial margins each with 2 spines on median part; 1 hepatic spine usually present on each side (rarely 2 hepatic spines, spine near external orbital angle small).

Rostrum with small denticles on anterior margin; median lobe with or without very shallow concavity on anterior margin. Chelipeds with carpi unarmed on extensor margins; fixed finger of smaller chela with simple or weakly bifurcate tip. Dactyli of ambulatory legs each with 3 or 4 (usually 3) slender corneous spines on flexor margin, excluding much larger distal spine on elevated broad base, and with long terminal claw.

Size.—To cl 7.5 mm (Johnson, 1970).

Coloration.—Unknown.

Habitat.—Shore to 128 m deep; muddy to sandy bottoms in shallow habitats; on bored, rotten driftwood, on washed in sponge (Johnson, 1970); sandy mud, stones, broken shells (Haig, 1981a).

Distribution.—East China Sea, Taiwan Strait, Hong Kong, Philippines, Singapore, Java, Flores, Queensland.

Remarks.—Davie (2002) pointed out that Johnson (1970) proposed *Porcellana* (*Pisidia*) *streptochiroides* as a “nom. nov.” for the species misidentified as *Porcellana streptochira* Miers, 1884 (= *Lissoporcellana quadrilobata* (Miers, 1884)) by De Man (1888) from Indonesia, and therefore Johnson’s Singapore material should have syntype status as he was actually describing a new species.

Examination of the specimens of *L. streptochiroides* from Singapore (six syntypes. Kampong Mata Ikan, 8 Jan 1955, one male cl 6.0 mm, ZRC 1984.2.21.1; Changi beach, 11 Sep 1953, one male cl 4.9 mm, one female cl 3.6 mm, three ovigerous females cl 3.6–5.5 mm, ZRC 1984.2.21.2–6) and the Taiwan Strait reported by Johnson (1970) and Haig (1981a) has revealed that the species is generally more similar to *Pisidia serratifrons* Stimpson, 1858 rather than other species of *Lissoporcellana*, in that the rostrum lacks a distinct median notch. However, besides the generic differentiation characters, *L. streptochiroides* differs from *P. serratifrons* by having two distinct spines on the mesobranchial margin of the carapace, a usually broader projection at the distal dorsoflexor end of the carpus of the larger cheliped, and the dactyli of the ambulatory legs each with a much more strongly elevated ultimate tooth on the flexor margin. *Pisidia serratifrons* usually has only a single distinct spine (sometimes with an additional minute spine in front of the distinct spine) on the mesobranchial margin of the carapace and a much narrower (blunt or acute) projection at the dorsoflexor end of the carpus of the larger cheliped. Moreover, the dorsal surface of the carapace is more weakly striate in *L. streptochiroides* than in *P. serratifrons*.

Lissoporcellana streptochiroides is still known only from the Taiwan Strait and not from Taiwan proper. The Taiwan Strait material differs from the Singapore specimens in having a somewhat more elongate carapace and the carpi of the chelipeds unarmed instead of with a small spine at the distal end of the dorso-extensor margin.

Genus *Neopetrolisthes* Miyake, 1937
 新岩瓷蟹屬

Neopetrolisthes Miyake, 1937a: 34 [type species: *Neopetrolisthes ohshimai* Miyake, 1937a, junior subjective synonym of *Porcellana maculata* H. Milne Edwards, 1837, by monotypy. Gender: masculine].

Diagnosis.—Carapace longer than broad; dorsal surface convex, nearly smooth or uneven, regions moderately defined. Rostrum sinuously triangular, nearly horizontal or slightly bent ventrally. External orbital angle terminating bluntly or not produced. Branchial margin unarmed. Pterygostomian flaps entire. Antennal peduncle with movable (second to fourth) articles freely accessible to orbit. Chelipeds subequal; chelae broad, flattened; dactylus opening horizontally. Ambulatory legs subcylindrical; dactyli each terminating in a single claw. Male with pair of gonopods on second abdominal segment. Telson divided into 7 plates.

Remarks.—This genus contains three Indo-West Pacific species (Osawa & Fujita, 2001). These species all are known to live among tentacles of large sea anemones such as *Entacmaea*, *Heteractis*, and *Stichodactyla* in tropical or subtropical coral reefs. *Neopetrolisthes maculatus* (H. Milne Edwards, 1837) is widely distributed in the Indo-West Pacific and is known to include two extreme color forms: “evenly distributed, small spots” and “uneven large blotches”. Although *N. ohshimai* Miyake, 1937 was described on the basis of the “uneven large blotches” morph, the species is treated as a junior synonym of *N. maculatus* (Haig, 1965, 1979; Osawa & Fujita, 2001). The records of the other two species are restricted. *Neopetrolisthes spinatus* Osawa & Fujita, 2001 is known only from the northwestern Pacific including the Ryukyu Islands, southwestern coast of Taiwan, and Bali Island of Indonesia; whereas *N. alobatus* (Laurie, 1926) occurs in the southwestern Indian Ocean including Mauritius, Kenya, and Tanzania. Two species of this genus have been reported from Taiwan.

Key to species of *Neopetrolisthes* from Taiwan

- 1. Carapace with strongly elevated protogastric ridge; supra-ocular spine present *N. spinatus*
- Carapace without elevated protogastric ridges; supra-ocular spine absent *N. maculatus*

***Neopetrolisthes maculatus* (H. Milne Edwards, 1837)**
 紅斑新岩瓷蟹



Fig. 65. Female (cl 6.7 mm), Hepingdao, Keelung, Aug 1993.



Fig. 66. Male (cl 6.2 mm), Dafu fishing port, Siaoliouciou, Pingtung County, 30 Oct 2009.

Porcellana maculata H. Milne Edwards, 1837: 253 [type locality: New Ireland, by subsequent designation; see Haig (1965)].

Neopetrolisthes ohshimai Miyake, 1937a: 35, unnumbered fig. [type locality: Ishigaki Island, Ryukyu Islands]; 1942: 350, pl.1–fig. 5, text-figs. 13–14.—Hsieh *et al.*, 1997: 328, figs. 24G, 29.

Neopetrolisthes maculatus.—Haig, 1979: 127.

Material examined.—Hepingdao, Keelung, Aug 1993: 1 female (cl 6.7 mm) (NTOU A01131). Dafu fishing port, Siaoliouciou, Pingtung County, 30 Oct 2009: 1 male (cl 6.2 mm) (NTOU A01149).

Diagnosis.—Carapace nearly smooth, but with numerous short striae on dorsal surface; protogastric ridges not distinctly elevated; branchial regions without elevated parts; no supra-ocular spine; pair of epibrachial spines present; rostrum without median groove on dorsal surface. Chelipeds with numerous short striae on dorsal surface of carpus and palm; carpus with at least distinct proximal tooth on dorsoflexor margin, small projection present at dorso-extensor end. Ambulatory legs with propodi comparatively short, each with 2 corneous spines at distoflexor end; dactyli each with 2 corneous spines on flexor margin.

Size.—To cl 14.5 mm (Miyake, 1937a).

Coloration.—There are two different color forms, although the ground color of the bodies of both forms is white. In one form, carapace and chelipeds are white, with an uneven pattern of irregular sizes red blotches; ambulatory legs also white, with some small red spots on meri of first pair (second pereopod). In the other form, the carapace and chelipeds have a uniform pattern of numerous small, reddish purple spots; meri of ambulatory legs also with numerous small, reddish purple spots.

Habitat.—Shallow subtidal water; coral and rocky reefs; associated with large sea anemones (*Cryptodendrum*, *Entacmaea*, *Gyrostoma*, *Heteractis*, *Stichodactyla*), typically found in breeding pairs (Davie, 2002).

Distribution.—Widely distributed in the Indo-West Pacific. From east coast of Africa to Christmas Island and Western Australia, Bismarck Archipelago, Queensland, Moluccas, Palau, Taiwan, Ryukyus, Marshall and Fiji Islands.

Remarks.—Haig (1965, 1979) considered *Neopetrolisthes ohshimai* Miyake, 1937a as a junior synonym of *Porcellana maculata* H. Milne Edwards, 1837, and pointed out that the Indian and Pacific Ocean populations of *N. maculatus* have different spot patterns. In the Indian Ocean population, the carapace and pereopods are covered with small rounded, evenly distributed spots; while in the Pacific Ocean population, the color pattern takes the form of large, uneven blotches. However, Osawa & Fujita (2001) noted that both spot-patterns occur in the Ryukyu Islands, western Pacific, and they are not distinguishable from each other by morphological characters; thus supporting the status of *N. ohshimai* as a junior synonym of *N. maculatus*. It is also found that this species has various spot sizes and patterns of reddish purple, red, or brown color on the carapace and pereopods. Both color morphs are also present in Taiwan. Detailed ecological and genetic studies will be needed to clarify if the different spot-pattern crabs should be referred a single or separate species.

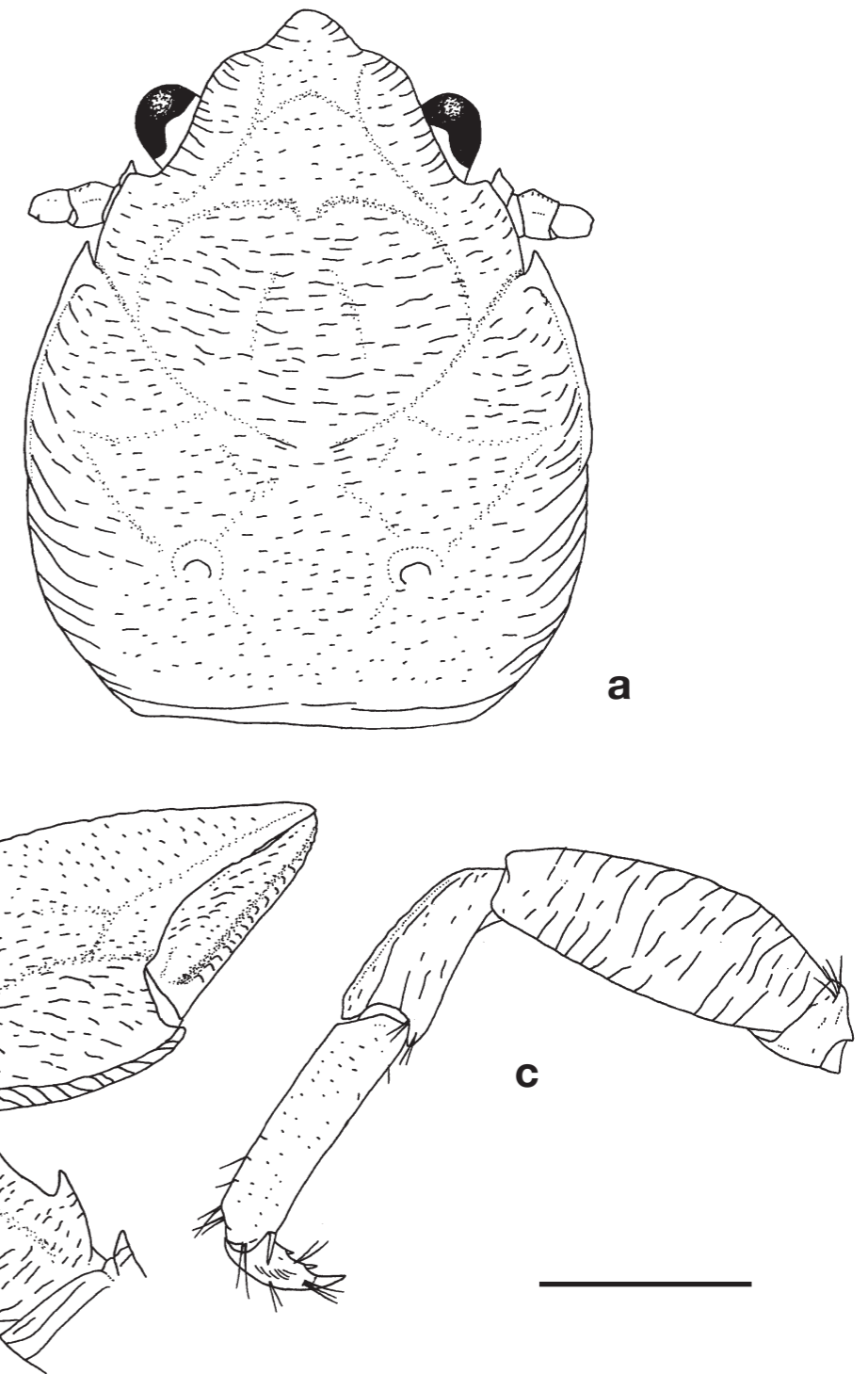


Fig. 67. Female (cl 6.7 mm), Hepingdao, Keelung, Aug 1993: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, left cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale: a–b = 2.0 mm; c = 2.5 mm.

Neopetrolisthes spinatus Osawa & Fujita, 2001
具刺新岩瓷蟹



Fig. 68. Female (cl 10.3 mm), Lang Island, Lanyu, Taitung County, 23 Jun 1993 (after Osawa *et al.*, 2007 and under the premission from Koninlijke BRILL NV).

Neopetrolisthes spinatus Osawa & Fujita, 2001: 163, figs. 1–4 [type locality: Okinawa Island, Ryukyu Islands].—Osawa *et al.*, 2007: 734, figs. 2A–E, 3.

Material examined.—Lang Island, Lanyu, Taitung County, 23 Jun 1993: 1 male (cl 7.0 mm), 1 female (cl 10.3 mm) (NTOU A00828).

Diagnosis.—Carapace uneven, with numerous short striae on dorsal surface; protogastric ridges distinctly elevated, directed anteriorly; branchial regions each with 2 elevated parts; supra-ocular and epibrachial spines present on each side; rostrum with median groove on dorsal surface. Chelipeds with numerous short striae on dorsal surface of carpus and palm; carpus without distinct teeth and lobes on dorsoflexor margin, no projection at dorso-extensor end. Ambulatory legs with propodi comparatively short, each with 2 corneous spines at distoflexor end; dactyli each with 2 corneous spines on flexor margin.

Size.—To cl 10.6 mm (Osawa & Fujita, 2001).

Coloration.—Carapace and pereopods whitish, covered with reddish purple dots. Dark reddish parts

present on median part of carapace, carpi of chelipeds and proximal halves of meri of ambulatory legs.

Habitat.—The type specimens from the Ryukyu Islands were found to be associated with a sea anemone, *Heteractis malu*; at depths of 5.0–19.7 m (Osawa & Fujita, 2001).

Distribution.—Taiwan and Okinawa Island in the Ryukyu Islands, southwestern Japan. Masuda (1999) also shows a photograph of this species (as *N. maculatus*) from the island of Bali, Indonesia.

Remarks.—The present specimens have recently been reported by Osawa *et al.* (2007). *Neopetrolisthes maculatus* and *N. spinatus* can readily be separated by the different ornamentation on the carapace in adults, although the larval characters are very similar between the two species (Osawa & Fujita, 2001; Fujita & Osawa, 2003).

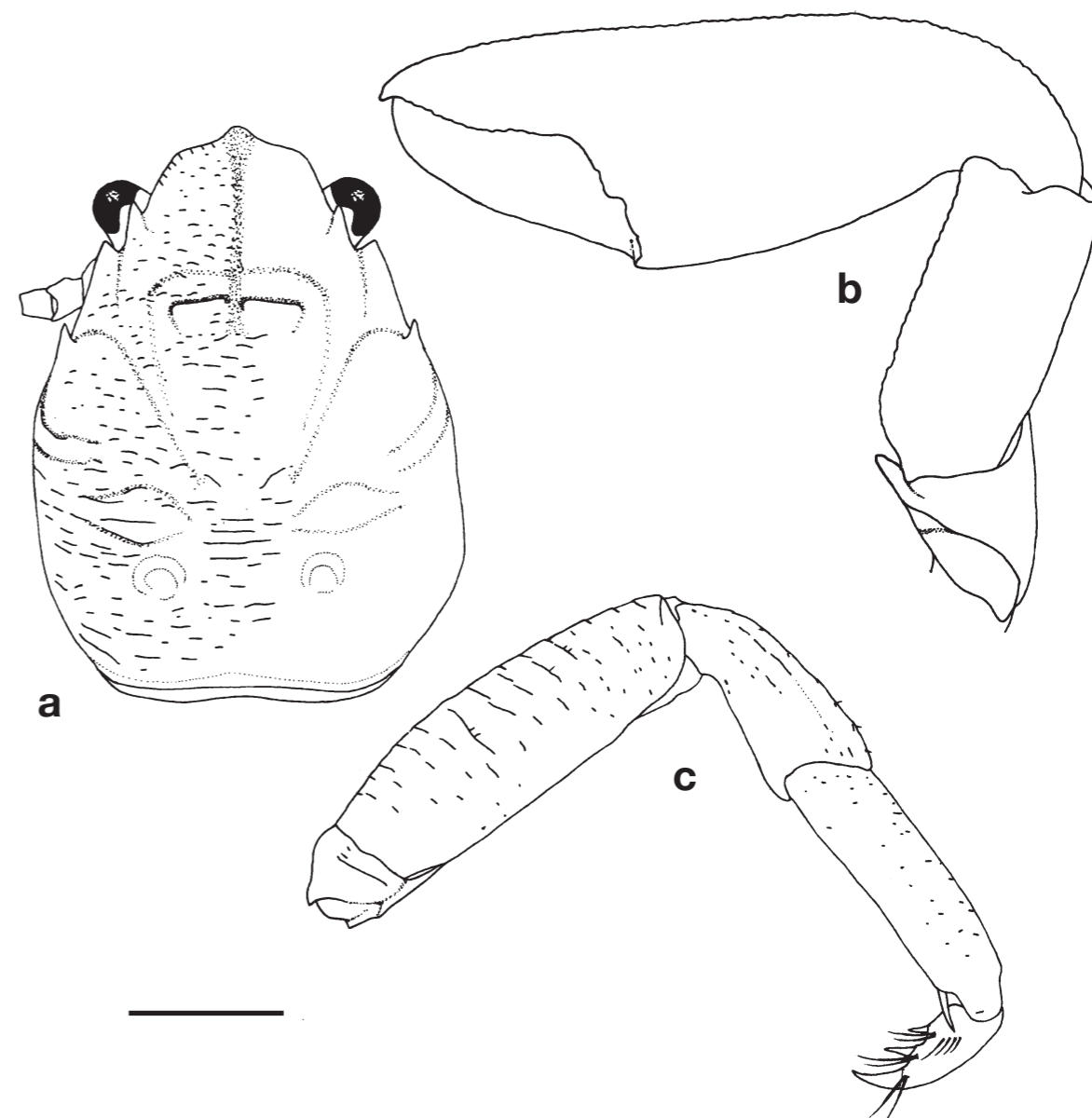


Fig. 69. Male (cl 7.0 mm), Lang Island, Lanyu, Taitung County, 23 Jun 1993: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, right cheliped, dorsal view; **c**, right second pereopod, lateral view. Scale: a, c = 1.9 mm; b = 1.3 mm (after Osawa *et al.*, 2007 and under the premission from Koninlijke BRILL NV).

Genus *Novorostrum* Osawa, 1998

異額瓷蟹屬

Novorostrum Osawa, 1998a: 161 [type species: *Petrolisthes indicus* De Man, 1893, by original designation.

Gender: neuter].

Diagnosis.—Carapace approximately as long as broad or slightly broader than long; dorsal surface weakly convex, uneven, regions well defined. Rostrum trilobate; median lobe exceeding lateral lobes, bent ventrally, divided into 3 parts: deep, longitudinal median groove and lateral elevations. External orbital angle not produced. Ocular peduncle broader than cornea in dorsal view. Branchial margins unarmed. Pterygostomian flaps entire. Antennal peduncle with movable (second to fourth) articles freely accessible to orbit. Chelipeds usually subequal; chelae broad, flattened; palm with velvety tomentum-like structure along extensor margin on ventral surface; dactylus opening horizontally. Ambulatory legs robust, flattened; dactyli each terminating in a single claw. Male with pair of gonopods on second abdominal segment. Telson divided into 7 plates.

Remarks.—This genus contains four species, including *Petrolisthes securiger* Melin, 1939. This species was treated as a junior synonym of *Novorostrum indicum* by Osawa (1998a), but examination of newly obtained specimens indicates that it is a distinct species (see “Remarks” for *N. securiger*). Two species of this genus are recorded from Taiwan and one of them is a new record for the island.

Key to species of *Novorostrum* from Taiwan

1. Carapace with branchial margins divergent on anterior two thirds. Dactyli of chelipeds each with dense, very short plumose setae on cutting region ventrally *N. indicum*
- Carapace with branchial margins subparallel on median parts. Dactyli of chelipeds without dense short plumose setae on cutting region ventrally *N. securiger*

Novorostrum indicum (De Man, 1893)

印度異額瓷蟹



Fig. 70. Male (cl 7.0 mm), Fulong, Taipei County, 4 Mar 2006.

Petrolisthes indicus De Man, 1893: 293, pl. 7—figs. 3, 3a [type locality: Endeh, Flores Island].—Miyake, 1943: 69, figs. 9–10.—Hsieh *et al.*, 1997: 309, figs. 14E, 19.

Novorostrum indicum.—Osawa, 1998a: 163, figs. 1–3.

Material examined.—Hepingdao, Keelung City, 11 Feb 1993: 1 male (cl 4.9 mm) (NTOU A00642).—no date: 2 males (cl 6.7, 8.2 mm), 3 females (cl 3.0–6.0 mm) (NTOU A00643). Fulong, Taipei County, 4 Mar 2006: 1 male (cl 7.0 mm) (NTOU A01006).—21 Jun 2006: 1 male (cl 3.1 mm) (NTOU A01008). Magang, Taipei County, 17 Apr 1992: 4 males (cl 6.2–7.0 mm), 2 females (cl 4.8, 5.6 mm) (NTOU A01005).—2 Jun 1992: 13 males (cl 4.2–8.2 mm), 9 ovigerous females (cl 5.4–8.2 mm), 1 female (cl 5.5 mm) (NTOU A00640). Shihtiping, Hualien County, 21 Sep 2006: 12 males (cl 1.8–5.0 mm), 6 females (cl 2.1–3.0 mm) (NTOU A01004). Sansiantai, Taitung County, 12 Dec 1991: 1 male (cl 3.2 mm) (NTOU01009). No specific locality: 1 male (cl 6.6 mm) (NTOU A01007).

Diagnosis.—Carapace broadly subtriangular in general outline; branchial margins divergent on anterior two thirds, then convergent posteriorly. Rostrum comparatively narrow; median lobe narrowly rounded.

Chelipeds elongate; carpi each with blunt broad tooth on proximal dorsoflexor margin and distinct, blunt or subacute projection at disto-extensor end; palms each unarmed on extensor margin; dactyli each with dense, very short plumose setae on cutting region ventrally. Ambulatory legs without blunt teeth on extensor margins of carpi and propodi.

Size.—To cl 8.2 mm (present study).

Coloration.—Carapace and pereopods with mottled pattern of pale blue and dark brown. Propodi and dactyli of ambulatory legs each with dark brown band on median part.

Habitat.—Intertidal, found under rocks.

Distribution.—Flores Island, Amboina Island and Lombok Island in Indonesia; Mindanao Island in the Philippines; Taiwan; and south Japan.

Remarks.—The distinguishing characters between *N. indicum* and *N. securiger* are discussed under the “Remarks” for the latter species. *Novorostrum indicum* is known to have the widest geographical distribution among the four species of the genus.

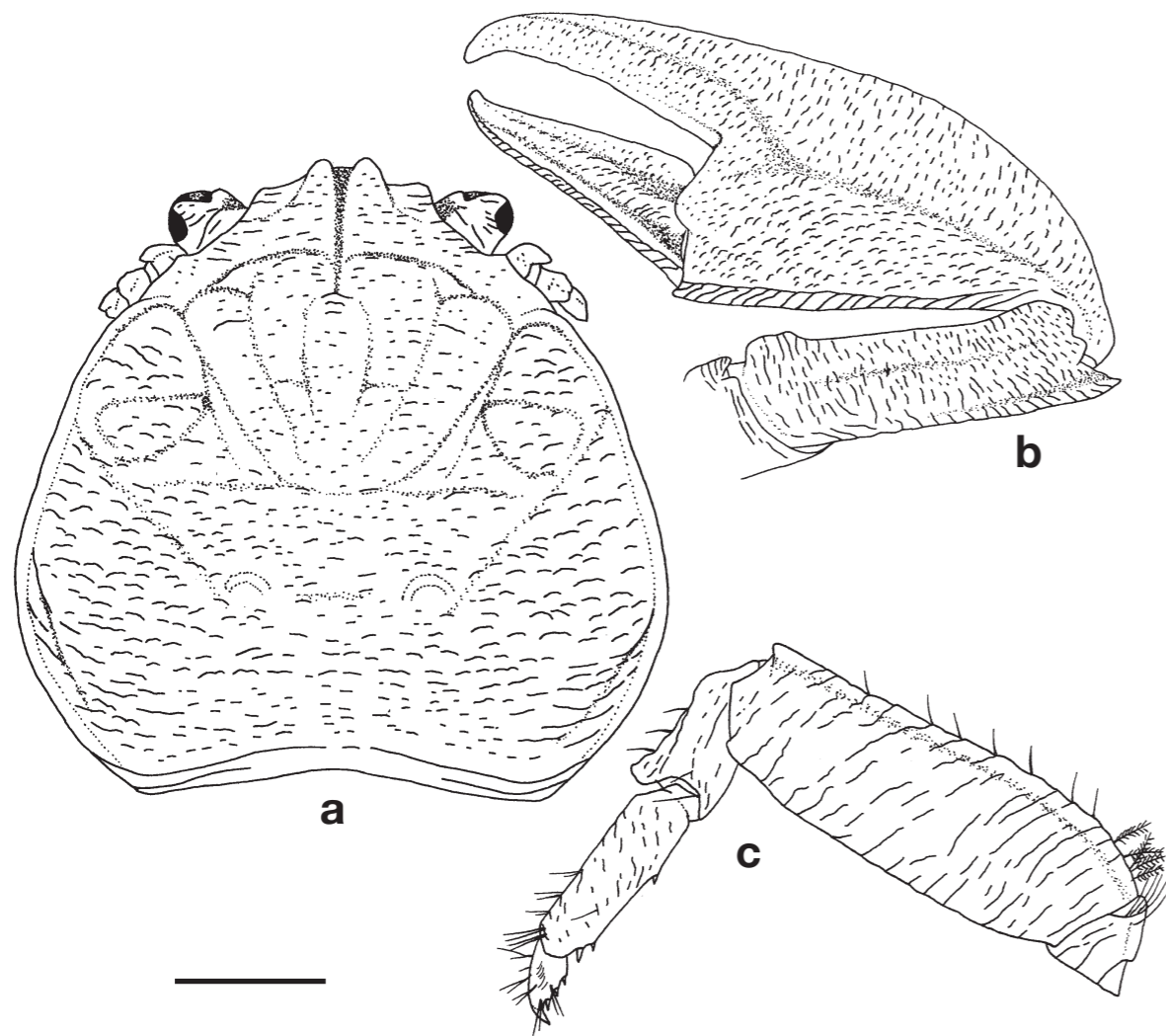


Fig. 71. Male (cl 8.2 mm), Magang, Taipei County, 2 Jun 1992: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, right cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale: a, c = 2.0 mm; b = 3.9 mm.

Novorostrum securiger (Melin, 1939)

斧手異額瓷蟹



Fig. 72. Ovigerous female (cl 6.0 mm), Magang, Taipei County, 2 Jun 1992.



Fig. 73. Ovigerous female (cl 6.0 mm), Magang, Taipei County, 2 Jun 1992.

Petrolisthes securiger Melin, 1939: 109, figs. 67–68 [type locality: Takinoura, Bonin (Ogasawara) Islands].

Material examined.—Magang, Taipei County, 2 Jun 1992: 1 male (cl 7.0 mm), 3 ovigerous females (cl 6.0–6.0 mm) (NTOU A01132). Shihtiping, Hualien County, 21 Sep 2006: 5 males (cl 2.2–6.2 mm), 1 ovigerous female (cl 3.3 mm), 3 females (cl 2.5–4.7 mm) (NTOU A00925).

Diagnosis.—Carapace hexagonal in general outline; branchial margins subparallel on median parts. Rostrum comparatively broad; median lobe broadly rounded. Chelipeds elongate; carpi each with blunt broad tooth on proximal dorsoflexor margin and distinct projection at disto-extensor end; palms each unarmed on extensor margin; dactyli without dense, very short plumose setae on cutting region ventrally; in males, broad gape present between fingers when closed, large membranous part also present at base of fingers. Ambulatory legs without blunt teeth on extensor margins of carpi and propodi.

Size.—To 7.0 mm (present study).

Coloration.—Carapace generally whitish or pale brown, with dark or red brown marks on anterior and lateral parts. Chelipeds and ambulatory legs dark or red brown. Dactyli and distal parts of propodi of ambulatory legs whitish.

Habitat.—Intertidal, found under small stones between large rocks.

Distribution.—Previously known only from Anijima Island, Ogasawara Islands, now found in Taiwan.

Remarks.—This is the first record of the species from Taiwan. Osawa (1998a) treated *Petrolisthes securiger* Melin, 1939, described from the Ogasawara Islands, as a junior synonym of *N. indicum*. Although one of the two syntypes (Takinoura, Bonin Islands, 3 Aug 1914, ovigerous female cl 4.0 mm, SMNH 2298) of *P. securiger* differs from the material examined by Osawa (1998a) in having the carapace with rather parallel branchial margins and the rostrum with the median lobe less strongly produced forward; these differences were suggested to be related to the smaller size. However, examination of additional specimens from Taiwan, the Ogasawara and Ryukyu Islands revealed that these differences are actually species specific characters and the name *N. securiger* should be revived. *Novorostrum securiger* differs from *N. indicum* in having the carapace with the gastric region being more strongly uneven and with the median branchial margins being subparallel instead of strongly convex, a relatively broader rostrum, dactyli of the chelipeds without dense short plumose setae on the cutting region ventrally, and male chelipeds each with a distinct broad gape between the fingers.

The distinct gape between the fingers of the male chelipeds seen in *N. securiger* is also known in *Petrolisthes mesodactylon* Kropp, 1984 from the Mariana Islands and Izu-Ogasawara Archipelago in Japan. Although *P. mesodactylon* is readily separated from the species of *Novorostrum* in having the rostrum sinuously triangular instead of trilobate, *P. mesodactylon* is similar to *N. securiger* in having weak elevations lateral to the median groove of the rostrum and a velvety tomentum-like structure along the ventral extensor margin of the chela. It is possible that further study may show that *P. mesodactylon* belongs to *Novorostrum*.

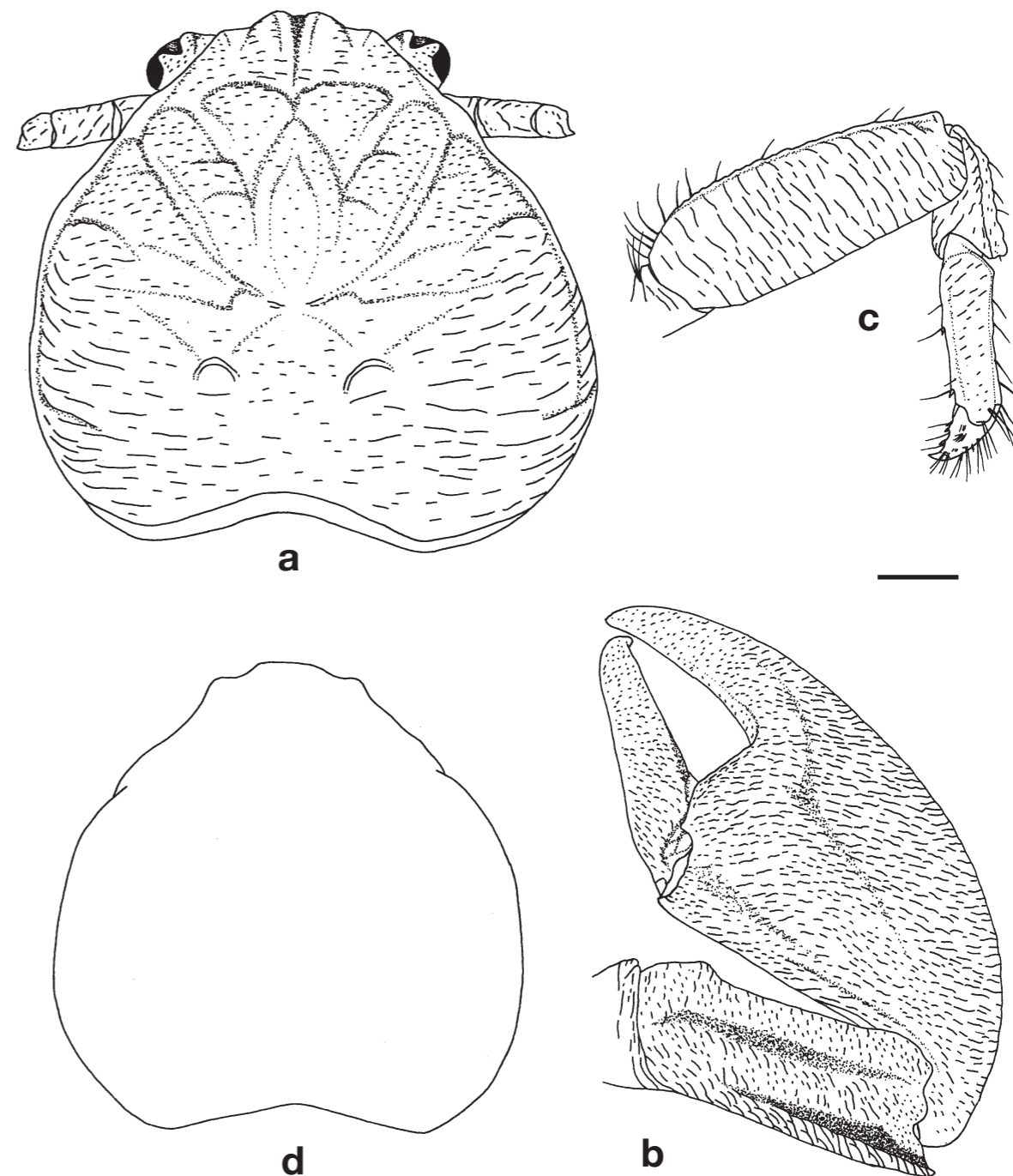


Fig. 74. Male (cl 6.2 mm), Shihtiping, Hualien County, 21 Sep 2006, a–c; male (cl 4.5 mm), same locality and date, d: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, right cheliped, dorsal view; **c**, right second pereopod, lateral view; **d**, carapace, dorsal view. Scale: a, c = 1.0 mm; b = 1.4 mm; d = 0.8 mm.

Genus *Pachycheles* Stimpson, 1858

厚瓷蟹屬

Pachycheles Stimpson, 1858: 228 [type species: *Porcellana grossimana* Guérin, 1835, by original designation. Gender: masculine].

Pisosoma Stimpson, 1858: 228 [type species: *Porcellana pisum* H. Milne Edwards, 1837, junior synonym of *Porcellana sculpta* H. Milne Edwards, 1837, by original designation. Gender: neuter].

Diagnosis.—Carapace approximately as long as broad or broader than long; dorsal surface convex, nearly smooth or uneven, regions moderately defined. Rostrum sinuously triangular or trilobate, bent ventrally. External orbital angle produced. Branchial margin unarmed or with blunt upstanding transverse ridges. Pterygostomian flaps incomplete; posterior portion composed of 1 or more pieces separated by membranous interspaces from anterior portion. Antennal peduncle with movable (second to fourth) articles freely accessible to orbit. Chelipeds unequal in size, thick and robust; chelae inflated; dactylus opening horizontally. Ambulatory legs with dactyli each terminating in a single claw. Male with or without pair of gonopods on second abdominal segment. Telson divided into 5 or 7 plates.

Remarks.—Thirty nine recent species are known in this genus (De Grave *et al.*, 2009), and 13 species are recognized in the Indo-West Pacific (Osawa, 2007b). The thick body and robust chelipeds of *Pachycheles* species give a general impression similar to that of *Polyonyx* species. Nevertheless, these two genera can be readily separated by the shapes of the pterygostomian flaps and antennal peduncles. The telson is divided into 5 plates in all the Indo-West Pacific species of *Pachycheles* and four of them are known from Taiwan.

Key to species of *Pachycheles* from Taiwan

1. Rostrum covered with dense, short plumose setae on dorsal surface *P. pectinica*rpus
- Rostrum not covered with short plumose setae on dorsal surface 2
2. Carapace and carpus and chela of chelipeds with scattered long setae on dorsal surface *P. pisoides*
- Carapace and carpus and chela of chelipeds without long setae on dorsal surface 3
3. Ambulatory legs with plumose setae on extensor margin; dactyli each with 4–6 corneous spines on flexor margin; male with gonopods *P. garciaensis*
- Ambulatory legs with simple setae on extensor margin; dactyli each with 3 corneous spines on flexor margin; male without gonopods *P. sculptus*

Pachycheles garciaensis (Ward, 1942)

羽毛厚瓷蟹



Fig. 75. Male (cl 4.1 mm), Siaoliouciou, Pingtung County, 20 Mar 1992.

Pisosoma garciaensis Ward, 1942: 64 [type locality: Diego Garcia, Chagos Archipelago].

Pachycheles garciaensis.—Haig, 1966a: 42.—Nakasone & Miyake, 1968a: 65, figs. 2–4.—Suzuki, 1985: 53.—Hsieh *et al.*, 1997: 288, figs. 5E, 8–9.

Material examined.—Hongchaikeng, Pingtung County, 9 Sep 2005: 1 male (cl 2.4 mm) (NTOU A01088). Siaoliouciou, Pingtung County, 20 Mar 1992: 2 males (cl 3.5, 4.1 mm), 1 ovigerous female (cl 3.9 mm) (NTOU A01133). Wanlitong, Pingtung County, 2 Jun 1992: 1 male (cl 3.6 mm), 1 female (cl 3.7 mm) (NTOU A00596).—9 Jan 1993: 1 female (cl 2.9 mm) (NTOU A00597).—10 Jan 1993: 4 males (cl 2.7–3.6 mm), 3 ovigerous females (cl 3.4–4.2 mm), 2 females (cl 2.1, 3.2 mm) (NTOU A00598).

Diagnosis.—Carapace and chelipeds without long setae on dorsal surface. Carapace broader than long. Rostrum broad, trilobate in frontal view, without dense, short plumose setae on dorsal surface. Chelipeds slightly rugose to somewhat tuberculate on dorsal surfaces of carpi and palms; carpi each with 3 or 4 blunt teeth on dorsoflexor margin; chelae each with 2 blunt crests of rugae or elongated and flattened tubercles along extensor margin on dorsal surface (1 along extensor margin, and 1 short or long along midline extending from

base of fixed finger). Ambulatory legs with plumose setae on extensor margins of carpi and propodi; dactyli each with 4–6 corneous spines on flexor margin. Male with pair of gonopods.

Size.—To cl 5.1 mm (Nakasone & Miyake, 1968a).

Coloration.—Carapace and chelipeds reddish, with irregular white marks. Ambulatory legs also reddish; meri and propodi with white band on each proximal and distal parts; dactyli white.

Habitat.—Intertidal to 6 m deep, interspaces of branches of dead and living corals (*Pocillopora* and *Seriatopora*).

Distribution.—Indian Ocean: Chagos Archipelago and Europa Island in Mozambique Channel. Pacific Ocean: Xisha Islands in the South China Sea, Taiwan, Ryukyu Islands, Izu Islands and Mariana Islands.

Remarks.—Ward (1942) gave only a very short original description of *Pisosoma garciaensis* and no illustrations of the species. Subsequently, Nakasone & Miyake (1968a) provided a detailed redescription of *P. garciaensis* based on the Japanese specimens and the information from the type material supplied by J. Haig. The present specimens from Taiwan agree well with the redescription of *P. garciaensis* given by Nakasone & Miyake (1968a).

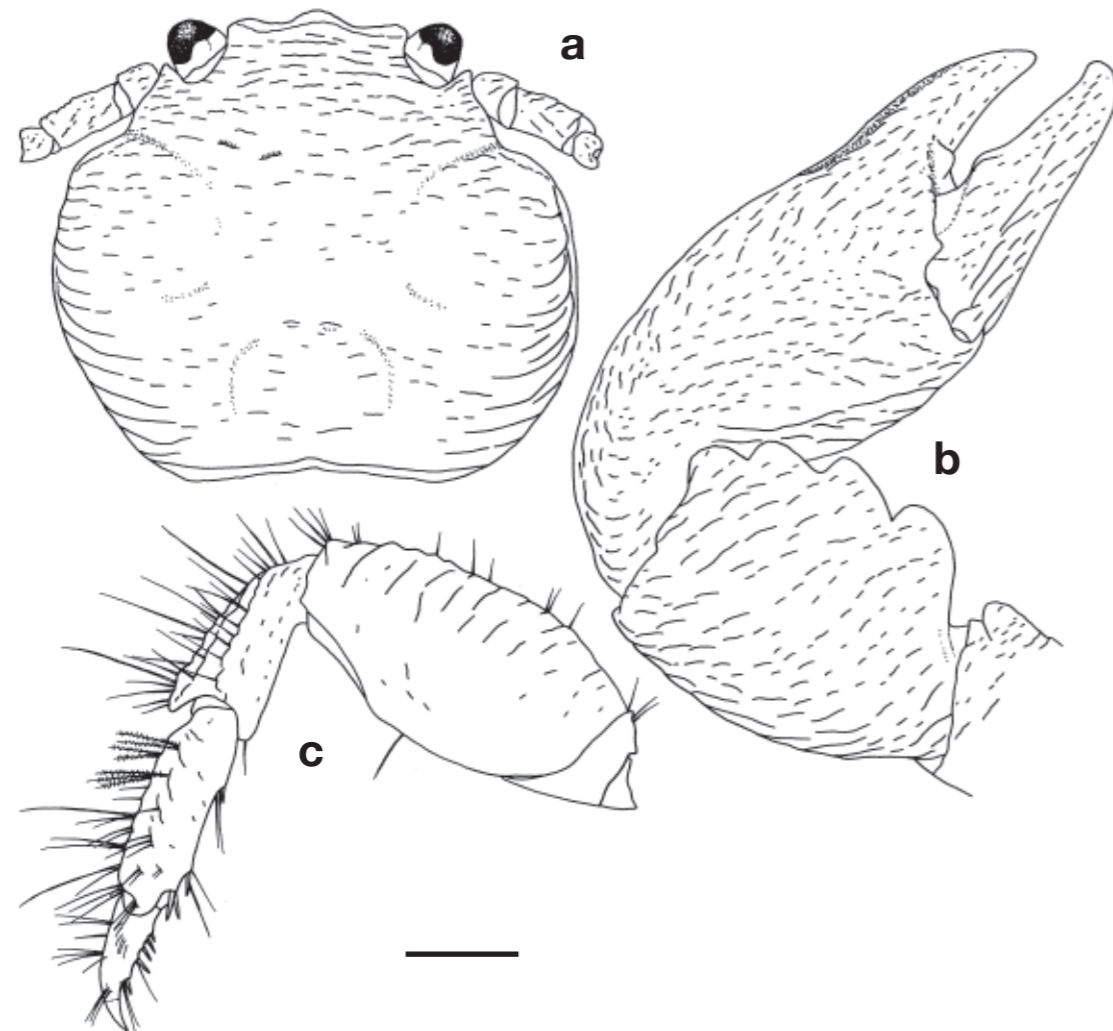


Fig. 76. Male (cl 4.1 mm), SiaoLiouciou, Pingtung County, 20 Mar 1992: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, larger left cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale: a, c = 1.0 mm; b = 1.3 mm.

Pachycheles pectiniscarpus Stimpson, 1858

櫛腕厚瓷蟹



Fig. 77. Male (cl 5.3 mm), Xiangluyu, Penghu County, 3 Aug 1992.



Fig. 78. Ovigerous female (cl 5.9 mm), Xiangluyu, Penghu County, 3 Aug 1992.

Pachycheles pectiniscarpus Stimpson, 1858: 242 [type locality: not specified]; 1907: 186, pl. 23–fig. 5 [type locality: Ly-i-moon Passage near Hong Kong].—Haig, 1992: 309, fig. 6.—Hsieh *et al.*, 1997: 281, figs. 4, 5A.—Yang & Sun, 2005: 15, fig. 12.

? *Pachycheles stevensii*.—Dörjes & Cheng, 1986: 228. [not *Pachycheles stevensii* Stimpson, 1858]

Material examined.—Magang, Taipei County, 22 Sep 1998: 1 male (cl 3.7 mm) (NTOU A01044). Baisha, Penghu County, 4 Sep 1990: 1 male (cl 3.1 mm) (NTOU A00706). Xiangluyu, Penghu County, 3 Aug 1992: 2 males (cl 5.2, 5.3 mm), 1 ovigerous female (cl 5.9 mm), 2 females (cl 3.1, 3.6 mm) (NTOU A01045).

Diagnosis.—Carapace approximately as long as broad or broader than long. Rostrum comparatively narrow, sinuously triangular, with dense, short plumose setae on dorsal surface. Chelipeds covered with flattened and somewhat elevated tubercles on dorsal surface; carpi not distinctly sulcate on dorsal surface, each with small blunt teeth on dorsoflexor margin; larger cheliped with distinct tuft of plumose setae on ventral surface at base of fingers, and with distinct rounded tooth proximally on cutting edge of dactylus. Ambulatory legs relatively stout; propodi each with tufts of dense plumose setae on extensor margin; dactyli each with 3 corneous spines on flexor margin. Male with pair of gonopods.

Size.—To cl 5.9 mm (present study).

Coloration.—Carapace and pereopods generally bluish brown or pale bluish brown. Carapace sometimes whitish on posterior part. Fingers of chelipeds whitish on distal tips.

Habitat.—Intertidal to 2 m deep, rocky shores, under rocks.

Distribution.—Known only from Taiwan, Hong Kong and Hainan Island.

Remarks.—This species is closest to *P. stevensii* Stimpson, 1858, recorded from Japan, Korea, and Vladivostok, but is readily distinguished by the larger cheliped with a distinct tuft of plumose setae on the ventral surface at the base of the fingers and with a distinct rounded tooth proximally on the cutting edge of the dactylus, and the dactyli of the ambulatory legs each with three corneous spines on the flexor margin. In *P. stevensii*, those tufts of setae and tooth are absent on the larger cheliped and four flexor spines are present on each dactylus of the ambulatory legs. Although Dörjes & Cheng (1986) listed *P. stevensii* from western Taiwan, it is very likely that their material represents *P. pectiniscarpus* instead. The presence of *P. stevensii* in Taiwan still needs to be verified.

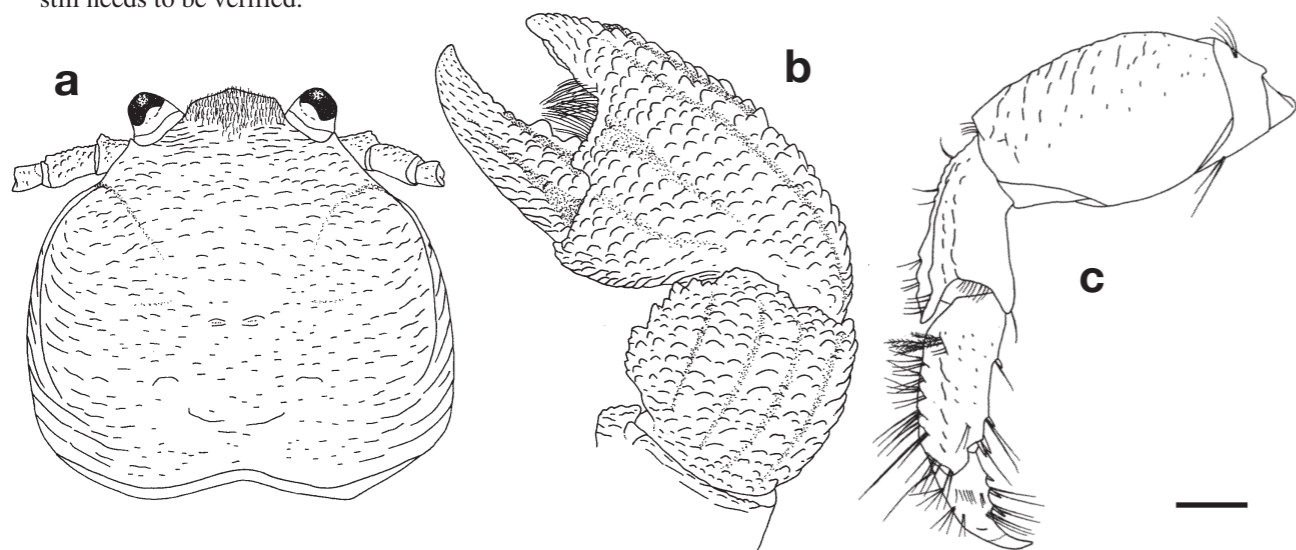


Fig. 79. Male (cl 5.3 mm), Xiangluyu, Penghu County, 3 Aug 1992: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, larger right cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale: a = 1.0 mm; b = 0.4 mm; c = 0.6 mm.

Pachycheles pisoides (Heller, 1865)
豌豆厚瓷蟹



Fig. 80. Ovigerous female (cl 3.53 mm), Hongchaikeng, Pingtung County, 23 Mar 2005.



Fig. 81. Male (cl 3.2 mm), Hongchaikeng, Pingtung County, 23 Mar 2005.

Porcellana pisoides Heller, 1865: 73, pl. 6-fig. 3 [type locality: Nicobar Islands].

Pachycheles lifuensis Borradaile, 1900: 424, fig. 3 [type locality: Lifu, Loyalty Islands].

Pachycheles fronto Melin, 1939: 114, figs. 69-71 [type locality: Chichi-jima Island, Ogasawara Islands].

Pachycheles pisoides.—Nakasone & Miyake, 1968a: 72, fig. 6, pl. 6-fig. 2.—Suzuki, 1985: 54.—Hsieh *et al.*, 1997: 284, figs. 5B, 6.

Material examined.—Hongchaikeng, Pingtung County, 23 Mar 2005: 5 males (cl 3.2-4.0 mm), 4 ovigerous females (cl 2.7-4.2 mm) (NTOU A01042). Siaoliouciou, Pingtung County, 20 Mar 1992: 2 males (cl 3.6, 3.6 mm), 1 ovigerous female (cl 4.0 mm), 1 female (cl 4.2 mm) (NTOU A01047). Wanlitong, Pingtung County, 2 Jun 1992: 1 damaged specimen (NTOU A00601).—9 Jan 1993: 2 males (cl 3.7, 3.7 mm), 1 ovigerous female (cl 4.2 mm) (NTOU A00602).—10 Jan 1993: 2 males (cl 2.9, 3.6 mm), 1 ovigerous female (cl 3.7 mm), 2 females (cl 2.9, 3.7 mm) (NTOU A00603).

Diagnosis.—Carapace and chelipeds with scattered, long stiff setae. Carapace broader than long. Rostrum broad, trilobate in frontal view, without dense, short plumose setae on dorsal surface. Cheliped with carpi each with 3 or 4 blunt teeth on dorsoflexor margin, dorsal surface with elevated short ridges or flattened tubercles along extensor margin; palms with low tubercles on dorsal extensor surface. Ambulatory legs slightly protuberant and with simple setae on extensor margins of carpi and propodi; dactyli each with 3 corneous spines on flexor margin. Male with pair of gonopods.

Size.—To cl 4.7 mm (Nakasone & Miyake, 1968a).

Coloration.—Carapace and pereopods generally dark or light brown. Carapace with white mark on median part. Chelipeds sometimes with irregular white marks; fingers whitish on distal tips. Ambulatory legs each with white band on proximal parts of meri and proximal and distal parts of propodi; dactyli white.

Habitat.—Intertidal to 3.6 m deep, interspaces of branches of dead and living corals (*Acropora*, *Pocillopora*, and *Seriatopora*).

Distribution.—Indian Ocean: Madagascar, Seychelles, Nicobar Islands and Western Australia. Pacific Ocean: several island groups, Taiwan, Ryukyu Islands east to Hawaiian and Society Islands.

Remarks.—Haig (1964) synonymized both *P. fronto* Melin, 1939 and *P. lifuensis* Borradaile, 1900 with *P. pisoides* based on comparison of their types. However, material of this species from the Ryukyu Islands of Japan can be separated into two distinct morphs according to the setation on the dorsal surface of the chelae; one has scattered long stiff setae, and another has a velvety tomentum (personal observation). The Taiwanese material belongs to “scattered long stiff setae” morph.

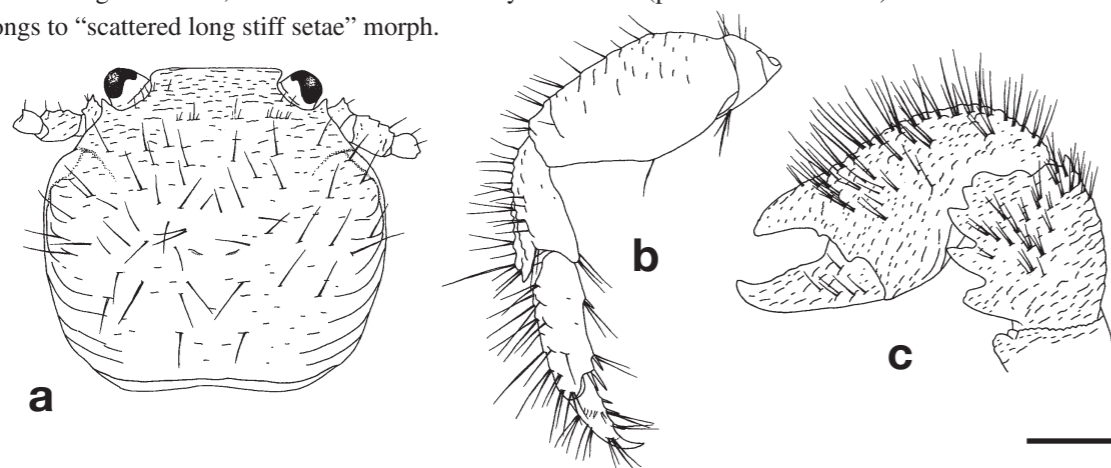


Fig. 82. Male (cl 3.7 mm), Wanlitong, Pingtung County, 9 Jan 1993: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, larger right cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale: a, c = 2.0 mm; b = 1.5 mm.

Pachycheles sculptus (H. Milne Edwards, 1837)

雕刻厚瓷蟹



Fig. 83. Male, locality not specified.



Fig. 84. Ovigerous female (cl 4.9 mm), Lintou, Penghu county, 22 May 1992.

Porcellana sculpta H. Milne Edwards, 1837: 253 [type locality: Java].

Porcellana pisum H. Milne Edwards, 1837: 254 [type locality: China].

Porcellana pulchella Haswell, 1882: 758 [type localities: Holborn Island and Port Molle, Australia].

Pachycheles sculptus var. *tuberculatus* Borradaile, 1900: 423 [type locality: Lifu, Loyalty Islands].

Pachycheles sculptus.—Haig, 1966a: 287; 1992: 310, fig. 7.—Nakasone & Miyake, 1968a: 61, fig. 1, pl. 5—figs. 1–3.—Hsieh *et al.*, 1997: 286, figs. 5C–D, 7, 32H.

Pachycheles pisum.—Yang & Sun, 1992: 200, figs. 6–7.

Material examined.—Nanwan, Pingtung County, 6 Dec 1985: 1 male (cl 3.7 mm) (NTOU A00592).—26 Mar 1986: 1 male (cl 3.0 mm) (NTOU A00591). Baisha, Penghu County, 4 Sep 1990: 1 male (cl 4.1 mm) (NTOU A00430). Lintou, Penghu County, 20 May 1992: 1 ovigerous female (cl 4.9 mm) (NTOU A00592).—22 May 1992: 1 male (cl 5.4 mm), 2 ovigerous females (cl 4.9, 5.2 mm) (NTOU A00588).

Diagnosis.—Carapace and chelipeds without long setae on dorsal surface. Carapace broader than long; anterior region with short transverse ridges. Rostrum broad, trilobate in frontal view, without dense, short plumose setae on dorsal surface. Chelipeds variable in ornamentation of dorsal surfaces; carpi each with 2–4 blunt teeth on dorsoflexor margin, and slightly rugose or with low, somewhat overlapping tubercles, or with irregular rows of strong, squamiform tubercles on dorsal surface; chelae weakly rugose, with 2 or 3 longitudinal blunt ridges of somewhat elevated rugae or elongate tubercles on dorsal surface; smaller cheliped more strongly ridged and tuberculate than larger cheliped. Ambulatory legs slightly protuberant and with simple setae on extensor margins of carpi and propodi; dactyli each with 3 corneous spines on flexor margin. Male without pair of gonopods.

Size.—To cl 11.7 mm (Haig, 1965).

Coloration.—Carapace and pereopods generally brown or reddish brown. Carapace with narrow or broad white mark on median part. Fingers of chelipeds whitish on distal tips.

Habitat.—Intertidal to 180 m deep, interspaces of branches of dead and living corals and sponges.

Distribution.—Indo-West Pacific. Indian Ocean from Seychelles, Mergui Archipelago and Western Australia. Malay Peninsula northward to Ryukyu Islands. Indonesia southward to northern and eastern Australia, and eastward to Tuamotu Archipelago.

Remarks.—The taxonomy and intraspecific variations of the chelipeds of this species are discussed by Haig (1964). Variations in the ornamentation on the chelipeds are illustrated by Nakasone & Miyake (1968a), and the stoutness of the ambulatory legs is mentioned to be rather variable by Osawa (2007b). The Taiwanese material has relatively stout ambulatory legs that are similar to those from the New Caledonia and Loyalty Islands reported by Osawa (2007b).

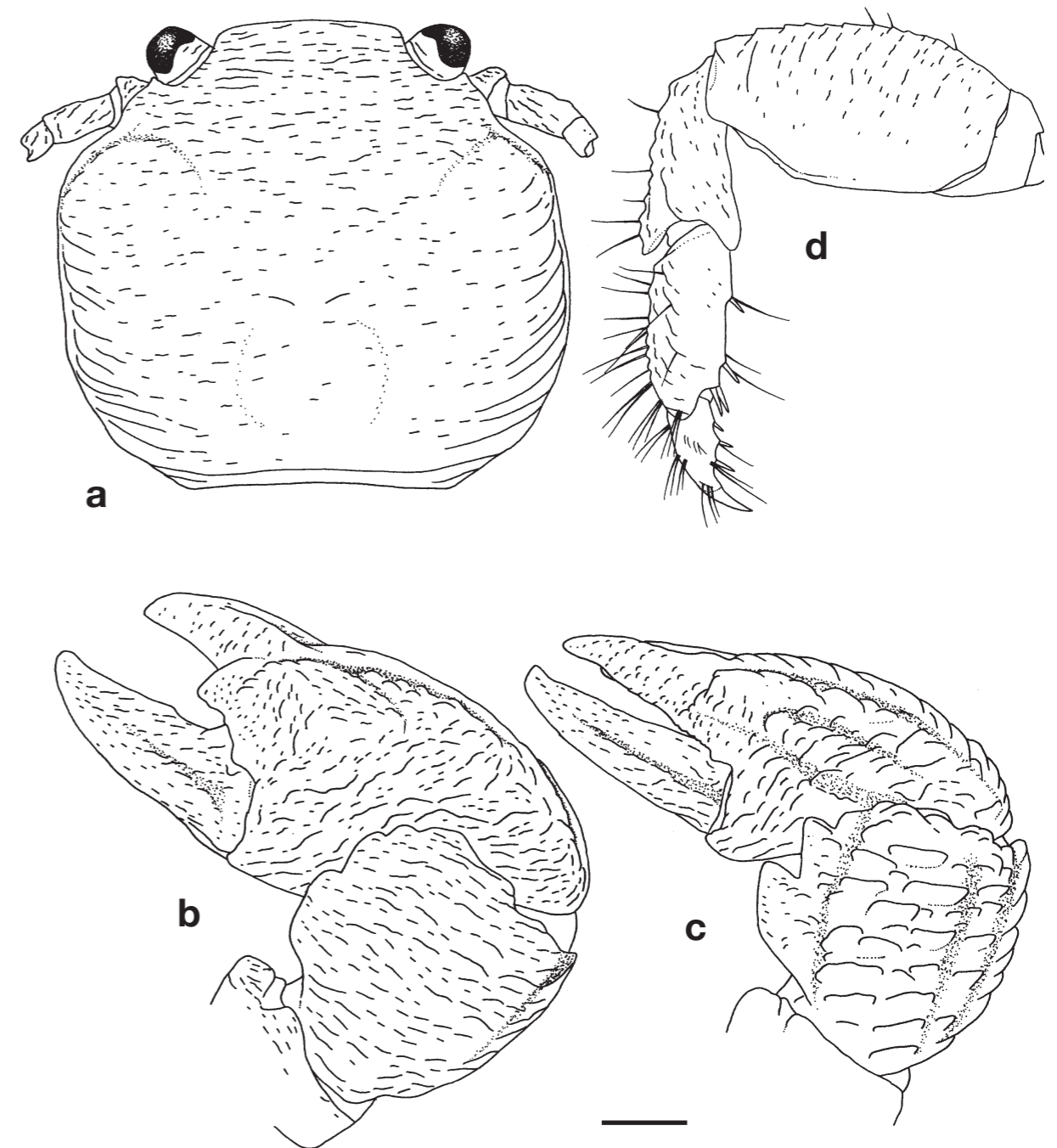


Fig. 85. Male (cl 5.4 mm), Lintou, Penghu County, 22 May 1992, a–b, d; ovigerous female (cl 5.2 mm), same locality and date, c: **a**, carapace and ocular and antennal peduncles, dorsal view; **b–c**, larger right cheliped, dorsal view; **d**, left second pereopod, lateral view. Scale: a, d = 1.0 mm; b = 1.6 mm; c = 1.3 mm.

Genus *Petrolisthes* Stimpson, 1858

岩瓷蟹屬

Petrolisthes Stimpson, 1858: 227 [type species: *Porcellana violacea* Guérin, 1829, by original designation.

Gender: masculine].

Diagnosis.—Carapace usually more or less as long as broad; dorsal surface flattened or weakly convex, regions moderately defined; armature and ornamentation various. Rostrum sinuously triangular or trilobate, median lobe usually bent ventrally. External orbital angle produced or not. Ocular peduncle approximately as broad as cornea in dorsal view. Branchial margins unarmed or with 1 or more spines. Pterygostomian flaps entire. Antennal peduncle with movable (second to fourth) articles freely accessible to orbit. Chelipeds usually subequal; chelae broad, flattened; dactylus opening horizontally. Ambulatory legs each with dactyli terminating in a single claw. Male with pair of gonopods on second abdominal segment. Telson divided into 7 plates.

Remarks.—This genus has the richest number of species in Porcellanidae, including 100 extant species in the world (De Grave *et al.*, 2009). In the Indo-West Pacific, 44 species are currently recognized. Nineteen species are found from Taiwan, including two species reported herein as new records for Taiwan.

Key to species of *Petrolisthes* from Taiwan

1. Supra-ocular spine present on each side 2
 - Supra-ocular spines absent 8
2. Branchial margins of carapace armed with spines 3
 - Branchial margins of carapace without spines 5
3. Internal orbital angles each produced into small spine *P. scabriculus*
 - Internal orbital angles unarmed 4
4. Rostrum sinuously triangular *P. militaris*
 - Rostrum trilobate *P. heterochrous*
5. Two pairs of epibranchial spines present *P. decacanthus*
 - One pair of epibranchial spines present 6
6. Third article of antennal peduncle strongly produced at anterior proximal angle *P. coccineus*
 - Third article of antennal peduncle weakly or moderately produced at proximal anterior angle 7
7. Palm of cheliped with 2 small spines on dorsal distoflexor margin. Carpus of first ambulatory leg without disto-extensor spine *P. carinipes*
 - Palm of cheliped without spines on dorsal distoflexor margin. Carpus of first ambulatory leg with disto-extensor spine *P. extremus*
8. Epibranchial spine present on each side 9
 - Epibranchial spines absent 16
9. Meri of ambulatory legs with spine(s) on extensor margin 10
 - Meri of ambulatory legs without spines on extensor margin 14
10. Meri of ambulatory legs each with a single spine on distal 0.3 of extensor margin (in *P. asiaticus*, occasionally several spines may present on extensor margin) 11
 - Meri of ambulatory legs each with row of spines on extensor margin 12
11. Palm of chelipeds with median longitudinal crest composed of flattened squamiform ridges on dorsal surface *P. asiaticus*

- Palm of chelipeds without median longitudinal crest composed of flattened squamiform ridges on dorsal surface *P. miyakei*
- 12. Carapace covered with numerous transverse ridges *P. moluccensis*
 - Carapace covered with numerous, short plumose setae 13
- 13. Carapace flattened on dorsal surface *P. pubescens*
 - Carapace uneven on dorsal surface *P. tomentosus*
- 14. Palms of chelipeds fringed with short plumose setae on proximal or entire extensor margins
 - *P. obtusifrons*
 - Palms of chelipeds without plumose setae on extensor margin 15
- 15. Carapace weakly striate and sparsely setose. Carpi of chelipeds each armed with 3 or 4 (rarely 5) teeth on dorsoflexor margin *P. lamarckii*
 - Carapace strongly striate and densely setose. Carpi of chelipeds each armed with 4–6 teeth on dorsoflexor margin *P. haswelli*
- 16. Carpi of chelipeds each armed with broad teeth on dorsoflexor margin 17
 - Carpi of chelipeds each with or without 1 tooth or lobe (1–2 additional small teeth or spines sometimes present) on dorsoflexor margin 18
- 17. Carpi of chelipeds each with a single distal spine on extensor margin *P. hastatus*
 - Carpi of chelipeds each with 2 or 3 spines on distal extensor margin *P. borraidailei*
- 18. Carpi of chelipeds each with 2 or more spines on distal extensor margin *P. japonicus*
 - Carpi of chelipeds each unarmed on extensor margin except for distal projection *P. unilobatus*

Petrolisthes asiaticus (Leach, 1820)

亞洲岩瓷蟹



Fig. 86. Male (cl 7.1 mm), Hemei, Taipei County, 5 Aug 2009.

Pisidia asiatica Leach, 1820: 54 [type locality: Isle of France (Mauritius)].

Petrolisthes leporinoides Ortmann, 1892: 263 [type locality: South Seas].

Petrolisthes yaeyamensis Miyake, 1937c: 157, unnumbered fig. [type locality: Ishigaki Island, Ryukyu Islands].

Petrolisthes asiaticus.—Miyake, 1942: 334, text-figs. 1, 2.—Suzuki, 1985: 53 (list).—Hsieh *et al.*, 1997: 320, figs. 24B–C, 25.

Material examined.—Hemei, Taipei County, 5 Aug 2009: 1 male (cl 7.1 mm) (NTOU A00923). Hongchaikeng, Pingtung County, 6 Jun 2005: 1 male (cl 3.6 mm) (NTOU A01052). Jioupeng, Pingtung County, 19 Mar 1992: 2 males (cl 5.8, 10.7 mm) (NTOU A01050). Nanwan, Pingtung County, 19 Mar 1992: 1 male (cl 5.1 mm) (NTOU A01051). Wanlitong, Pingtung County, 29 Jan 1986: 1 male (cl 6.5 mm) (NTOU A00667). No specific locality: 1 male (cl 3.7 mm) (NTOU A01053).

Diagnosis.—Carapace with short delicate striae on gastric region; rostrum trilobate; no supra-ocular spine; brachial margins convex, each with epibranchial spine at anterior angle of cervical groove. Second article of antennal peduncle with distinct anterior lobe. Chelipeds with numerous short, squamiform ridges on dorsal

surface; carpus armed with 3 or 4 relatively small and narrow teeth on dorsoflexor margin; dorso-extensor margin with 2 or 3 spines on distal third; palm with distinct longitudinal crest composed of flattened squamiform ridges on dorsal midline; extensor margin unarmed. Ambulatory legs moderately slender; meri each with 1–4 spines on distal two thirds of extensor margin, lateral flexor margin with distal spine each on second and third pereopods, but unarmed on fourth pereopod; carpi each with disto-extensor spine on second pereopod; dactyli each with 3 corneous spines on flexor margin. Ridges on surfaces with sparse short setae on anterior margins.

Size.—To cl 13.3 mm (Miyake, 1943).

Coloration.—Carapace and pereopods generally bluish brown, with scattered dark brown marks. Fingers of chelipeds red at distal tips. Ambulatory legs with white mark on distal part of each merus; propodi each with white bands on proximal and distal parts.

Habitat.—Intertidal, found under rocks.

Distribution.—Widely distributed in the Indo-West Pacific. Indian Ocean: Seychelles, Mauritius, Gulf of Thailand, Sumatra, Moluccas. Pacific Ocean: Philippines, Guangxi Province in China, Taiwan, south Japan (from Kii Peninsula to Ryukyu Islands), Mariana Islands, Palau, North Australia, Caroline Islands, New Caledonia, Fiji, Tuvalu (Ellice Islands), Rotuma, Western Samoa, Phoenix Islands.

Remarks.—*Petrolisthes asiaticus* has been treated as having only a single spine on the distal third of the extensor margin of the merus in at least one ambulatory leg (e.g. Miyake, 1942; Kropp, 1984). However, examination of the Taiwanese and Japanese specimens has shown that this character is variable; there are one to four spines on the distal two thirds margin, and sometimes only a single spine proximal to the median part. Among the Indo-West Pacific species, the general appearance of *P. asiaticus* is closest to *P. miyakei* Kropp, 1984 and *P. trilobatus* Osawa, 1996. These three species have the carapace lacking dense plumose setae and distinct transverse ridges on the dorsal surface and bearing an epibranchial spine but no supraocular and mesobranchial spines on each side, and the ambulatory legs having one or more spines on the extensor margin of the meri. Nevertheless, *P. asiaticus* is readily distinguished from both *P. miyakei* and *P. trilobatus* by the presence of a median longitudinal crest composed of flattened squamiform ridges on the dorsal surface of the palm of the cheliped.

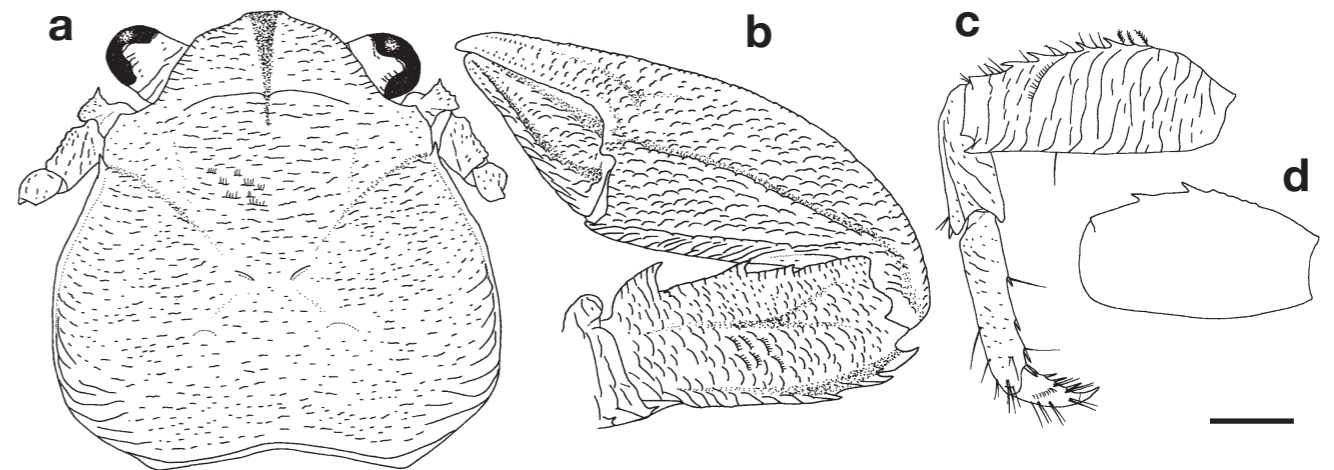


Fig. 87. Male (cl 10.7 mm), Jioupeng, Pingtung County, 19 Mar 1992: a, carapace and ocular and antennal peduncles, dorsal view; b, right cheliped, dorsal view; c, left second pereopod, lateral view; d, right fourth pereopod, merus, lateral view. Scale: a, c–d = 2.0 mm; b = 2.8 mm.

Petrolisthes borradailei Kropp, 1984

波氏岩瓷蟹

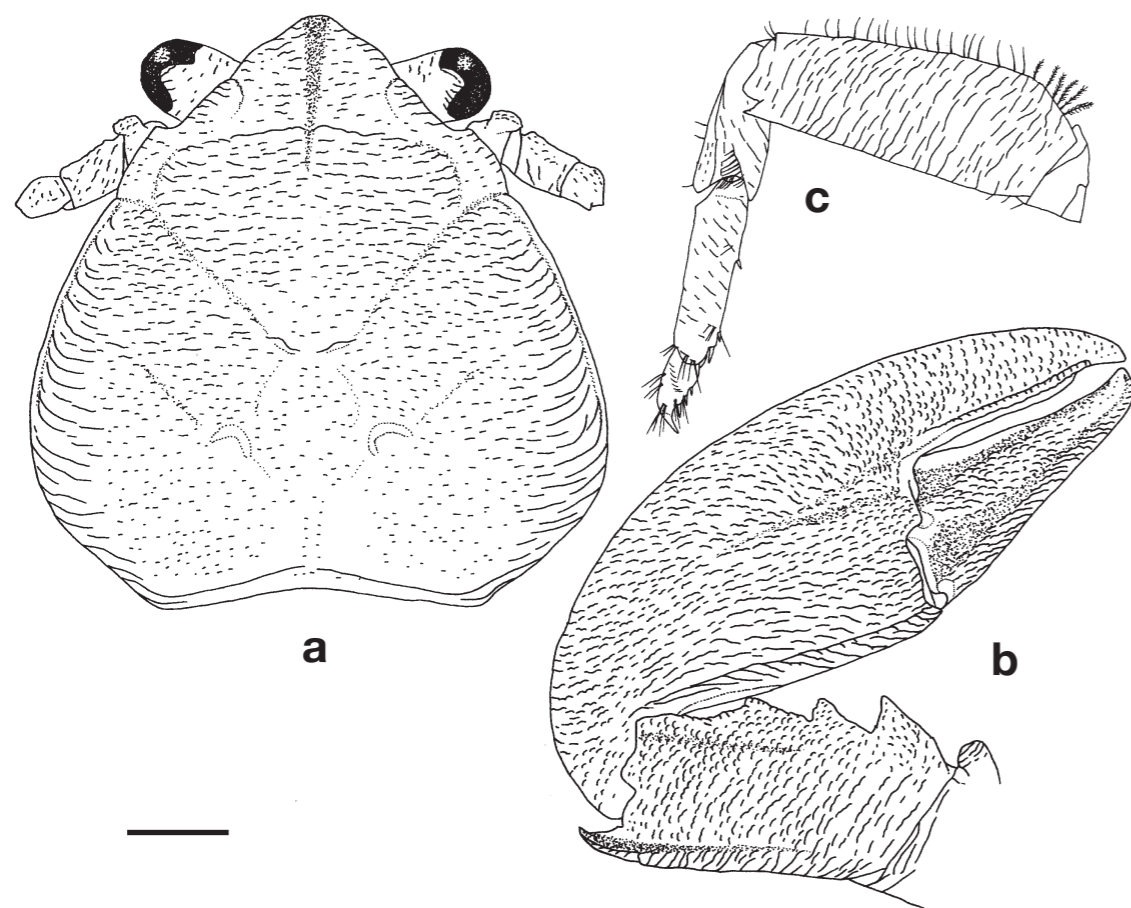


Fig. 88. Male (cl 11.4 mm), Fulong, Taipei County, 9 Aug 2006: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, left cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale: a, c = 2.0 mm; b = 2.8 mm.

Petrolisthes lamarckii var. *rufescens*.—Borradaile, 1898: 465.—Miyake, 1942: 345, text-figs. 9–10, pl. 1–fig. 2.

[not *Petrolisthes rufescens* (Heller, 1861)]

Petrolisthes borradailei Kropp, 1984: 96, fig. 3 [type locality: Pagan, Mariana Islands].—Hsieh *et al.*, 1997: 315, figs. 14H, 22.

Material examined.—Fulong, Taipei County, 9 Aug 2006: 1 male (cl 11.4 mm), 1 ovigerous female (cl 10.4 mm) (NTOU A01136).

Diagnosis.—Carapace with numerous short, delicate striae on gastric region and anterior branchial region; rostrum sinuously triangular; supra-ocular lobe distinct but supra-ocular spine absent; brachial margins convex, unarmed at anterior angle of cervical groove. Second article of antennal peduncle with distinct anterior lobe. Chelipeds with numerous short striae and small flattened tubercles and granules on dorsal surface; carpus armed with 3 or 4 broad teeth on dorsoflexor margin, proximal tooth largest; dorso-extensor margin with distinct, distal acute projection followed proximally by 1 spine and/or 1 or 2 short elevated ridges; palm unarmed and without

setae on extensor margin. Ambulatory legs relatively stout; meri each unarmed but with row of short plumose setae on extensor margin, lateral flexor margin with distinct distal spine each on second and third pereopods, but unarmed on fourth pereopod; carpi each unarmed on extensor margin; dactyli each with 3 corneous spines on flexor margin. Ridges on surfaces with sparse short setae on anterior margins.

Size.—To cl 13.7 mm (Kropp, 1984).

Coloration.—Carapace overall dark green, mottled with blue and burgundy patches. Chelipeds similar to carapace; extensor portion of manus with distinctive line of irregularly spaced, pale orange dots; dactylus deep red-purple with blue-dotted striations (Kropp, 1984).

Habitat.—Intertidal, found under small rocks and boulders.

Distribution.—Widely distributed in the Indo-West Pacific. In Indian Ocean, Chagos Archipelago and Seychelles. In Pacific Ocean, scattered island groups north to Ryukyu Islands, south to Loyalty Islands, and east to Tuamotu Archipelago.

Remarks.—*Petrolisthes borradailei* is distinguished from *P. lamarckii* (Leach, 1820) and its closely related species by the absence of an epibranchial spine on each side of the carapace. The original description of *P. borradailei* by Kropp (1984) stated that the carpus of each cheliped has two sharp distal spines followed proximally by a blunt spine and several elevated squamae on the extensor margin. However, in the Taiwanese material, the subdistal spine is reduced to a short elevated ridge.

Petrolisthes carinipes (Heller, 1861)

脊足岩瓷蟹



Fig. 89. Ovigerous female (cl 7.8 mm), Houwan, Pingtung County, 5 Jun 1992:



Fig. 90. Male (cl 2.6 mm), Hongchaikeng, Pingtung County, 23 Mar 2005.

Porcellana carinipes Heller, 1861: 24 [type locality: Red Sea].

Petrolisthes carinipes.—Miyake & Nakasone, 1966: 177, figs. 4–5.—Lewinsohn, 1974: 249 (in part), figs. 1–6.—Hsieh *et al.*, 1997: 301, figs. 14B, 15.

Material examined.—Hongchaikeng, Pingtung County, 23 Mar 2005: 1 male (cl 2.6 mm) (NTOU A01043). Houwan, Pingtung County, 5 Jun 1992: 1 ovigerous female (cl 7.8 mm) (NTOU A00615). Wanlitong, Pingtung County, 9 Jan 1993: 1 ovigerous female (cl 4.5 mm) (NTOU A01046).—10 Jan 1993: 1 female (cl 3.6 mm) (NTOU A01090).

Diagnosis.—Carapace with distinct transverse ridges on gastric region and branchial regions; rostrum trilobate; 1 supra-ocular spine and 1 epibranchial spine present; branchial margins strongly convex, unarmed. Antennal peduncles each with distinct anterior lobe bearing anteroproximal spine on second article; third article not strongly produced at anterior proximal angle. Chelipeds with distinct transverse or oblique squamiform ridges on dorsal surfaces of carpi and palm; carpi each with 3 or 4 spine-tipped, broad teeth on dorsoflexor margin, dorso-extensor margin with 4 or 5 spines on distal half; chelae each with distinct longitudinal crest of oblique ridges along midline, extensor margin with row of spines, dorsoflexor margin bearing 2 small subdistal spines. Ambulatory legs relatively slender; meri each with row of spines and plumose setae on extensor margin, lateral flexor margin with distinct distal spine on second and third pereopods, but unarmed on fourth pereopod; carpi unarmed on extensor margins; dactyli each with 3 corneous spines on flexor margin. Ridges on surfaces with row of short plumose setae on anterior margins.

Size.—To cl 7.8 mm (present study).

Coloration.—Carapace and chelipeds dark green or dark brown, with irregular white marks. Ambulatory legs also dark green or dark brown; meri with white bands on median and distal parts; propodi with white bands or marks on proximal and distal parts. Juveniles with larger white marks.

Habitat.—Coral reefs, intertidal to 3.6 m deep. Haig (1983) reported that *P. carinipes* was collected from a coral (*Millepora tenera*) and a sea urchin (*Astropyga radiata*). Osawa (1998b) reported that *P. carinipes* occurred together with blackish ophiuroids *Ophiocoma erinaceus* or *O. pica*, and *P. masakii* Miyake, 1943 was also found with the same ophiuroids.

Distribution.—Indian Ocean: Red Sea, Gulf of Aden, Seychelles, and Mauritius. Pacific Ocean: Ogasawara, Ryukyu, Mariana Islands, Taiwan, Nansha Islands in the South China Sea, and Chesterfield Islands.

Remarks.—All the specimens of this species examined by the authors are generally dark green to dark brown with scattered white marks on the body when they are fresh. Miyake (1998) published color photographs of *P. scabriculus* (Dana, 1852) and *P. carinipes* from Japan (pl. 51–fig. 6; pl. 52–fig. 1). However, judging from the coloration, the photograph of “*P. scabriculus*” actually represents *P. carinipes* and that of “*P. carinipes*” likely refers to *P. extremus* Kropp & Haig, 1994 instead.

Miyake & Nakasone (1966) proposed the “new name” *Petrolisthes melini* (actually a new species) for those “*P. carinipes*” reported from the Bonin (Ogasawara) Islands by Melin (1939), and mentioned that the former species lacks epibranchial spines on the carapace. However, Lewinsohn (1974) re-examined both the holotype of *P. carinipes* from the Red Sea and Melin’s (1939) material, and found that the Bonin Island specimens have epibranchial spines. Nevertheless, Lewinsohn (1974) noted that there are some differences between Melin’s (1939) material and the holotype of *P. carinipes*, such as: (1) the carpus of the first ambulatory leg has a spine on the disto-extensor margin in Melin’s (1939) material, but the spine is absent in the type; and (2) the palm of the cheliped is fringed with plumose setae on the extensor margin in Melin’s (1939) specimens, instead of naked in the type. Although Lewinsohn (1974) did not describe the presence of two small spines near the distal end of the dorsoflexor margin of the chela in the holotype (Red Sea, male cl 4.9 mm, NHMW 18801), re-examination of the holotype has revealed that it actually has such spines.

The material from Taiwan shows that the absence of spine on the carpus of the first ambulatory leg is a specific character for *P. carinipes*. Therefore, it appears that “*P. carinipes*” reported by Melin (1939) agrees more with *P. extremus*. If Melin’s (1939) material is conspecific with *P. extremus*, then the name *P. melini* will have priority over *P. extremus*. Detailed comparison of Melin’s (1939) specimens and the type material of *P. extremus* will be needed to verify the taxonomic status of *P. melini* and *P. extremus*.

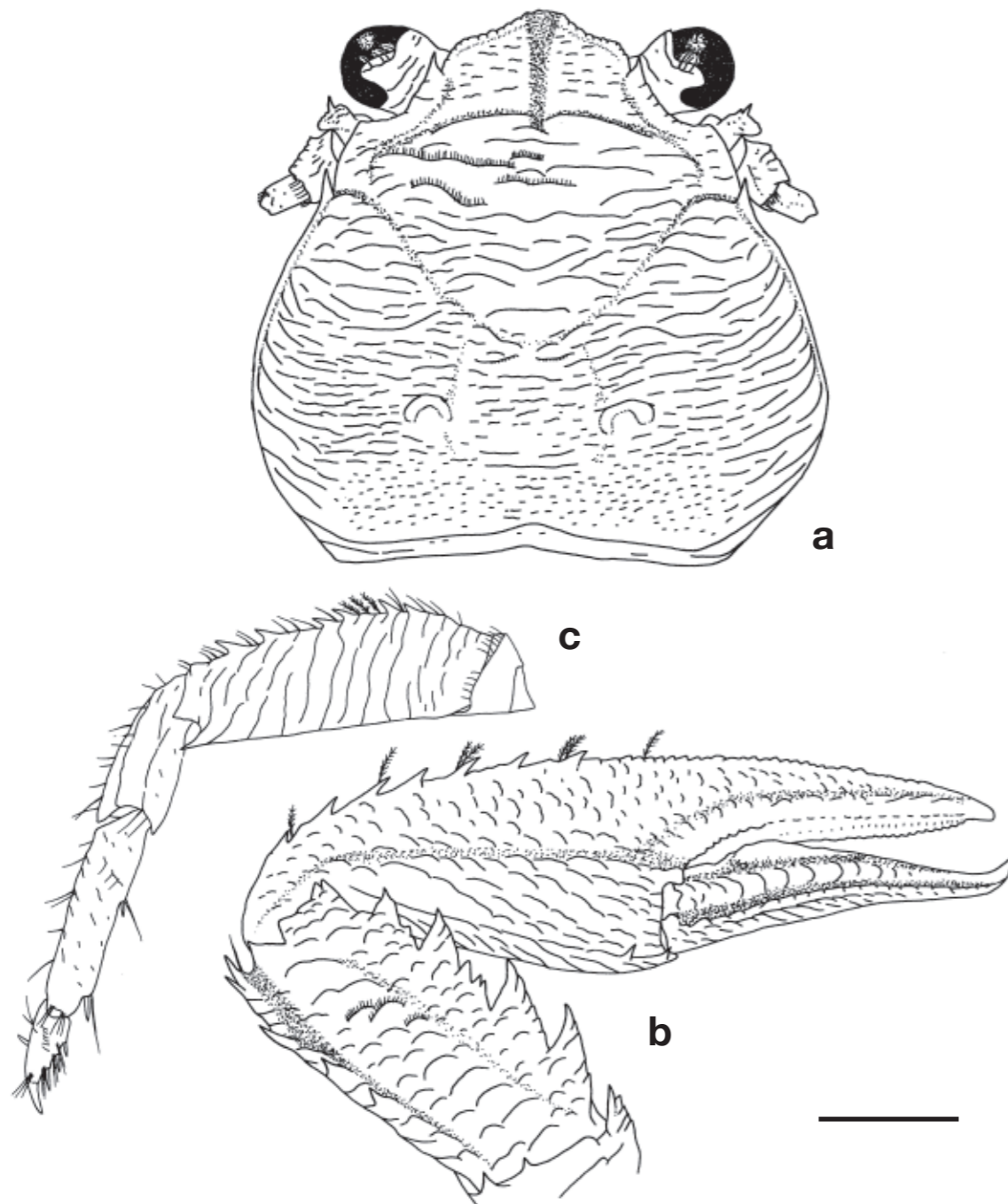


Fig. 91. Ovigerous female (cl 7.8 mm), Houwan, Pingtung County, 5 June 1992: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, left cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale = 2.0 mm.

Petrolisthes coccineus (Owen, 1839)

紅褐岩瓷蟹



Fig. 92. Male (cl 12.6 mm), Badouzih, Keelung City, 9 Nov 2006.

Porcellana coccinea Owen, 1839: 87, pl. 26 [type locality: Low (= Tuamotu) Islands].

Porcellana barbata Heller, 1862: 523 [type locality: Nicobar Islands].

Petrolisthes nipponensis Miyake, 1937d: 213, fig. 2, pl. 12—fig. 1 [type locality: Seto (Shirahama), Wakayama Prefecture, Japan].

Petrolisthes coccineus.—Miyake, 1943: 59, figs. 3–4.—Haig, 1992: 313, fig. 9.—Hsieh *et al.*, 1997: 303, figs. 14C, 16.

Material examined.—Badouzih, Keelung City, 15 Nov 1991: 1 female (cl 10.3 mm) (NTOU A00624).—9 Nov 2006: 4 males (cl 5.8–12.6 mm), 1 juvenile (cl 2.3 mm) (NTOU A00924). Kueihou, Taipei County, 4 Jul 1979: 1 ovigerous female (cl 12.7 mm) (NTOU A01089). Longdong, Taipei County, May 1999: 2 females (cl 14.4, 16.8 mm) (NTOU A01013). Magang, Taipei County, 27 Apr 1990: 1 male (cl 7.0 mm), 1 female (cl 6.9 mm) (NTOU A00620).—7 Jun 1990: 1 male (cl 17.0 mm), 1 ovigerous female (cl 12.8 mm) (NTOU A00619).—17 Apr 1992: 1 damaged specimen (NTOU A00625).—2 Jun 1992: 13 males (cl 4.1–12.7 mm), 2 ovigerous females (cl 9.5, 10.6 mm), 5 females (cl 8.5–10.9 mm) (NTOU A00622).—14 Jul 1995: 2 males (cl

11.0, 12.0 mm), 2 females (cl 12.8, 13.4 mm) (NTOU A00621). Shihtiping, Hualien County, 21 Sep 2006: 1 male (cl 5.8 mm) (NTOU A01054). Lijhengjiao, Penghu County, 21 May 1992: 2 males (cl 5.4, 20.6 mm) (NTOU A00617). Xiangluyu, Penghu County, 3 Aug 1992: 1 male (cl 10.1 mm), 1 female (cl 8.1 mm) (NTOU A00618). Wuciou, Kinmen County, 5 Apr 1988: 1 male (cl 10.1 mm) (NTOU A00623). Ingkoushi (locality in Taiwan unable to locate), 15 May 1969: 1 male (cl 17.2 mm) (NTOU A01011).

Diagnosis.—Carapace with distinct transverse ridges on gastric region and anterior branchial regions; rostrum relatively narrow, sinuously triangular; 1 supra-ocular spine and 1 epibranchial spine present; branchial margins strongly convex, unarmed. Antennal peduncles each with distinct anterior lobe bearing anteroproximal spine on second article; third article strongly produced at anterior proximal angle. Chelipeds with distinct transverse or oblique, squamiform ridges on dorsal surfaces of carpi and palms; carpi each with 3 or 4 acute, relatively narrow, teeth on dorsoflexor margin, dorso-extensor margin with 4 or 5 spines on distal third; chelae each with distinct longitudinal crest of short ridges on midline, extensor margin with row of spines and short plumose setae, dorsoflexor margin unarmed. Ambulatory legs moderately slender; meri each with row of spines and plumose setae on extensor margin, lateral flexor margins each with distal spine, strongest on second and third pereopods; carpi each with disto-extensor spine on second pereopod; dactyli each with 3 corneous spines on flexor margin. Ridges on surfaces with row of short plumose setae on anterior margins.

Size.—To cl 20.6 mm (present study).

Coloration.—Carapace and pereopods red or reddish brown; ridges on carapace and chelipeds dark red. Fingers of chelipeds orange at distal tips. Ambulatory legs with irregular white marks on propodi and dactyli.

Habitat.—Intertidal to 7.2 m deep, under rocks.

Distribution.—Widely but scatterly recorded from the Indo-West Pacific. North to Honshu in Japan, south to Indonesia, west to eastern African coast, and east to Tuamotu Archipelago and Hawaiian Islands.

Remarks.—This species is one of the largest porcellanids, with the carapace length and breadth between lateral tips of carpi of chelipeds reaching to about 20 mm and 70 mm, respectively. *Petrolisthes coccineus* can be readily distinguished from the two most similar species, *P. carinipes* and *P. extremus*, by the rostrum being relatively narrow and sinuously triangular, branchial margins of the carapace being much more strongly convex, and the third article of the antennal peduncle with a distinct spine near the anterior proximal angle.

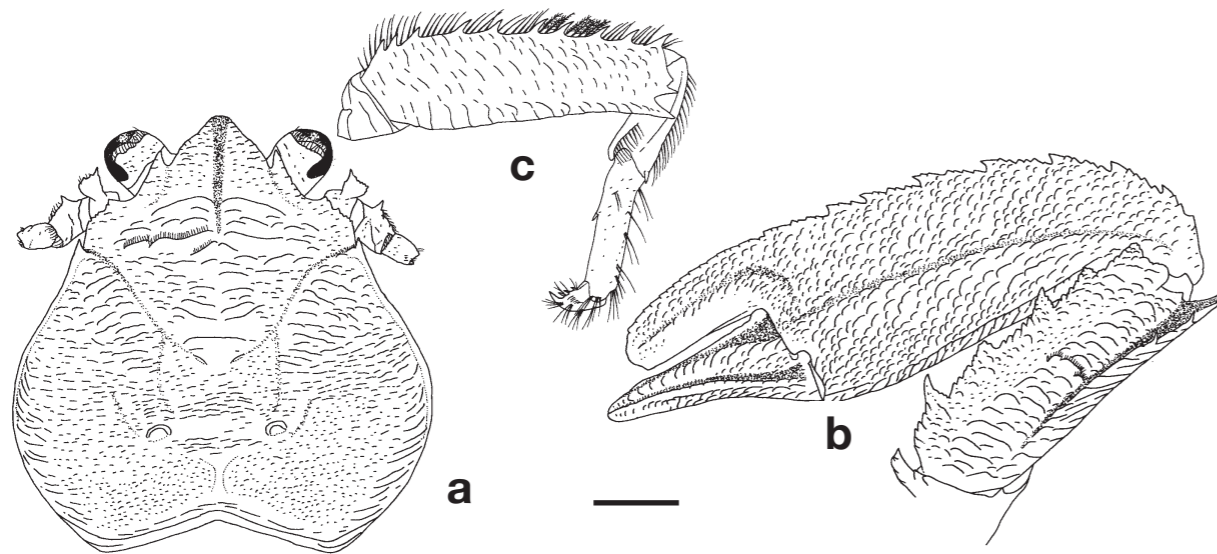


Fig. 93. Male (cl 17.0 mm), Magang, Taipei County, 7 Jun 1990: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, right cheliped, dorsal view; **c**, right second pereopod, lateral view. Scale: a, c = 3.6 mm; b = 4.9 mm.

Petrolisthes decacanthus Ortmann, 1897

十刺岩瓷蟹



Fig. 94. Male (cl 3.4 mm), Wanlitong, Pingtung County, 10 Jan 1993.

Petrolisthes decacanthus Ortmann, 1897: 283, pl. 17—fig. 2 [type locality: Tahiti, Society Islands].—Haig & Kropp, 1987: 176, figs. 3–4.—Pauley *et al.*, 2003: 491.—Osawa *et al.*, 2007: 732, fig. 1.

Material examined.—Tungching Bay, Lanyu, Taitung County, 22 Dec 1992: 1 male (cl 6.5 mm) (NTOU A00825). Hongchaikeng, Pingtung County, 9 Sep 2005: 1 male (cl 3.3 mm) (NTOU A01049). Wanlitong, Pingtung County, 2 Jun 1991: 1 ovigerous female (cl 5.3 mm) (NTOU A00827).—2 Jun 1992: 1 male (cl 5.5 mm), 2 females (cl 4.8, 6.0 mm) (NTOU A00826).—10 Jan 1993: 1 male (cl 3.4 mm) (NTOU A01048).

Diagnosis.—Carapace with numerous short, transverse ridges on dorsal surface; rostrum trilobate; one supra-ocular, one external orbital, one hepatic, and 2 epibranchial spines present; branchial margins convex, unarmed. Second article of antennal peduncle with distinct anterior lobe bearing anteroproximal spine. Chelipeds with distinct transverse or oblique, squamiform ridges on dorsal surfaces of carpus and palm; carpi each with 4 spine-tipped, broad teeth on dorsoflexor margin, dorso-extensor margin with row of small spines along entire length. Ambulatory legs relatively stout; meri each with row of spines and plumose setae on extensor margin, lateral flexor margin with distinct distal spine each on second and third pereopods, but

unarmed on fourth pereopod; carpi each with disto-extensor spine on second pereopod; dactyli each armed with 3 corneous spines on flexor margin. Ridges on surfaces with row of short plumose setae on anterior margins.

Size.—To cl 12.8 mm (Haig & Kropp, 1987).

Coloration.—Carapace and chelipeds whitish, with numerous irregular, light brown marks. Chelipeds also with some dark brown marks on carpi and chelae; fingers with reddish marks on distal parts. Ambulatory legs with 2 irregular, light brown bands on meri; propodi each with dark brown band on median part.

Habitat.—Subtidal to 3 m deep, on large blocks of reef rock having many crevices, or on coralline algae (Haig & Kropp, 1987).

Distribution.—This species has a wide but scattered distribution in the Indo-West Pacific, mainly on oceanic islands. Indian Ocean: Glorioso Islands, Seychelles, Maldives. Pacific Ocean: Taiwan, Mariana Islands, Palau Islands, Caroline Islands, West Coral Sea, Marshall Islands, Samoa, Society Islands.

Remarks.—The present specimens were recently reported from Taiwan by Osawa *et al.* (2007), but the collecting year for the lots NTOU A00825 and NTOU A00826 was actually 1992 instead of 1981. The differences between *P. decacanthus* and its related species are discussed in Haig & Kropp (1987) and Osawa (1997).

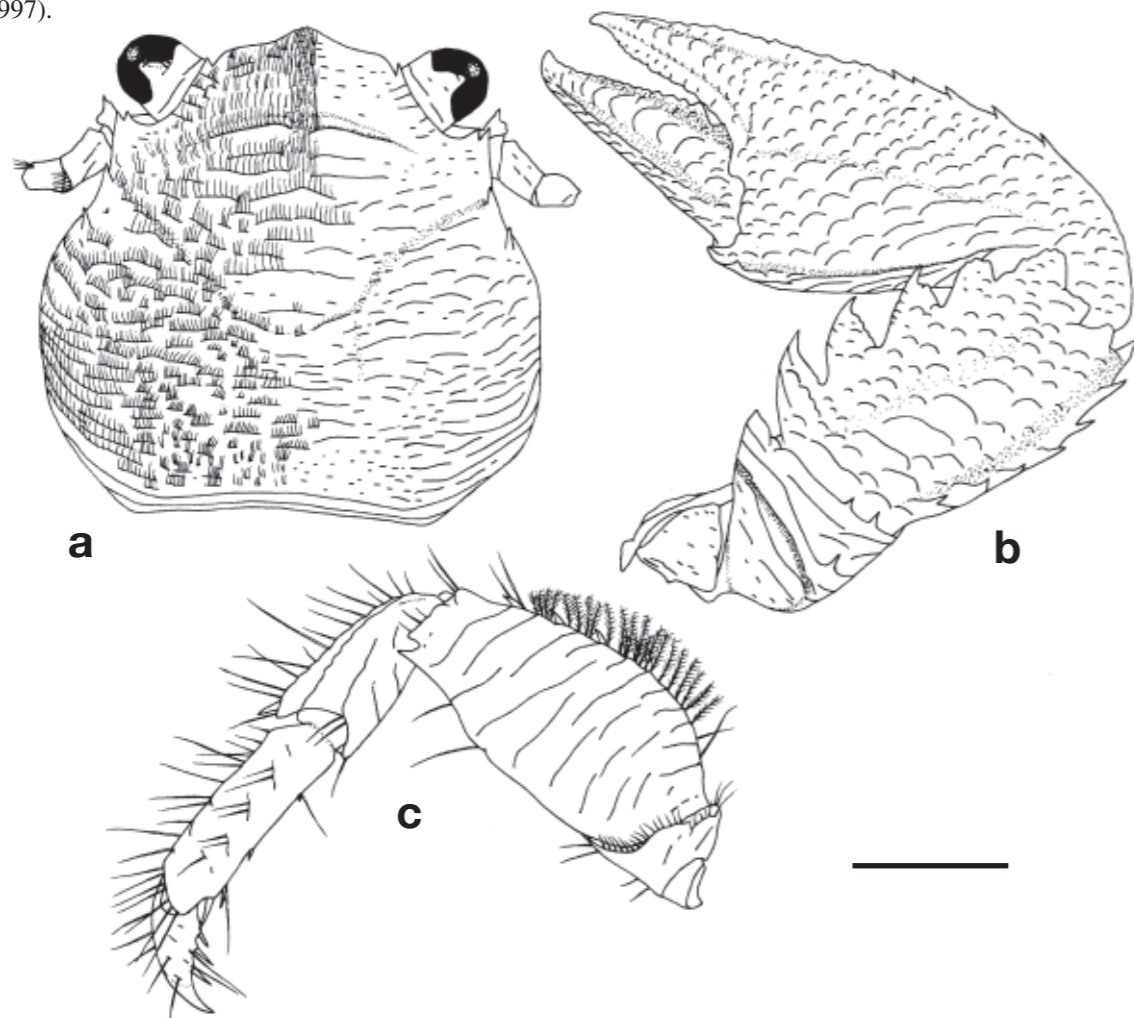


Fig. 95. Female (cl 6.0 mm), Wanlitong, Pingtung County, 2 Jun 1992: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, right cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale: a, c = 2.0 mm; b = 1.6 mm (after Osawa *et al.*, 2007 and under the permission from Koninklijke BRILL NV).

Petrolisthes extremus Kropp & Haig, 1994

遠方岩瓷蟹



Fig. 96. Ovigerous female (cl 6.1mm), Wanlitong, Pingtung County, 2 Jun 1992.

Petrolisthes extremus Kropp & Haig, 1994: 312, fig. 1 [type locality: Guam, Mariana Islands].—Hsieh *et al.*, 1997: 305, fig. 17.

Material examined.—Badouzih, Keelung City, 19 Dec 2006: 7 males (cl 4.1–7.6 mm), 1 female (cl 3.6 mm) (NTOU A00921). Longdong, Taipei County, 7 Dec 1991: 1 male (cl 10.1 mm) (NTOU A00989).—May 1999: 1 male (cl 14.3 mm) (NTOU A01139). Hongchaikeng, Pingtung County, 9 Sep 2005: 2 males (cl 3.7, 5.9 mm) (NTOU A00998). Wanlitong, Pingtung County, 2 Jun 1992: 1 male (cl 8.2 mm), 1 ovigerous female (cl 6.1 mm) (NTOU A01003).—9 Jan 1993: 1 male (cl 5.8 mm), 1 female (cl 6.1 mm) (NTOU A01140).—10 Jan 1993: 2 males (cl 2.7, 3.8 mm), 2 females (cl 3.2, 4.0 mm) (NTOU A00616).

Diagnosis.—Carapace with distinct transverse ridges on gastric region and branchial regions; rostrum trilobate; 1 supra-ocular spine and 1 epibranchial spine present; branchial margins convex, unarmed. Antennal peduncles each with distinct anterior lobe bearing anteroproximal spine on second article; third article not strongly produced at anterior proximal angle. Chelipeds with distinct transverse or oblique, squamiform ridges on dorsal surfaces of carpi and palms; carpi each with 3 or 4 spine-tipped, broad teeth on dorsoflexor margin,

dorso-extensor margin with 4–6 spines on distal half; chelae each with distinct longitudinal crest of oblique ridges along midline, extensor margin with row of acute or blunt spines, dorsoflexor margin unarmed. Ambulatory legs relatively slender; meri each with row of spines and plumose setae on extensor margin, lateral flexor margin with distinct distal spine on second pereopod, but unarmed on fourth pereopod; carpi each with disto-extensor spine on second pereopod; dactyli each with 3 corneous spines on flexor margin. Ridges on surfaces with row of short plumose setae on anterior margins.

Size.—To cl 14.3 mm (present study).

Coloration.—Carapace and chelipeds generally greenish to reddish brown; ridges reddish. Fingers of chelipeds reddish on margins. Ambulatory legs greenish brown on meri; propodi brown, each with pale blue band on proximal part; dactyli brown.

Habitat.—Intertidal to 7 m deep, found under rocks or base of pocilloporid corals (Haig & Kropp, 1994).

Distribution.—Cocos Keeling Islands in the eastern Indian Ocean. Taiwan, Ryukyu Islands, Mariana Islands, Lord Howe Island, Kermadec Islands, and Easter Island in the Pacific.

Remarks.—The paratypes of this species include some Taiwanese specimens. The present specimens identified to *P. extremus* include two forms. One form (a specimen from Longdong) differs from the typical form (specimens from other localities) in having a narrower rostrum and the palm of the cheliped with shorter and more numerous squamiform ridges on the dorsal median crest. Among the Taiwanese specimens, only the typical broad rostrum form in Taiwan has color information. The relationships between *P. extremus* and *P. melini* are given under the “Remarks” of *P. carinipes*.

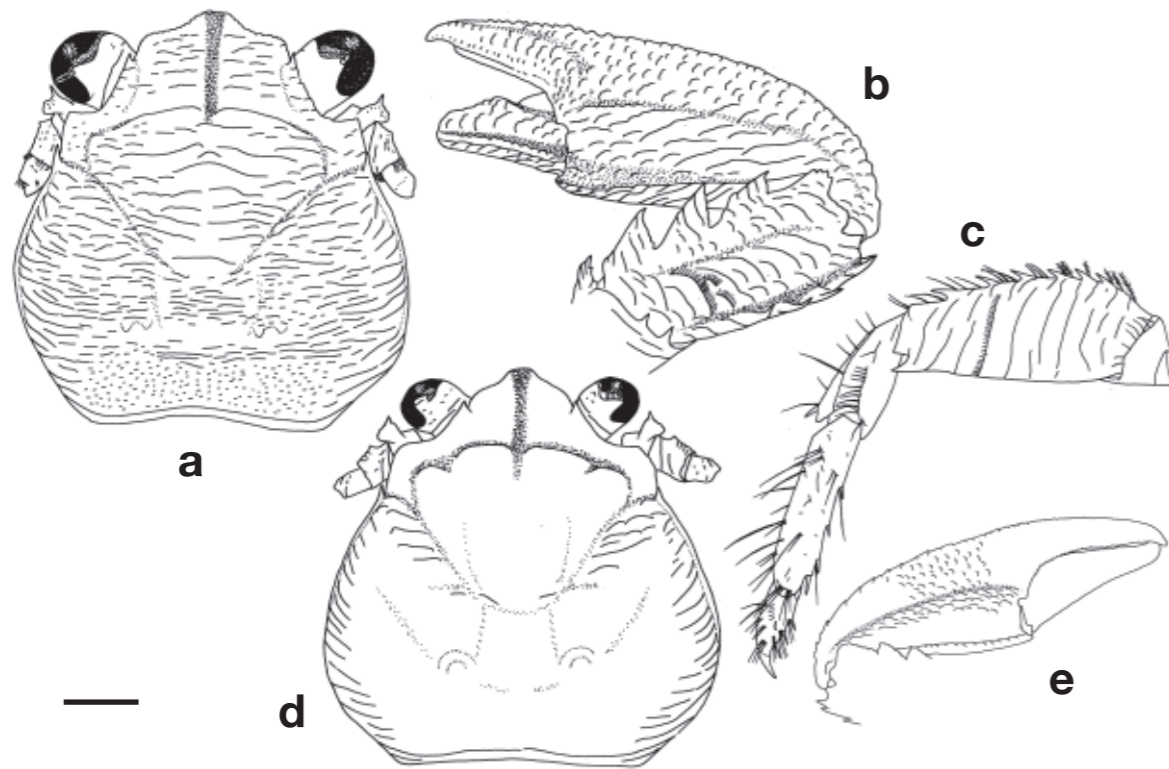


Fig. 97. Male (cl 5.8 mm), Wanlitong, Pingtung County, 9 Jan 1993, a–c; male (cl 14.3 mm), Longdong, Taipei County, May 1999, d–e: **a, d**, carapace and ocular and antennal peduncles, dorsal view; **b**, right cheliped, dorsal view; **c**, left second pereopod, lateral view; **e**, left chela, dorsal view. Scale: a, c = 1.0 mm; b = 1.3 mm; d = 2.5 mm; e = 5.0 mm.

Petrolisthes hastatus Stimpson, 1858

矛形岩瓷蟹



Fig. 98. Male (cl 12.1 mm), Fulong, Taipei County, 9 Aug 2006.



Fig. 99. Ovigerous female (cl 9.0 mm), Dabaisha, Ludao, Taitung County, 22 Jul 2009.



Fig. 100. Male (cl 11.5 mm), Hemei, Taipei County, 5 Aug 2009.



Fig. 101. Male (cl 7.2 mm), Kending, Pingtung County, 24 Jul 2009.

Petrolisthes hastatus Stimpson, 1858: 228 [type localities: Kikaisima Island, Amami-Osima Island, Ryukyu Islands]; 1907: 184, pl. 22—fig. 4.—Maki & Tsuchiya, 1923: 113, pl. 11—fig. 3.—Miyake, 1943: 54, figs. 5–6.—Nakasone & Miyake, 1971: 5, pl. 1—figs. A–D.—Hsieh *et al.*, 1997: 307, figs. 14D, 18.

Porcellana inermis Heller, 1862: 524 [type locality: Nicobar Islands].

Petrolisthes inermis.—De Man, 1893: 288, pl. 7—fig. 1; 1902: 691, pl. 23—fig. 36, 36a–d.

Petrolisthes tenkatei De Man, 1893: 289, pl. 7—fig. 2 [type locality: Endeh, Flores, Indonesia].

Petrolisthes n. sp.—De Man, 1902: 692, pl. 23—fig. 37, 37a–c.

Material examined.—Hepingdao, Keelung City, 2 Dec 1993: 1 male (cl 8.5 mm), 1 female (cl 9.2 mm) (NTOU A00652). Badouzh, Keelung City, 31 Oct 1992: 1 male (cl 5.3 mm), 2 females (cl 4.8, 6.6 mm) (NTOU A01012). Fulong, Taipei County, 4 Mar 2006: 2 males (cl 4.0, 8.2 mm), 1 ovigerous female (cl 6.2 mm), 1 female (cl 7.0 mm) (NTOU A01060).—4 Jun 2006: 1 male (cl 3.8 mm) (NTOU A01061).—9 Aug 2006: 3 males (cl 4.6–12.1 mm), 1 ovigerous female (cl 9.8 mm), 2 females (cl 5.1, 5.2 mm) (NTOU A01062).—20 Oct 2006: 28 males (cl 3.6–7.9 mm), 14 ovigerous females (cl 5.5–7.0 mm), 38 females (cl 3.6–8.2 mm), 1 damaged specimen (NTOU A01063).—6 Feb 2007: 3 males (cl 5.2–5.6 mm), 1 female (cl 4.3 mm) (NTOU A01064).—18 Aug 2009: 5 males (cl 6.5–8.6 mm) (NTOU A01030). Gongliao, Taipei County, no date: 2 ovigerous females (cl 9.6, 10.9 mm) (NTOU A01056). Hemei, Taipei County, 17 Apr 1992: 2 males (cl 9.7, 10.2 mm), 1 female (cl 4.9 mm) (NTOU A00638).—28 Sep 1992: 1 male (cl 5.4 mm), 1 female (cl 6.5 mm) (NTOU A00649).—24 Apr 1996: 1 female (cl 11.3 mm) (NTOU A01058).—10 Jan 2007: 1 male (cl 7.7 mm) (NTOU A01059).—5 Aug 2009: 1 male (cl 11.5 mm) (NTOU A00920). Magang, Taipei County, 9 Mar 1990: 1 male (cl 10.8 mm) (NTOU A00635).—22 Dec 1991: 1 male (cl 8.1 mm), 1 female (cl 10.6 mm) (NTOU A00636).—Dec 1991: 1 female (cl 11.0 mm) (NTOU A01067).—17 Apr 1992: 6 males (cl 3.8–12.2 mm), 10 females (cl 6.7–11.3 mm) (NTOU A00637).—2 Jun 1992: 5 males (cl 7.8–13.1 mm), 5 ovigerous females (cl 6.9–10.1 mm), 2 females (cl 6.1, 9.6 mm) (NTOU A00650).—30 Jun 1992: 2 males (cl 3.2, 9.3 mm) (NTOU A00663).—5 Feb 2007: 2 males (cl 4.4, 6.9 mm), 1 female (cl 9.0 mm) (NTOU A01068). Mao-ao, Taipei County, 22 Aug 2006: 1 male (cl 9.0 mm) (NTOU A01065).—8 Feb 2007: 1 male (cl 10.6 mm) (NTOU A01066). Shen-ao, Taipei County, 13 Mar 1990: 1 damaged specimen (NTOU A00668). Siao-sianglan, Taipei County, no date: 5 males (cl 3.2–10.2 mm), 2 ovigerous females (cl 7.3, 9.8 mm) (NTOU A01057). Checheng, Pingtung County, 12 Feb 1990: 2 males (cl 6.8, 8.6 mm) (NTOU A00626). Hongmaogang, Hsinchu County, 14 Oct 1989: 1 damaged specimen (NTOU A01077). Hongchaikeng, Pingtung County, 3 Jun 2005: 3 males (cl 3.9–7.1 mm) (NTOU A01076). Houwan, Pingtung County, 5 Jun 1992: 3 males (cl 4.6–6.4 mm) (NTOU A00427). Jioupeng, Pingtung County, 22 Jan 1992: 7 males (cl 6.2–9.2 mm), 1 ovigerous females (cl 7.4 mm), 2 females (cl 7.7, 8.5 mm) (NTOU A00665).—19 Mar 1992: 20 males (cl 3.2–10.1 mm), 11 females (cl 3.0–7.6 mm) (NTOU A01078).—10 Jan 1993: 4 males (cl 6.4–9.1 mm), 2 ovigerous females (cl 8.2, 10.1 mm), 1 female (cl 8.0 mm) (NTOU A00639). Kending, Pingtung County, 24 Jul 2009: 1 male (cl 7.2 mm) (NTOU A00919). Nanwan, Pingtung County, 26 Jan 1991: 1 male (cl 9.1 mm), 1 female (cl 8.1 mm) (NTOU A01074).—23 Oct 1991: 1 ovigerous female (cl 6.8 mm), 1 female (cl 7.5 mm) (NTOU A01075). Wanlitong, Pingtung County, 29 Jan 1986: 3 damaged specimens (NTOU A00627).—18 Mar 1992: 1 male (cl 8.9 mm), 2 ovigerous females (cl 6.3, 6.7 mm) (NTOU A00628). Pingtung County, 26 Oct 1985: 8 males (cl 5.4–11.3 mm), 8 females (cl 5.6–7.6 mm) (NTOU A00630). Chenggong, Taitung County, 28 Feb 1992: 2 males (cl 6.9, 8.5 mm), 2 females (cl 6.2, 6.4 mm) (NTOU A01072). Sansiantai, Taitung County, 11 Oct 1991: 4 males (cl 6.9–7.9 mm), 1 female (cl 7.2 mm) (NTOU A00632).—11 Dec 1991: 8 males (cl 5.8–10.1 mm) (NTOU A00664).—27 Feb 1992: 38 males (cl 4.3–9.8 mm), 1 ovigerous female (cl 10.7 mm), 2 females (cl 9.5, 9.8 mm), 2 damaged specimens (NTOU A01069). Shanyuan, Taitung County, 20 Apr 1992: 2 males (cl 7.8, 8.1 mm), 3 ovigerous females (cl 4.9–5.2 mm), 1 female (cl 5.0 mm) (NTOU A01075). Dabaisha, Ludao, Taitung County, 22 Jul 2009: 1 ovigerous female (cl 9.0

mm) (NTOU A00918).—no date: 7 males (cl 7.1–11.3 mm), 1 ovigerous female (cl 10.7 mm), 2 females (cl 9.5, 9.8 mm), 2 damaged specimens (NTOU A01069). East coast, Taiwan, 27 Feb 1992: 2 males (cl 9.1, 9.2 mm) (NTOU A01071). No specific locality: 4 May 1981: 1 male (cl 8.9 mm), 1 female (cl 8.1 mm) (NTOU A00266).—14 Jul 1992: 1 male (cl 8.5 mm) (NTOU A01055).—11 Dec 2008: 3 ovigerous females (cl 6.0–9.6 mm) (NTOU A01081).—no date: 1 female (cl 10.6 mm) (NTOU A01083).—1 male (cl 11.1 mm) (NTOU A01084).—1 female (cl 8.8 mm) (NTOU A01085).—1 male (cl 4.0 mm) (NTOU A01086).—1 damaged specimen (NTOU A01082).

Diagnosis.—Carapace with numerous short, delicate striae on gastric region and anterior branchial region; rostrum sinuously triangular; no supra-ocular spine; brachial margins convex, unarmed at anterior angle of cervical groove. Second article of antennal peduncle with distinct anterior lobe. Chelipeds with numerous short striae and small flattened tubercles on dorsal surface; carpus armed with 2–4 comparatively narrow, small teeth on dorsoflexor margin, proximal tooth largest and acute; dorso-extensor margin unarmed except for distal strong acute projection; palm unarmed and without setae on extensor margin; dactyli each with dense short plumose setae on cutting region. Ambulatory legs moderately slender; meri somewhat crenulated, unarmed or with 1–6 spines and plumose setae on extensor margin, lateral flexor margin with distinct distal spine each on second and third pereopods, but unarmed on fourth pereopod; carpi each unarmed on extensor margin; dactyli each with 3 corneous spines on flexor margin. Ridges on surfaces with sparse short setae on anterior margins.

Size.—To cl 13.3 mm (Hsieh *et al.*, 1997).

Coloration.—Carapace and pereopods brown, yellowish brown or bluish brown, usually with irregular dark brown or black marks. Fingers of chelipeds orange at distal tips; dactyli also with small orange mark at base of cutting edge. Propodi of ambulatory legs dark brown, with white bands on proximal and distal parts.

Habitat.—Intertidal, under rocks.

Distribution.—Indonesia, Sulu Islands, then westward through Malay Archipelago to east coast of India; Singapore northward to Tokara Islands in Japan; New Guinea eastward to New Caledonia, Fiji, and Samoa.

Remarks.—The taxonomy and intraspecific variations of this species have been extensively discussed by Haig (1964) and Nakasone & Miyake (1971) (also see Osawa, 2007b). *Petrolisthes hastatus* seems to agree with *P. leptocheles* (Heller, 1861), known from the northwestern Indian Ocean including Red Sea and Persian Gulf, in almost all morphological aspects (see Lewinsohn, 1969; Tirmizi *et al.*, 1989; Werding & Hiller, 2007). Careful comparison between the materials from the northwestern Indian Ocean and other Indo-West Pacific areas is necessary to determine if *P. hastatus* and *P. leptocheles* are synonymous.

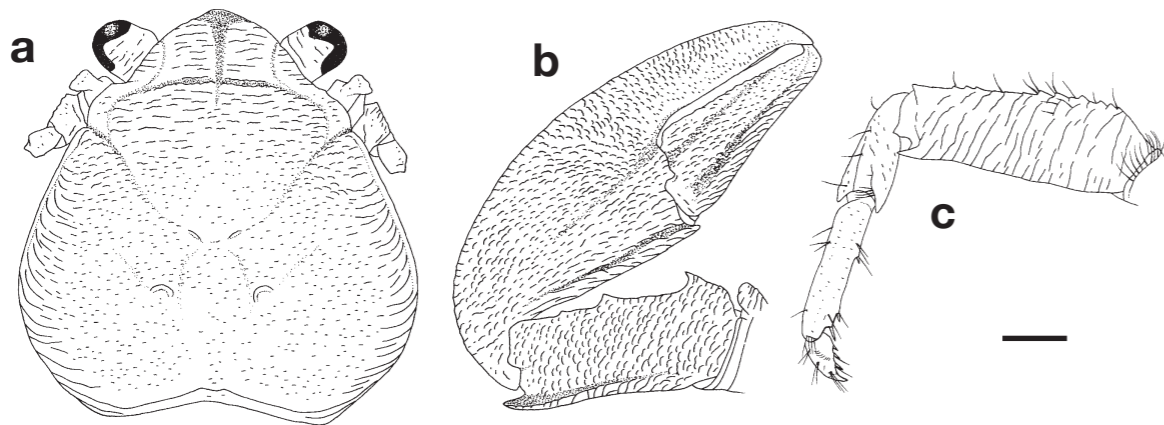


Fig. 102. Male (cl 12.1 mm), Fulong, Taipei County, 9 Aug 2006: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, left cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale: a, c = 2.0 mm; b = 3.1 mm.

Petrolisthes haswelli Miers, 1884

哈氏岩瓷蟹



Fig. 103. Male (cl 11.0 mm), Yong-an fishing port, Taoyuan County, 15 Oct 1989.

Petrolisthes haswelli Miers, 1884: 269, pl. 29–fig. A [type locality: Thursday Island, Torres Straits, Queensland].—Haig, 1979: 123, fig. 4.—Yang & Sun, 1992: 199, figs. 4–5.—Hsieh *et al.*, 1997: 324, figs. 24E, 27.

Material examined.—Fulong, Taipei County, 4 Mar 2006: 1 male (cl 15.6 mm) (NTOU A01141).—6 Feb 2007: 1 female (cl 9.5 mm) (NTOU A00952). Magang, Taipei County, 3 Oct 1991: 1 male (cl 12.0 mm), 5 females (cl 5.4–10.8 mm) (NTOU A00676).—Nov 1991: 1 female (cl 13.2 mm) (NTOU A00948).—2 Jun 1992: 1 male (cl 7.7 mm) (NTOU A00949).—5 Feb 2007: 1 female (cl 2.9 mm) (NTOU A00950). Shen-ao, Taipei County, 13 Mar 1990: 4 males (cl 8.1–9.3 mm), 3 females (cl 8.1–12.0 mm) (NTOU A00669). Yong-an fishing port, Taoyuan County, 15 Oct 1989: 1 male (cl 11.0 mm) (NTOU A00681). Nanwan, Pingtung County, 23 Jan 1992: 2 males (cl 4.4, 6.6 mm), 6 females (cl 4.2–8.3 mm) (NTOU A00674). Wanlitong, Pingtung County, 1 Jun 1992: 3 ovigerous females (cl 6.5–8.0 mm) (NTOU A00672). Jibei, Penghu County, 6 Sep 1990: 1 male (cl 11.3 mm), 2 females (cl 9.4, 9.6 mm) (NTOU A00670). No specific locality: 1 female (cl 10.8 mm) (NTOU A00951).—1 male (cl 19.8 mm) (NTOU A00953).—1 male (cl 17.3 mm) (NTOU A00972).

Diagnosis.—Carapace with numerous short, relatively distinct striae on gastric region and anterior branchial region; rostrum sinuously triangular; no supra-ocular spine; brachial margins convex, each with epibranchial spine at anterior angle of cervical groove. Second article of antennal peduncle with distinct anterior lobe. Chelipeds with numerous short, comparatively distinct striae and small flattened tubercles on dorsal surface; carpus armed with 4–6 broad teeth on dorsoflexor margin, proximal tooth largest; dorso-extensor margin with 3 spines on distal third; palm unarmed and without setae on extensor margin. Ambulatory legs moderately stout; meri unarmed, each with sparse short plumose setae on extensor margin, lateral flexor margin with distinct distal spine each on second and third pereopods, but unarmed on fourth pereopod; carpi each with disto-extensor spine on second pereopod; dactyli each with 3 corneous spines on flexor margin. Ridges on surfaces with short setae on anterior margins.

Size.—To cl 19.8 mm (present study).

Coloration.—Carapace and chelipeds brown, with numerous irregular, reddish marks. Fingers of chelipeds reddish on margins. Ambulatory legs also brown, with small reddish marks on meri and carpi; propodi red with white bands on proximal and lateral parts; dactyli also reddish.

Habitat.—Intertidal, under rocks.

Distribution.—Loyalty Islands, Australia (Queensland, Northern Territory, and Western Australia), Moluccas, Guangxi and Hainan Island in China, Taiwan, and Ryukyu Islands.

Remarks.—*Petrolisthes haswelli* is very similar to a form of the “*P. lamarckii*” species complex that has a sinuously triangular rostrum and the carpus of the cheliped armed with more than four teeth on the dorsoflexor margin. Their preserved specimens are generally very difficult to distinguish from each other. In *P. haswelli*, the carapace is more strongly convex, more striate, and more densely setose on the dorsal surface, and the rostrum may be more strongly bent ventrally. Live and fresh specimens of *P. haswelli* lack a row of broadly spaced small orange spots along the extensor margin of the dorsal surface of the chela, the row of color spots is always present in this form of the “*P. lamarckii*” species complex.

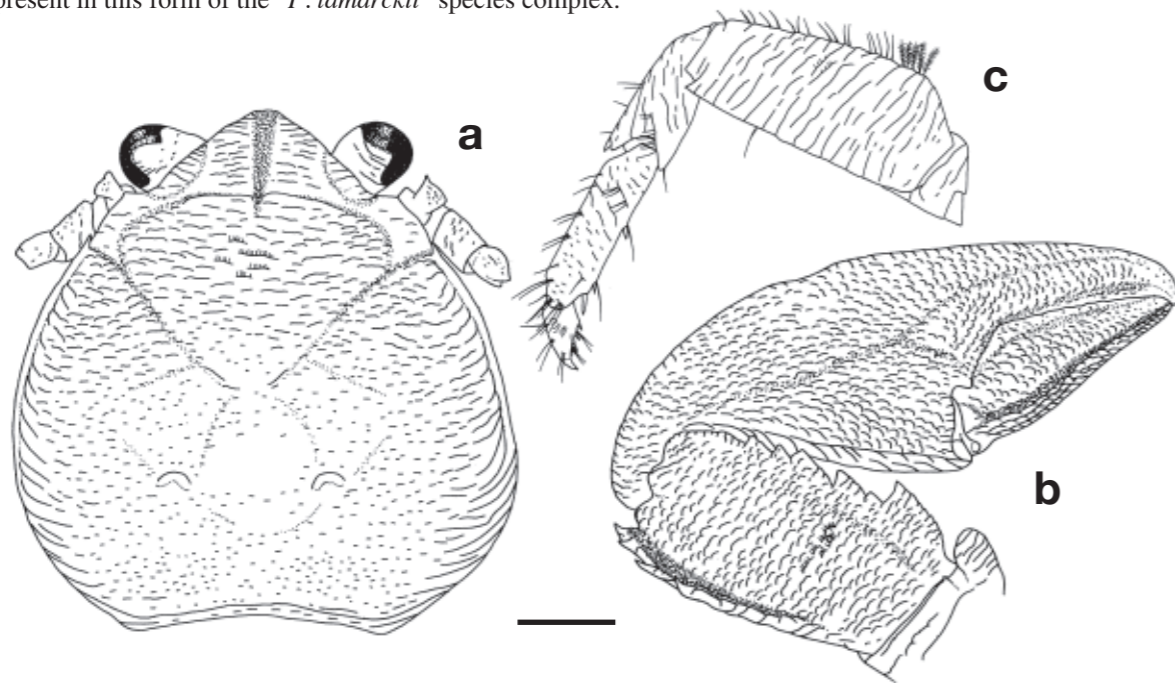


Fig. 104. Male (cl 15.6 mm), Fulong, Taipei County, 4 Mar 2006: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, left cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale: a, c = 3.0 mm; b = 3.7 mm

Petrolisthes heterochrous Kropp, 1986

異色岩瓷蟹



Fig. 105. Lanyu, Taitung County, 23 Jul 1985.

Petrolisthes heterochrous Kropp, 1986: 458, fig. 3 [type locality: Guam, Mariana Islands].

Petrolisthes militaris.—Yang, 1983: 1, pl. 1.—Yang & Xu, 1994: 113, fig. 1A. [not *Petrolisthes militaris* (Heller, 1862)]

Material examined.—Lanyu, Taitung County, 23 Jul 1985: 1 specimen (from photograph with specimen not located).

Diagnosis.—Carapace with distinct transverse ridges on gastric region; rostrum trilobate, unarmed at lateral angles of lateral lobes; 1 supra-ocular spine and 2 epibranchial spines present; branchial margins convex, with 1 or 2 median spines. Second article of antennal peduncle with distinct anterior lobe bearing anteroproximal spine. Chelipeds with distinct transverse or oblique, squamiform ridges on dorsal surfaces of carpi and palm; carpi each with 4 usually spine-tipped, broad teeth on dorsoflexor margin, dorso-extensor margin with 5 spines on distal two thirds; chelae each with distinct longitudinal crest of short ridges along midline, extensor margin with row of spines and plumose setae, dorsoflexor margin unarmed. Ambulatory legs relatively slender; meri each with row of spines and plumose setae on extensor margin, lateral flexor margin

with distinct distal spine each on second and third pereopods but unarmed on fourth pereopod; carpi each with disto-extensor spine on second pereopod; dactyli each with 4 corneous spines on flexor margin. Ridges on surfaces with row of short plumose setae on anterior margins.

Size.—To cl 5.1 mm (present study).

Coloration.—Variable. One extreme: carapace almost uniform red-purple with 2 white spots at mesobranchial spines; sometimes reddish with scattered orange patches, with transverse white and orange bands on rostrum. Other extreme: carapace light tan with mottled pattern of blue-green, tan-orange. Many intermediate patterns between two extremes (Kropp, 1986). In the Taiwanese specimen, carapace and chelipeds light tan with some red marks. Ambulatory legs red; meri and propodi each with white band on median parts.

Habitat.—Subtidal to 30 m deep; occurring in crevices in dead coral rubbles, dead branching corals, and on the base of living corals.

Distribution.—Western Pacific: Nansha and Xisha Islands in the South China Sea, Ryukyu Islands, Mariana Islands, Marshall Islands, New Caledonia, Loyalty Islands, and Chesterfield Islands. Now from Taiwan.

Remarks.—*Petrolisthes heterochrous* is most similar to *P. aegyptiacus* Werding & Hiller, 2007 from the Red Sea, but is distinguished by the presence of two instead of one epibranchial spines on each side of the carapace. *Petrolisthes militaris* (Heller, 1862) and *P. scabriculus* (Dana, 1852) also resemble *P. heterochrous*, but differ in the shape of the rostrum and armature on the internal orbital margins of the carapace. The rostrum is sinuously triangular in *P. militaris*, whereas it is trilobate in *P. heterochrous* and *P. scabriculus*. The internal orbital angles each have a small spine in *P. scabriculus*, but this spine is absent in *P. heterochrous* and *P. militaris*. The present photograph clearly represents *P. heterochrous*, although the specimen cannot be now located. Thus, the diagnosis and line drawings of this species are based on a specimen from the Ryukyu Islands, southwestern Japan, close to Taiwan. This is the first record of *P. heterochrous* from Taiwan.

Petrolisthes japonicus (De Haan, 1849)

日本岩瓷蟹



Fig. 107. Male (cl 6.8 mm), Hemei, Taipei County, 5 Aug 2009.

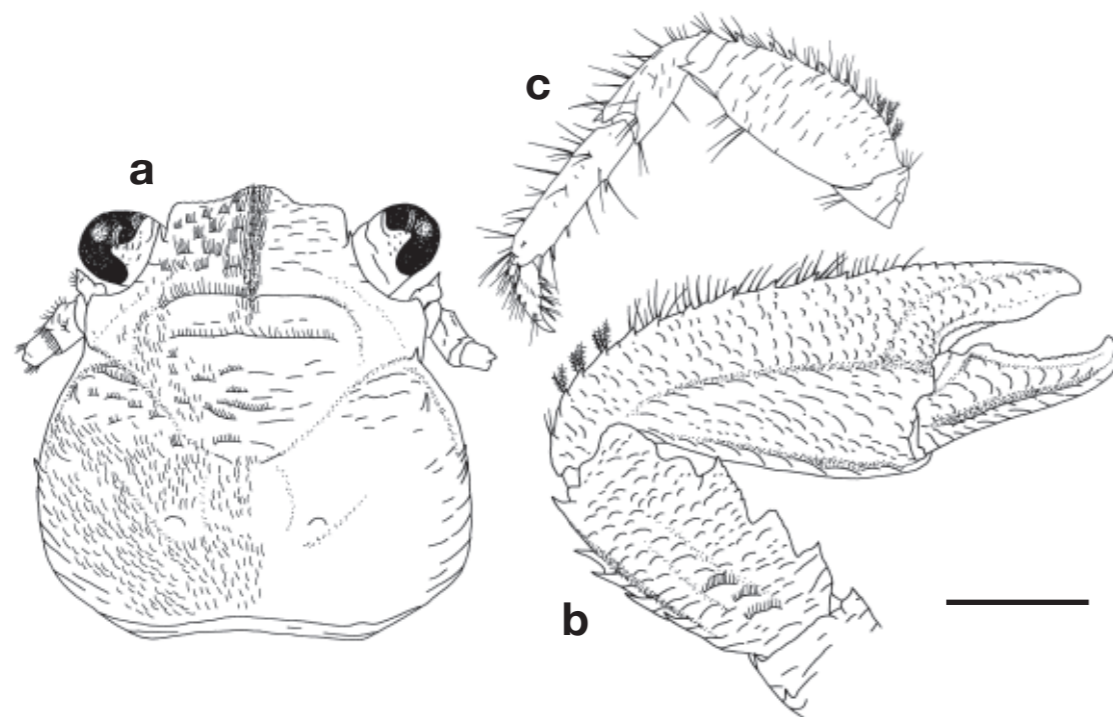


Fig. 106. Male (cl 5.1 mm), Kuroshima Island, Ryukyu Islands, Japan, 4 Aug 1993: a, carapace and ocular and antennal peduncles, dorsal view; b, left cheliped, dorsal view; c, left second pereopod, lateral view. Scale: a, c = 1.6 mm; b = 1.8 mm.

Porcellana japonica De Haan, 1849: 199, pl. 50—fig. 5 [type locality: Japan].

Petrolisthes japonicus.—Miyake, 1943: 72, figs. 11–13.—Dörjes & Cheng, 1986: 228.—Haig, 1992: 314, fig. 10.—Hsieh *et al.*, 1997: 313, figs. 14G, 21.

Petrolisthes teres.—Melin, 1939: 104, figs. 65–66. [not *Petrolisthes teres* Melin, 1939; new name for *Petrolisthes inermis* Haswell, 1882, which is a homonym of *Porcellana inermis* Heller, 1862 (= *Petrolisthes hastatus* Stimpson, 1858)]

Material examined.—Wanghaixiang, Keelung City, 31 Oct 1992: 1 female (cl 5.3 mm) (NTOU A01034). Fulong, Taipei County, 9 Aug 2006: 1 male (cl 3.5 mm), 1 ovigerous female (cl 7.9 mm) (NTOU A01018).—6 Feb 2007: 2 females (cl 5.0, 6.3 mm) (NTOU A01020).—no date: 1 male (cl 7.5 mm) (NTOU A01019). Gongliao, Taipei County, no date: 3 males (cl 4.7–9.4 mm), 1 ovigerous female (cl 5.5 mm) (NTOU A01032). Hemei, Taipei County, 17 Apr 1992: 15 males (cl 4.8–10.4 mm), 2 females (cl 6.3, 8.1 mm), 1 damaged specimen (NTOU A01040).—16 Mar 1992: 1 female (cl 7.4 mm) (NTOU A00969).—24 Apr 1996: 3 males (cl 8.8–11.4 mm) (NTOU A01016).—7 Feb 2007: 2 females (cl 4.2, 5.2 mm) (NTOU A01014).—5 Aug 2009: 3

males (cl 4.5–7.1 mm), 1 ovigerous female (cl 6.5 mm), 1 juvenile (cl 3.0 mm) (NTOU A01015). Longdong, Taipei County, 22 Nov 2002: 1 female (cl 7.2 mm) (NTOU A01017).—19 Dec 2006: 1 female (cl 5.1 mm) (NTOU A01177).—1999: 2 males (cl 10.4, 12.0 mm), 1 ovigerous female (cl 8.5 mm) (NTOU A01033). Magang, Taipei County, 27 Apr 1990: 1 male (cl 5.0 mm) (NTOU A00656).—Nov 1991: 4 males (cl 6.3–8.4 mm), 2 females (cl 6.1, 7.2 mm), 2 damaged specimens (NTOU A01028).—17 Apr 1992: 23 males (cl 5.1–10.4 mm), 19 ovigerous females (cl 5.4–7.7 mm), 3 females (cl 5.0–7.0 mm) (NTOU A00653).—17 Apr 1992: 1 male (cl 5.3 mm) (NTOU A00657).—2 Jun 1992: 3 males (cl 7.1–8.2 mm), 5 ovigerous females (cl 6.0–7.9 mm), 2 females (cl 6.4, 7.4 mm) (NTOU A01029).—30 Jun 1992: 2 males (cl 8.1, 8.8 mm) (NTOU A01025).—5 Feb 2007: 1 male (cl 4.7 mm), 1 female (cl 5.2 mm) (NTOU A01024).—no date: 4 males (cl 5.4–9.9 mm), 1 ovigerous female (cl 7.4 mm), 5 females (cl 7.0–8.4 mm) (NTOU A01022), 3 ovigerous females (cl 7.0–8.0 mm) (NTOU A01026). Mao-ao, Taipei County, 9 Mar 1990: 3 males (cl 7.3–7.5 mm), 1 female (cl 6.7 mm) (NTOU A00658).—8 Feb 2007: 1 male (cl 5.4 mm), 1 female (cl 6.9 mm) (NTOU A01021). Siasianglan, Taipei County, 16 Jul 1992: 10 males (cl 3.3–4.3 mm), 5 females (cl 3.4–4.1 mm), 9 juveniles (cl 2.5–3.0 mm) (NTOU A00433). Yong-an fishing port, Taoyuan County, 15 Oct 1989: many damaged specimens (NTOU A01036). Houlong, Miaoli County, 28 Oct 1992: 9 males (cl 4.0–8.0 mm), 8 females (cl 4.0–7.2 mm) (NTOU A00428).—12 Sep 1981: 20 males (cl 3.7–9.2 mm), 4 females (cl 4.3–5.6 mm), 2 juveniles (cl 2.3, 2.9 mm) (NTOU A00429).—11 May 1991: 1 ovigerous female (cl 8.4 mm) (NTOU A00434).—12 Sep 1992: 1 damaged specimen (NTOU A01031). Jialulan, Taitung County, 28 Feb 1992: 4 males (cl 5.8–8.9 mm), 1 female (cl 6.8 mm) (NTOU A01035). Fongguei, Penghu County, 2 Sep 1990: 3 males (cl 5.9–9.0 mm), 1 female (cl 7.7 mm) (NTOU A00659).—2 Sep 1990: 1 damaged specimen (NTOU A00654). Sansiantai, Taitung County, 11 Dec 1991: 1 male (cl 10.8 mm) (NTOU A01142). Wang-an, Penghu County, 28 Sep 1992: 6 males (cl 3.3–6.7 mm), 2 females (cl 3.7, 7.6 mm), 2 juveniles (cl 2.1, 2.8 mm) (NTOU A00660). Penghu County, 28 Sep 1992: 7 males (cl 5.9–9.0 mm), 2 females (cl 5.9, 6.7 mm) (NTOU A01027). Wuciou, Kinmen County, 5 Apr 1988: 2 males (cl 7.1, 7.9 mm) (NTOU A00655). No specific locality: 10 males (cl 3.3–7.9 mm), 1 ovigerous female (cl 7.0 mm), 11 females (cl 4.2–7.6 mm), many damaged specimens (NTOU A01039).—1 male (cl 7.5 mm) (NTOU A01038).—1 ovigerous female (cl 6.7 mm) (NTOU A01037).

Diagnosis.—Carapace with numerous short, delicate striae on gastric region and anterior branchial region; rostrum sinuously triangular; no supra-ocular spine; brachial margins convex, unarmed at anterior angle of cervical groove. Second article of antennal peduncle with rounded or subtriangular anterior lobe, frequently bearing small anteroproximal spine. Chelipeds with numerous short, delicate striae on dorsal surface; carpus armed with single, usually acute (but occasionally blunt) tooth on dorsoflexor margin proximally, sometimes with additional small spiniform tooth; dorso-extensor margin with 2 or 3 spines on distal third; palm unarmed and without setae on extensor margin. Ambulatory legs relatively stout; meri unarmed, each with sparse short setae on extensor margin, lateral flexor margin with distinct distal spine each on second and third pereopods, but unarmed on fourth pereopod; carpi each with disto-extensor spine on second pereopod; dactyli each with 3 corneous spines on flexor margin. Ridges on surfaces with sparse short setae on anterior margins.

Size.—To cl 12.0 mm (present study).

Coloration.—Carapace and pereopods generally brown or bluish brown, with irregular narrow, pale blue marks. Dactyli of chelipeds each with small orange mark on proximal part of cutting edge. Propodi of ambulatory legs each with white band on proximal part.

Habitat.—Intertidal, found under rocks.

Distribution.—Japan (Honshu to Kyushu, Ogasawara and Ryukyu Islands), Korea, China (Hong Kong and Guangxi to Zhejiang), and Taiwan.

Remarks.—*Petrolisthes japonicus* is one of the commonest porcellanids in intertidal rocky shores of

eastern Asian waters.

Melin (1939) gave a new name, *Petrolisthes teres*, for *Petrolisthes inermis* Haswell, 1882 because the latter name was preoccupied by *Porcellana inermis* Heller, 1862 (= *Petrolisthes hastatus* Stimpson, 1858). Thus, the types of *Petrolisthes teres* should be the material described as *P. inermis* by Haswell (1882) and not the Bonin (Ogasawara) Islands specimens that Melin (1939) used to describe *P. teres*. Haig (1964) later pointed out that Melin (1939) was wrong in identifying his Ogasawara material with Haswell's (1882) species. Re-examination of Melin's (1939) specimens (Kopepe Bay, Bonin Islands, 6 Aug 1914, one male cl 7.0 mm, one female cl 3.1 mm, SMNH 2297) has revealed that they are actually *P. japonicus*. The syntypes of *P. teres* (= *P. inermis* Haswell, 1882; Port Denison, Queensland, Australia, two specimens, not measured, AM P3891) are now dry and mounted on a glass slide. Judging from the photographs of the syntypes provided by P. Berents, there is a small spine on the anterior margin of the third article of the antennal peduncle. Such a spine is absent in *P. japonicus*. Among other morphologically allied congeners, the spine is present in *P. elongatus* (H. Milne Edwards, 1837), *P. kranjiensis* Johnson, 1970, *P. limicola* Haig, 1988 as well as those '*P. inermis*' reported by Miyake (1943) and '*P. teres*' reported by Johnson (1970). More detailed studies will be necessary to determine the exact identity of *P. teres*.

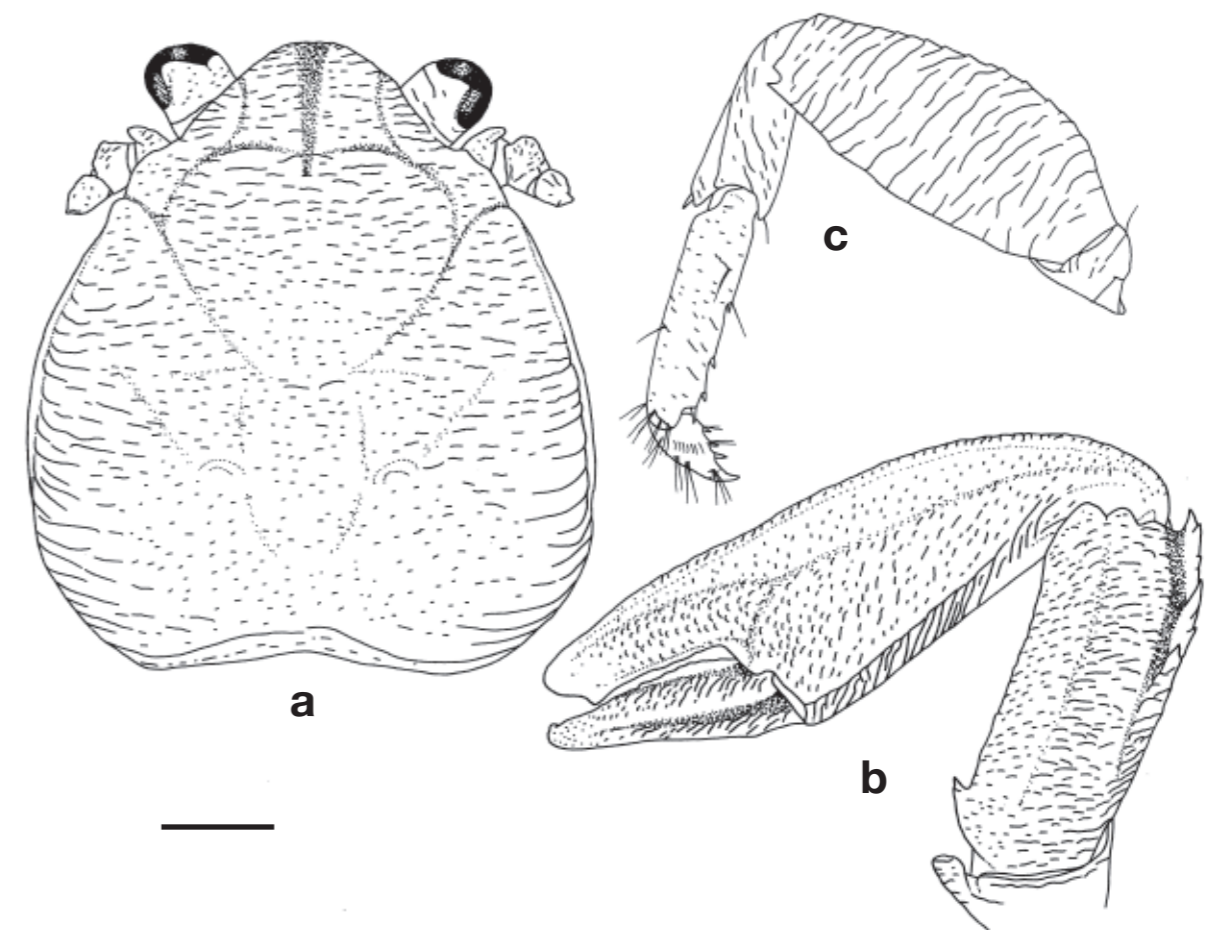


Fig. 108. Male (cl 10.8 mm), Sansiantai, Taitung County, 11 Dec 1991: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, right cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale: a, c = 2.0 mm; b = 3.2 mm.

Petrolisthes lamarckii (Leach, 1820)
拉氏岩瓷蟹



Fig. 109. Hepingdao, Keelung City, 10 Jul 2005.



Fig. 111. Fulong, Taipei County, Mar 2006.



Fig. 110. Ovigerous female (cl 9.2 mm), Hemei, Taipei County, 5 Aug 2009.



Fig. 112. Male (cl 5.7 mm), Fulong, Taipei County, 18 Aug 2009.

Pisidia lamarckii Leach, 1820: 54 [type locality: not specified].

Porcellana dentata H. Milne Edwards, 1837: 251 [type locality: Java].

Porcellana pulchripes White, 1847: 129 [*nomen nudum*].

Porcellana speciosa Dana, 1852: 417 [type localities: Drummond Island, Kingsmills Group; Wake Island; Mangsi Islands, Philippines; Raraka, Tuamotu Archipelago]; 1855: pl. 26–fig. 8.

Porcellana bellis Heller, 1865: 76 [type locality: Nicobar].

Petrolisthes lamarckii.—Miyake, 1942: 342, text-figs. 7–8; 1943: 98, fig. 29.—Kropp, 1984: 100.—Haig, 1992: 315, fig. 11.—Hsieh *et al.*, 1997: 326, figs. 24F, 28.

Material examined.—Badouzi, Keelung City, Nov 1981: 1 female (cl 7.5 mm) (NTOU A00678). Hepingdao, Keelung City, 13 Oct 1993: 1 female (cl 6.6 mm) (NTOU A00987). Wanghaixiang, Keelung City, 31 Oct 1992: 2 males (cl 3.0, 7.0 mm) (NTOU A00988). Fulong, Taipei County, 4 Jun 2006: 2 males (cl 3.2, 3.9 mm) (NTOU A00960).—26 Jun 2006: 6 males (cl 2.6–10.2 mm), 3 females (cl 3.7–5.7 mm) (NTOU A00958).—9 Aug 2006: 12 males (cl 3.4–14.5 mm), 2 ovigerous females (cl 5.9, 8.4 mm), 9 females (cl 3.4–12.2 mm) (NTOU A00955).—20 Oct 2006: 21 males (cl 3.4–6.8 mm), 2 ovigerous females (cl 5.6, 6.3 mm), 16 females (cl 4.4–8.8 mm) (NTOU A00954).—20 Oct 2006: 3 males (cl 8.6–9.4 mm) (NTOU A00959).—6 Feb 2007: 12 males (cl 6.08–10 mm), 5 females (cl 6.58–10.43 mm) (NTOU A01122).—4 Mar 2007: 1 female (cl 6.7 mm) (NTOU A00961).—18 Dec 2008: 1 male (cl 10.8 mm) (NTOU A00957).—18 Aug 2009: 1 male (cl 5.7 mm), 1 ovigerous female (cl 4.7 mm) (NTOU A00956). Gongliao, Taipei County, no date: 2 males (cl 7.2, 10.6 mm) (NTOU A00990). Hemei, Taipei County, 1 Dec 2006: 2 males (cl 7.6, 8.0 mm), 2 females (cl 3.8, 4.4 mm) (NTOU A00967).—5 Aug 2009: 1 ovigerous female (cl 9.2 mm) (NTOU A00968). Magang, Taipei County, 17 Apr 1992: 2 males (cl 4.1, 4.2 mm), 1 female (cl 3.1 mm) (NTOU A00964).—2 Jun 1992: 1 male (cl 6.9 mm), 1 female (cl 4.4 mm) (NTOU A00265).—14 Jul 1992: 1 male (cl 14.1 mm) (NTOU A01143).—2 Jun 2003: 1 male (cl 7.0 mm) (NTOU A00966).—2006: 1 male (cl 6.7 mm) (NTOU A00965).—5 Feb 2007: 4 males (cl 3.8–7.6 mm), 2 females (cl 2.6, 3.8 mm) (NTOU A00963).—no date: 3 males (cl 5.3–9.6 mm), 1 damaged specimen (NTOU A00962). Mao-ao, Taipei County, 20 Oct 2006: 17 males (cl 4.0–8.3 mm), 2 ovigerous females (cl 5.8, 7.2 mm), 10 females (cl 3.7–11.1 mm), 4 juveniles (cl 3.0–3.1 mm) (NTOU A00991). Yong-an, Taoyuan County, 15 Oct 1989: 1 male (cl 11.0 mm) (NTOU A00681). Houlong, Miaoli County, 12 Sep 1992: 7 males (cl 9.26–16.56 mm), 2 ovigerous females (cl 12.7, 13.0 mm), 2 females (cl 8.3, 10 mm), 3 juveniles (cl 1.8–3.0 mm) (NTOU A01121). Maobitou, Pingtung County, no date: 1 female (cl 7.3 mm) (NTOU A00426). Nanwan, Pingtung County, 23 Oct 1991: 2 damaged specimens (NTOU A00996). Siaoliouciou, Pingtung County, 20 Mar 1992: 10 males (cl 5.7–11.2 mm), 15 ovigerous females (cl 5.6–8.7 mm), 2 females (cl 5.4, 7.1 mm) (NTOU A00994). Wanlitong, Pingtung County, 1 Jun 1992: 1 male (cl 6.6 mm), 1 female (cl 5.8 mm) (NTOU A00682). South Taiwan, no date: 1 male (cl 7.6 mm) (NTOU A00993). Shanyuan, Taitung County, 20 Apr 1992: 1 male (cl 8.7 mm) (NTOU A00677). Baisha, Penghu County, Apr 1979: 1 female damaged (NTOU A00992). Fongguei, Penghu County, 2 Sep 1990: 3 males (cl 12.0–17.4 mm) (NTOU A00677). Guoye, Penghu County, 23 Apr 1992: 1 female (cl 6.4 mm) (NTOU A00999).—24 Apr 1994: 1 damaged specimen (NTOU A00997). Penghu County, 11 Oct 1984: 2 males (cl 15.9, 19.0 mm), 2 females (cl 9.0, 10.7 mm) (NTOU A00930).—2 Sep 1990: 2 males (cl 15.9, 17.4 mm) (NTOU A01145). Tongwangkoucyu (locality in Taiwan unable to locate), 14 Jan 1982: 14 Jul 1992: 3 females (cl 3.2–6.4 mm), 2 damaged specimens (NTOU A00671). 1 male (cl 10.3 mm), 1 female (cl 9.3 mm) (NTOU A00680). No specific locality: 14 Jul 1992: 3 females (cl 3.2–6.4 mm), 2 damaged specimens (NTOU A00671).—1 male (cl 8.2 mm) (NTOU A01000).—3 females (cl 8.0–8.7 mm) (NTOU A01001).—1 male (cl 14.8 mm) (NTOU A01002).

Diagnosis.—Carapace with numerous, short delicate striae on gastric region and anterior branchial region; rostrum trilobate or sinuously triangular; no supra-ocular spine; brachial margins convex, each with epibranchial

spine at anterior angle of cervical groove. Second article of antennal peduncle with distinct anterior lobe. Chelipeds with numerous, short delicate striae on dorsal surface; carpus armed with 3–5 broad blunt teeth on dorsoflexor margin, proximal tooth largest, other teeth usually low; dorso-extensor margin with 3 or 4 spines on distal third; palm unarmed and without setae on extensor margin. Ambulatory legs moderately slender; meri unarmed, each with sparse short setae on extensor margin, lateral flexor margin with small distal spine each on second and third pereopods (spine on second pereopod blunt or acute), but unarmed on fourth pereopod; carpi unarmed on extensor margins or with disto-extensor spine only on second pereopod; dactyli each with 3 corneous spines on flexor margin. Ridges on surfaces with sparse short setae on anterior margins.

Size.—To cl 19.0 mm (present study).

Coloration.—In specimens having 4 or more teeth on the dorsoflexor margin of cheliped carpus, carapace and pereopods generally brown or bluish brown, with numerous irregular, small, dark brown marks. Chelae each with row of broadly spaced, small orange spots along extensor margin on dorsal surface; fingers orange at distal tips; dactyli with small orange mark on proximal part of cutting edge. Propodi of ambulatory legs dark bluish brown, with bluish white bands on proximal and distal parts; dactyli brownish. In specimens having only 3 teeth on dorsoflexor margin of cheliped carpus, carapace and pereopods generally reddish brown, with numerous, small white spots. Fingers of chelipeds orangish red at distal tips; dactyli with small orange mark on proximal part of cutting edge. Propodi of ambulatory legs red to reddish brown, with white bands on proximal and distal parts; dactyli also red.

Habitat.—Intertidal, found under rocks.

Distribution.—Throughout the tropical Indo-West Pacific, westward to eastern African coast and Red Sea, eastward to Line and Tuamotu Islands.

Remarks.—The taxonomy of this species remains unsatisfactory. The present material includes two morphologically different forms. They are usually distinguished by the shape of the rostrum, and the armature on the carpi of the chelipeds and meri and carpi of the second pereopods as shown in the above diagnosis. In one form, the rostrum is trilobate, the carpi of the chelipeds each has three broad teeth on the dorsoflexor margin, and the second pereopod possesses a blunt, small distal spine on the lateral flexor margin of the merus and lacks a disto-extensor spine on the carpus. The other form generally reaches to a larger size than the former form; the rostrum is sinuously triangular, the carpi of the chelipeds each have four or five broad teeth on the dorsoflexor margin, and the second pereopod possesses an acute, small distal spine on the lateral flexor margin of the merus and is armed with a disto-extensor spine on the carpus. The two forms are also different in the presence or absence of a row of widely spaced, small orange spots along the extensor margin of the dorsal surface of the chela.

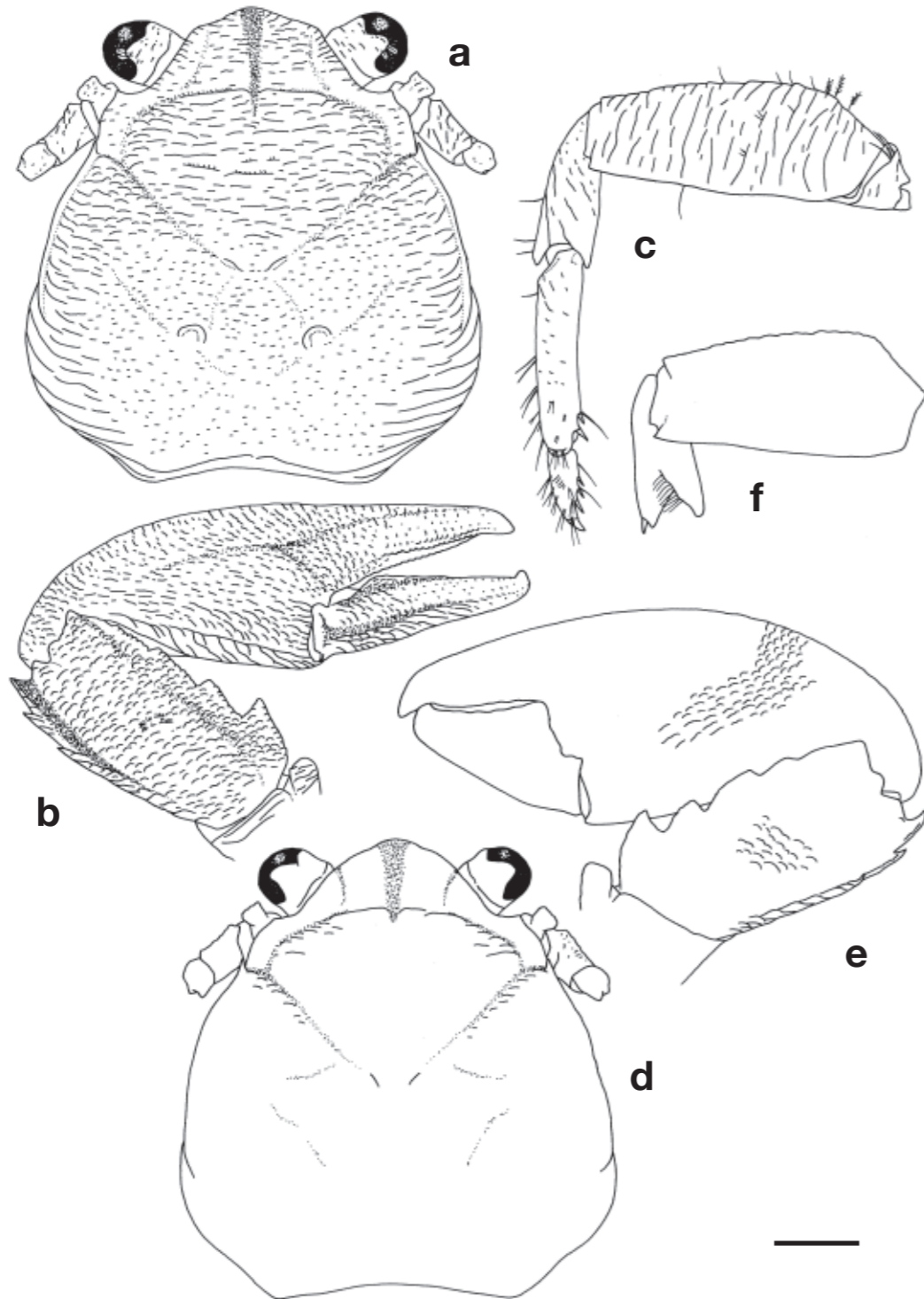


Fig. 113. Male (cl 11.2 mm), SiaoLiouciou, Pingtung County, 20 Mar 1992, a–c; male (cl 14.1 mm), Magang, Taipei County, 14 Jul 1992, d–f: **a, d**, carapace and ocular and antennal peduncles, dorsal view; **b**, left cheliped, dorsal view; **c**, left second pereopod, lateral view; **e**, right cheliped, dorsal view; **f**, left second pereopod, merus and carpus, lateral view. Scale: a = 2.0 mm; b = 3.6 mm, c = 3.2 mm; d, f = 2.8 mm; e = 4.1 mm.

Petrolisthes militaris (Heller, 1862)

好鬥岩瓷蟹



Fig. 114. Male (cl 7.6 mm), Nanfang-ao fishing port, Yilan County, 10 Mar 1990.

Porcellana annulipes White, 1847: 63 [*nomen nudum*].

Porcellana militaris Heller, 1862: 523 [type locality: Nicobar Islands].

Petrolisthes militaris.—Miyake, 1943: 54, figs. 1–2.—Haig, 1964: 357, fig. 1; 1979: 122, fig. 2; Haig, 1992: 316, fig. 12.—Hsieh *et al.*, 1997: 293, figs. 5G, 11.—Osawa, 2007b: 26, fig. 8a–b.

Petrolisthes carinipes.—Lewinsohn 1969: 144, figs. 31a–d. [not *Petrolisthes carinipes* (Heller 1861)]

Material examined.—Nanfang-ao fishing port, Yilan County, 10 Mar 1990, 1 male (cl 7.6 mm) (NTOU A00609).—3 Jul 1992: 1 male (cl 9.2 mm) (NTOU A00610). Baisha, Penghu County, 4 Sep 1990: 1 female (cl 3.5 mm) (NTOU A00608).

Diagnosis.—Carapace with distinct transverse ridges on gastric region; rostrum sinuously triangular, unarmed at lateral angles of lateral lobes; 1 supra-ocular spine and 2 epibranchial spines present; branchial margins convex, with 2 or 3 median spines. Second article of antennal peduncle with distinct anterior lobe bearing anteroproximal spine. Chelipeds with distinct transverse or oblique, squamiform ridges on dorsal surfaces of carpi and palm; carpi each with 4 or 5 spine-tipped, broad teeth on dorsoflexor margin, dorso-

extensor margin with 3 or 4 spines on distal half; chelae each with distinct longitudinal crest of short ridges along midline, extensor margin with row of spines and sparse or numerous plumose setae, dorsoflexor margin unarmed. Ambulatory legs relatively slender; meri each with row of spines and plumose setae on extensor margin, lateral flexor margin with distinct distal spine each on second and third pereopods but unarmed on fourth pereopod; carpi each with disto-extensor spine on second pereopod; dactyli each with 4 corneous spines on flexor margin. Ridges on surfaces with row of short plumose setae on anterior margins.

Size.—To cl 10.2 mm (Hsieh *et al.*, 1997; Osawa, 2007b).

Coloration.—Carapace and chelipeds reddish brown, with numerous small, red spots. Ambulatory legs also reddish brown; meri and carpi with irregular red marks; propodi each with broad red band on median part.

Habitat.—Subtidal to about 180 m deep, often associated with corals at shallower depths (Haig, 1964, 1979).

Distribution.—Widely distributed in the Indian Ocean including the Red Sea, in the Pacific northward to Tsugaru Strait, Japan, eastward to New Caledonia, southward to northern Australia.

Remarks.—*Petrolisthes militaris* closely resembles *P. heterochrous* and *P. scabriculus*. The characters distinguishing these three species are discussed under the “Remarks” for *P. heterochrous*. Haig (1979) mentioned that most of the Moluccas specimens she examined had a poorly developed median longitudinal crest and a series of small sharp granules instead of transverse ridges on the dorsal surface of the chela. These characters are not known in specimens from other Indo-West Pacific localities. It is possible that the Moluccas material may belong to a different species. On the other hand, western Pacific specimens currently identified as *P. militaris* also include at least two forms with different colorations and habitats (personal observation). More studies are needed to determine if these different forms represent the same or different species.

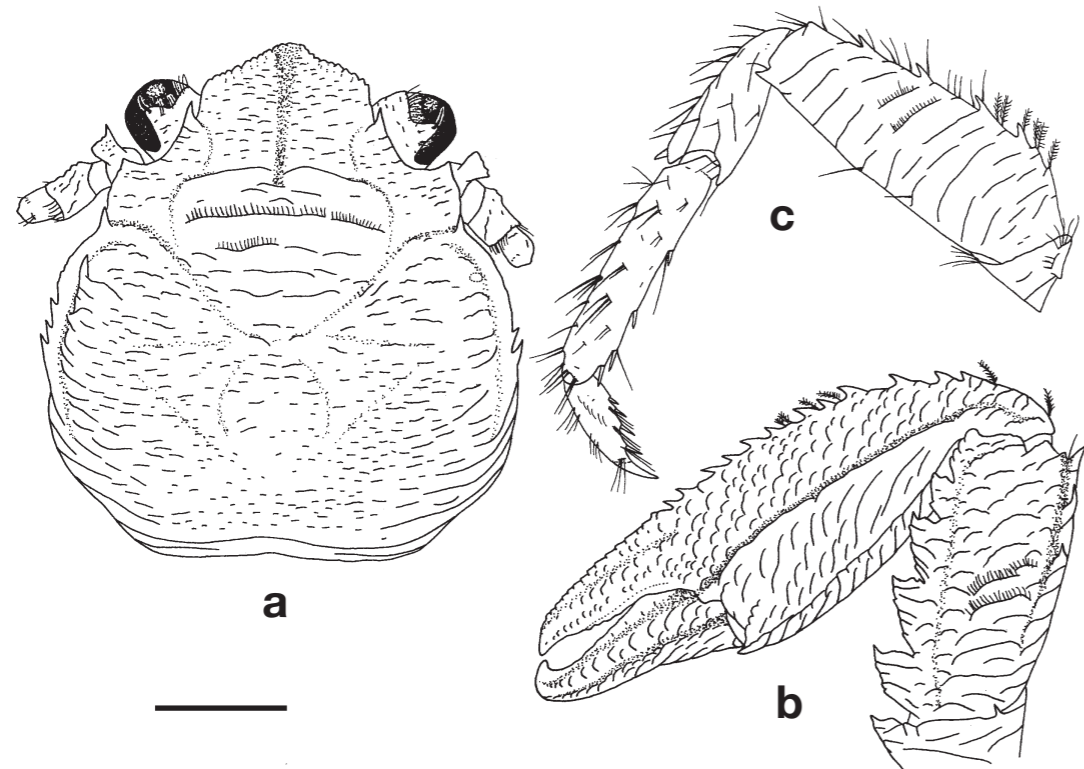


Fig. 115. Male (cl 7.6 mm), Nanfang-ao fishing port, Yilan County, 10 Mar 1990: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, right cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale: a, c = 2.0 mm; b = 2.8 mm.

Petrolisthes miyakei Kropp, 1984

三宅岩瓷蟹

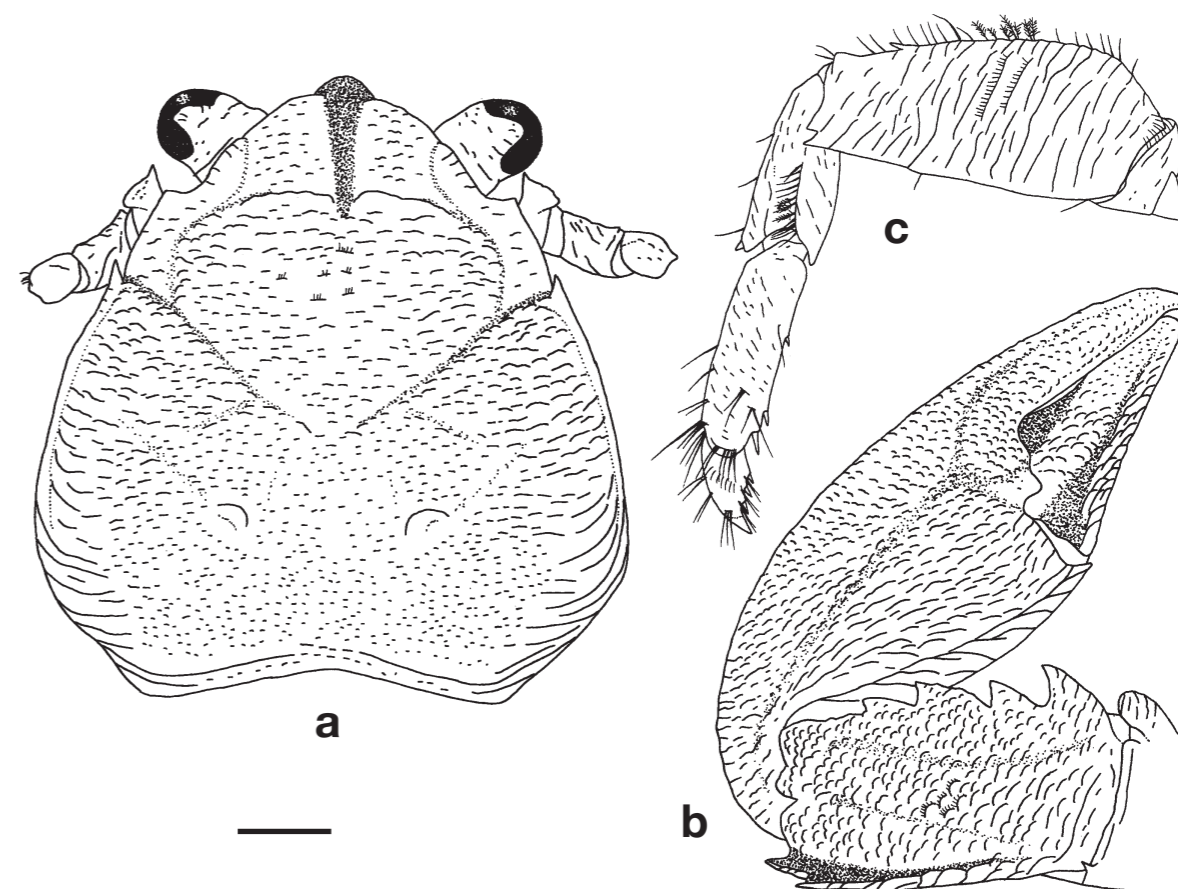


Fig. 116. Ovigerous female (cl 12.9 mm), Shanyuan, Taitung County, 20 Apr 1992: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, left cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale: a, c = 2.0 mm; b = 2.5 mm.

Petrolisthes miyakei Kropp, 1984: 93, fig. 2 [type locality: Guam, Mariana Islands].—Hsieh *et al.*, 1997: 322, figs. 24D, 26.

Material examined.—Su-ao, Yilan County, 23 Jul 1970: 1 male (cl 13.9 mm) (NTOU A00443). Shanyuan, Taitung County, 20 Apr 1992: 1 ovigerous female (cl 12.9 mm) (NTOU A00432).

Diagnosis.—Carapace with short delicate striae on gastric region and anterior branchial regions; rostrum sinuously triangular; supra-ocular lobe distinct but supra-ocular spine absent; brachial margins convex, each with epibranchial spine at anterior angle of cervical groove. Second article of antennal peduncle with distinct anterior lobe bearing small spine at anterior proximal angle. Chelipeds with numerous short ridges on dorsal surface; carpus armed with 4 subacute or blunt, broad teeth on dorsoflexor margin; dorso-extensor margin with 2 or 3 spines on distal third, followed by some elevated short ridges; palm without distinct, longitudinal crest on midline; extensor margin unarmed. Ambulatory legs relatively stout; meri each with row of plumose setae on entire length and spine on distal quarter of extensor margin, lateral flexor margin with distal spine each on

second and third pereopods, but unarmed on fourth pereopod; carpi each with disto-extensor spine on second pereopod; dactyli each with 3 corneous spines on flexor margin. Ridges on surfaces with sparse short setae on anterior margins.

Size.—To cl 16.7 mm (Kropp, 1984).

Coloration.—Overall color of carapace tan with a prominent reddish purple reticulated pattern. Rostrum with patches of light blue. Chelipeds generally similar to carapace. Extensor margin of palm with azure blue stripe extending from near carpal joint to tip of immovable finger. Tips of fingers reddish orange. Antennal flagellum red-orange. Ventral surface mostly white with patches of purple (Kropp, 1984).

Habitat.—Intertidal. The type material from the Mariana Islands was collected from sand-covered pavement underneath small limestone blocks and boulders at the landward edge of an erosion bench (Kropp, 1984). The Taiwanese specimen was obtained from among branches of corals (Hsieh *et al.*, 1997).

Distribution.—Only Mariana Islands and Taiwan.

Remarks.—This species is so far known only from two widely separated localities in the western Pacific (Taiwan and Mariana Islands). *Petrolisthes miyakei* resembles *P. asiaticus* and *P. trilobatus*. Their distinguishing characters are discussed under the “Remarks” for *P. asiaticus*.

Petrolisthes moluccensis (De Man, 1888)

馬魯古岩瓷蟹



Fig. 117. Female (cl 6.5 mm), Wanlitong, Pingtung County, 9 Jan 1993.

Porcellana (Petrolisthes) moluccensis De Man, 1888: 411, pl. 18–fig. 5 [type locality: Amboina, Moluccas, Indonesia].

Petrolisthes moluccensis.—Miyake, 1942: 337, figs. 3–4.—Hsieh *et al.*, 1997: 322, figs. 24D, 26.

Material examined.—Wanlitong, Pingtung County, 9 Jan 1993: 1 female (cl 6.5 mm), 1 damaged specimen (NTOU A00437).

Diagnosis.—Carapace with numerous short and long transverse ridges on dorsal surface; rostrum trilobate; no supra-ocular spine; branchial margins convex, each with epibranchial spine at anterior angle of cervical groove. Second article of antennal peduncle with distinct anterior lobe bearing anteroproximal spine. Chelipeds covered with distinct transverse or oblique ridges on dorsal surfaces of carpi and palms; carpi each with 4 or 5 broad teeth (proximal tooth spine-tipped) on dorsoflexor margin, dorso-extensor margin with 3 or 4 spines on distal half. Ambulatory legs relatively slender; meri each with row of spines and plumose setae on extensor margin, lateral flexor margins each with small distal spine on second and third pereopods, but unarmed on fourth pereopod; carpi each with disto-extensor spine on second pereopod; dactyli each armed with 3 corneous spines

on flexor margin. Ridges on surfaces with row of short plumose setae on anterior margins.

Size.—To cl 12.4 mm (Haig, 1965).

Coloration.—Carapace and chelipeds greenish brown, with irregular small red marks. Fingers of chelipeds reddish purple at distal tips and adjacent parts. Ambulatory legs greenish brown, with small reddish marks on meri and carpi; propodi brown, with white bands on proximal and distal parts.

Habitat.—Shallow water on coral reefs.

Distribution.—Indian Ocean: Somalia, Red Sea, Persian Gulf, Seychelles, Mauritius, Abrolhos Islands off Western Australia. Pacific Ocean: eastern Indonesia, Nansha Islands in China, Palau, Ryukyu Islands, and Chesterfield Islands.

Remarks.—This species has two extremes of color patterns with intermediate color forms. In one extreme, the general coloration is yellow or brown on the dorsal surface of the carapace and pereopods, the other extreme is generally purplish brown. *Petrolisthes moluccensis* appears closest to *P. elegans* Haig, 1981b in having the carapace covered with numerous transverse ridges, the absence of supra-ocular and mesobranchial spines, the presence of epibranchial spine, and the meri of ambulatory legs each armed with a row of spines on the extensor margin. However, *P. moluccensis* differs from *P. elegans* in having the rostrum relatively weakly trilobate, the median lobe of the rostrum distinctly exceeding instead of produced subequally with the lateral lobes, and the external orbital angle without a strong projection.

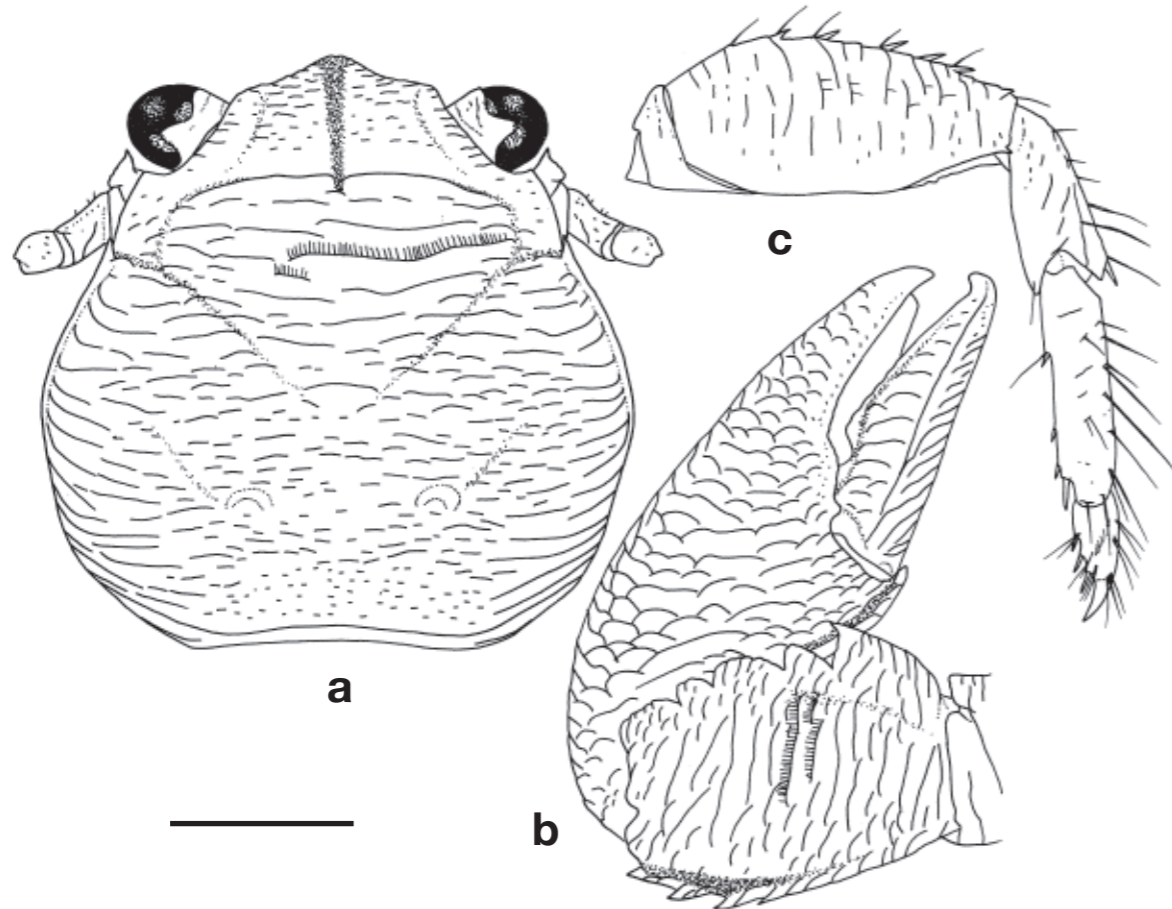


Fig. 118. Female (cl 6.5 mm), Wanlitong, Pingtung County, 9 Jan 1993: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, left cheliped, dorsal view; **c**, right second pereopod, lateral view. Scale: a, c = 2.0 mm; b = 2.5 mm.

Petrolisthes obtusifrons Miyake, 1937

鈍額岩瓷蟹



Fig. 119. Ovigerous female (cl 5.7 mm), Siaoliouciou, Pingtung County, 20 Mar 1992.

Petrolisthes obtusifrons Miyake, 1937b: 155, unnumbered fig. [type locality: Ishigaki Island, Ryukyu Islands].

Petrolisthes varicolor Osawa, 1998b: 607, figs. 7–9 [type locality: Aka Island, Ryukyu Islands].

Material examined.—Jioupeng, Pingtung County, 19 Mar 1992: 3 males (cl 3.9–4.6 mm), 1 ovigerous female (cl 5.5 mm), 1 juvenile (cl 2.3 mm) (NTOU A00935). Siaogang, Taitung County, 20 Sep 2006: 1 ovigerous female (cl 5.5 mm) (NTOU A00931). Siaoliouciou, Pingtung County, 20 Mar 1992: 1 male (cl 6.8 mm), 1 female (cl 3.3 mm), 1 ovigerous female (cl 5.7 mm) (NTOU A00679).

Diagnosis.—Carapace with short delicate striae on gastric region; rostrum trilobate; no supra-ocular spine; brachial margins subparallel on median part, each with epibranchial spine at anterior angle of cervical groove. Second article of antennal peduncle with distinct anterior lobe. Chelipeds with numerous short delicate striae on dorsal surface; carpus armed with 3 broad teeth on dorsoflexor margin; dorso-extensor margin with 3 spines on distal third; palm with row of short plumose setae and some small protuberances or spines on extensor margin. Ambulatory legs moderately slender; meri unarmed but with row of short plumose setae on extensor margin, lateral flexor margins each with small distal spine on second and third pereopods, but unarmed on fourth

pereopod; carpi unarmed on extensor margins; dactyli each with 3 corneous spines on flexor margin. Ridges on surfaces with sparse short setae on anterior margins.

Size.—To cl 6.8 mm (present study).

Coloration.—Two extremes of color patterns are known, although there are intermediate color forms between the extremes (Osawa, 1998b). In one extreme, the dorsal surface of the carapace and chelipeds is pale brown or bluish brown with numerous, small white spots and several to numerous small dark brown spots. Ambulatory legs pale brown or bluish brown with transverse dark brown bands on each lateral surface of meri to propodi. Ventral surface of abdomen and chelipeds usually white, sometimes fingers reddish. In the other extreme, the dorsal surface of the carapace and chelipeds, and lateral surfaces of the ambulatory legs, are brown or bluish green with numerous, very small white spots. Chelipeds sometimes reddish on distal part of fingers. Carpi and propodi of ambulatory legs with white and dark red bands on lateral surfaces. Ventral surface red. Third maxillipeds with orange color on meri to dactyli. In Taiwanese material, the carapace and chelipeds are bluish green, with some small dark brown spots. Third maxillipeds orange. Ambulatory legs also bluish green on meri, with white band on distal part; carpi and propodi red, with one and two white bands, respectively. Eggs dark blue.

Habitat.—Intertidal, found under dead coral blocks and plates or among dead coral branches.

Distribution.—Ryukyu Islands and Phuket Island (Thailand), now also from Taiwan.

Remarks.—Osawa (2007b: 25) considered this species as the senior synonym of *P. varicolor* Osawa, 1998b after re-examination of the holotype of *P. obtusifrons*. *Petrolisthes obtusifrons* is mostly similar to *P. fimbriatus* Borradaile, 1898 but differs in the median branchial margins of the carapace being subparallel rather than convex, and the palm of the male cheliped bearing a row of short plumose setae only on the proximal part instead of the entire length of the extensor margin. *Petrolisthes obtusifrons* is recorded for the first time from Taiwan.

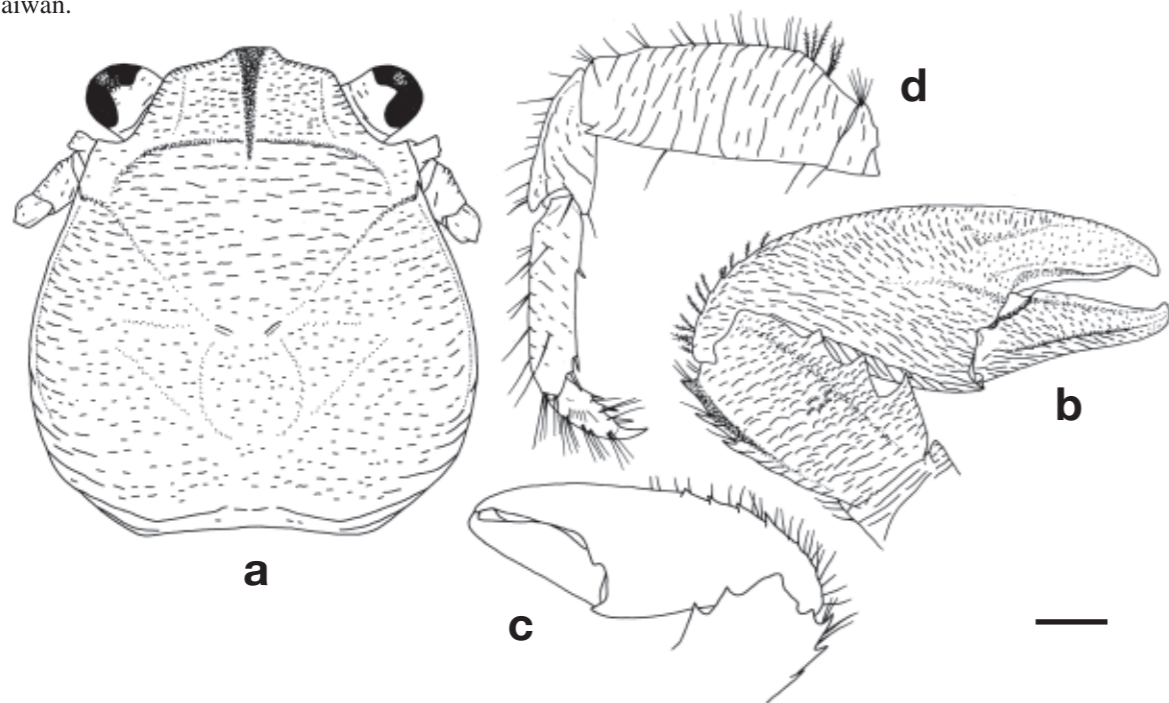


Fig. 120. Male (cl 6.8 mm), Siaoliouciou, Pingtung County, 20 Mar 1992, a–b, d; ovigerous female (cl 5.7 mm), same locality and date, c: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, left cheliped, dorsal view; **c**, right chela, dorsal view; **d**, left second pereopod, lateral view. Scale: a, d = 1.0 mm; b–c = 1.6 mm.

Petrolisthes pubescens Stimpson, 1858

軟毛岩瓷蟹



Fig. 121. Ovigerous female (cl 3.1 mm), Badouzi, Keelung City, 9 Nov 2006.

Petrolisthes pubescens Stimpson, 1858: 228 [type locality: Foukow Bay (= Naze Bay), Amami-Oshima, Ryukyu Islands]; 1907: 183, pl. 22–fig. 3.—Kropp, 1986: 456, fig. 2.—Hsieh *et al.*, 1997: 295, figs. 5H, 12.

Petrolisthes tomentosus.—Miyake, 1943: 85, figs. 19–21. [not *Petrolisthes tomentosus* (Dana, 1852)]

Material examined.—Badouzi, Keelung City, 9 Nov 2006: 1 male (cl 3.1 mm), 1 ovigerous female (cl 3.1 mm), 1 juveniles (cl 2.5 mm) (NTOU A00947). Magang, Taipei County, 14 Jun 1991: 1 female (cl 8.3 mm) (NTOU A00612). Siaoliouciou, Pingtung County, 8 Jan 1993: 1 female (cl 7.7 mm) (NTOU A00661). Wanlitong, Pingtung County, 6 Mar 1996: 1 female (cl 6.6 mm) (NTOU A00425). No specific locality: 1 male (cl 5.3 mm) (NTOU A00946).

Diagnosis.—Carapace covered with short setae on dorsal surface, setae concealing very short delicate striae; rostrum trilobate; no supra-ocular spine; brachial margins convex, each with epibranchial spine at anterior angle of cervical groove. Second article of antennal peduncle with distinct anterior lobe bearing small spine at anteroproximal angle. Chelipeds covered with short plumose setae on dorsal surface; carpus with row of squamiform ridges on dorsal longitudinal midline, dorsoflexor margin with 3 or 4 relatively narrow, marginally

serrated teeth and some smaller spiniform teeth, dorso-extensor margin with 3 or 4 spines on distal third to half; palm with row of spines and numerous plumose setae on extensor margin. Ambulatory legs moderately slender; meri each with row of spines and plumose setae on extensor margin, lateral flexor margins each with distinct distal spine on second and third pereopods, but unarmed on fourth pereopod; carpi each with disto-extensor spine on second pereopod; dactyli each with 3 corneous spines on flexor margin.

Size.—To cl 10.0 mm (Hsieh *et al.*, 1997).

Coloration.—Carapace and chelipeds light grey, with irregular reddish brown marks. Third maxillipeds blue on propodi and dactyli. Dactyli of chelipeds each with small orange mark on proximal part of cutting edge. Ambulatory legs with irregular reddish brown marks on meri and carpi; propodi red, with white bands on proximal and distal parts; dactyli also red. Setae pale brown.

Habitat.—Intertidal to shallow subtidal, found under rocks and corals.

Distribution.—Red Sea, Mauritius, Moluccas, Taiwan, southern Japan, Ryukyu Islands, Queensland, New Caledonia and Marquesas Islands.

Remarks.—*Petrolisthes pubescens* was confused with *P. tomentosus* (Dana, 1852) until the study by Kropp (1986). *Petrolisthes pubescens* resembles *P. tomentosus* in having a pubescent carapace, but can be readily distinguished in the lack of distinct elevations on the gastric, anterior branchial, and mesial posterior branchial regions.

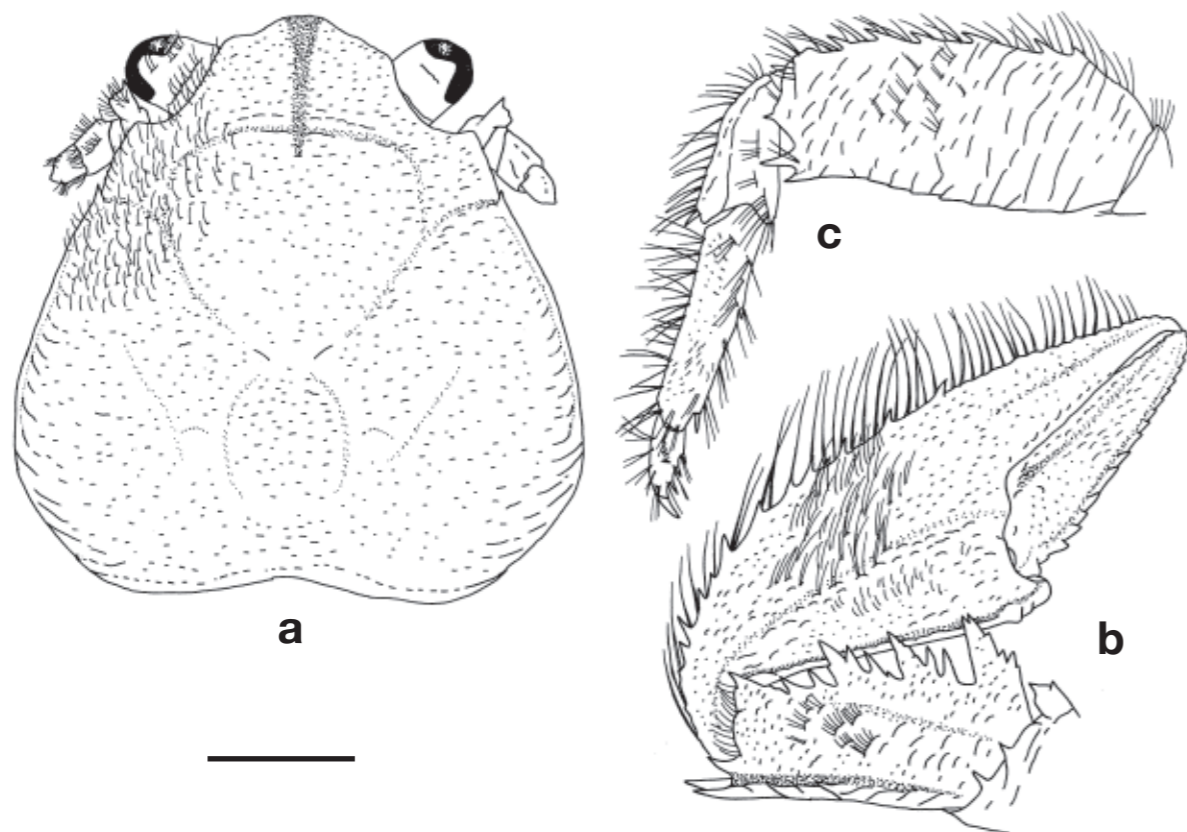


Fig. 122. Female (cl 7.7 mm), Siaoliouciou, Pingtung County, 8 Jan 1993: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, left cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale: a, c = 2.0 mm; b = 2.5 mm.

Petrolisthes scabriculus (Dana, 1852)

粗糙岩瓷蟹



Fig. 123. Ovigerous female (cl 7.7 mm), Landong, Kending, Pingtung County, 10 Dec 2009.

Porcellana scabricula Dana, 1852: 424 [type locality: Sulu Sea]; 1855: pl. 28–fig. 13.

Porcellana (Petrolisthes) scabricula.—De Man, 1888: 411

Petrolisthes scabriculus.—Haig, 1964: 358, fig. 2; 1979: 120, fig. 1.—Nakasone & Miyake, 1968b: 107, text-fig. 4.—Hsieh *et al.*, 1997: 291, figs. 5F, 10.—Osawa, 2007b: 28, fig. 8c–d.

Material examined.—Nanwan, Pingtung County, 5 Dec 1985: 1 damaged male (NTOU A00606). Dasi, Yilan County, 15 Apr 1993: 1 male (cl 4.9 mm) (NTOU A00607). Landong, Kending, Pingtung County, 10 Dec 2009: 1 ovigerous female (cl 7.7 mm) (NTOU A00604). Siaogang, Taitung County, 20 Sep 2006: 2 males (cl 3.8, 4.6 mm) (NTOU A01150).

Diagnosis.—Carapace with distinct transverse ridges on gastric region; rostrum trilobate, with small spine at lateral angle of each lateral lobe; 1 supra-ocular spine and 2 epibranchial spines present; branchial margins convex, with 3 median spines and some smaller denticles in front of row of spines. Second article of antennal peduncle with distinct anterior lobe bearing anteroproximal spine. Chelipeds with distinct transverse or oblique, squamiform ridges on dorsal surfaces of carpi and palms; carpi each with 4 or 5 spine-tipped, broad teeth on

dorsoflexor margin, dorso-extensor margin with 5–7 spines along almost entire length; chelae each with distinct longitudinal crest of short ridges on midline, extensor margin with row of spines and long plumose setae, dorsoflexor margin with small subdistal spine. Ambulatory legs relatively slender; meri each with row of spines and plumose setae on extensor margin, lateral flexor margins each with distinct distal spine on second and third pereopods but unarmed on fourth pereopod; carpi each with disto-extensor spine on second pereopod; dactyli each with 3 or 4 corneous spines on flexor margin. Ridges on surfaces with row of short plumose setae on anterior margins.

Size.—To cl 7.6 mm (Haig, 1965).

Coloration.—Carapace brown, with 2 pairs of small orange marks on mesial branchial region. Chelipeds with mottled pattern of brown and reddish brown and some small white marks. Ambulatory legs also generally brown; meri and carpi with irregular white marks; propodi with white bands on proximal and distal parts; dactyli reddish.

Habitat.—Shallow water to about 55 m deep, often associated with corals (Haig, 1979).

Distribution.—Gulf of Thailand, Philippines, Indonesia, New Guinea, western and eastern Australia, Nansha Islands in the South China Sea, Taiwan, Ryukyu Islands, New Caledonia and the Loyalty Islands.

Remarks.—Distinctions among the three closely related species of *P. heterochrous*, *P. militaris*, and *P. scabriculus* are given under the “Remarks” for *P. heterochrous*.

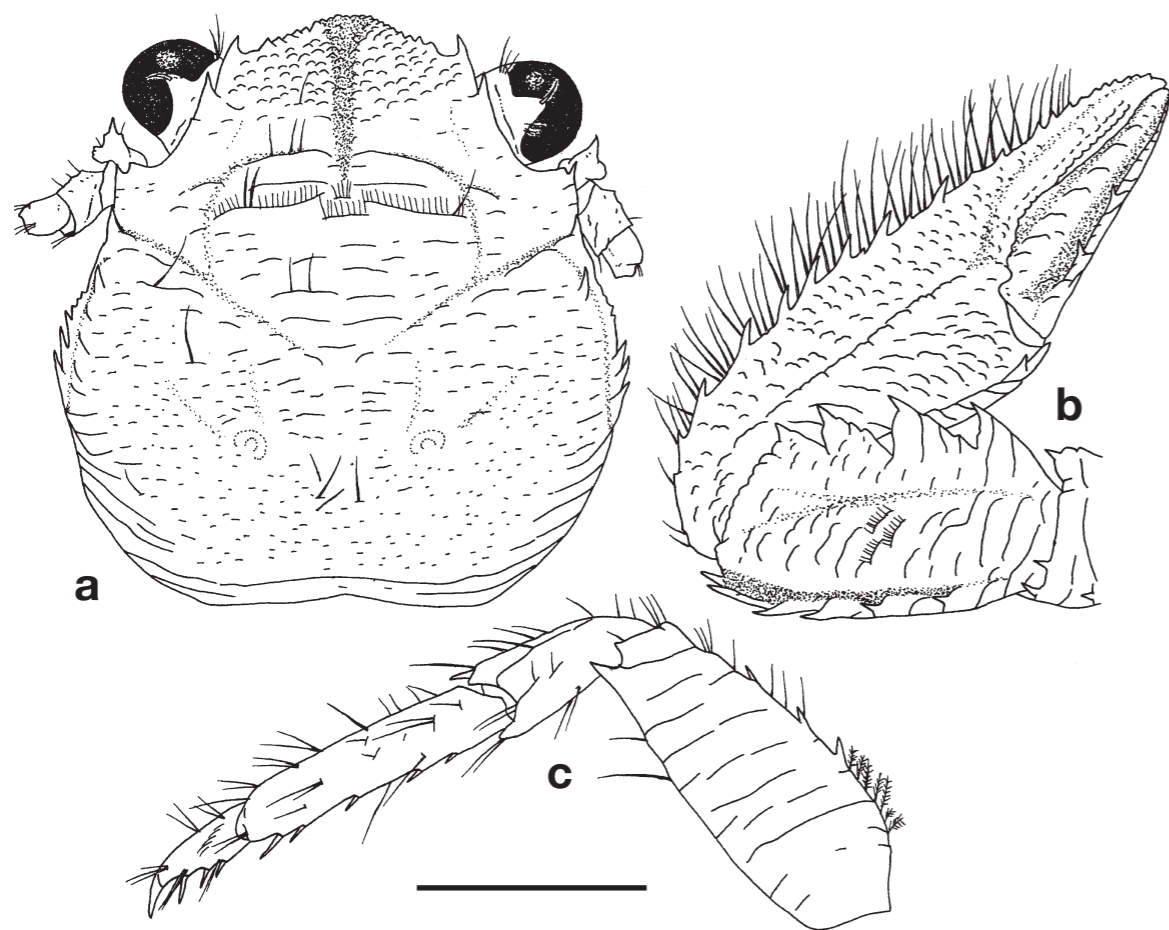


Fig. 124. Male (cl 4.9 mm), Dasi, Yilan County, 15 Apr 1993: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, left cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale: a, c = 2.0 mm; b = 2.5 mm.

Petrolisthes tomentosus (Dana, 1852)

密毛岩瓷蟹



Fig. 125. Male (cl 4.8 mm), Wanlitong, Pingtung County, 10 Jan 1993.

Porcellana tomentosa Dana, 1852: 420 [type locality: Tuamotu]; 1855: pl. 26–fig. 10.

Porcellana penicillata Heller, 1865: 79 [type locality: Nicobars].

Porcellana villosa Richers, 1880: 160, pl. 17–figs. 11–12 [type locality: Mauritius].

Petrolisthes penicillatus.—Miyake, 1942: 347, text-figs. 11–12.

Petrolisthes tomentosus.—Kropp, 1986: 453, fig. 1.—Hsieh *et al.*, 1997: 291, figs. 5F, 10.

Material examined.—Wanlitong, Pingtung County, 10 Jan 1993: 1 male (cl 4.8 mm) (NTOU A00435).

Diagnosis.—Carapace covered with short plumose setae and 5 rounded elevations each bearing tuft of longer setae, largest on gastric region, 1 on each anterior branchial region, 2 flanking cardiac region; rostrum trilobate; no supra-ocular spine; brachial margins convex, each with small epibranchial spine at anterior angle of cervical groove. Second article of antennal peduncle with distinct anterior lobe bearing small spine at anteroproximal angle. Chelipeds covered with short plumose setae on dorsal surface; carpus with row of squamiform ridges on dorsal longitudinal midline, dorsoflexor margin with 3 or 4 relatively narrow, spine-tipped teeth, dorso-extensor margin with distal strong, acute projection followed by slightly elevated short ridges; palm

with row of spines and numerous plumose setae on extensor margin. Ambulatory legs relatively stout; meri each with row of dense plumose setae along entire length and 1 or 2 subdistal spines on extensor margin, lateral flexor margins each with distinct distal spine on second and third pereopods, but unarmed on fourth pereopod; carpi unarmed on extensor margins; dactyli each with 3 corneous spines on flexor margin.

Size.—To cl 7.2 mm (Osawa, 2007b).

Coloration.—Carapace and pereopods generally white, covered with numerous pale brown setae.

Habitat.—Low intertidal to 11 m deep; found under rocks, on dead corals or on the bases of living corals.

Distribution.—Widespread in the Indo-West Pacific. Indian Ocean: from Somalia and Madagascar to Nicobar Islands and Western Australia; Pacific: from Taiwan and Palau to New Caledonia, Chesterfield Islands and Tuamotu Archipelago.

Remarks.—Kropp (1986) redescribed this species as having a spine on the disto-extensor margin of the carpus of the second pereopod, but the Taiwanese specimen lacks this spine. *Petrolisthes tomentosus* differs from *P. pubescens* in having distinct elevations on the gastric, anterior branchial, and mesial posterior branchial regions of the carapace.

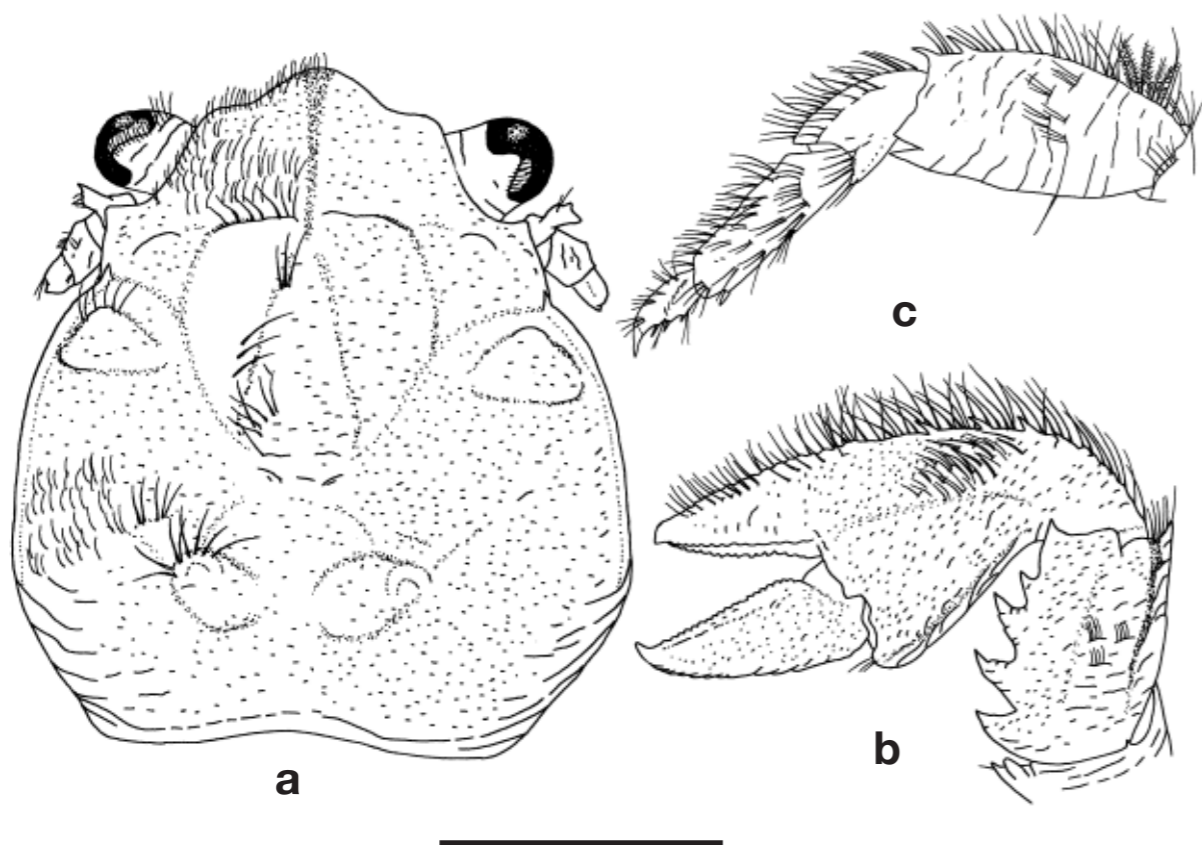


Fig. 126. Male (cl 4.8 mm), Wanlitong, Pingtung County, 10 Jan 1993: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, right cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale: a = 2.0 mm, b–c = 2.6 mm.

Petrolisthes unilobatus Henderson, 1888

單葉岩瓷蟹



Fig. 127. Ovigerous female (cl 7.5 mm), Fulong, Taipei County, 12 Aug 2006.



Fig. 128. Ovigerous female (cl 13.0 mm), Hemei, Taipei County, 5 Aug 2009.

Petrolisthes unilobatus Henderson, 1888: 106, pl. 11—figs. 3, 3a [type locality: Tongatabu Islands].—Miyake, 1943: 66, figs. 7–8.—Hsieh *et al.*, 1997: 311, figs. 14F, 20.

Material examined.—Fulong, Taipei County, 12 Aug 2006: 1 ovigerous female (cl 7.5 mm) (NTOU A00933).—6 Feb 2007: 1 male (cl 6.4 mm) (NTOU A00934).—18 Dec 2008: 1 female (cl 6.9 mm) (NTOU A00935).—no date: 1 male (cl 6.3 mm) (NTOU A00936). Hemei, Taipei County, 28 Sep 1992: 12 males (cl 3.5–7.7 mm), 1 female (cl 6.7 mm) (NTOU A00648).—19 Mar 2007: 1 male (cl 12.6 mm) (NTOU A00937).—5 Aug 2009: 1 ovigerous female (cl 13.0 mm), 1 female (cl 9.5 mm) (NTOU A00938). Magang, Taipei County, 15 May 1991: 3 males (cl 7.2–9.4 mm) (NTOU A00940).—17 Apr 1992: 1 male (cl 9.4 mm), 1 female (cl 5.6 mm) (NTOU A00942).—2 Jun 1992: 1 male (cl 7.7 mm), 2 ovigerous females (cl 7.2, 7.4 mm), 2 females (cl 6.4, 7.4 mm) (NTOU A00941).—17 Apr 2003: 1 male (cl 5.1 mm) (NTOU A00644).—5 Feb 2007: 1 female (cl 4.5 mm) (NTOU A00943).—no date: 5 males (cl 5.9–7.6 mm), 6 ovigerous females (cl 5.6–6.4 mm) (NTOU A00944). Mao-ao, Taipei County, 9 Mar 1990: 3 males (cl 7.0–8.1 mm) (NTOU A00645). Dabaisha, Luda, Taitung County, 21 Jul 2009: 1 ovigerous female (cl 4.9 mm), 1 female (cl 3.1 mm) (NTOU A00939). Lang Island, Lanyu, Taitung County, 22 Dec 1992: 6 males (cl 3.0–4.9 mm), 3 females (cl 4.0–5.0 mm) (NTOU A00646). No specific locality: 2 males (cl 7.7, 8.7 mm), 1 female (cl 5.8 mm) (NTOU A00945)

Diagnosis.—Carapace with numerous short, delicate striae on gastric region and anterior branchial region; rostrum sinuously triangular; no supra-ocular spine; brachial margins convex, unarmed at anterior angle of cervical groove. Second article of antennal peduncle with a small rounded anterior lobe. Chelipeds with numerous short, delicate striae on dorsal surface; carpus armed with single blunt, low tooth on dorsoflexor margin proximally; dorso-extensor margin unarmed except for distal strong, acute projection; palm unarmed and without setae on extensor margin; dactyli each with dense short plumose setae on cutting region. Ambulatory legs relatively stout; meri unarmed, with sparse short setae on extensor margin, lateral flexor margin with small but distinct distal spine on second pereopod, but unarmed on third and fourth pereopods; carpi unarmed on extensor margins; dactyli each with 3 corneous spines on flexor margin. Ridges on surfaces with sparse short setae on anterior margins.

Size.—To cl 13.0 mm (present study).

Coloration.—Carapace and pereopods bluish or yellowish brown, with scattered dark brown marks. Dactyli of chelipeds each with small orange mark on proximal part of cutting margin. Propodi of ambulatory legs with pale blue or white bands on proximal and distal parts.

Habitat.—Intertidal, found under rocks.

Distribution.—Tongatabu Islands (Tonga) in southwestern Pacific, Ryukyu Islands in southern Japan, and Taiwan.

Remarks.—This species resembles *P. japonicus* in general appearance, but can be readily separated by the carpi of the chelipeds each with only a distal projection instead of the projection being accompanied with some small spines on the dorso-extensor margin and the meri of the ambulatory legs being much stouter.

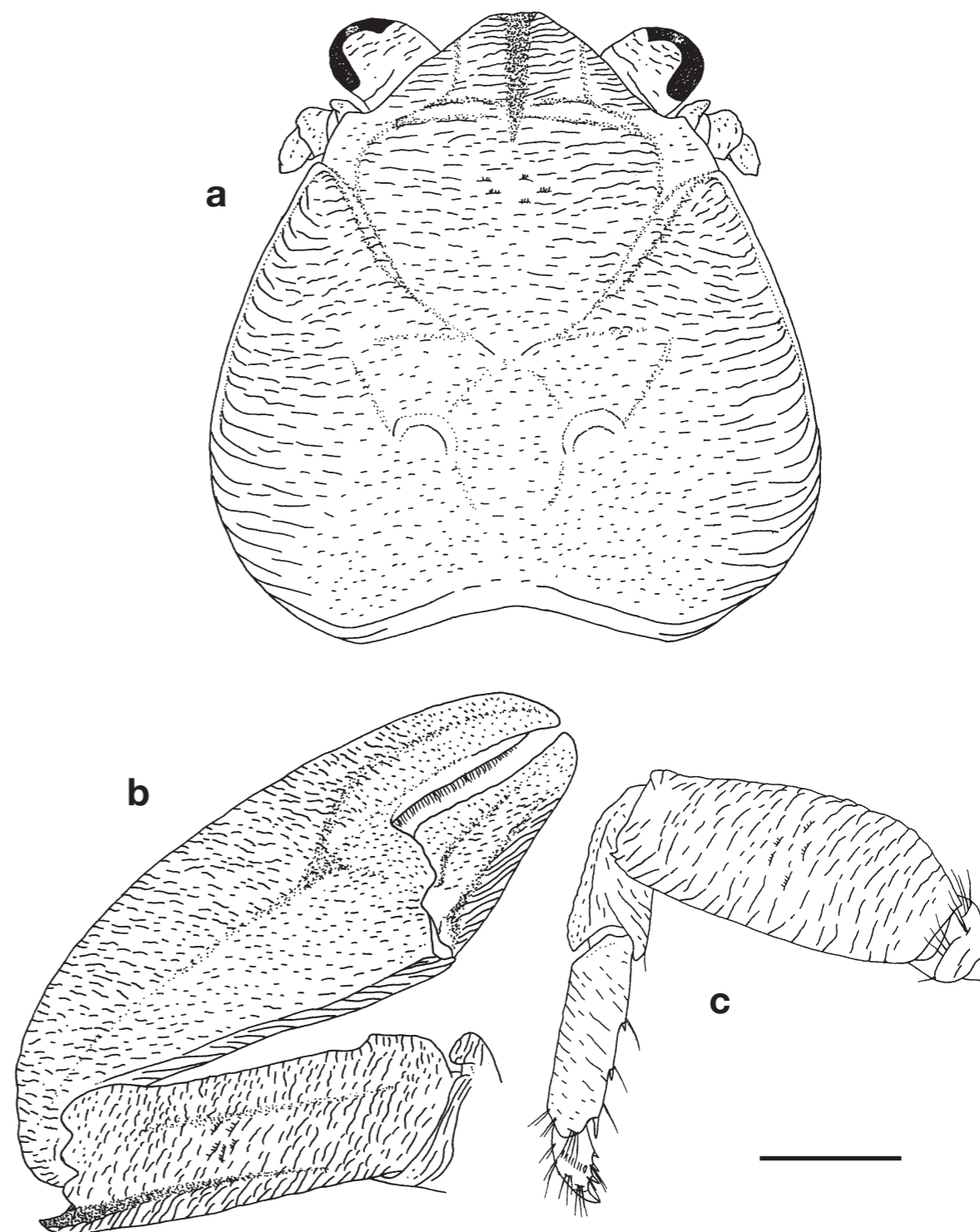


Fig. 129. Male (cl 8.1 mm), Mao-ao, Taipei County, 9 Mar 1990: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, left cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale: a, c = 2.0 mm; b = 3.1 mm.

Genus *Pisidia* Leach, 1820

豆瓷蟹屬

Pisidia Leach, 1820: 53 [type species: *Cancer longicornis* Linnaeus, 1767, by subsequent designation by the ICZN (1964) under its plenary powers in Opinion 701. Gender: feminine].

Streptochirus Stimpson, 1907: 188 [type species: *Porcellana serratifrons* Stimpson, 1858, by subsequent designation of Haig (1960). Gender: masculine].

Diagnosis.—Carapace approximately as long as broad; dorsal surface usually somewhat convex (in *P. dispar* (Stimpson, 1858), strongly convex), nearly smooth, regions weakly or moderately defined. Rostrum tridentate or trilobate, usually horizontal (in *P. dispar*, median lobe strongly bent ventrally); median lobe without distinct median notch on frontal margin. External orbital angle usually terminating in small spine (not strongly produced in *P. dispar*). Hepatic spine(s) usually present (in *P. streptocheles* (Stimpson, 1858), absent or present). Branchial margin armed with 1 or more spines. Pterygostomial flaps entire. Antennal peduncle with movable (second to fourth) articles excluded from orbit by projection of immovable (first) article adpressed to anterior margin of carapace. Chelipeds usually unequal in size and armature, sexually dimorphic; chelae rather flattened; dactylus usually opening obliquely, angle of opening and distortion more pronounced in small cheliped than in larger cheliped; smaller cheliped with more pronounced twisting of fingers than larger cheliped and usually with weaker armature in adult male than in female and juvenile. Ambulatory legs with dactyli each terminating in a single claw. Male with pair of gonopods on second abdominal segment. Telson divided into 7 plates.

Remarks.—This genus includes 10 extant species in the world (De Grave, *et al.*, 2009). In the Indo-West Pacific, nine species are known (Osawa, 2007b). *Pisidia* is closely allied to *Lissoporcellana*, but generally differs in the shape of the rostrum and chelae, and the chelipeds having sexual dimorphism in the spinulation and degree of distortion of the fingers as discussed under the “Remarks” for *Lissoporcellana*. Only one species is known from Taiwan and another one is still only found in the Taiwan Strait. As noted above, *P. dispar* differs considerably from other congeners in several characters. More studies may eventually reveal that *P. dispar* should belong to a separate genus.

Key to species of *Pisidia* from Taiwan

1. Rostrum strongly bent ventrally, not divided into distinct lobes in dorsal view, but median lobe strongly produced and acute in frontal view *P. dispar*
– Rostrum nearly horizontal in lateral view, divided into 3 lobes in dorsal view *P. serratifrons*

Pisidia dispar (Stimpson, 1858)

異形豆瓷蟹



Fig. 130. Male (cl 2.3 mm), Danshuei, Taipei County, 1 Apr 1995.

Porcellana dispar Stimpson, 1858: 242 [type locality: Port Jackson, Australia]; 1907: 190, pl. 23–fig. 3.
Polyonyx carinatus Ortmann, 1892: 268, pl. 12–figs. 2, 2e [type locality: Amami-Oshima, Ryukyu Islands].
Porcellana rostrata Baker, 1905: 260, pl. 35–figs. 1, 1a–b [type locality: Investigator Strait, South Australia].
Pisidia dispar.—Nakasone & Miyake, 1968b: 97, text-fig. 1.—Haig, 1979: 128, figs. 10–11; 1992: 317, fig. 13.—Hsieh *et al.*, 1997: 332, figs. 31, 32A.

Material examined.—Danshuei, Taipei County, 1 Apr 1984: 1 male (cl 2.4 mm) (NTOU A00683).—1 Apr 1995: 1 male (cl 2.3 mm) (NTOU A00685). Nanwan, Pingtung County, 23 Oct 1991: 1 female (cl 3.2 mm) (NTOU A00707). Siaogang, Taitung County, 20 Sep 2006: 1 male (2.7 mm) (NTOU A00915). Tungching Bay, Lanyu, Taitung County, 21 Dec 1992: 1 female (cl 1.9 mm) (NTOU A00686).

Diagnosis.—Carapace with numerous delicate, short striae, strongly convex on gastric region; rostrum strongly bent ventrally, not divided into distinct lobes in dorsal view, with median lobe strongly produced and acute in frontal view; external orbital angle not strongly produced; branchial margins each with 2 median spines. Male chelipeds distinctly unequal; larger cheliped with carpus broadened distally, unarmed or with 2 low,

usually acute teeth on dorsoflexor margin, dorso-extensor margin with 2 or 3 small spines on distal third; chela broad, slightly crenulated but without spines on extensor margin. Male smaller cheliped with carpus not broadened distally, with elevated longitudinal ridge along midline, dorsoflexor margin with 2 low acute teeth, dorso-extensor margin with 3–7 small spines (spines on proximal half occasionally reduced to serrated ridges); chela narrow, with slender fingers being longer than palm and row of small teeth and plumose setae on extensor margin; cutting regions of fingers with dense plumose setae; distal tip of dactylus weakly bifurcate. Female chelipeds approximately equal; carpi and chelae with armature generally similar to that of male smaller cheliped, but fingers as long as or shorter than palm and not opening at distinctly oblique angle. Ambulatory legs slender, with sparse plumose setae marginally; meri slightly crenulated but unarmed on extensor margin; carpi unarmed on extensor margin; dactyli each with 4 or 5 corneous spines on flexor margin.

Size.—To cl 5.0 mm (Haig, 1965).

Coloration.—Carapace and pereopods generally pale brown. Chelipeds with some dark brown marks on fingers.

Habitat.—Intertidal to 188 m; under stones and in coral crevices, mussel clumps, and other sheltered places (Haig 1979, 1981a).

Distribution.—Northward to Kii Peninsula in Japan, southward to temperate Australia, eastwards to the Fiji Islands, and westward to Moluccas.

Remarks.—The shape of the chelipeds is very different in males and females of this species. Although Hsieh *et al.* (1997) reported male specimens, they could not be located at the time of writing this catalog. The present illustrations of the male chelipeds are based on a specimen from the Ryukyu Islands, southwestern Japan. *Pisidia dispar* is most similar to *P. variabilis* (Yang & Sun, 1985), but differs in the meri of the ambulatory legs being unarmed on the extensor margins.

This species is one of the smallest porcellanids, usually only reaching 3.0 mm in carapace length. The very small size makes it difficult to find them in habitats such as dead coral crevices.

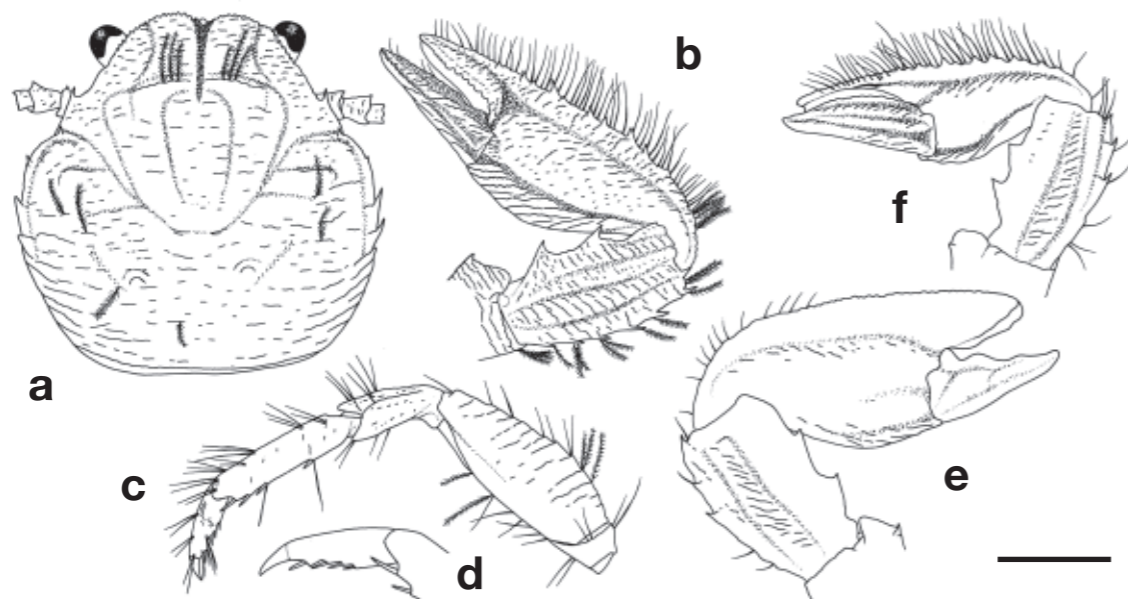


Fig. 131. Female (cl 3.2 mm), Nanwan, Pingtung County, 23 Oct 1991, a–d; male (cl 2.7 mm), Chatan, Okinawa Island, Ryukyu Islands, Japan, 2 May 2007, e, f: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, right larger cheliped, dorsal view; **c**, left second pereopod, lateral view; **d**, same, dactylus, lateral view; **e**, larger cheliped, dorsal view; **f**, smaller cheliped, dorsal view. Scale: a, c = 1.0 mm; b, e–f = 1.3 mm; d = 0.6 mm.

Pisidia serratifrons (Stimpson, 1858)

鋸額豆瓷蟹



Fig. 132. Male, Nangan, Matsu, Lienchiang County, 18 Feb 1994.

Porcellana serratifrons Stimpson, 1858: 242 [type locality: Hong Kong]; 1907: 189, pl. 23–fig. 2.—Miyake, 1943: 121, figs. 44–45.

Porcellana spinulifrons Miers, 1879: 21 [type locality: “Korean Channel” = Korea Strait].

Pisidia serratifrons.—Haig, 1981a: 277; 1992: 319, fig. 15.—Hsieh *et al.*, 1997: 330, figs. 24H, 30.

Material examined.—Furong-ao, Matsu, Lienchiang County, 24 Feb 1992: 3 males (cl 6.9–8.0 mm) (NTOU A00436). Nangan, Matsu, Lienchiang County, 24 Feb 1992: 2 males (cl 7.3, 6.9 mm) (NTOU A00424). No specific locality: 4 females (cl 4.5–6.3 mm) (NTOU A00914).—8 damaged specimens (NTOU A00916).—2 females (cl 6.9, 6.9 mm) (NTOU A00995).

Diagnosis.—Carapace with numerous short striae, flattened on dorsal surface; rostrum nearly horizontal in lateral view, divided into 3 lobes in dorsal view, median lobe distinctly broader than lateral lobes, denticulate on anterior margin; external orbital angle terminating in small spine; branchial margins each with 1 spine anterior to midpoint. Chelipeds with carpi unarmed or each with 2 low lobes or small acute teeth except for small, blunt or acute, distal projection on dorsoflexor margin, dorso-extensor margin with small, acute distal projection

(spine) and with slightly elevated short ridge or small spine on distal third; chela unarmed (male larger cheliped) or with row of small teeth (male smaller cheliped and female chelipeds) on extensor margin; median longitudinal crest on dorsal surface of palm obsolete and smooth (larger cheliped), or distinct but smooth (male smaller cheliped), or with row of slightly elevated short ridges (female smaller cheliped); cutting regions of fingers with dense plumose setae; tip of dactylus of small cheliped bifurcate. Ambulatory legs relatively slender, with sparse plumose setae marginally; meri slightly crenulated but unarmed on extensor margin; carpi each with extensor margin terminating in small spine; dactyli each with 4 or 5 corneous spines on flexor margin.

Size.—To cl 11.3 mm (Miyake, 1943).

Coloration.—Carapace and pereopods generally dark brown. Carapace with 2 pairs of white marks on mesial branchial regions and with numerous small spots on entire surface. Ambulatory legs with irregular white marks. Stimpson (1907) mentioned the coloration as “grayish-brown; anterior part of carapace, and sometimes the chelipeds, mottled with dark brood-red”.

Habitat.—Intertidal to 68 m deep (Haig, 1981a); found among fouling animals and seaweeds on ships’ bottoms (Miyake, 1943); beneath silt and mud-covered rocks and among ascidians and rock oysters, dead coral base, sheltering under crinoids (Haig, 1992).

Distribution.—Yellow Sea, Korean Strait, Taiwan Strait, East and South China Seas, Honshu south to Kyushu in Japan.

Remarks.—*Pisidia serratifrons* is so far only known from Matsu on the eastern side of the Taiwan Strait near mainland China, and has not yet been found in Taiwan proper. The armature on the branchial margins of the carapace and carpi of the chelipeds is rather variable in this species. The syntypes from Hong Kong (Stimpson, 1907) and material from Japan (Miyake, 1943) are described as having the branchial margin of the carapace sometimes bearing a minute spine in front of a distinct submedian spine. Such variation is also present in the present Taiwan Strait material. Moreover, the male syntype has the carpus of the cheliped armed with two spines on the dorso-extensor distal margin, and the Japanese specimens have two or three spines on this margin. However, the Taiwan Strait material usually has only one distal spine, which is sometimes accompanied with an additional spine on the distal third of the dorso-extensor margin of the carpus of the cheliped. *Pisidia striata* Yang & Sun, 1990 closely resembles *P. serratifrons*, but differs in that the fixed finger of the smaller cheliped is not bifurcate.

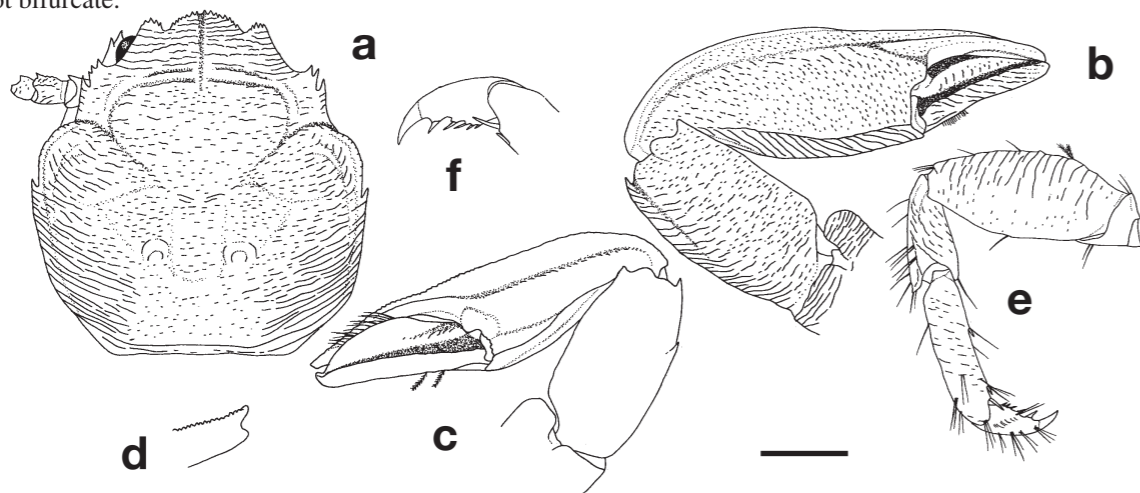


Fig. 133. Male (cl 8.0 mm), Furong-ao, Matsu, Lienchiang County, 24 Feb 1992: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, larger cheliped, dorsal view; **c**, smaller cheliped, dorsal view; **d**, same, distal tip of fixed finger, ventral view; **e**, left second pereopod, lateral view; **f**, same, dactylus, lateral view. Scale: a, e = 2.0 mm; b–d = 2.5 mm; f = 1.3 mm.

Genus *Polyonyx* Stimpson, 1858

多指瓷蟹屬

Polyonyx Stimpson, 1858: 229 [type species: *Porcellana macrocheles* Gibbes, 1850, by original designation. As discussed by Haig (1956), this species name is preoccupied by *Porcellana macrocheles* Poeppig, 1836 (a junior synonym of *Porcellana violacea* Guérin, 1829); and thus, it was replaced by *Polyonyx gibbesi* Haig, 1956. Gender: masculine].

Diagnosis.—Carapace broader than long; dorsal surface moderately to strongly convex, usually nearly smooth, regions weakly or moderately defined. Rostrum trilobate; median lobe bent ventrally. External orbital angle not or slightly produced. Hepatic and branchial margins unarmed. Pterygostomian flaps entire. Antennal peduncle with movable (second to fourth) articles excluded from orbit by projection of immovable (first) article adpressed to anterior margin of carapace. Chelipeds usually unequal; chelae inflated, subcylindrical; dactylus opening obliquely. Ambulatory legs with dactyli each bearing biunguiculate claw. Male with or without pair of gonopods on second abdominal segment. Telson divided into 7 plates.

Remarks.—This genus is comprised of 18 extant species in the world (De Grave *et al.*, 2009), although the taxonomy of some species needs re-assessment (Osawa, 2007a, b). For example, the genus *Euleniaios* Ng & Nakasone, 1993 was established for *Polyonyx cometes* Walker, 1887, but Werding (2001) did not recognize this genus. Nevertheless, Osawa (2007b) suggested that the characteristic structure on the carapace of *P. cometes* discussed by Ng & Nakasone (1993) may support the establishment of *Euleniaios*. Detailed comparisons of all the species of *Polyonyx* will be necessary to fully assess the validity of *Euleniaios*. Most species of *Polyonyx* are known to be associated with corals, sponges, and tube-dwelling polychaetes such as *Chaetopterus* and *Mesochaetopterus* (Werding 2001; Osawa 2001). Only two species are known from Taiwan, one of them is a new record for the island.

Key to species of *Polyonyx* from Taiwan

1. Dactyli of ambulatory legs each with extensor claw subequal in length to flexor claw; flexor margin with 1 spine *P. obesulus*
- Dactyli of ambulatory legs each with extensor claw much shorter than flexor claw; flexor margin with 2 spines *P. sinensis*

Polyonyx obesulus Miers, 1884
肥胖多指瓷蟹



Fig. 134. Ovigerous female (cl 2.5 mm), Gongguanbi, Ludao, Taitung County, 22 Jul 2009.

Porcellana obesula White, 1847, 130 [*nomen nudum*].

Polyonyx obesulus Miers, 1884: 272, pl. 29–fig. D [type locality: Madgica-Sima (= Sakishima) Islands, Ryukyu Islands].—Johnson, 1958: 108–fig. 4.—Haig, 1964: 378; 1979: 132, figs. 20–22; 1992; 321, fig. 17.—Yang & Xu, 1994: 117, fig. 4.—Osawa, 2007b: 36, fig. 11.

Porcellana (*Polyonyx*) sp.—De Man, 1888: 424, pl. 19–fig. 1.

Porcellana (*Polyonyx*) *tuberculosa* De Man, 1888: 424 [type locality: Amboina, Moluccas, Indonesia].

Polyonyx parvidens Nobili, 1906a: 161 [type locality: Persian Gulf].

Polyonyx paucidens Nobili, 1906b: 70, pl. 5–fig. 16 [*lapsus calami* for *Polyonyx parvidens* Nobili, 1906].

Polyonyx biunguiculatus.—Haig, 1964: 377 (in part).—Hsieh *et al.*, 1997: 349, fig. 40. [not *Polyonyx biunguiculatus* (Dana, 1852)]

Material examined.—Gongguanbi, Ludao, Taitung County, 22 Jul 2009: 1 male (cl 2.3 mm), 1 ovigerous female (cl 2.5 mm) (NTOU A01144). Taiwan Strait, 25°28'N, 120°29'E, 66 m, Apr 1897: 1 male (cl 3.7 mm) (ZMUC).

Diagnosis.—Carapace nearly smooth, with small pits and very short, delicate striae on dorsal surface; rostrum trilobate, without row of dense plumose setae on anterior margin, median lobe broad and blunt, exceeding lateral lobes. Chelipeds with long carpi each without distinct lobes on dorsoflexor margin; chelae with short striae or small protuberances on dorsal extensor surface; dactyli each with elevated ridge on dorsoflexor (posterior) margin, distal tips curved. Ambulatory legs with dactyli each with extensor claw more slender than and subequal in length to flexor claw, flexor margin with 1 small corneous spine. Male with or without pair of gonopods on second abdominal segment.

Size.—To cl 8.2 mm (Haig, 1979).

Coloration.—In specimens from Lyudao, carapace and chelipeds bright red, with irregular white marks. Ambulatory legs almost entirely bright red. Eggs dark blue.

Habitat.—Shallow water to about 55 m deep, frequently in sponges and crevices of corals (Haig, 1979, 1992).

Distribution.—Indo-West Pacific, from Persian Gulf to Sakishima (Ryukyu) Islands in Japan, Indonesia, tropical Australia, and Loyalty Islands.

Remarks.—As pointed out by Johnson (1958: 96, 112), *Polyonyx paucidens* Nobili, 1906b is a *lapsus calami* for *P. parvidens* Nobili, 1906a. The holotype in the Muséum national d'Histoire naturelle, Paris, is labeled "*Polyonyx paucidens*" (see Haig 1966b; Osawa, 2007b).

The specimen from the eastern part of the Taiwan Strait reported as *P. biunguiculatus* (Dana, 1852) by Haig (1964) was re-examined. The specimen is a small male and lacks gonopods. It is actually *P. obesulus* since only one corneous spine is present on the flexor margin of the dactylus of each ambulatory leg. This species is now also found from Taiwan proper and represents a new record for Taiwan. However, the Lyudao material differs from the Taiwan Strait specimen in having a relatively broader carapace and stouter propodi of the ambulatory legs, a projection proximal to the corneous spine on the flexor margin of the dactylus of each ambulatory leg, and a pair of gonopods in the male. These characters agree well with the specimens from the Loyalty Islands reported by Osawa (2007b). The taxonomy of *P. biunguiculatus* and *P. obesulus* is still problematic (see Osawa, 2007b), and a revision of these two species as well as their synonyms will be necessary. For the time being, the Taiwanese material is tentatively referred to *P. obesulus*.

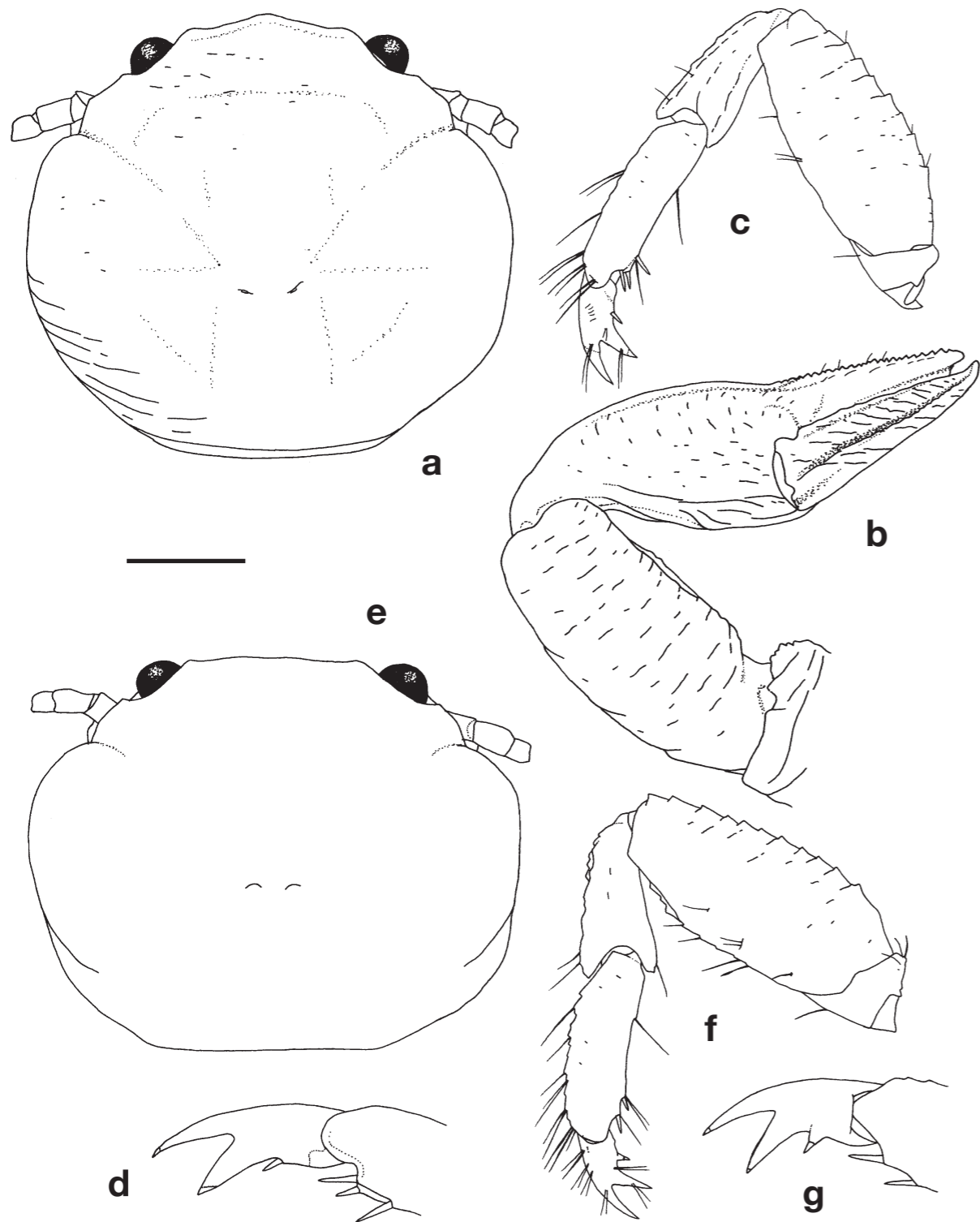


Fig. 135. Male (cl 3.7 mm), Taiwan Strait, 25°28'N, 120°29'E, Apr 1897, a–d; male (cl 2.3 mm), Gongguanbi, Ludao, Taitung County, 22 Jul 2009, e–g: **a, e**, carapace and ocular and antennal peduncles, dorsal view; **b**, larger left cheliped, dorsal view; **c, f**, left second pereopod, lateral view; **d, g**, same, dactylus, lateral view. Scale: a, c, e–f = 1.0 mm; b = 1.3 mm; d, g = 0.5 mm.

Polyonyx sinensis Stimpson, 1858
中華多指瓷蟹



Fig. 136. Male, Gaomei, Taichung County, 9 Nov 1996.

Polyonyx sinensis Stimpson, 1858: 244; 1907: 194, pl. 19–fig. 5 [type locality: China Sea].—Miyake, 1943: 138, figs. 56–57.

Polyonyx asiaticus Shen, 1936: 279, figs. 1–2 [type locality: Chefoo, Shantung Peninsula, China].

Polyonyx bella Hsueh & Huang, 1998: 332, figs. 1–3 [type locality: Gaomei, Taichung County, Taiwan].—Werdinger, 2001: 109.

Material examined.—Gaomei, Taichung County, 9 Nov 1996, 1 female (cl 3.6 mm) (NMNS 2502–1, holotype of *Polyonyx bella*), 1 male (cl 3.0 mm) (NMNS 2502–2, paratype of *Polyonyx bella*), 11 females (cl 2.9–3.5 mm) (NMNS 2502–3, paratypes of *Polyonyx bella*).

Diagnosis.—Carapace with small pits and very short delicate striae on dorsal surface; rostrum faintly trilobate, without row of dense plumose setae on anterior margin, median lobe low; branchial margins subparallel. Chelipeds with long carpi each with broad blunt lobe on distal half of dorsoflexor margin; carpus of larger cheliped with broad concavity on proximal half of dorsoflexor margin; chelae with row of plumose setae on extensor margin; dactyli usually with obsolete (larger cheliped) or distinct (smaller cheliped) longitudinal

row of denticles on dorsoflexor (posterior) margin; fingers of larger cheliped crossing distally with dactylus distinctly curved. Ambulatory legs relatively short; meri each subequal to or longer than combined length of carpus, propodus, and dactylus; carpi unarmed; propodi short; dactyli each with extensor claw much shorter than flexor claw, flexor margin with 2 small spines.

Size.—To cl 3.6 mm (Hsueh & Huang, 1998).

Coloration.—Carapace and pereopods generally light brown. Carapace with reticulated pattern of dark brown color on mesial branchial regions. Chelipeds with irregular dark brown marks. Ambulatory legs with dark brown band on median part of each meri and propodi; carpi also each with dark brown mark. Stimpson (1907) described the coloration as “a clear, pale-bluish gray color, with large spots of a neutral tint or sepia color”.

Habitat.—Low intertidal to about 48 m deep, shelly sand or sand bottom; associated with tubes of *Chaetopterus variopedatus* and *Mesochaetopterus japonica* (Miyake, 1965, Hsueh & Huang, 1998).

Distribution.—China, Taiwan, and Japan.

Remarks.—The holotype and twelve paratypes of *P. bella* Hsueh & Huang, 1998 were re-examined. Although Hsueh & Huang (1998) considered the presence of transverse rows of granules on the epigastric region of the carapace as a specific character of *P. bella*, such rows of granules were not found in the types. On the other hand, the types of *P. bella* agree well with the descriptions of *P. sinensis* given by Stimpson (1858, 1907) and Miyake (1943). Comparison with some Japanese specimens of *P. sinensis* (Kagoshima Bay, Kyushu, one male cl 3.7 mm, two females cl 3.9 and 4.4 mm, CBM-ZC 8871) also shows no clear morphological and color distinctions between these two species. This supports Werding’s (2001) conclusion that *P. bella* is a junior synonym of *P. sinensis*.

Polyonyx vermicola Ng & Sasekumar, 1993 is closely allied to *P. sinensis*. Re-examination of the paratypes of *P. vermicola* (Morib, Selangor state, Peninsular Malaysia, 1975, 13 males, nine females, not measured, ZRC 1993.6818–6839) shows that this species differs from *P. sinensis* in having the fixed finger of the larger cheliped with the tip somewhat turned outwards rather than straight. *Polyonyx thai* Werding, 2001 also resembles *P. sinensis* and *P. vermicola*, but differs in having the carpus of the larger cheliped being proportionally shorter (about 1.5 vs 2.0 times as long as broad) and its dorsoflexor margin with a deep short, proximal concavity instead of a broad concavity on the proximal half.

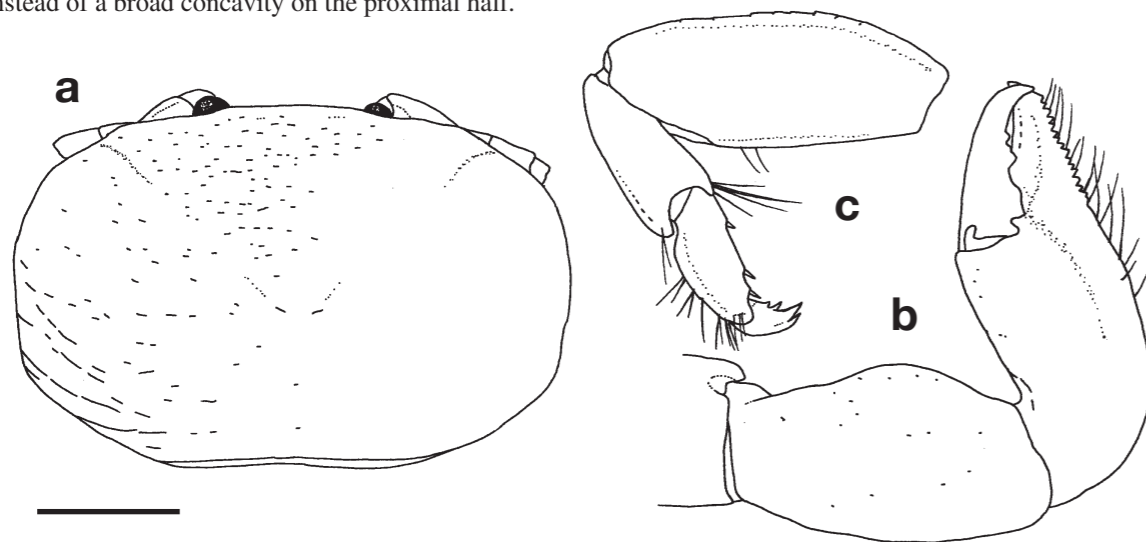


Fig. 137. Female (cl 3.6 mm, holotype of *Polyonyx bella*), Gaomei, Taichung County, 9 Nov 1996: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, larger right cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale: a, c = 1.4 mm; b = 2.1 mm.

Genus *Porcellanella* White, 1852

小瓷蟹屬

Porcellanella White, 1852: 395 [type species: *Porcellana triloba* White, 1852, by monotypy. Gender: feminine].

Diagnosis.—Carapace distinctly longer than broad; dorsal surface weakly convex, nearly smooth, regions weakly defined. Rostrum trilobate; median lobe exceeding lateral lobes, nearly horizontal. External orbital angle not or weakly produced. Branchial margin unarmed. Pterygostomian flaps entire. Antennal peduncle with movable (second to fourth) articles excluded from orbit by projection of immovable (first) article adpressed to anterior margin of carapace. Chelipeds subequal; chelae inflated, subcylindrical; dactylus opening obliquely. Ambulatory legs short; dactyli each with quadriunguiculate claw. Male with pair of gonopods on second abdominal segment. Telson divided into 7 plates.

Remarks.—This genus includes only two species, *P. triloba* White, 1852 and *P. haigae* Sankarankutty, 1963, both occurring in the Indo-West Pacific. These species live on the branches of Pennatulacea (sea pens) such as *Cavernularia*, *Pteroeides*, *Veretillum*, and *Virgularia* on muddy or sandy bottoms. Only one species has been recorded from Taiwan.

Porcellanella triloba White, 1852

三葉小瓷蟹



Fig. 138. Ovigerous female (cl 8.3 mm), Dasi fishing port, Yilan County, 13 Jan 2005.

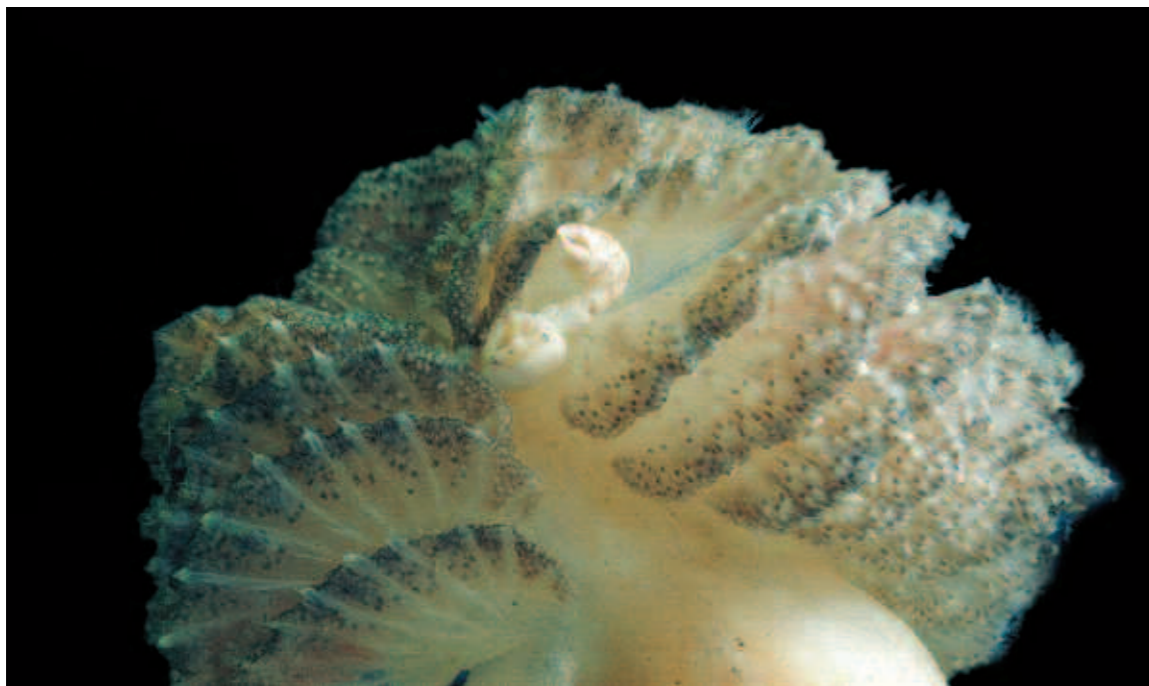


Fig. 139. Male (cl 10.1 mm), Dasi fishing port, Yilan County, 25 Sep 1992.

Porcellanella triloba White, 1852: 394, pl. 5—figs. 2, 2a [type locality: off Cape Capricorn, Queensland].—Haig, 1965: 111; 1981a: 287; 1992: 323, fig. 19.—Nakasone & Yu, 1987: 107, fig. 1, pl. 1.—Hsieh *et al.*, 1997: 347, figs. 32F, 39.

Porcellanella picta Stimpson, 1858: 243 [type locality: Hong Kong]; 1907: 193, pl. 22—fig. 6.—Miyake, 1943: 134, figs. 54–55.

Material examined.—Nanliao fishing port, Mituo, Kaohsiung County, 31 Oct 1992: 1 male (cl 7.6 mm) (NTOU A00903).—25 Nov 1992: 1 male (cl 9.2 mm) (NTOU A00696). Kaohsiung County, 1992: 1 male (cl 10.8 mm) (NTOU A00896). Dasi fishing port, Yilan County, 5 Jul 1990: 1 male (cl 10.0 mm), 1 ovigerous female (cl 9.5 mm), 2 females (cl 10.4, 10.8 mm) (NTOU A00699).—8 Jan 1991: 1 male (cl 11.1 mm) (NTOU A00700).—27 Jul 1992: 1 ovigerous female (cl 10.5 mm) (NTOU A00901).—28 Jul 1992: 1 ovigerous female (cl 10.3 mm) (NTOU A00702).—25 Sep 1992: 1 male (cl 10.1 mm) (NTOU A00698).—24 Oct 1992: 1 ovigerous female (cl 10.7 mm) (NTOU A00900).—8 Dec 1992: 1 female (cl 11.3 mm) (NTOU A00902).—25 Nov 1992: 1 male (cl 7.4 mm) (NTOU A00701).—5 Mar 1993: 1 male (cl 10.2 mm) (NTOU A00898).—17 Jul 2000: 2 ovigerous females (cl 9.4, 10.1 mm) (NTOU A00904).—13 Jan 2005: 1 ovigerous female (cl 8.3 mm) (NTOU A00586).—25 Apr 2008: 1 male (cl 8.2 mm) (NTOU A00897).—no date: 1 ovigerous female (cl 8.8 mm) (NTOU A00899). Nanfang-ao fishing port, Yilan County, 16 Mar 1986: 1 male (cl 9.6 mm), 1 female (cl 11.5 mm) (NTOU A00693). CP 169, 22°27.29'N, 120°17.90'E, 36m, 26 May 2002: 1 ovigerous female (cl 9.0 mm) (NTOU A00904).

Diagnosis.—Carapace with interrupted and uninterrupted transverse ridges on anterior region; branchial margins somewhat convergent posteriorly. Chelipeds with meri each with distinct, roundly subtriangular lobe on dorsoflexor margin distally; carpi relatively short; palm each with tufts of dense plumose setae along midline on distal half of ventral surface. Ambulatory legs with sparse plumose setae; dactyli each with 4 distinct teeth, proximal second tooth strongest.

Size.—To cl 11.5 mm (present study).

Coloration.—Carapace and pereopods pale yellowish or white. Carapace with pinkish brown mark located near each margin between median and lateral frontal lobes; long pinkish brown mark present along anterior third of each lateral margin. Chelipeds with irregular pinkish brown marks. Ambulatory legs without distinct marks. Marks on carapace and cheliped with dark colored margins. Eggs white, red or orange in different development stages. Stimpson (1907) described the coloration of the material from Hong Kong as “white, with a few large, blue, margined spots or ocelli on the hands and the anterior portion of the carapax”.

Habitat.—Intertidal to about 72 m deep, sand and mud bottoms, associated with sea pens such as *Pennatula* and *Pteroeides*.

Distribution.—East coast of Africa and Persian Gulf across the Indian Ocean to the East Indian Archipelago, thence south to the east and west coasts of tropical Australia and north to Honshu, Japan.

Remarks.—The specimen illustrated has the dactylus of the left second pereopod bearing a minute spinule near the proximalmost tooth. This species is distinguished from *P. haigae* by the merus of the cheliped being armed with a distinct, subtriangular lobe on the dorsoflexor margin distally (in *P. haigae*, this lobe is indistinct) and stouter carpus of the cheliped, and the dactyli of the ambulatory legs each with the proximal second tooth largest (in *P. haigae*, the distal second tooth is largest).

Genus *Raphidopus* Stimpson, 1858

細足蟹屬

Raphidopus Stimpson, 1858: 228 [type species: *Raphidopus ciliatus* Stimpson, 1858, by monotypy. Gender: masculine].

Diagnosis.—Carapace distinctly broader than long; dorsal surface somewhat convex and weakly uneven, regions moderately or distinctly defined. Rostrum trilobate, horizontal or slightly bent ventrally. External orbital angle not produced. Branchial margins unarmed or with some spines. Pterygostomian flaps entire, with dense plumose setae. Antennal peduncle with movable (second to fourth) articles excluded from orbit by projection of immovable (first) article adpressed to anterior margin of carapace. Chelipeds subequal or somewhat unequal, generally covered with long plumose setae; chelae inflated; dactylus opening obliquely. Ambulatory legs slender; dactyli each with a single claw, almost straight and without spines on flexor margin. Male with pair of gonopods on second abdominal segment. Telson divided into 7 plates.

Remarks.—This genus contains three species, all from the Indo-West Pacific: *R. ciliatus* Stimpson, 1858, *R. indicus* Henderson, 1893 and *R. johnsoni* Ng & Nakasone, 1994. These species seem to be free-living or live in association with burrowing worms (terebellid polychaetes) or sea cucumbers on muddy bottom (Ng & Nakasone, 1994). Only one species has been recorded from Taiwan.

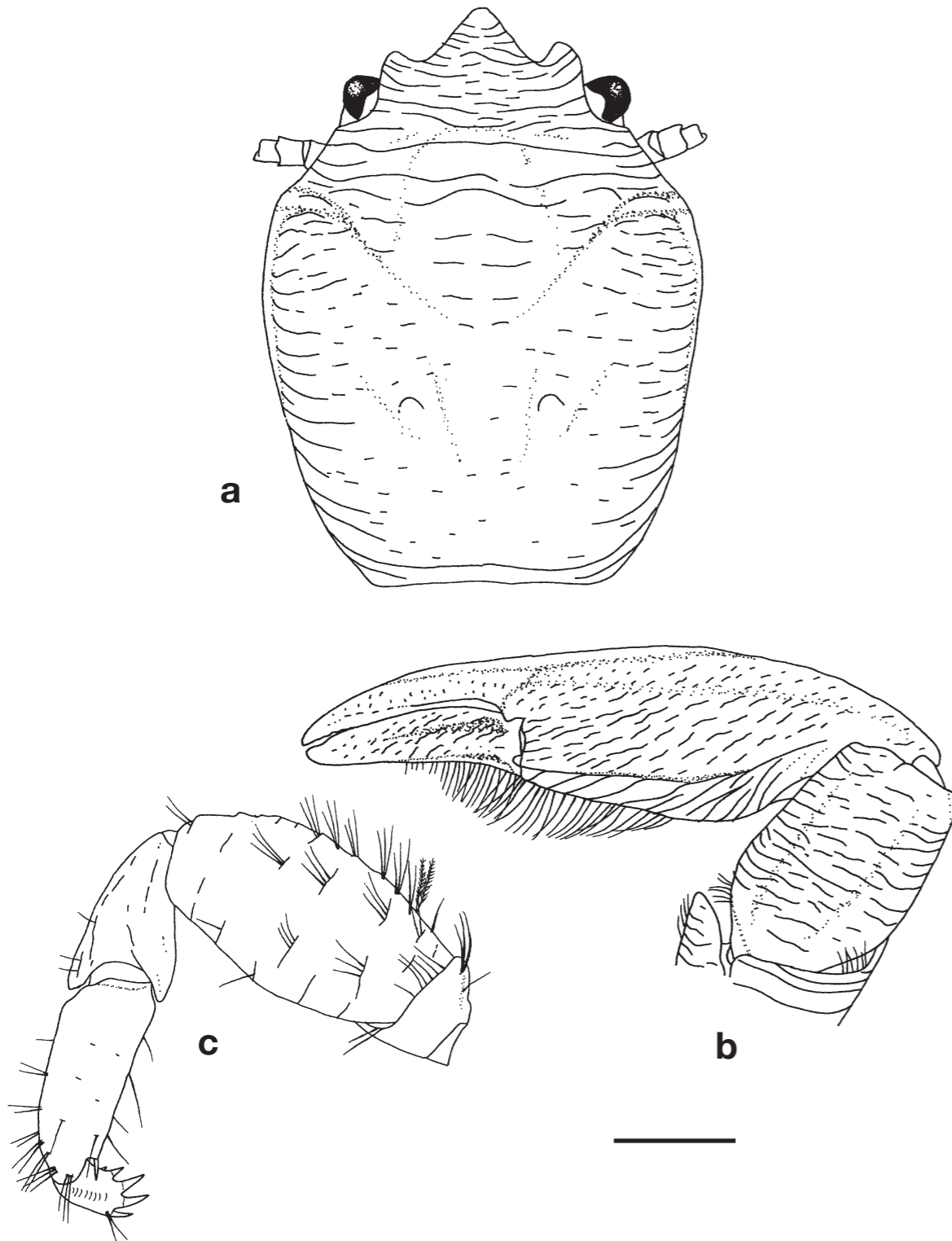


Fig. 140. Male (cl 9.6 mm), Nanfang-ao fishing port, Yilan County, 16 Mar 1986: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, right cheliped, dorsal view; **c**, left second pereopod, lateral view. Scale: a, c = 2.0 mm; b = 1.3 mm.

Raphidopus ciliatus Stimpson, 1858
細足蟹屬



Fig. 141. Male (cl 9.2 mm), Chaishan, Kaohsiung City, 1992.

Raphidopus ciliatus Stimpson, 1858: 241 [type locality: Hong Kong]; 1907: 185, pl. 22—fig. 5.—Miyake, 1943: 146, figs. 61–62.—Haig, 1981a: 274; 1992: 324, fig. 20.—Ng & Nakasone, 1994: 3, figs. 1–2.—Hsieh *et al.*, 1997: 351, figs. 32G, 41.

Material examined.—Tongsiao, Miaoli County, 30 Aug 1992: 1 male (cl 5.9 mm) (NTOU A00708). Jishueisi, Tainan County, 17 May 1991: 1 male (cl 9.4 mm) (NTOU A00910). Chaishan, Kaohsiung City, 1992: 1 male (cl 9.2 mm) (NTOU A00907).

Diagnosis.—Carapace covered with short transverse striae; branchial margins each with 2 or 3 median spines and some smaller denticles; cervical grooves each with distinctly defined anterior angles. Chelipeds with carpi and palms each with distinct blunt ridge on dorsal midline; carpi broadened distally, dorso-extensor margin with row of spines decreasing in size proximally; large gape present between fingers of larger cheliped; fixed finger of larger cheliped with prominent subtriangular tooth on median cutting margin. Ambulatory legs with each segment relatively narrow and slender, especially on second pereopods.

Size.—To cl 9.4 mm (present study).

Coloration.—Carapace purplish brown on anterior two thirds and white on posterior third. Chelipeds with mottled pattern of purplish brown and white. Ambulatory legs entirely white. Setae brown.

Habitat.—Low intertidal to 27 m deep, soft muddy or sandy substrates, free-living or rarely associated with burrows of sea cucumbers (Miyake, 1998; Ng & Nakasone, 1994).

Distribution.—Australia, Korea, Japan, Taiwan, Hong Kong, Guangxi Province in China, Singapore, Gulf of Thailand, western Malay Peninsula and Arabian Sea.

Remarks.—*Raphidopus ciliatus* differs from *R. indicus* and *R. johnsoni* in having the carapace with some distinct spines on the branchial margins and the carpi of the chelipeds each with a row of distinct spines on the dorso-extensor margin. These margins are unarmed in both *R. indicus* and *R. johnsoni*.

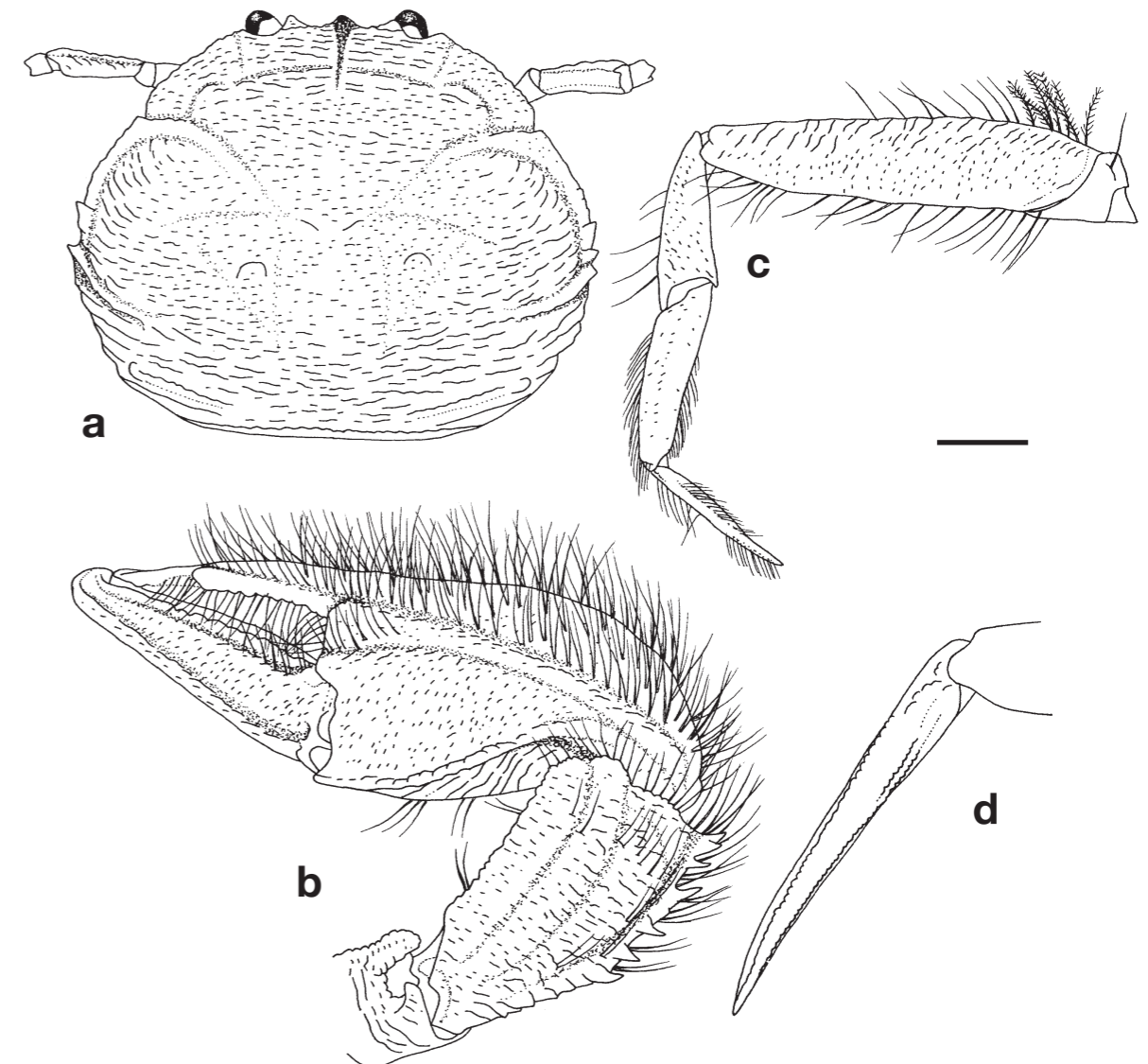


Fig. 142. Male (cl 9.4 mm), Jishueisi, Tainan County, 17 May 1991: **a**, carapace and ocular and antennal peduncles, dorsal view; **b**, right cheliped, dorsal view; **c**, left second pereopod, lateral view; **d**, same, dactylus, lateral view. Scale: a, c = 2.0 mm; b = 5.0 mm; d = 1.6 mm.

Taxonomic and Nomenclatural Decisions Made in This Work

Revised status:

Petrolisthes securiger Melin, 1939 removed from the synonymy of *Novorostrum indicum* (De Man, 1893).

Type species designation:

Leptolithodes Benedict, 1895. Type species *Paralomis aculeata* Henderson, 1888, here selected.

Pristopus Benedict, 1895. Type species *Pristopus verrilli* Benedict, 1895, here selected.

[*Leptolithodes* and *Pristopus* presently in synonymy of *Paralomis* White, 1856]

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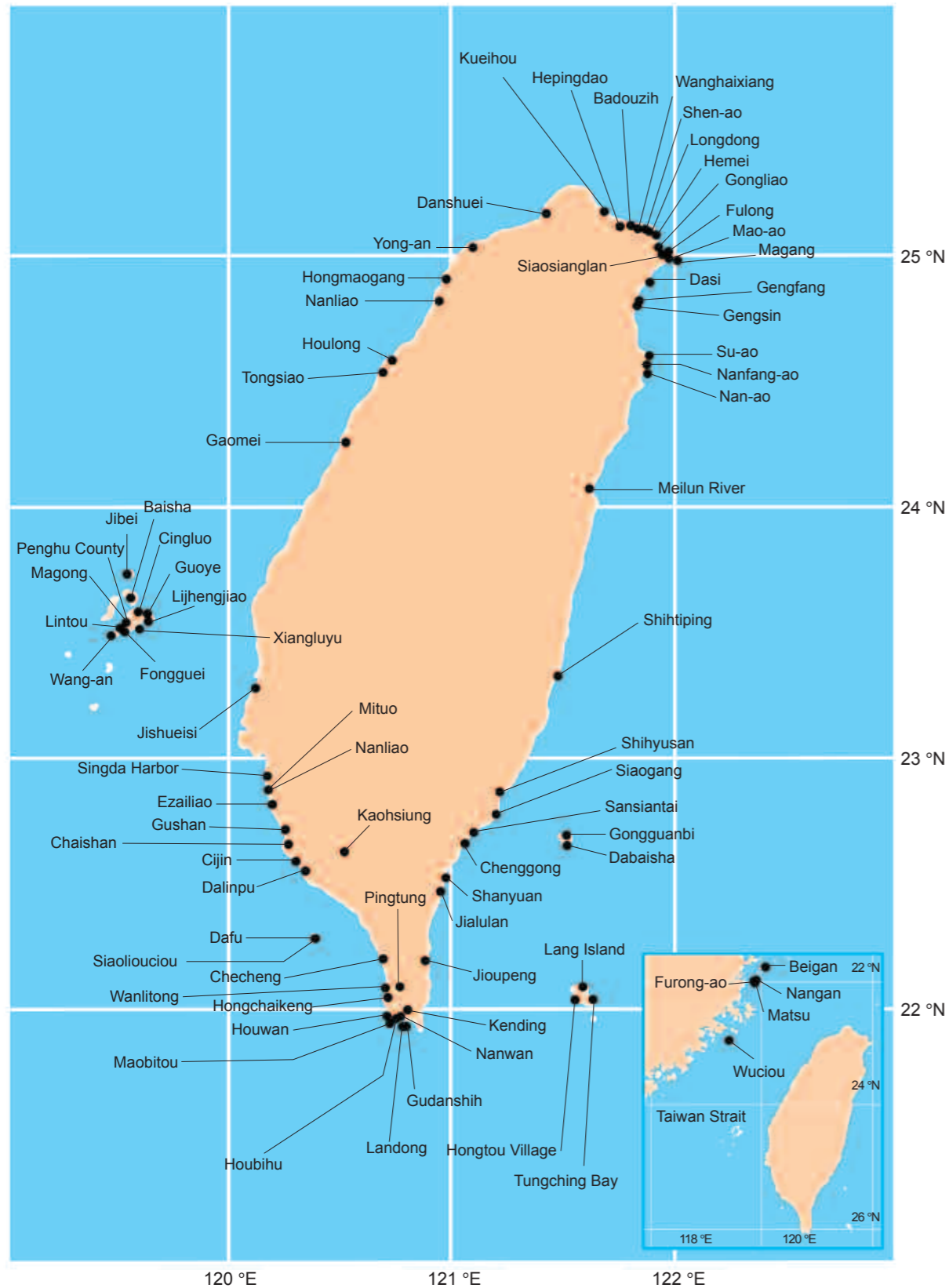
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Map of Taiwan



List of Localities in English and Chinese

Badouzh, Keelung City	基隆市, 八斗子	Landong, Kending, Pingtung County	屏東縣, 墾丁, 藍洞
Baisha, Penghu County	澎湖縣, 白沙	Lang Island (Iralalay), Lanyu, Taitung County	臺東縣, 蘭嶼, 朗島
Beigan, Matsu, Lienchiang	連江縣, 馬祖, 北竿	Lijhengjiao, Penghu County	澎湖縣, 裡正角
Chashan, Kaosiung City	高雄市, 柴山	Lintou, Penghu County	澎湖縣, 林投
Checheng, Pingtung County	屏東縣, 車城	Longdong, Taipei County	臺北縣, 龍洞
Chenggong, Taitung County	臺東縣, 成功	Magang, Taipei County	臺北縣, 馬崗
Cijin, Kaohsiung County	高雄縣, 旗津	Magong, Penghu County	澎湖縣, 馬公
Cingluo, Penghu County	澎湖縣, 青螺	Mao-ao, Taipei County	臺北縣, 卯澳
Dabaisha, Ludao, Taitung County	臺東縣, 綠島, 大白沙	Maobitou, Pingtung County	屏東縣, 貓鼻頭
Dafu, SiaoLiouciou, Pingtung County	屏東縣, 小琉球, 大福	Matsu, Lienchiang	連江縣, 馬祖
Dalinpu, Kaohsiung City	高雄市, 大林埔	Meilun River, Hualien County	花蓮縣, 美崙溪
Danshuei, Taipei County	臺北縣, 淡水	Mituo, Kaohsiung County	高雄縣, 彌陀
Dasi, Yilan County	宜蘭縣, 大溪	Nan-ao, Yilan County	宜蘭縣, 南澳
Ezailiao, Kaohsiung County	高雄縣, 蚵仔寮	Nanfang-ao, Yilan County	宜蘭縣, 南方澳
Fongguei, Penghu County	澎湖縣, 風櫃	Nangan, Matsu, Lienchiang County	連江縣, 南竿, 馬祖
Fulong, Taipei County	臺北縣, 福隆	Nanliao, Hsinchu City	新竹市, 南寮
Furong-ao, Matsu, Lienchiang County	連江縣, 馬祖, 芙蓉澳	Nanliao, Mituo, Kaohsiung County	高雄縣, 彌陀, 南寮
Gaomei, Taichung County	臺中縣, 高美	Nanwan, Pingtung County	屏東縣, 南灣
Gengfang, Yilan County	宜蘭縣, 梗枋	Penghu County	澎湖縣
Gengsin, Yilan County	宜蘭縣, 更新	Pingtung County	屏東縣
Gongguanbi, Ludao, Taitung County	臺東縣, 綠島, 公館鼻	Sansiantai, Taitung County	臺東縣, 三仙台
Gongliao, Taipei County	臺北縣, 貢寮	Shanyuan, Taitung County	臺東縣, 杉原
Gudanshih, Kending, Pingtung County	屏東縣, 墾丁, 孤單石	Shen-ao, Taipei County	臺北縣, 深澳
Guoye, Penghu County	澎湖縣, 果葉	Shihiting, Hualien County	花蓮縣, 石梯坪
Gushan, Kaohsiung City	高雄市, 鼓山	Shihyusan, Taitung County	臺東縣, 石雨傘
Hemei, Taipei County	臺北縣, 和美	Siaogang, Taitung County	臺東縣, 小港
Hepingdao, Keelung City	基隆市, 和平島	Siaoliouciou, Pingtung County	屏東縣, 小琉球
Hongchaikeng, Pingtung County	屏東縣, 紅柴坑	Siasianglan, Taipei County	臺北縣, 小香蘭
Hongmaogang, Hsinchu County	新竹縣, 紅毛港	Singda Harbor, Kaohsiung County	高雄縣, 興達港
Hongtou Village, Lanyu, Taitung County	臺東縣, 蘭嶼, 紅頭村	Su-ao, Yilan County	宜蘭縣, 蘇澳
Houbihu, Kending, Pingtung County	屏東縣, 墾丁, 後壁湖	Tongshiao, Miaoli County	苗栗縣, 通宵
Houlong, Miaoli County	苗栗縣, 後龍	Tongwangkoucyu (locality unable to locate)	通望口區 (確切地點不明)
Houwan, Pingtung County	屏東縣, 後灣	Tungching Bay, Lanyu, Taitung County	臺東縣, 蘭嶼, 東清灣
Jialulan, Taitung County	臺東縣, 加路蘭	Wang-an, Penghu County	澎湖縣, 望安
Jibei, Penghu County	澎湖縣, 吉貝	Wanghaixiang, Keelung City	基隆市, 望海巷
Jioupeng, Pingtung County	屏東縣, 九棚	Wanlitong, Pingtung County	屏東縣, 萬里桐
Jishueisi, Tainan County	臺南縣, 急水溪	Wuciou, Kinmen County	金門縣, 烏坵
Kaohsiung County	高雄縣	Xiangluyu, Penghu County	澎湖縣, 香爐嶼
Kending, Pingtung County	屏東縣, 墾丁	Yong-an, Taoyuan County	桃園縣, 永安
Kueihou, Taipei County	臺北縣, 龜吼		

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