

The crabs of the families Dromiidae, Raninidae, Corystidae and Palicidae (Crustacea: Decapoda: Brachyura) of Taiwan

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黃襖麟 陳天任 王嘉祥 臺灣之綿蟹科、蛙蟹科、盔蟹科及扁蟹科蟹類 (甲殼綱: 十足目: 短尾類) 國立臺灣博物館專題論著第 10 輯: 155-180, March 2000

摘要

本報告記述臺灣產之綿蟹科(Dromiidae)、蛙蟹科(Raninidae)、盔蟹科(Corystidae)及扁蟹科(Palicidae)四科的蟹類, 其中綿蟹科有十種, 分別為幹練平殼蟹(*Conchoecetes artificiosus*)、中型平殼蟹(*C. intermedius*)、擬態隱綿蟹(*Cryptodromia fallax*)、真綿蟹(*Dromia dormia*)、韋氏綿蟹(*D. wilsoni*)、韓氏羅綿蟹(*Lauridromia dehaani*)、中型羅綿蟹(*L. intermedia*)、顆粒板蟹(*Petalomera granulata*)、肯氏圓綿蟹(*Sphaerodromia kendalli*)和脊足武綿蟹(*Takedromia cristatipes*)。蛙蟹科六種, 分別為葛氏六角蟹(*Cosmonotus grayi*)、指天背蟹(*Notopus dorsipes*)、東方小蛙蟹(*Ranilia orientalis*)、蛙形蟹(*Ranina ranina*)、窄琵琶蟹(*Lyreidus stenops*)和三齒琵琶蟹(*L. tridentatus*)。以上兩科有八種是臺灣的新記錄。盔蟹科三種, 其中的臺灣瓊娜蟹(*Jonas formosae*)以前認為是顯著瓊娜蟹(*Jonas distincta*)的亞種, 但兩者在臺灣都可發現, 本報告視其為獨立的種; 另外一種為瓊氏瓊娜蟹(*Jonas choprai*)。扁蟹科則是臺灣的新記錄科, 目前僅發現有一種刺足刺緣蟹(*Crossotonotus spinipes*)。

關鍵詞: 螃蟹、綿蟹科、蛙蟹科、盔蟹科、扁蟹科、臺灣、新記錄。

Abstract

The taxonomy of four families of marine crabs from Taiwan, the Dromiidae, Raninidae, Corystidae and Palicidae is treated. Ten species of dromiids (*Conchoecetes artificiosus*, *C. intermedius*, *Cryptodromia fallax*, *Dromia dormia*, *D. wilsoni*, *Lauridromia dehaani*, *L. intermedia*, *Petalomera granulata*, *Sphaerodromia kendalli*, *Takedromia cristatipes*) and six species of raninids (*Cosmonotus grayi*, *Notopus dorsipes*, *Ranilia orientalis*, *Ranina ranina*, *Ly-*

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reidus stenops, *L. tridentatus*) are recorded. Of these, eight are new records for the island. With regards to the three species of Corystidae, the identity of *Jonas distincta formosae*, a taxon previously regarded only as a subspecies of *Jonas distincta* or with doubt, is clarified, and is recognized as a distinct species. Both species present in Taiwan. Another species, *Jonas choprai*, is also redescribed. The palicid *Crossotonotus spinipes* (and the family Palicidae) is also recorded from Taiwan for the first time.

Key words: Crabs, Dromiidae, Raninidae, Corystidae, Palicidae, Taiwan, new records.

Introduction

Brachyuran crabs of the families Dromiidae (sponge crabs), Raninidae (frog crabs) and Corystidae (mole crabs) are poorly studied in Taiwan and only eight species are known thus far. These are, Dromiidae: *Conchoecetes artificiosus* (Fabricius, 1798), *Lauridromia dehaani* (Rathbun, 1923), *L. intermedia* (Laurie, 1906); Raninidae: *Cosmonotus grayi* Adams and White, 1848, *Lyreidus stenops* Wood Mason, 1887, *Ranina ranina* (Linnaeus, 1758); and Corystidae: *Jonas distincta* (De Haan, 1835), *J. formosae* Balss, 1922.

Consolidation of specimens from various collections showed that the dromiid, raninid and corystid fauna for Taiwan is higher than previously known. We here record 19 species from these three families from the island. In addition, the family Palicidae is recorded from Taiwan for the first time. Unless otherwise stated, the specimens were collected from local fishing ports or fish markets and are deposited in the crustacean collection of the National Taiwan Ocean University, Keelung (NTOU); Taiwan Museum, Taipei (TMCD); National Museum of Natural Sciences, Taichung (NMNS); National Science Museum, Tokyo (NSMT); and Zoological Reference Collection (ZRC) of the Raffles Museum, National University of Singapore. Measurements provided are of the carapace widths and lengths respectively. The abbreviation G1 is used for the male first pleopod. Synonymies are restricted for

original descriptions, literature relevant to Taiwan or of taxonomic significance. Comparative material from other localities (when necessary) are also listed in the under the material examined.

Taxonomy

Family Dromiidae De Haan, 1833

Conchoecetes artificiosus

(Fabricius, 1798)

(Fig. 1a, b)

Dromia artificiosa Fabricius, 1798: 360 (type-locality: Indian Ocean).

Conchoecetes artificiosus-Stimpson, 1858: 240; Chang, 1963: 95; McLay, 1993: 175.

Material examined.

TAIWAN: Tainan County, Anping, 1 male (dried), 4 VI 1979 (TMCD 383); 1 male (22.9 by 21.9 mm), IV 1998 (NTOU).--Taitung County, 1 dried specimen, 15 VII 1962 (TMCD 255).

HONG KONG: 1 male, 1992 (ZRC 1996.1885).

VIETNAM: 8° 10'N 104° 35'E, trawler, 1 ovigerous female, 22 IX 1969 (ZRC 1969.10.4.3).

SINGAPORE: South China Sea, 1 male, 16 IX 1983 (ZRC 1984.6309).

THAILAND: Chonburi Province, Gulf of Thailand, Angsila Fishing Port, trawls, 4 males (largest 26.3 by 25.0 mm), 1 female (21.3 by 21.0 mm), 29 IX 1998 (ZRC); 1 ovigerous female, 1996 (ZRC 1997.674).

Remarks.--*Conchoecetes artificiosus* is the

only species in the genus which has a distinct lateral tooth at the junction of the antero- and posterolateral margins, which is clearly demarcated from the rest of the anterolateral margin by a distinct notch. McLay (1993: 175), in his key, noted that *C. artificiosus* has two anterolateral teeth, but the first tooth is actually so broad and low that it is not easy to discern in most cases. The pink bright fingers are very characteristic for this species even in preserved specimens, although the extent of the pink pigmentation varies from between one- to two-thirds of the fingers. In contrast, the fingers of *C. intermedius* are light brown in fresh material, and completely white in preserved specimens.

Conchoecetes artificiosus has a wide distribution ranging from the Indian Ocean to Australia and China (Dai and Yang, 1991). Chang (1963) first recorded the species from Taiwan. In life, it has a brownish felt, which when removed, exposes a white carapace (Fig. la). As is well known, this species carries a bivalve shell on its back (Fig. lb). This species is apparently uncommon in Taiwan.

***Conchoecetes intermedius* Lewinsohn,
1984 (Fig. lc)**

Conchoecetes intermedius Lewinsohn, 1984 (type-locality: Madagascar): 119, Fig. 4.

Conchoecetes canaliculatus Yang and Dai, 1994: 127, 145, Fig. 3 (type-locality: South China Sea).

Material examined.

TAIWAN: Tungkang Pingtung County, 1 male (40.4 by 40.0 mm), 11 XII 1984 (NTOU).

SINGAPORE: South China Sea, 1 ovigerous female, 15 XII 1982 (ZRC 1993.321).

THAILAND: Ko Ma, off Ko Phi Phi, Gulf of Thailand, 25 m, 1 female (25.6 by 25.5 mm), 1990s (ZRC).

Remarks.--*Conchoecetes intermedius* is

similar to *C. artificiosus* superficially but can easily be separated by its entirely smooth and unarmed anterolateral margin. Adult specimens also grow to almost twice the size of large *C. artificiosus*. The anterolateral margin of large *C. intermedius* is lower than the orbits and eyes (when viewed frontally), and is covered with numerous well spaced small granules which are less obvious in smaller specimens. In *C. artificiosus*, the anterolateral margin is above the eyes.

Yang and Dai (1994) described a new species, *C. canaliculatus*, on the basis of a single female specimen (33.0 by 31.0 mm) from the South China Sea. They distinguished *C. canaliculatus* from *C. intermedius* by four main characters, viz. the carapace is completely calcified with the cervical and branchial grooves distinct (vs. carapace partially calcified, with a very weak branchial groove and no cervical groove), presence of a fringe of setae on each of the dorsal and ventral margins of the dactylus of the first and second ambulatory legs (vs. with two fringes of setae on each of the margins), with two tubercles on the external surface (of the propodus presumably) of the third ambulatory leg and the dactylus is claw-shaped (vs. without any tubercles on the external surface of the third ambulatory leg and the dactylus is hooked); and the fourth ambulatory leg is relatively stouter, with the merus 3.8 times as long as broad, the carpus twice as long as broad and the propodus about as long as broad (vs. fourth ambulatory leg relatively more slender, with the merus 5.4 times as long as broad, the carpus three times as long as broad and the propodus longer than broad) (Yang and Dai, 1994: 146). There are, however, problems. In their Chinese discussion of the differences between the two species, they noted that one difference was that the carpus of the third ambulatory leg had two tubercles on the external surface (Yang and Dai, 1994: 128), but in their Eng-

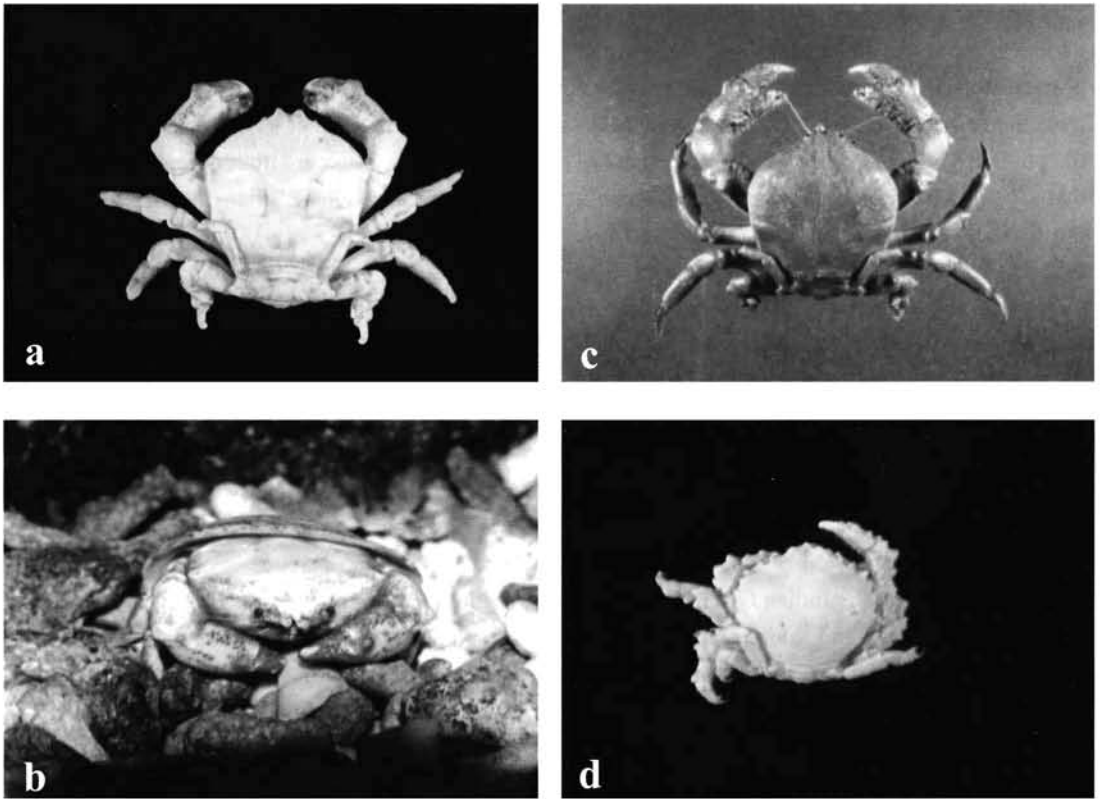


Fig. 1. a, *Conchoecetes artificiosus* (Fabricius, 1798), male (22.9 by 21.9 mm) (NTOU); b, *C. artificiosus*, male (22.9 by 21.9 mm) (NTOU), in life; c, *Conchoecetes intermedius* Lewinsohn, 1984, preserved specimen, male (40.4 by 40.0 mm) (NTOU); d, *Cryptodromia fallax* (Lamarck, 1818), preserved specimen, male (8.0 by 6.8 mm) (TMCD 2810).

lish comparisons (Yang and Dai, 1994: 146), they did not mention which segment had the two tubercles. It is clear from their descriptions and figures in any case, that the segment referred to is almost certainly the propodus.

None of the differences pointed out by Yang and Dai (1994) to distinguish the two species, however, are valid. Lewinsohn (1984: 121) had specifically described the propodus of the third ambulatory leg as having two tubercles. On his figure (Lewinsohn, 1984: Fig. 4e), the orientation of the propodus was such the two tubercles in question were directed laterally and not clearly visible. The supposed presence of two

rows (fringes) of setae on each of the dorsal and ventral margins of the dactylus of the first and second ambulatory legs in *C. intermedius* is incorrect. In describing the dactylus, Lewinsohn (1984: 121) stated that "...its upper margin bears a fringe of plumose setae and a row of shorter setae is visible over the middle of the outer surface; on the inner surface of the upper margin a second upper fringe of setae is present, so that, when seen from above, the dactylus appears invested with a double fringe of plumose setae between which there is a naked groove". Examination of the two present specimens from Taiwan and Thailand shows that the dactylus of the first

and second ambulatory legs, and the propodus of the third ambulatory leg, is as described and figured by Lewinsohn (1984) for *C. intermedius*, and that for *C. canaliculatus* by Yang and Dai (1994). The differences in the relative proportions of the fourth ambulatory legs between *C. intermedius* and *C. canaliculatus* highlighted by Yang and Dai (1994) seem valid but we believe this can be explained by sexual dimorphism in this species. The type of *C. intermedius* is a male, while that of *C. canaliculatus* is a female. The present male specimen from Taiwan has relatively longer fourth ambulatory legs while the female from Thailand has relatively shorter ones. The differences in shape of the dactylus of the fourth ambulatory leg noted by Yang and Dai (1994) are probably associated with size. That on the holotype male of *C. intermedius* (17.0 by 16.0 mm) figured by Lewinsohn (1984: Fig. 4e) is strongly recurved. The female specimen presently examined (25.6 by 25.5 mm) has a gently falcate dactylus, whilst that of the holotype female of *C. canaliculatus* (33.0 by 31.0 mm) is even more gently falcate (Yang and Dai, 1994: Fig. 3E). In the largest male (40.4 by 40.0 mm) from Taiwan, the dactylus is only slightly curved. The carapace differences are also clearly due to size differences. The holotype male of *C. intermedius* is small (17.0 by 16.0 mm) and the branchial grooves are weak with the cervical grooves indiscernible. In the larger female specimen from Thailand (25.6 by 25.5 mm), the cervical grooves are very shallow but just discernible after the pubescence has been removed. The larger holotype female of *C. canaliculatus* (33.0 by 31.0 mm) has a shallow cervical groove (Yang and Dai, 1994: Fig. 3A) (not apparent in their pl. 1 Fig. 2) and in the largest male from Taiwan (40.4 by 40.0 mm), the cervical and branchial grooves are both relatively deep and very distinct. On this evidence, we believe that

C. canaliculatus Yang and Dai, 1994, should be regarded as a junior synonym of *C. intermedius* Lewinsohn, 1984.

The present species appears to be very rare in Taiwan.

***Cryptodromia fallax* (Lamarck, 1818)**

(Fig. 1d)

Dromia fallax Lamarck, 1818: 264 (type-locality: not known).

Cryptodromia canaliculata Stimpson, 1858: 240 (type-locality: Japan).

Material examined.

Kaohsiung County, Yungan, 1 male (8.0 by 6.8 mm), no date (TMCD 2810).

Remarks.--The taxonomy of *C. fallax* and its synonymy with *C. canaliculata* has been discussed by McLay (1993). This species has been reported from a very wide area from the Indian Ocean to Polynesia and Japan. The presence of this species in Taiwan is thus expected, but it seems to be rather rare in local waters.

***Dromia dormia* (Linnaeus, 1763)**

(Fig. 2a)

Cancer dormia Linnaeus, 1763: 413 (type-locality: not known).

Dromia dormia- McLay, 1993: 151, Fig. 16c. (For complete synonymy, see McLay, 1993: 151)

Material examined.

Taipei County, Lungtung, 1 male (98.2 by 88.9 mm), 3 females (92.4 by 86.7 mm to 133.9 by 124.5 mm), V 1999 (NTOU).

Keelung: 1 male (117.9 by 94.0 mm), 8 III 1986 (ZRC); Peace Island, 1 male (129.4 by 117.2 mm), X 1998 (NTOU).

Ilan County, Tahsi, 1 male (53.7 by 46.8 mm), 28 VI 1995 (NTOU).

Remarks.--One of the characters McLay

(1993: 124) used to diagnose *Dromia* was the absence of a spine on the outer margin of the dactylus of the fourth ambulatory leg. In the smallest specimen (53.7 by 46.8 mm) examined, however, the base of the dactylus of the fourth ambulatory leg has a very small spine which is weakly calcified and semi-movable. This small spine is absent in large specimens. There is, however, a clearly discernible scar on the fourth ambulatory dactylus of these large specimens, exactly where the spine was positioned in small ones. This suggests that the spine is lost as the specimens grow in size.

Although *Dromia dormia* has a very wide Indo-West Pacific distribution from east Africa to New Caledonia and Hawaii (McLay, 1993; Ng, 1998), this species is recorded for the first time from Taiwan. It is a very large species compared to the better known *Lauridromia dehaani* in Taiwan but is apparently less common. The two species are readily distinguished from each other by the dactylus of the first two ambulatory legs bearing a few strong spines in *D. dormia* but having many tiny spinules in *L. dehaani*. Furthermore, the lateral teeth on the carapace are generally acute in *L. dehaani* but blunt in *D. dormia*. McLay also indicated that in *Dromia*, the last two male abdominal segments (excluding the telson) are immovable whereas these segments are movable in *Lauridromia*. It is pertinent to note here, however, that the suture between the last two segments are clearly discernible in members of both genera. In *Dromia* species, the two segments are completely immovable while in *Lauridromia* species, the two segments are able to articulate slightly. It is also useful to point out that although the fingers of the chelae are white in adult *D. dormia*, those of the small specimen examined are pink. More fresh specimens of various sizes will be needed to verify whether the colors of the fingers change

with size.

***Dromia wilsoni* (Fulton and Grant, 1902)**
(Fig. 2b)

Petalomera wilsoni Fulton and Grant, 1902: 61, pl. 9 (type-locality: Australia).

Dromia wilsoni- McLay, 1993: 156, Fig. 16e.

Material examined.

TAIWAN: Ilan County, Tahsi, 1 female (40.2 by 29.0 mm), 30 I 1998 (NTOU).

JAPAN: Kii-Nagashima, 1 male (35.5 by 25.6 mm), 1 female (34.1 by 25.6mm), 14 IV 1977 (ZRC).

Remarks.--The present specimen from Taiwan agrees well with published descriptions of the species (Sakai, 1976; McLay, 1991). McLay (1993) argued that this species should be transferred to *Dromia* rather than retain it in *Petalomera*. McLay (1993: 151) noted that the inner margin of the dactylus of the third ambulatory leg has three very small spines, but these are not discernible in the present specimen. The preserved Taiwanese specimen has the finger of the chelae pink in color.

Dromia wilsoni occurs in both temperate and tropical waters, and has been recorded from New Zealand, Australia, Philippines, French Polynesia, Japan (McLay, 1991, 1993). Nevertheless, this is its first record from Taiwan, where it appears to be rather rare.

***Lauridromia dehaani* (Rathbun, 1923)**
(Fig. 2c)

Dromia dehaani Rathbun, 1923: 68 (type-locality: Japan); Chang, 1963: 95; Sakai, 1976: 8, pl. 2 Fig. 1.

Lauridromia dehaani-McLay, 1993: 145.

Material examined.

North of Taiwan: 27° 20'06"N, 122° 25'10"

E, 1 juvenile (8.3 by 7.6 mm), 8 VII 1989 (NTOU); Pengchiayu, 1 ovigerous female (69.4 by 65.4 mm), 93 m, 23 V 1990 (NTOU).

Taipei County: Lungtung, 1 male (68.5 by 65.5 mm), 1 female (74.7 by 70.1 mm), V 1999 (NTOU).

Keelung: 1 male (64.9 by 61.8 mm), 10 V 1974 (ZRC); Peace Island, 1 female (63.8 by 62.9 mm), III 1992 (NTOU).

Ilan County: Tahsi, 1 male (88.1 by 81.4 mm), 2 ovigerous females (63.6 by 62.0 mm and 78.7 by 77.7 mm), 4 X 1984 (NTOU); 1 ovigerous female (69.4 by 65.4 mm), 13 XI 1985 (NTOU); 1 female, 7 III 1986 (TMCD 2140); 1 female, 3-4 VIII 1996 (ZRC); Kengfang, 1 female (73.8 by 71.1 mm), 8 XI 1991 (NTOU); Nangfangao,

1 female (72.7 by 63.3 mm), no date (ZRC).

Kaohsiung County: 2 dried specimens, 15 III 1962 (TMCD 380, 381); 1 male (dried), 4 XI 1966 (TMCD 281); Kushan, 1 male (87.0 by 77.9 mm), 2 XII 1995 (NTOU).

Locality in Taiwan not specified: 1 female (61.1 by 58.6 mm), 13 V 1997 (NTOU); 3 males (70.7 by 64.9 mm to 89.1 by 88.6 mm), no date (NTOU).

Remarks. --This is the most common dromiid species in Taiwan and had been recorded from Taiwan by Chang (1963). *Lauridromia dehaani* is known from a wide area in the Indo-West Pacific, from the Gulf of Aden to Japan (McLay, 1993; Ng, 1998) and is also the most common species of *Lauridromia* (and large

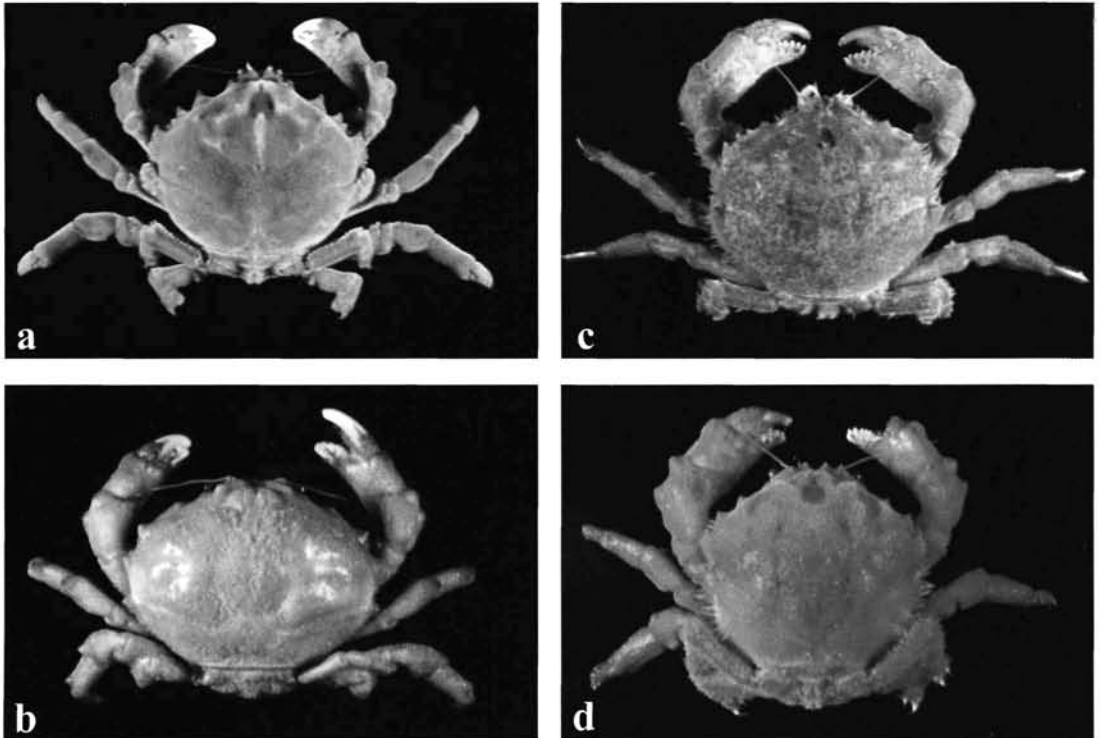


Fig. 2. a, *Dromia dormia* (Linnaeus, 1758), male (129.4 by 117.22 mm) (NTOU); b, *Dromia wilsoni* (Fulton and Grant, 1902), preserved specimen, female (40.2 by 29.0 mm) (NTOU); c, *Lauridromia dehaani* (Rathbun, 1923), male (68.5 by 65.5 mm) (NTOU); d, *Lauridromia intermedia* (Laurie, 1906), male (47.7 by 47.1 mm) (NTOU).

dromiid) in East Chinese seas (Dai and Yang, 1991; Dai and Ng, 1997).

***Lauridromia intermedia* (Laurie, 1906)**

(Fig. 2d)

Dromia intermedia Laurie, 1906: 351 (type-locality: Sri Lanka); Lin, 1949: 12.

Lauridromia intermedia-McLay, 1993: 146, Fig. 15d.

Material examined.

Taipei County: Lungtung, 1 male (47.7 by 47.1 mm), 31 V 1999 (NTOU).

Keelung: Peace Island, 1 female (49.8 by 47.7 mm), no date (NTOU).

Kaohsiung County: Chungyun, 1 female (36.0 by 35.7 mm), 25 III 1998 (NMNS).

Pingtong County: Fangliao, 1 female (dried), 10 VIII 1972 (TMCD 257).

Remarks.--*Lauridromia intermedia* has wide distribution from Madagascar to Japan and New Caledonia (McLay, 1993). Lin (1949) first listed this species from Taiwan. The present species appears to be uncommon in Taiwan and can be distinguished from the most common local dromiid species *L. dehaani* by the median rostral tooth being very small and not visible dorsally. Furthermore, the dark spot on the anteromedian part of the carapace is not faded in the preserved

specimens examined.

***Petalomera granulata* Stimpson, 1858**

(Fig. 3a)

Petalomera granulata Stimpson, 1858: 240 (type-locality: Japan); McLay, 1993: 165.

Material examined.

Ilan County, Tahsi, 1 female (TMCD 2084), 1 female (20.8 by 20.8 mm) (ZRC 1993.7195), 8 VIII 1985.

Locality in Taiwan not specified: 1 dried female, no date (TMCD 382).

Remarks.--This species has previously been reported from Chinese seas and Japan but not from Taiwan, where it is apparently uncommon. In the revision by McLay (1993), only two species of *Petalomera* are recognised, the other being *Petalomera pulchra* Miers, 1884, from northern Australia, eastern Indonesia and New Caledonia. According to McLay (1993: 165), *P. granulata* can be separated from *P. pulchra* by its anterolateral margin having three teeth (against two teeth) and the areoles on the carapace being distinct (against indistinct). In the present specimens, it is not easy to discern the number of anterolateral teeth, with the entire margin serrated, but about three small teeth can be seen. The areolation on the carapace is also not very

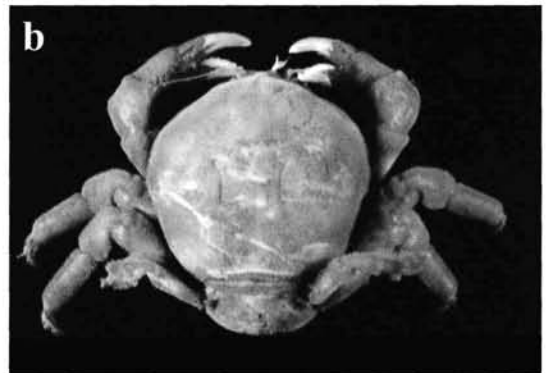


Fig. 3. a, *Petalomera granulata* Stimpson, 1858, dried female (TMCD 382); b, *Sphaerodromia kendalli* (Alcock and Anderson, 1894), preserved specimen, female (50.0 by 48.3 mm) (NMNS).

distinct but discernible. The specimens on hand, however, agree very well with the published descriptions and figures of *P. granulata* by Stimpson (1907), Sakai (1976) and Dai and Yang (1991). Compared to the descriptions and figures of Miers (1884) and McLay (1993) of *P. pulchra*, the dorsal surfaces of the carapaces of the present specimens appear less granulated, the anterolateral margin is more arcuate with the teeth less distinct.

Sphaerodromia kendalli
(Alcock and Anderson, 1894)
(Fig. 3b)

Dromidia kendalli Alcock and Anderson, 1894: 175 (type-locality: Bay of Bengal).

Sphaerodromia kendalli-McLay, 1993: 127, Figs. 2a-I, 15a.

Material examined.

Ilan County, Tahsi, female (50.0 by 48.3 mm), 19 I 1999 (NMNS).

Remarks.--This species, apparently uncommon, is recorded from Taiwan for the first time. *Sphaerodromia kendalli* is distinct in that the anterolateral margin of the carapace is entire. The fingers of the chela of the present specimen, although preserved in alcohol, still retains traces of pinkish-red pigments.

***Takedromia cristatipes* (Sakai, 1969)**

Cryptodromia cristatipes Sakai, 1969: 245, pl. 1 Fig. 1 (type-locality: Japan); Sakai, 1976: 18, text-Fig. 10.

Takedromia cristatipes-McLay, 1993: 212, Figs. 9a, b, 19a, b.

Material examined.

Ilan County, Tahsi, 1 female, 11 IV 1989 (TMCD 2494).

Remarks.--This species was described from

Japan (Sakai, 1969, 1976) and McLay (1993) subsequently recorded it from New Caledonia. This is its first record from Taiwan, where it seems to be quite rare. The present species reportedly has a wide depth range, from 50 m to 430 m (McLay, 1993).

Family Raninidae De Haan, 1839

***Cosmonotus grayi* Adams and White,**
1848

Cosmonotus grayi Adams and White, 1848: 60, pl. 13 Fig. 3 (type-locality: Borneo); Sakai, 1937: 173, pl. 16 Fig. 2; Sakai, 1976: 57, pl. 20 Fig. 3.

Material examined.

No specimen from Taiwan available.

Remarks.--This species was first recorded from Taiwan by Sakai (1937) but it has a wide Indo-West Pacific distribution ranging from the Persian Gulf to Australia and Japan. No recent specimen of this species from Taiwan has been found. It is likely that *C. grayi* is very rare in local waters, at least presently.

***Lyreidus stenops* Wood Mason, 1887**
(Fig. 4a)

Lyreidus stenops Wood Mason, 1887: 209, pl. 1 Figs. 7, 8 (type-locality: Indian Ocean); Sakai, 1976: 54, pl. 21 Fig. 3.

Lyreidus integra Terazaki, 1902: 217 (type-locality: Japan).

Lyreidus politus Parisi, 1914: 311, pl. 13 Fig. 5 (type-locality: Taiwan); Chang, 1963: 96.

Material examined.

Ilan County, Tahsi, 2 males (TMCD 2329), 1 male (ZRC 1995.579), 10 XII 1987.

Remarks.--This species has been reported from Japan to the Philippines, and was first re-

corded from Taiwan by Chang (1963). Although *L. stenops* appeared to be relatively common in Taiwan some years ago, it seems to be rather rare now. Figure 4a is from a specimen in NTOU collected in 1984, although the specimen itself cannot be located at the time of writing.

***Lyreidus tridentatus* De Haan, 1841**

(Fig. 4b)

Lyreidus tridentatus De Haan, 1841: 140, pl. 35

Fig.6 (type-locality: Japan); Sakai, 1976: 53, pl. 21 Fig. 2.

(For complete synonymy, see Sakai, 1976: 53)

Material examined.

TAIWAN: Keelung, 1 male (dried), 28 X 1966 (TMCD 278).-Tainan County, Anping, 2 dried specimen, 2 XI 1966 (TMCD 395, 396)-

Ilan County, Tahsi, 1 female, 25 III 1986 (TMCD 2157); 1 male (23.0 by 40.2 mm), 5 VII 1991 (NTOU).-Ilan County, Nangfangao, 1 male (27.8 by 50.0 mm), 16 III 1986 (NTOU).-Pingtung County, Tungkang, 1 male (25.0 by 45.0 mm), 3 IX 1997 (NTOU).-Locality not specified, 1 male (TMCD 3250, CHCD 1330).

JAPAN: offshore Yomitan village, Okinawa, 2 females, 6 IX 1978 (ZRC).

Remarks.--Although *Lyreidus tridentatus* has been reported from a very wide area in the West Pacific (Japan to Hawaii and New Zealand), it has surprisingly, never been reported from Taiwan before. One other species of *Lyreidus*, *L. stenops* Wood Mason, 1887 (as *Lyreidus politus*) has been reported by Chang (1963). *Lyreidus tridentatus* is not uncommon in Taiwan.

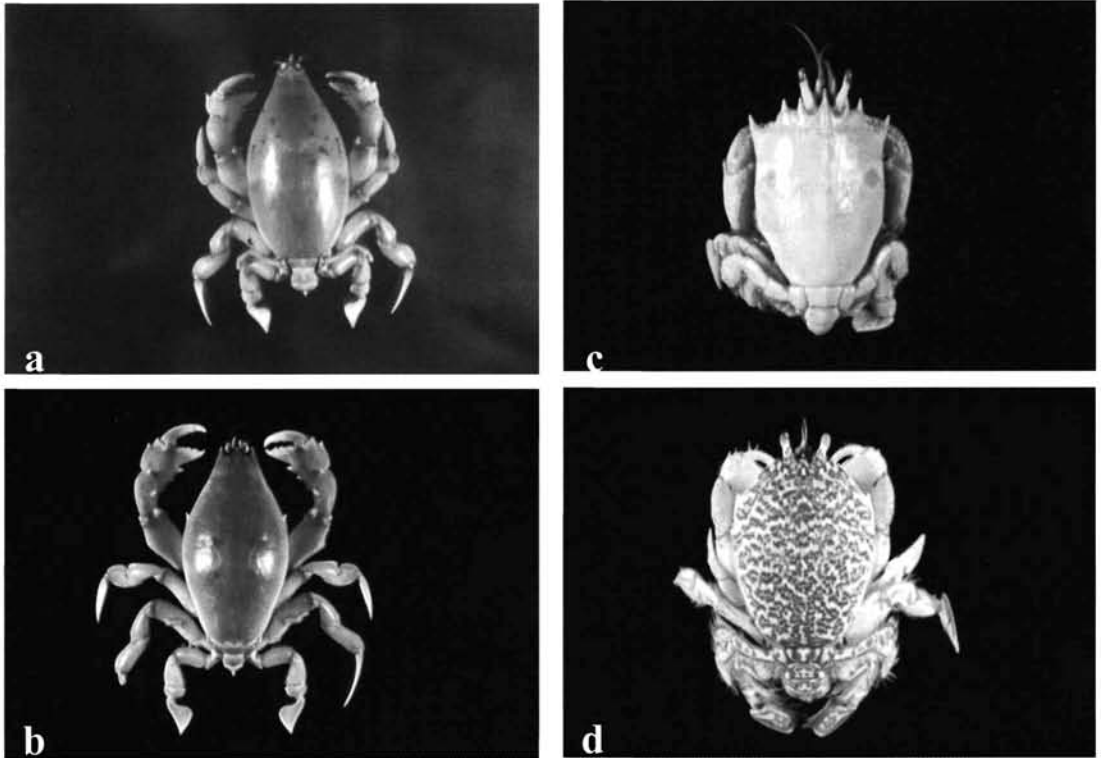


Fig. 4. a, *Lyreidus stenops* Wood Mason, 1887; b, *Lyreidus tridentatus* De Haan, 1841, male (25.0 by 45.0 mm) (NTOU); c, *Ntotopus dorsipes* (Fabricius, 1798), preserved specimen, male (17.3 by 24.5 mm) (NTOU); d, *Ranilia orientalis* Sakai, 1963, female (34.0 by 44.8 mm) (NTOU).

***Notopus dorsipes* (Fabricius, 1798)**

(Fig. 4c)

Albunea dorsipes Fabricius, 1798: 397 (type-locality: not known).

Notopus dorsipes-Sakai, 1976: 55, pl. 20 Fig. 1.

Material examined.

Kaohsiung County, 1 male (dried) 15 VII 1968 (TMCD 397).--Mito, 1 male (20.5 by 27.3 mm), 6 I 1993 (ZRC); 1 male (173.3 by 24.5 mm), 7 I 1993 (NTOU).

Remarks.--This species has a very wide distribution ranging from Japan through to Philippines and various parts of the Indian Ocean. Its presence in Taiwan is thus not unexpected. Although all the present material is preserved, there is still a pair of large red lateral spots on the carapace (Fig. 4c). This species appears to be rather rare in Taiwan.

***Ranilia orientalis* Sakai, 1963**

(Fig. 4d)

Ranilia orientalis Sakai, 1963: 226, Fig. 6 (type-

locality: Japan); Sakai, 1976: 56, pl. 20 Fig. 4.

Material examined.

TAIWAN: Kaohsiung County, Kushan, 1 female (carapace damaged), 14 I 1988 (NTOU).--Ilan County, Tahsi, 1 female (34.0 by 44.8 mm), 20 II 1998 (NTOU).

JAPAN: Mikawa Bay, central Japan, 1 male (30.7 by 41.8 mm) (ZRC 1969. 11. 18. 4).

Remarks.--This species was described on the basis of one male from Sagami Bay in Japan. Serène and Umali (1972) subsequently provided a detailed redescription of the species. In the ZRC is a male specimen from Japan donated by the late Tune Sakai. The present Taiwanese specimen agree very well with the ZRC specimen as well as the description and figures of this species (Sakai, 1963, 1965, 1975). *Ranilia orientalis* has previously been recorded from Japan and the South China Sea (Sakai, 1976; Dai and Yang, 1991) but it seems to be rather rare in Taiwan.

***Ranina ranina* (Linnaeus, 1758)**

(Fig. 5a, b)

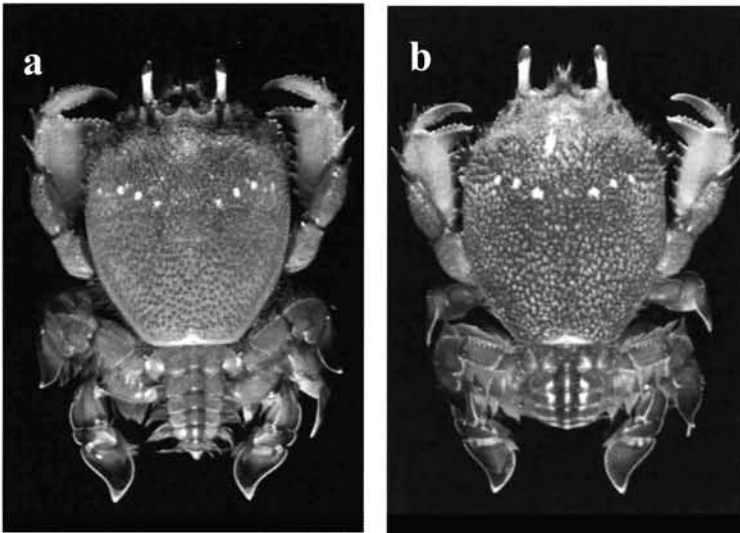


Fig. 5. a, *Ranina ranina* (Linnaeus, 1758), male (71.7 by 80.7 mm) (NTOU); b, *R. ranina*, female (47.9 by 59.1 mm) (NTOU).

Cancer raninus Linnaeus, 1758: 625 (type-locality: Indian Ocean).

Ranina dentata H. Milne Edwards, 1837: 194, pl. 21 Figs. 1-5 (type-locality: Indian Ocean).

Ranina ranina-Maki and Tsuchiya, 1923:122; Lin, 1949: 15; Wang and Chen, 1981: 150; Ho, 1996: 72.

Material examined.

Keelung: 1 dried male, 15 VII 1985 (TMCD 393).

Ilan County: Kengfang, 1 male (48.1 by 60.0 mm), 22 II 1991 (NTOU); 5 males, 3 females (ZRC 1995.591), 2 males, 2 females (TMCD), VI 1993; 3 males (46.4 by 58.4 mm to 71.7 by 80.7 mm), 1 ovigerous female (61.2 by 74.1 mm), 1 females (61.0 by 72.3 mm), V 1999 (NTOU); 1 male (56.0 by 67.7 mm), 3 ovigerous females (54.1 by 66.5 mm to 62.3 by 76.4 mm), 2 females (54.3 by 65.6 mm and 54.9 by 67.8 mm), 23 VI 1999 (NTOU).--Nangfangao, 1 female (47.9 by 59.1 mm), 21 VII 1985 (NTOU).

Locality in Taiwan not specified: no date, 1 dried specimen (TMCD 6); 1 male, 2 females (dried) (TMCD 260); 1 male (56.6 by 70.1 mm), 1 female (68.2 by 80.3 mm) (NTOU).

Remarks.--This is a very widely distributed species ranging from the Indian Ocean to Polynesia (Ng, 1998). It is a commercial species in Taiwan (but of minor economic importance because it is not always abundant) and commands excellent prices in markets (Ho, 1996; Ng, 1998). Taiwanese specimens we have examined are all smaller than specimens from other areas (maximum carapace length 15 cm and 0.9 kg for males), and even males do not have the anterolateral angle of the carapace as greatly enlarged. Because of the high market premium for this species, large numbers (including live specimens for the seafood trade) are regularly imported into Taiwan from Australia and the Philippines. It appears that most of the large specim-

ens, including live specimens, seen in Taiwanese markets are from these countries.

Family Corystidae Samouelle, 1819

***Jonas* Jacquinot, 1853,
in Jacquinot and Lucas, 1853**

Remarks.--The genus *Jonas* was originally established by Jacquinot (1853, in Jacquinot and Lucas, 1853) for only one species, *J. macrophthalmus* Jacquinot, 1853, in Jacquinot and Lucas, 1853. Five species and subspecies are now regarded as belonging to this genus, viz. *J. macrophthalmus*, *J. distincta distincta* (De Haan, 1835), *J. distincta formosae* Balss, 1922, *J. distincta indica* Chopra, 1935, and *J. leuteanus* Ward, 1933 (see Serène, 1968).

Sakai (1976) commented on the taxonomy of *J. distincta* and its three subspecies, and argued that the carapace features of *J. distincta indica* were so distinct that it can be regarded as a distinct species while *J. distincta formosae* differed from *J. distincta distincta* only in the pattern of granules on the carapace. As will be discussed later, all three should be regarded as separate species. Chen (1998) regarded *J. formosae* and *J. distincta* as distinct species. Nothing else is known about *J. macrophthalmus* and *J. leuteanus* since their original descriptions (but see discussion later for *J. formosae*).

Jonas and *Gomez* Gray, 1832 (type species *G. bicornis* Gray, 1831, by monotypy=*Corystes* (*Oeidea*) *vigintispinosa* De Haan, 1835) are very close, and following current literature, they are generally separated by the fact that the carapace of *Gomez* is proportionately much broader and more egg-shaped, the dorsal carapace surface is more strongly convex, the anterolateral margin has three small subequal teeth with the posterolateral margin having smaller tubercles, the cornea is relatively smaller, and

the dactylus of the fourth ambulatory leg is not spatuliform. *Jonas* on the other hand, has a more slender and elongate carapace, the dorsal carapace surface is gently convex, the anterolateral margin has three large teeth which become smaller posteriorly with the posterolateral margin having much smaller tubercles, the cornea is relatively large, and the dactylus of the fourth ambulatory leg is spatuliform (see Sakai, 1976; Dai and Yang, 1991). Examination of a good series of specimens from both genera also indicate that they can be separated by several other features. The outer distal angle of the buccal cavity has a long and prominent spine in *Jonas* but in *Gomez*a, this angle has three to four short, subequal spines instead. The sixth male abdominal segment in *Gomez*a is very unusual in that the posteromedian part is greatly enlarged and projects posteriorly such that it forms a "hood" over the telson, shielding most of it from view. In *Jonas*, the sixth male abdominal segment is normal and the telson is exposed. In addition, the epistome of *Gomez*a is very narrow (broader than long), with the basal antennal segment relatively short and squarish in shape. In *Jonas*, the epistome is distinctly more elongate (as long as or longer than broad) and the basal antennal segment is distinctly longer than broad. The rostrum of the two genera also seem to differ. In *Gomez*a, the outer lateral margins of the rostrum slope gently, sometimes appearing almost subparallel, making the rostrum appear rather broad. In *Jonas*, the outer lateral margins of the rostrum slope very sharply, giving it a more triangular and narrower appearance overall. While the anterior half of the dorsal surface of the carapace of *Gomez*a is indeed distinctly more swollen than any known *Jonas* species, this is not true of the intestinal region. In *Jonas*, the intestinal region is distinctly convex whereas in *Gomez*a, it appears almost flat.

There is a good series of *Gomez*a *bicornis* in the ZRC from various parts of Southeast Asia. The anterolateral teeth (especially the anterior ones) do vary somewhat in size, with specimens sometimes appearing more spinose. Larger specimens are invariably females, and these large specimens differ from the males in having a distinctly more globose carapace. The general form of the lateral carapace teeth, however, is relatively constant. Yamaguchi and Baba (1993: 375, Fig. 129) noted that five of De Haan's specimens of *Corystes vigintispinosa* are still extant, from which they designated a lectotype. For the record, *G. bicornis* has been reported from a wide area in the Indo-West Pacific, from Sri Lanka (= Ceylon) to Singapore, Indonesia, Queensland (Australia) and Japan.

Comparative material of *Gomez*a *bicornis*:

South China Sea, 150 miles off Singapore, 1 male, 1 female, 19 VIII 1983 (ZRC 1984.6303-6304); 1 female, 10 IX 1983 (ZRC 1984.5806).--Singapore, Siglap, 1 ovigerous female, VII 1934 (ZRC 1965. 10. 10. 7); Sultan Shoal, 2 females, 1 juvenile, 1935 (ZRC 1965. 10. 10. 9-11)-Indonesia, Tanjong Gemal, northern part of Pulau Bintan, Riau Archipelago, 1 young female (7.2 by 10.9 mm), V 1993 (ZRC).--Thailand, Gulf of Thailand, Chonburi, 1 female (43.8 by 49.3 mm), 1996 (ZRC 1998.507).

***Jonas distincta* (De Hann, 1835)**

(Figs. 6a, 7)

Corystes (Oeidea) distincta De Haan, 1835: 45, pl. 13 fig. 2 (type-locality: Japan).

Jonas distincta-Ward, 1933: 379; Chang, 1963: 97; Sakai, 1939: 369; Sakai, 1976: 304, pl.101 fig. 1; Yamaguchi, 1993: 578; Chen, 1998: 245, Fig. 12.

Material examined.

TAIWAN: Ilan County, Tahsi, 1 male (21.0

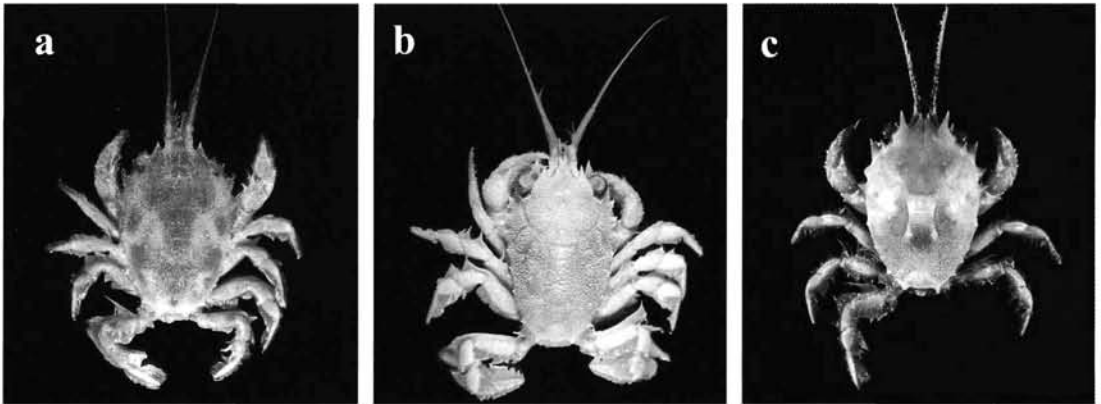


Fig. 6. a, *Jonas distincta* (De Haan, 1835), female (20.5 by 30.0 mm) (NTOU); b, *Jonas formosae* Balss, 1922, preserved specimen, male (20.6 by 35.9 mm) (NTOU); c, *Jonas choprai*, female Serène, 1971 (26.7 by 37.1 mm) (ZRC).

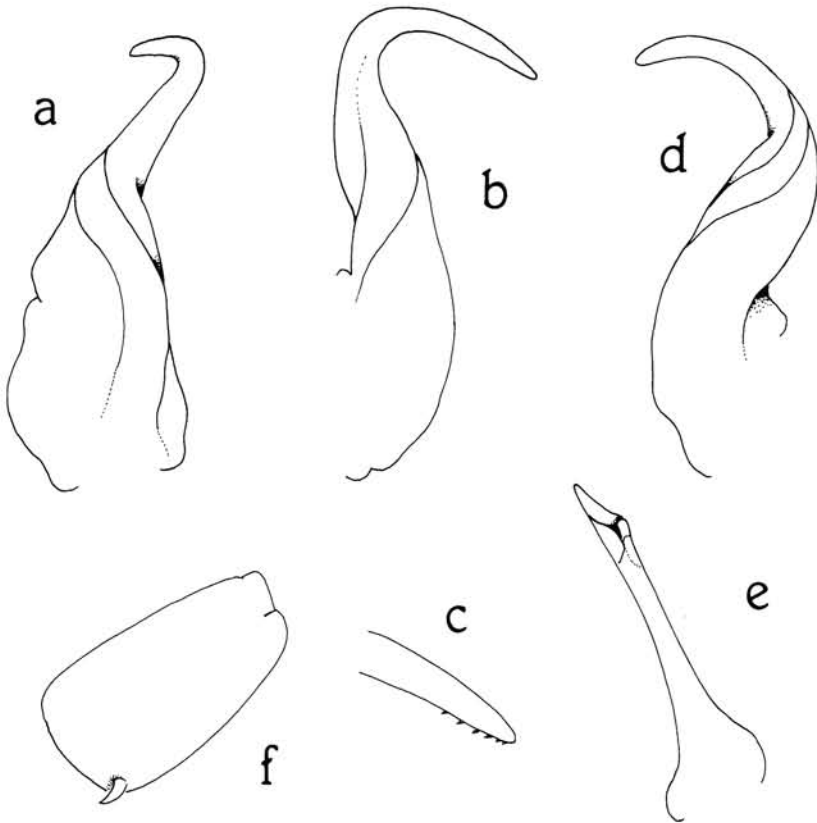


Fig. 7. *Jonas distincta* (De Haan, 1835). Male (23.3 by 36.5 mm) (ZRC). a, right G1, draw in situ; b, d, left G1; c, distal part of left G1; e, left G2; f, merus of last right ambulatory leg.

by 33.4 mm), 1 IV 1984 (NTOU); 1 male (16.3 by 24.8 mm), 8 V 1985 (NTOU); 1 male (23.4 by 38.0 mm), 17 X 1985 (NTOU); 1 male, 7 III 1986 (TMCD 2155); 3 males (20.9 by 35.2 mm to 24.7 by 39.5 mm), 6 IX 1986 (NTOU); 1 male, 10 XII 1987 (TMCD 2330); 1 male (20.7 by 32.9 mm), 23 III 1988 (NTOU); 1 male (16.6 by 27.0 mm), 8 VI 1988 (NTOU); 1 male (TMCD 2597), 1 male (23.3 by 36.5 mm) (ZRC 1965.613), 18 X 1989; 1 male (16.0 by 25.9 mm), 23 VIII 1990 (NTOU); 1 male (21.6 by 35.6 mm), 28 IX 1995 (NTOU); 1 male, 3-4 VIII 1996 (ZRC 1997.757); 5 males (20.4 by 34.0 mm to 23.8 by 37.9 mm), 1 IX 1997 (NTOU); 1 male (25.8 by 40.9 mm), XII 1997 (ZRC); 1 female, 15 V 1998 (ZRC 1998.533); 1 female (20.5 by 30.0 mm), 28 V 1999 (NTOU).--Hualien County, 1 female (dried), 10 XI 1961 (TMCD 280).--Tainan County, Anping, 1 dried specimen, 20 X 1966 (TMCD 476).--Kaohsiung County, Hsingtakang, 1 female (23.4 by 37.5 mm), 2 IX 1990 (ZRC).--Mito, 1 female (21.2 by 33.9 mm), 3 IV 1988 (NTOU); 1 female (19.0 by 32.6 mm), 25 XI 1992 (NTOU).--Pingtung County, Tungkang, 1 male (16.1 by 29.1 mm), XII 1984 (ZRC).--Penghu County, Makung, 2 males (22.0 by 34.9 mm and 20.9 by 33.5 mm), 3 VIII 1992 (NTOU); 2 males (18.8 by 30.1 mm and 22.4 by 37.1 mm), 15 IX 1996 (NTOU).--No locality and date, 1 dried specimen (TMCD 27); 1 male (21.8 by 36.4 mm), 2 females (17.1 by 28.4 mm and 21.8 by 36.4 mm) (NTOU).

JAPAN: Minase, Kochi, 1 male (23.3 by 37.4 mm) (neotype, here designated), 1 female (16.8 by 23.9 mm), 11 V 1973 (ZRC); 4 males (largest 21.4 by 34.1 mm), 11 V 1973 (NSMT 4424).--Ariake Sea, 1 male (24.6 by 39.8 mm), 15 VI 1982 (NSMT 8197).-- East China Sea, 1 male (27.0 by 44.0 mm), 3 VII 1985 (NSMT 9828).

Remarks.--The taxonomy of *J. distincta* s.

str., and its two supposed subspecies, *J. distincta formosae* Balss, 1922 (type locality Kaohsiung, Taiwan), and *J. distincta indica* Chopra, 1935 (type locality India) was discussed by Sakai (1976). Sakai (1976) commented that *J. distincta formosae* could only be effectively separated from *J. distincta distincta* by all the granules on its carapace being smaller, similar sized and uniformly distributed. In *J. distincta distincta*, there are large granules clustered at the highest point of each region with the surrounding areas having small, uniformly distributed granules. *Jonas distincta indica*, on the other hand, has the granule pattern of *J. distincta distincta*, but the carapace was more ovoid in shape and Sakai (1976) suggested that it was a good species. The taxonomic position of *J. distincta indica*, however, is far from certain. Chopra (1935: 500, text fig. 15; pl. 9 figs. 4, 5) had described it as a subspecies of *Gomezia*, and from his description and figures, it somewhat resembles *G. bicornis*, especially with regards to its rostrum shape. The postero-lateral teeth appear proportionately larger than those of typical *Jonas* species, but the value of this difference is difficult to assess. All these problems stem from the fact that *J. distincta indica* was described from a very small and probably juvenile specimen (4.6 by 6.1 mm, probably a male) and no adults are known.

Chen (1998: 244) recognised *J. distincta distincta* and *J. distincta formosae* as separate species, arguing that the differences in the proportions of the last ambulatory legs, structures of the male and female abdomens, G1s and G2s are diagnostic. Examination of a good series of adult specimens of *J. distincta distincta* and *J. distincta formosae* from Taiwan and Southeast Asia supports Chen's supposition that both taxa are separate species. The different granule pattern on the carapace is quite distinct, and effectively separates adults of the two taxa. In *J. distincta*,

many of the granules, especially on the major regions, lateral and orbital margins are large and acutely pearliform (Fig. 6a). There are usually no such acutely pearliform granules on the carapace in *J. formosae* (Fig. 6b). The carapace of *J. distincta* is distinctly more longitudinally ovate compared to that of *J. formosae*, which is distinctly broader anteriorly than posteriorly. While the lateral carapace margins of *J. distincta* are clearly convex, the margins of *J. formosae* are distinctly less so, and appear distinctly converging towards the posterior carapace margin. The postero-proximal spine on the merus of last right ambulatory legs of *J. distincta* are also generally proportionately longer and more hooked (Fig. 7f) than in *J. formosae* (Fig. 8g). Most significantly, their G1s are very different. In *J. distincta*, the G1 is hooked, the distalmost part being subconical (Fig. 7a-b, d). In *J. formosae*, however, not only is the G1 hooked, the distal part is extremely elongate, the tip being drawn out and appears filamentous (Fig. 8a-c).

In smaller specimens, however, the differences in carapace shape and granulation pattern are sometimes less obvious, with *J. distincta* closely resembling *J. formosae*. In a small male specimen (16.1 by 29.1 mm, ZRC) from Tungkuang, the carapace shape and granule pattern resemble that of typical *J. formosae*. A small male specimen of *J. formosae* (13.1 by 22.5 mm, NTOU) from Mito on the other hand, has indistinct clumps several of small granules on the raised median regions of the carapace, somewhat approaching the condition in *J. distincta*. The G1 structures, however, for these two specimens are diagnostic for their respective species. As such, small female specimens may be difficult to identify. The above observed variation is not yet known for adult specimens for the two species.

Jonas distincta was described from Japan,

and the figure of the species provided by De Haan (1835) agrees very well with the present concept of the taxon. According to Yamaguchi (1993: 578), the type(s) are no longer extant. *Jonas formosae* was described from southern Taiwan, and although Balss' (1922a, b) description was very short, his figure is clear and diagnostic. In Taiwan, both *J. distincta* and *J. formosae* are known, although the more common species appears to be *J. distincta*. In Southeast Asia, only *J. formosae* is known. The figure of *J. distincta* provided by Sakai (1976) agrees very well with what is here regarded as *J. distincta* s. str. The photograph provided of "*J. distincta*" by Dai et al. (1986) and Dai and Yang (1991) is too grainy to be able to confidently recognize the species, but the G1 figured (Dai et al., 1986: fig. 100(1); Dai and Yang, 1991: Fig. 100(1)) clearly corresponds with what is here defined for *J. distincta*. We nevertheless expect both *J. distincta* and *J. formosae* to be present in many parts of southern China. The record of *J. distincta* from Korea is valid, the excellent figures of Kim (1973: 340, Fig. 120, pl. 80. 87) confirming that it is this species. In any case, all old records of both species from the northern part of the South China Sea to southern Japan must be rechecked to confirm their identities. In view of the fact that there are no types of *J. distincta*, and because both species are so closely related and can be expected to be sympatric (and possibly even syntopic), we feel that in the interests of a stable taxonomy, a neotype for *J. distincta* should be selected. A male specimen 23.3 by 37.4 mm (ZRC) from Kochi, Japan, is here selected as the neotype of *Jonas distincta* (De Haan, 1835).

Jonas distincta s. str. has been reported from Japan to various parts of the East China Sea. It had been reported previously from Taiwan by Chang (1963). The records by Horikawa (1940)

and Lin (1949) from Taiwan are for *J. formosae*, but it is possible their specimens are in fact mixed and include *J. distincta* as well.

In Taiwan, the species is found on sand-muddy substrates in relatively shallow waters up to 100 m water. Dai and Yang (1991) noted that the species occurred on sandy or muddy-sandy bottoms 30 to 90 m deep. They are not known from littoral habitats.

***Jonas formosae* Balss, 1922**

(Figs. 6b, 8)

Jonas distincta formosae Balss, 1922a: 4 (type locality: Takao, southern Taiwan); Balss, 1922b: 114, pl. 2 Fig. 3; Sakai, 1976: 305.

Jonas distincta formosensis-Horikawa, 1940: 25; Lin, 1949: 17.

Jonas formosae-Chen, 1998: 243, Fig. 11.

Material examined.

TAIWAN: Keelung, 1 male (19.1 by 32.1

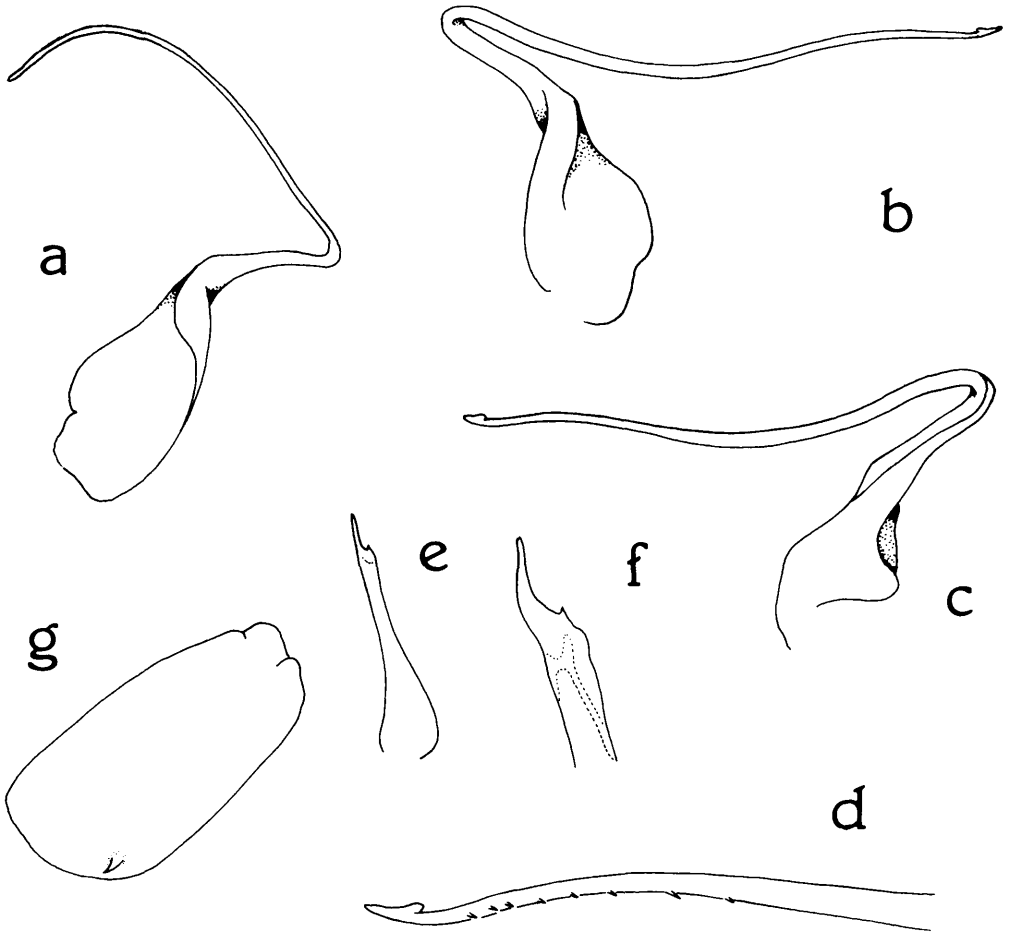


Fig. 8. *Jonas formosae* Balss, 1922. a, male (20.9 by 35.3 mm), South China Sea (ZRC 1984.5807); b-g, male (18.8 by 31.9 mm), Thailand (ZRC 1970.2.11.1.2); a, right G1, draw in situ; b, c, left G1; d, distal part of left G1; e, left G2; f, distal part of left G2; g, merus of last right ambulatory leg.

mm) (ZRC 1969.11.20.1), 1 female (20.2 by 31.4 mm) (ZRC 1969.11.20.2), no date, coll. R. Serene.--Hsinchu County, 1 male (20.6 by 35.9 mm), 15 V 1986 (NTOU).--Kaohsiung County, Hsingtakang, 1 male (16.8 by 29.7 mm), 2 IX 1990 (ZRC); Mito, 1 male (13.1 by 22.5 mm), 7 VI 1992 (NTOU); 1 female (16.5 by 27.6 mm), 7 I 1993 (NTOU); 1 female (21.2 by 33.9 mm), 3 IV 1988 (NTOU).

SOUTH CHINA SEA: 30 miles off Horsburgh Lighthouse, 11 males, 10 females, 26 XI 1982, 15 XII 1982 (ZRC 1984.50-70); 12 males, 19 VIII 1983 (ZRC 1984.71-82); 2 males, 28 VIII 1983 (ZRC 1984.5345-5346); 6 males (largest 20.9 by 35.3 mm), 1 female (21.0 by 34.9 mm), 10 IX 1983 (ZRC 1984.5807-5813).

SINGAPORE: 1 male (17.8 by 29.9 mm), VI 1933 (ZRC 1965.10.10.12)

THAILAND: Bangkok, 3 males (largest 19.6 by 35.0 mm), 4 females (largest 23.1 by 38.7 mm), 1970 (ZRC 1970.2.11.1-7).

Remarks.--*Jonas formosae* was described on the basis of two males from "Takao" (=Kaohsiung) in Taiwan. No measurements were provided, but from the figure of the specimen (Balss, 1922b: pl. 2 Fig. 5) which was supposedly depicted full size, one male measures 27.0 by 42.0 mm. Both specimens (syntypes) are supposedly in the Bremen Museum in Germany. The present material from Taiwan agree extremely well with Balss' (1922a, b) description and figure.

Jonas formosae is the only species known from Southeast Asia and northern Taiwan represents the northern limit of its known range. *Jonas distincta*, on the other hand, is not known south of Taiwan.

A note on *Jonas macrophthalmus* Jacquinot, 1853, and *J. leuteanus* Ward, 1933, is necessary. *Jonas macrophthalmus* is poorly known and was apparently described from a single female specimen 20.0 by 28.0 mm collected from shallow

waters off New Guinea. Jacquinot (1853: 88) described the regions of the carapace of the species as "...sont couvertes de tubercules blancs, petits et tris-peu serris", i.e. having small white granules which are not very closely packed, without any indication that there were granules of differing sizes or if there was any clumping. This is also evident on his figure (Jacquinot, 1853: pl. 8 fig. 4). With regards to this character, as well as the shape of the carapace and structure of the anterolateral armature, *J. macrophthalmus* is very close to *J. formosae*. *Jonas leuteanus* was described on the basis of a male specimen 30 mm in carapace length collected from shallow waters of Lindeman Island in Queensland, Australia. While Ward (1933: 380) compared the species with *J. distincta*, he made no mention of *J. formosae* and was apparently unaware of it. Neither did he refer to *J. macrophthalmus*. From Ward's (1933: 379, pl.23 fig. 8) description, comparisons and figure, however, *J. leuteanus* is almost identical to *J. formosae*.

There is thus every chance that both *J. macrophthalmus* and *J. leuteanus* are in fact synonymous with *J. formosae*, in which case the earliest name is *J. macrophthalmus*. Pending a reexamination of the type material of all three taxa and a revision of the genus, we prefer to adopt the cautious approach and retain the use of *J. formosae* for the present specimens from Taiwan and South China Sea.

Most of the present specimens of *J. formosae* were trawled from relatively shallow waters less than 200 m in depth, from sandy-muddy substrates. It is apparently a wholly sublittoral species.

For affinities and differences with *J. distincta*, see discussion for that species.

***Jonas choprai* Serène, 1971**
(Figs. 6c, 9, 10)

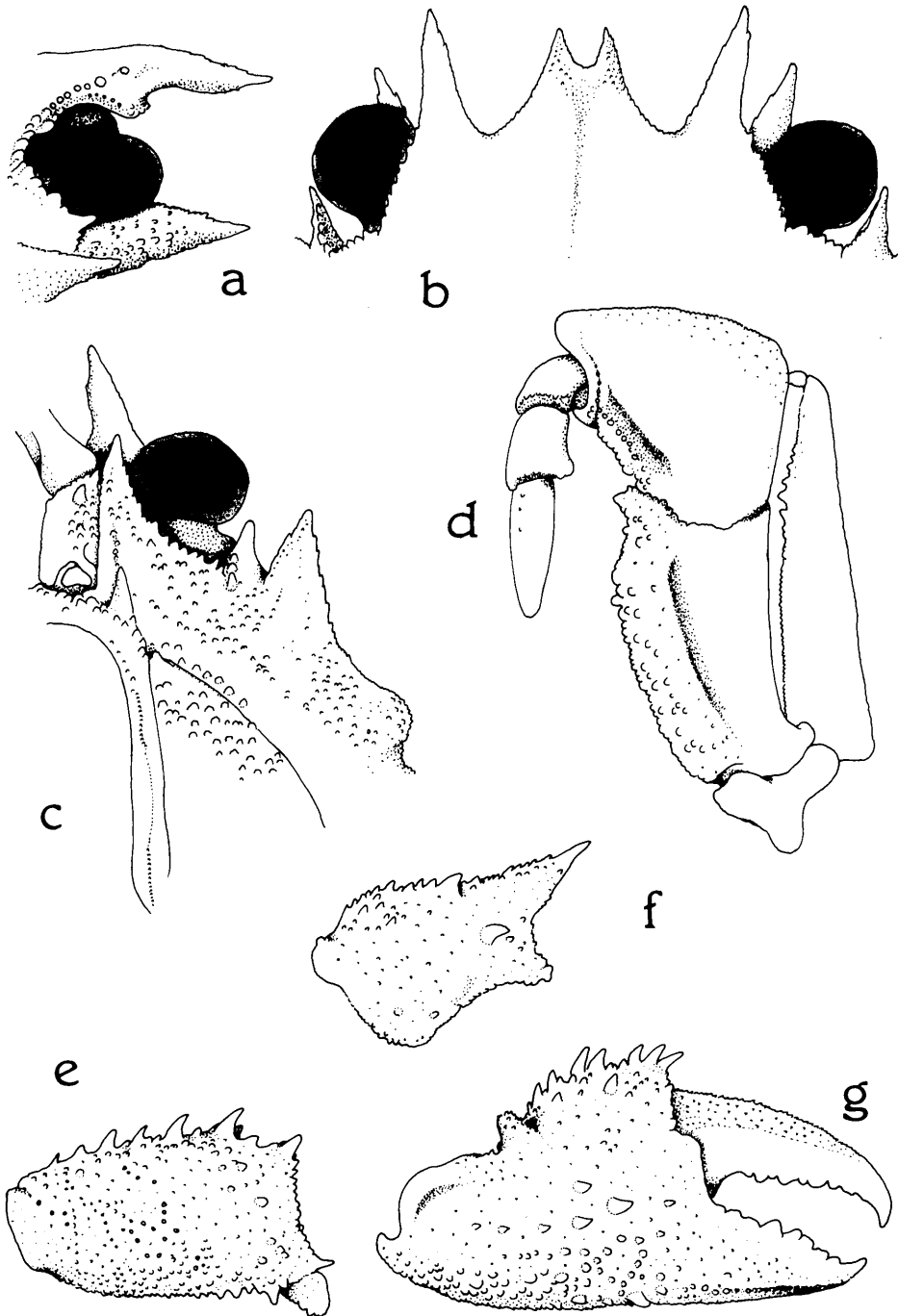


Fig. 9. *Jonas choprai* Serène, 1971. Female (26.7 by 37.1 mm), Taiwan (ZRC). a, frontal region (dorsal view); b, frontal region (lateral view); c, frontal region (ventral view); d, left third maxilliped; e, carpus of right cheliped; f, merus of right cheliped (setae denuded); g, right chela (setae denuded).

Material examined.

Holotype: Taiwan, female (with sacculinid) (21.0 by 28.0 mm), coll. Fisheries Research Institute, Kellung, 1964 (ZRC 1969. 11. 20. 3).

Others: N.E. Taiwan, Ilan County, Tahsi, female (26.7 by 37.1 mm), 1 IX 1997 (ZRC).

Redescription of recent specimen.--Carapace distinctly oval, ca. 1.4 times longer than broad; dorsal surface distinctly glabrous, convex transversely and longitudinally, posterior two-thirds covered with numerous small, rounded, evenly spaced granules, anterior half covered with lower and more obscure granules, frontal regions appearing almost completely smooth; regions well defined with prominent gastric and cervical grooves. Rostrum prominent, bifurcated, base relatively narrow; rostral teeth relatively short, separated by deep U-shaped notch; rostrum separated from inner supraorbital tooth by

broad, deep U-shaped notch. Supraorbital margin granulated, with 2 distinct notches; inner tooth very long, extending beyond tip of rostrum, gently curved when viewed laterally; outer tooth (equivalent to external orbital tooth) distinct. Infraorbital margin granulated; inner orbital tooth strong, shorter than inner supraorbital tooth when viewed from above. Eyes relatively large, completely filling orbits. Outer distal edge of buccal cavity with strong anteriorly directed spine. Pterygostomial, subbranchial and suborbital surfaces covered with numerous small rounded granules. Anterolateral and posterolateral margins poorly demarcated; anterolateral margin with 3 large triangular teeth, first largest and strongest, third smallest; posterolateral margin with 5 small but clearly discernible tubercles. Posterior carapace margin with a prominent posteriorly directed spine at each edge. Basal antennal segment granulated, with 2 sharp tuber-

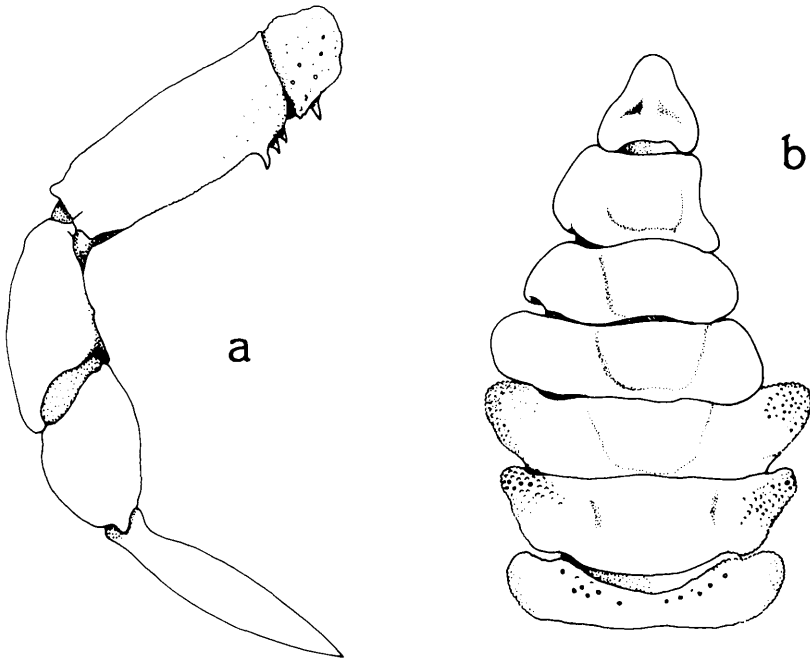


Fig.10. *Jonas choprai* Serène, 1971. Female (26.7 by 37.1 mm), Taiwan (ZRC). a, left fourth ambulatory leg (setae denuded); b, abdomen.

cles on outer distal surface; first antennal segment barely reaching tip of inner supraorbital tooth. Third maxillipeds relatively elongate; outer surfaces granular. Ischium distinctly demarcated from basis; inner margin strongly granulated, appearing almost serrated, with deep submedian sulcus; merus subtriangular, inner margin distinctly granulated. Inner margin of exopod appears almost serrated, with long flagellum.

Chelipeds subequal; inner and outer surfaces of all segments granulated to varying degrees. Basis-ischium with small tubercle on inner distal angle. Merus relatively short, dorsal margin with about 7 sharp spines, gradually increasing in size from subproximal to subdistal spine; distal margin finely granulated; ventral margin strongly granulated, with sharp, anteriorly directed distal spine. Carpus subtriangular; inner distal angle with long spine; dorsal margin with 1 short, sharp tooth; medio-distal surface with 1 sharp, recurved spine. Fingers of chela distinctly shorter than palm; tips of both fingers distinctly recurved; cutting edges with numerous blunt teeth and denticles; dorsal surface of dactylus with numerous small sharp granules; subventral margin of pollex with row of closely packed small, rounded granules resembling stridulatory ridge. Dorsal margin of palm with numerous sharp, slightly recurved spines and tubercles; ventral margin with numerous granules and tubercles of varying sharpness; median surface with several sharp tubercles.

Ambulatory legs relatively short, second leg longest. Merus of fourth leg with 3 distinct subdistal ventral spines; meri of other legs unarmed. Basis-ischium of fourth leg with 3 subdistal ventral spines, rest of outer surface with scattered small granules; basis-ischia of other legs unarmed. All other segments unarmed. Dactylus of first to third ambulatory legs almost styliform, slightly compressed laterally. Dactylus

of fourth ambulatory leg distinctly spatuliform. Lateral margins of segments strongly setose.

Abdominal segments 3-6 and telson triangular; lateral margins of telson distinctly concave, tip rounded; left side of segments 4-6 abnormal, appears deformed, left lateral margins convex; lateral surfaces of segments 2 and 3 finely granulated, segments trapezoidal; medio-distal margin of segment 1 covered with scattered small rounded granules. Appendages on abdomen abnormally formed, not setose; right side of segments 2-4 with poorly formed pleopods, gradually decreasing in size, that on segment 2 hooked; left side of segment 3 with poorly developed pleopod, pleopod on segment 2 biramous, endopod hooked. No trace of appendages on other segments.

Remarks.--Serène (1971) described *Jonas choprai* from a sacculinid infested female specimen collected from Keelung in Taiwan. He briefly diagnosed the species and distinguished it from *J. formosae* (as *J. distinctus formosus* (spelling incorrect)) by the form of the inner supraorbital spine, inner infraorbital spine, external orbital tooth, as well as form and proportions of the carapace. The recent specimen agrees very well with the holotype female in almost all aspects and is so different from all known species of *Jonas* (and *Gomezia*) that we have little hesitation in agreeing with Serène. We have, however, added a redescription of the species based on the present female specimen to complement Serène's rather brief diagnosis. The only regret we have at present is that the specimen is somewhat abnormal with regards to its abdomen and pleopods, and is not a good specimen by any standard. The carapace and all other structures, however, are all normal. The left side of the fourth to six abdominal segments is abnormal, and may have been due to physical or other damage. The pleopods all appear somewhat abnor-

mal, and on the left side, there is no pleopod on the second segment. The specimen, however, is still clearly a female, with the vulvae well developed and appearing normal, and there is no trace of male gonopores. It is thus not a hermaphrodite.

As a species of *Jonas*, however, *J. choprai* is rather unusual in its relatively broader carapace and having supraorbital spines which are distinctly longer than the rostrum. All other known species of *Jonas* have supraorbital spines which are distinctly shorter or at most, just reaching the rostrum. The only species of *Gomezia* on the other hand, has supraorbital spines which are longer than the rostrum. In addition, for *J. choprai*, when compared to known congeners, its basal antennal segment is strongly granulated with some sharp tubercles (vs. smooth to weakly granulated), the merus of its last ambulatory leg has three spines on its ventro-distal margin (vs. only one distinct spine) and the basis-ischium of its last ambulatory leg has three prominent spines (vs. absent). Among *Jonas* species, the form of the anterolateral armature of *J. choprai* is most similar to that of *J. distincta* s. str., but in *J. choprai*, the teeth are even stronger and proportionately larger. With regards to the egg-shaped carapace and long supraorbital spines, *J. choprai* superficially resembles *Gomezia bicornis*, but as discussed earlier, it lacks the generic characters of *Gomezia*.

Family Palicidae Bouvier, 1897

Crossotonotus spinipes

(De Man, 1888)

(Fig. 11)

Material examined.

Northern Lanyu Island, 1 female (30.7 by 27.2 mm), 8 VII 1997 (NTOU).



Fig. 11. *Crossotonotus spinipes* (De Man, 1888), female (30.7 by 27.2 mm) (NTOU).

Remarks.--The present specimen agrees very well with *Crossotonotus spinipes* (De Man, 1888) (see Sakai, 1976), a species with a wide Indo-West Pacific distribution. This species is known from relatively shallow waters near reefs (Sakai, 1976) and the present specimen was collected by SCUBA at night from a depth of about five metres. According to P. Castro (pers. comm.) who is currently revising the Palicidae, *C. spinipes* is a close but distinct from *C. compressipes* A. Milne Edwards, 1873.

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References

- Adams, A. and A. White. 1848, 1849.** Crustacea. viii+66 pp., pls. 1-13. *In*: A. Adams (Ed.), The zoology of the voyage of the H. M. S. Samarang; under the command of Captain Sir Edward Belcher, C. B., F. R. A. S., F. G. S. during the Years 1843-1846. Reeve, Benham and Reeve, London. [Pp. 1-32 and pls. 1-6 were published in 1848; pp. i-viii, 33-66 and pls. 7-13 in 1849]
- Baless, H. 1922a.** Diagnosen neuer japanischer Decapoden. *Zoologische Anzeiger*, 54: 1-6.
- Baless, H. 1922b.** Ostasiatische Decapoden. IV. Die Brachyrynchen (Cancridea). *Archiv für Naturgeschichte*, 88 (A) (11): 94-166, pls. 1-2.
- Chang, C.-M. 1963.** A check-list of Taiwan crabs with descriptions of 19 new records. *Biological Bulletin of the Tunghai University*, 14: 1-23.
- Chen, H.-L. 1998.** Further study on the crabs (Crustacea: Brachyura) from Nansha Island and adjacent waters. pp. 228-264. *In*: Studies on marine flora and fauna and biogeography of the Nansha Island and neighbouring waters, 3. Beijing.
- Chopra, B. 1935.** Further notes on Crustacea Decapoda in the Indian Museum. VIII. On the Decapod Crustacea collected by the Bengal Pilot Service off the mouth of the River Hooghly. Brachygnatha (Oxyryncha and Brachyryncha). *Records of the Indian Museum*, 37: 463-514, pl. 9.
- Dai, A.-Y., and P. K. L. Ng. 1997.** Notes on an unusual specimen of *Lauridromia dehaani* (Rathbun) (Decapoda, Brachyura, Dromiidae) from Hong Kong. *Crustaceana*, 70 (6): 754-757.
- Dai A.-Y., and S.-L. Yang. 1991.** Crabs of the China Seas. 21+608 Pp., figs. 1-295, pls. 1-74, China Ocean Press, Beijing and Springer-Verlag, Berlin.
- Dai, A.-Y., S.-L. Yang, Y.-Z. Song and G.-X. Chen. 1986.** China Ocean Press, *Crabs of the China Seas*. Beijing. (in Chinese)
- Fabricius, J. C. 1798.** *Entomologia systematica emendata et aucta secundum classes, ordines, genera, species, adjectis synonymis, locis, observationibus, discriptionibus. supplementum entomologiae systematicae*. 572. pp. Hafniae.
- Fulton, S. W., and F. E. Grant. 1902.** Some little known Victorian Decapod Crustacea with descriptions of new species, no. 2. *Proceedings of the Royal Society of Victoria*, 15: 59-68, pls. 8-10.
- Gray, J. E. 1831.** Description of a new genus and some undescribed species of Crustacea. *Zoological Miscellany*, London, pp. 39-41.
- Guinot, D., D. Doumenc, and C. C. Chintiroglou. 1995.** A review of the carrying behaviour in brachyuran crabs, with additional information on the symbioses with sea anemones. *Raffles Bulletin of Zoology*, 43 (2): 377-416.
- Hann, W. D. 1833-1849.** Crustacea. *In*: P. F. Siebold (Ed.), *Fauna Japonica sive Descriptio Animalium, quae in Itinere per Japoniam, Jussu et Auspiciis Superiorum, Qui Summum in India Batava Imperium Tenent, Suscepto, Annis 1823-1830 Collegit, Notis, Observationibus et Adumbrationibus Illustravit, (Crustacea): i-xvii+i-xxxi+i-ix- xvi+1-243, pls. A-J, L-Q, 1-55, circ. tabl. 2. Lugduni-Batavorum*.
- Ho, P.-H. 1996.** Crabs. Pp. 71-90. *In*: K. C. Shio (Ed), *Common seafood of Taiwan. Part 1. Taiwan Fisheries Bureau, Taipei*. (in Chinese).
- Horikawa, Y. 1940.** A list of Formosan crabs. *Scientific Taiwan*, 8: 21-31. (in Japanese)
- Jacquinot, H., and H. Lucas. 1852-1853.** Crustacea. *In*: *Voyage au Pole Sud et dans*

- l'Océanie sur les Corvettes l'Astrolabe et la Zélée exécuté par ordre du roi pendant les années 1837-1838-1839-1840 sous le commandement de M. J. Dumont d'Urville. Gide et Baudre, Paris. Atlas, 1852, 9 pls.
- Kim, H. S. 1973.** Anomura and Brachyura. *In*: Illustrated encyclopaedia of fauna and flora of Korea. Vol. 14. Ministry of Education, Republic of Korea, Sam Wha Publishing Co.
- Lamarck, J. B. P. A. 1818.** Histoire naturelle des animaux sans vertèbres, présentant les caractères généraux et particuliers de ces animaux, leur distribution, leurs classes, leurs familles, leurs genres, et al citation des principales espèces qui s'y rapportent; précédée d'une introduction offrant la détermination des caractères essentiels de l'animal, sa distinction du végétal et des autres corps naturels, enfin, l'exposition des principes fondamentaux de la zoologie. 5: 1-612.
- Laurie, D. 1906.** Report on the Brachyura collected by Professor Herdman, at Ceylon, in 1902. pp. 349-432, 2 pls. *In*: W. A. Herdman (Ed.), Report to the Government of Ceylon on the Pearl Oyster Fisheries of the Gulf of Manaar, Part 5, Supplementary Report, 40.
- Lewinsohn, C. 1984.** Dromiidae from Madagascar and the Seychelles (Crustacea Decapoda, Brachyura). Bulletin du Muséum national d'Histoire Naturelle, Paris, (4) 6 (A) (1): 89-129, pls. 1-4.
- Lin, C.-C. 1949.** A catalogue of brachyurous Crustacea of Taiwan. Quarterly Journal of the Taiwan Museum, 2(1): 10-33.
- Linnaeus, C. 1758.** Systema Naturae per Regna Tria naturae, Secundum Classes, Ordines, genera, Species, cum Characteribus, Differentiis Specierum, Synonymis, Locis. 10th edition, 1: i-iii, 1-824 pp.
- Linnaeus, C. 1763.** Centuria Insectorum, quam, praeside D. D. Car. von Linne, proposuit Boas, Calmariensis. pp. 384-419. *In*: C. Linnaeus, Amoenitates Academicae; seu dissertationes variae, physicae, medicae, botanicae, Antehac seorsim editae, nunc collectae and auctae, 6.
- Maki, M., and K. Tsuchiya. 1923.** A monograph of the Decapod Crustaceans of Formosa. x1+215+4 pp. Report of the Agriculture Bureau, Government of Research Institute of Taihoku, No. 3. (in Japange)
- Man, J. G., De. 1888.** Report on the Podophthalmous Crustacea of the Mergui Archipelago, collected for the Trustees of the Indian Museum, Calcutta, by Dr John Anderson, F. R. S. Superintendent of the Museum. Pars I-V. Journal of the Linnaean Society (Zoology), 22 (138-140): 129-312, pls. 1-19.
- McLay, C. L. 1991.** A small collection of deep water sponge crabs (Brachyura: Dromiidae) from French Polynesia, including a new species of *Sphaerodromia* Alcock, 1899. Bulletin du Muséum national d'Histoire Naturelle, Paris, (4) 3 (A) (3-4): 457-481.
- McLay, C. L. 1993.** Crustacea: Decapoda: The Sponge Crabs (Dromiidae) of New Caledonia and the Philippines with a review of the genera. pp. 111-251. *In*: A. Crosnier (Ed.), Résultats des campagnes MUSORSTOM, 10. Mémoires du Muséum national d'Histoire Naturelle, Paris, 156.
- Miers, E. J. 1884.** Crustacea. pp. 1178-322, pls. 18-34. *In*: Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H. M. S. "Alert" 1881-2. British Museum, London.
- Milne Edwards, H. 1834-1837.** Histoire natu-

- relle des Crustacés, comprenant l'anatomie, la physiologie et la classification des ces animaux, 1: xxxv+468pp. Atlas [1834, 1837, 1840]: 1-32, pls. 1-14, 14 bis, 15-25, 25 bis, 26-42. Librairie Encyclopedique de Roret, Paris.
- Ng, P. K. L. 1998.** Crabs. pp. 1045-1159. In: K. E. Carpenter and N. Volker (Eds.), *FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific. Volume 2. Cephalopods, crustaceans, holothurians and sharks.* Food and Agriculture Organisation, Rome.
- Ng, P. K. L., and J.-F. Huang. 1997.** Unrecorded crabs (Crustacea: Decapoda: Brachyura) from Taiwan and Tungsha Islands, with description of a new genus and species of Xanthidae. *Zoological Studies*, 36(4): 261-276.
- Parisi, G. 1914.** I. Decapoda giapponesi del Museo di Milano. I. Oxystomata. *Atti della Societas Italiano Science Naturali*, 53: 5-35, pls. 11-13.
- Rathbun, M. J. 1923.** An analysis of "*Dromia dormia* Linnaeus". *Proceedings of the Biological Society of Washington*, 36: 65-70.
- Sakai, T. 1937.** Studies on the crabs of Japan II. Oxystomata. *Science Reports of the Tokyo Bunrika Daigaku*, B3(2): 67-192, pls. 10-19.
- Sakai, T. 1939.** Studies on the crabs of Japan. IV. Brachygnatha, Brachyrhyncha. *Yoken-do Ltd. Tokyo.* pp. 365-741, pls. 42-111.
- Sakai, T. 1963.** Description of two new genera and fourteen new species of Japanese crabs from the collection of His Majesty the Emperor of Japan. *Crustaceana*, 5: 213-233.
- Sakai, T. 1965.** The Crabs of Sagami Bay. English Text, xvi+206pp. Japanese Text, pp. 1-92, Bibliography and indices, pp. 1-32, pls. 1-100. Maruzen, Tokyo.
- Sakai, T. 1969.** Two new genera and twenty-two new species of crabs from Japan. *Proceedings of the Biological Society of Washington*, 82: 243-280, pls. 1, 2.
- Sakai, T. 1976.** Crabs of Japan and the Adjacent Seas. In 3 volumes; English Text, xxix+773pp., Japanese Text, 460 pp., Plates volume, 16pp. + 25 pls. Kodansha Ltd., Tokyo.
- Samouelle, G. 1819.** The entomologist's useful compendium, or an introduction to the knowledge of the British insects. 496 pp., London.
- Serène, R. 1971.** Observations préliminaires sur des Brachyours nouveaux ou Mal Connus du Sud-est Asiatique (Crustacea Decapoda). *Bulletin du Muséum national d'Histoire Naturelle, Paris*, (2) 42(5): 903-918.
- Serène, R., and A. F. Umali. 1972.** The family Raninidae and other new and rare species of Brachyuran Decapods from the Philippines and adjacent regions. *Philippine Journal of Science*, 99 (1-2): 21-105, pls. 1-9.
- Stimpson, W. 1858.** *Prodromus descriptionis animalium evertibratorum, quae in Expeditione ad Oceanum Pacificum Septentrionalem, a Republica Federata missa...obervavit et descripsit. Pars VII. Crustacea Anomura.* *Proceedings of the Academy of Natural Sciences of Philidelphia*, 10: 225-252.
- Terazaki, T. 1902.** On Japanese crabs. *Zoological Magazine*, 14(159): 161-285.
- Wang, C.-H., and C.-W. Chen. 1981.** The list of brachyurous collections at Taiwan Museum (1). *Annual of Taiwan Museum*, 24: 149-156. (in Chinese with English abstract)
- Ward, M. 1933.** New genera and species of marine Decapoda Brachyura from the coasts of New South Wales and Queensland. *Australian Zoologist*, 7(5): 377-394, pls. 21-23.

- Wood Mason, J. 1887.** Description of a new species of Crustacea belonging to the Brachyurous family Raninidae. *Journal of the Asiatic Society of Bengal*, 56:206- 209, 1 pl.
- Yamaguchi, T. 1993.** A list of species described in the crustacean volume of fauna Japonica as belonging to the Japanese fauna. pp. 571-598. *In*: T. Yamaguchi (Ed.), Ph. F. von Siebold and natural history of Japan. Crustacea. Carcinological Society of Japan, Tokyo.
- Yamaguchi, T., and K. Baba. 1993.** Crustacean specimens collected in Japan by Ph. F. Von Siebold and H. Burger and held by the Nationaal Naturhistorisch Museum in Leiden and other museums. pp. 145~170. *In*: T. Yamaguchi (Ed.), Ph. F. von Siebold and natural history of Japan. Crustacea. Carcinological Society of Japan, Tokyo.
- Yang, S., and A. Dai. 1994.** Further notes on the crabs (Decapoda Brachyura) from Nansha Islands and adjacent waters. pp. 125-147, pl. 1. *In*: Marine fauna and flora and biogeography of the Nansha islands and neighbouring waters. Ocean Press, Beijing.