JOURNAL OF CRUSTACEAN BIOLOGY, 20, SPECIAL NUMBER 2: 207–217, 2000

# FURTHER RECORDS OF THALASSINIDEAN SHRIMPS FROM TAIWAN (DECAPODA: AXIIDAE AND CALOCARIDIDAE), WITH DESCRIPTIONS OF THREE NEW SPECIES

*Brian Kensley, Feng-Jiau Lin, and Hsiang-Ping Yu*

(BK) Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560–0163, U.S.A. (e-mail: Kensley.Brian@nmnh.si.edu); (FJL and HPY) Graduate School of Fisheries Sciences, National Taiwan Ocean University, Keelung, Taiwan, R.O.C.

ABSTRACT

Three axiid species and one calocaridid are recorded from Taiwan. The three deepwater species are described as new: *Calaxius manningi,* having a finely pitted carapace and strongly spinose chelipeds; *Calocarides chani,* which possesses finely tuberculate first chelipeds; and *Ambiaxius foveolatus,* which has a shallowly pitted carapace branchiostegite. *Neaxius acanthus* (A. Milne Edwards) is recorded from the coral reefs of Taiwan.

The axiid and calocaridid shrimp fauna of the seas around Taiwan until recently was almost unknown. Recent studies of the decapod crustacean fauna of Taiwan found three species of these shrimps, all of them undescribed (Kensley and Chan, 1998). As the decapod survey continues, more species are being revealed. The present paper adds four species to the list, while a species of *Oxyrhynchaxius* is in process of being recorded (Lin *et al.,* 2000). The shallow-water axiid, *Neaxius acanthus* (A. Milne Edwards, 1879) is common in coral reef areas and is formally recorded here from Taiwan for the first time. Of the seven genera and eight species of axiids and calocaridids now recorded from Taiwan, six are known only from this region. Undoubtedly, further records for the area will be made as exploration continues.

The specimens are deposited at the National Taiwan Ocean University, Keelung (NTOU) and the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM). The carapace length measurement (cl) from orbital margin to posterior margin of carapace, excludes the rostrum.

## RESULTS

### Family Axiidae

### *Calaxius manningi,* new species

Figs. 1, 2, 7A

*Material Examined.*—Holotype, NTOU H–1999–1–11, ♀ cl. 19.3 mm, Tai-Shi, N.E. Taiwan, 500 m, 11 Jan 1999.—Paratype, NTOU P–1998–5–17, ♂ (specimen in process of molt, carapace and most of pleonite terga and sterna lost), Tai-Shi, N.E. Taiwain, 350–500 m, 17 May 1998.

*Description.*—Carapace with rostrum reaching well beyond eyes, almost reaching to distal margin of antennal peduncle article 4, with 2 pairs of lateral spines, and pair of strong supraorbital spines at base; median carina well marked, reaching from anterior rostrum to posterior margin of carapace, with single spine anterior to tubercle; submedian carina poorly defined, bearing 2 strong spines on each side; lateral carina bearing 2 strong spines posterior to supraorbital spine on each side; cervical groove strong, especially middorsally; suprabranchial groove anterolaterally distinct; most of branchiostegite and posterodorsal carapace pitted. Abdominal pleuron 1 narrow, ventrally acute; pleuron 2 anteroventrally rounded, posteroventrally produced, acute; pleuron 3 with tooth at about midlength of ventral margin, posteroventrally acute; pleura 4 and 5 as in 3, but median tooth smaller; pleuron 6 with small median tooth on ventral margin, posteroventrally rounded. Telson about 1.5 times longer than wide, with acute shoulder anteriorly, 2 pairs of strong dorsal spines, small marginal articulated spine in posterior half, row of 3 articulated spines marking posterior margin, latter evenly convex.

Antennal acicle slender, not quite reaching distal margin of peduncle article 4. Pereiopod 1, chelipeds subequal, similar; ischium with strong posterodistal spine; merus with 3 spines on posterior margin, 2 spines

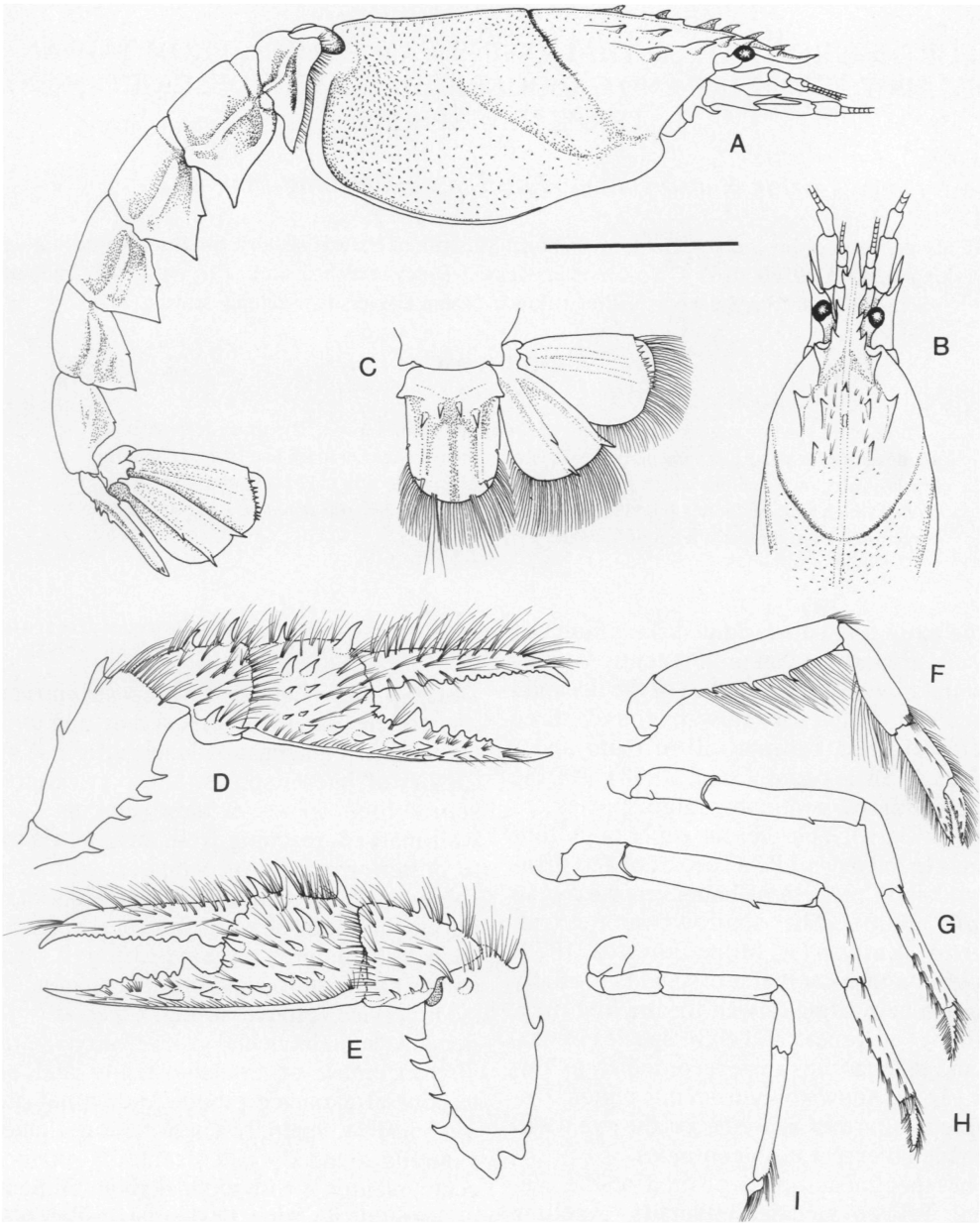


Fig. 1. *Calaxius manningi,* new species, holotype. A, lateral view; B, anterior carapace in dorsal view; C, telson and right uropod in dorsal view; D, E, left and right pereiopod 1; F, G, H, I, pereiopods 2–5. Scale = 10 mm.

on anterior margin, single distal spine on lateral surface; carpus with numerous clumps of setae, 2 spines on anterior margin, ridge on outer surface near posterior margin bearing 2 or 3 spines; propodus with numerous clumps of setae, 3 strong spines on anterior margin, several scattered spines on lateral surface, irregular row of 7 spines near posterior margin, fixed finger longer than palm, with single strong triangular tooth proximally and several smaller teeth along cutting edge; dactylus densely setose, cutting edge bearing several small teeth plus larger obtuse proximal tubercle. Pereiopod 2 strongly setose, merus with 3 spines on posterior margin. Pereiopods 3 and 4 similar, 3 slightly longer, merus with single spine on posterior margin. Pereiopod 5 shorter than 4, merus lacking

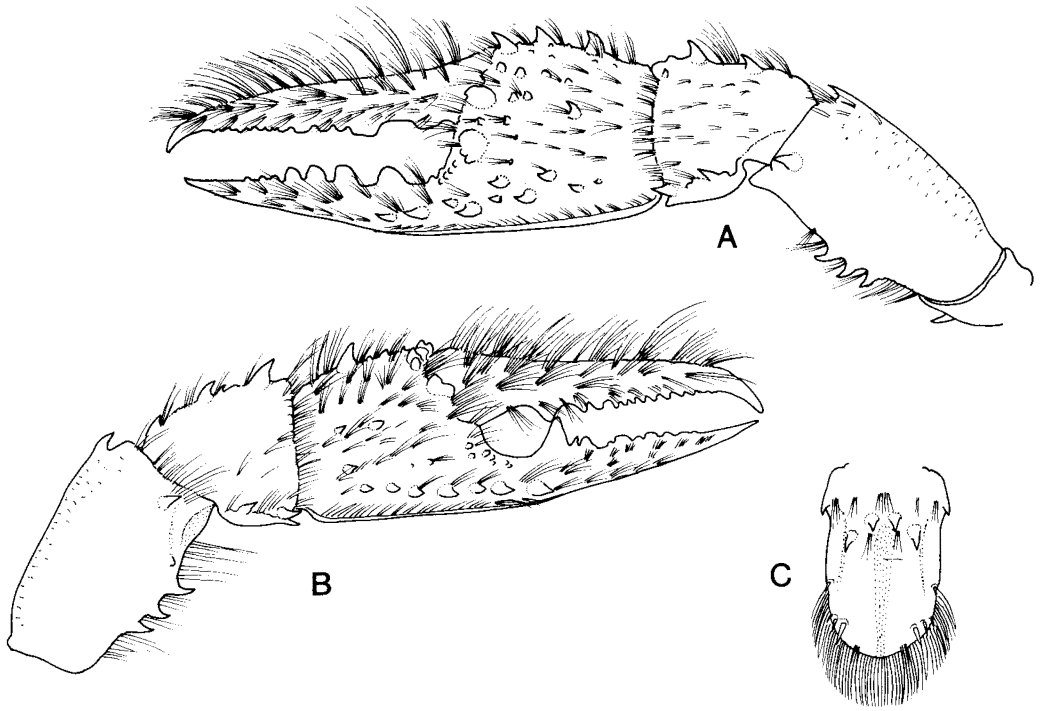


Fig. 2. *Calaxius manningi,* new species, paratype. A, B, left and right pereiopod 1; C, telson in dorsal view.

spine; dactylus setose, twisted. Lateral uropodal ramus, lateral margin unarmed, distal suture line bearing 9 spinules; mesial ramus with single strong distolateral spine, dorsal ridge bearing 2 spines, distalmost on distal margin.

*Color.*—Body generally yellowish-brown, with pereiopods 2–5 somewhat pinkish-brown. Tips of chelae of pereiopod 1 white. Eyes dark brown. Setae dark gray.

*Variation.*—The paratypic male shows some slight differences from the holotypic female in the chelipeds of pereiopod 1. The chelipeds are slightly dissimilar, with one having a broader propodal palm than the other and fewer spines on the lateral surface, while the merus has a single distal spine on the anterior margin.

*Remarks.*—Of the eight described species of *Calaxius,* the present material only bears some resemblance to *Calaxius acutirostris* Sakai and de Saint Laurent, 1989 (Fig. 23) from the Philippines. The type locality for this latter species was given as Madagascar, but material from the Philippines was also illustrated. Almost certainly, several species of *Calaxius* have been confused under this name. *Calaxius acutirostris* (from the Philippines) appears to differ from *C. manningi* in having four spines on the posterior meral margin of pereiopod 1, the lateral margin of the inner uropodal ramus bears three spines, while the telson margins are serrate.

*Calaxius sibogae* (de Man, 1925) from Indonesia in the Ceram Sea region, while bearing a slight resemblance to the present species, possesses far less spinose first pereiopods, and much smaller spines on the submedian carina.

*Etymology.*—The species is named for Dr. Raymond B. Manning, carcinologist *par excellence,* generous colleague and friend.

### ***Calocarides chani,*** new species
Figs. 3, 4, 7B–D

*Material Examined.*—Holotype, NTOU H–1995–11–2, 1 ♂ cl. 10.6 mm, Tai-Shi fishing port, I-Lan County, N.E. Taiwan, commercial trawler, about 400 m, soft bottom, 2 Nov 1995.—Paratypes: NTOU P–1998–5–28, 1 ♂ cl. 10.3 mm, Tai-Shi, N.E. Taiwan, 28 May 1998.—NTOU P-1997-12-4, 2 ♂♂ cl. 11.0 mm, damaged, Tai-shi, N.E. Taiwan, 4 Dec 1997.—NTOU P–1995–7–3, 1 ♂ cl. 12.0 mm, Tai-Shi, N.E. Taiwan, 350 m, 3 Jul 1995.—USNM

253363, 2 ♂♂ cl. 10.2 mm, 10.6 mm, Tai-Shi, N.E. Taiwan, 500–600 m, 28 May 1998.

*Additional Material.*—NTOU, 2 ♂♂ cl. 11.0 mm, 12.2 mm, Tai-Shi fishing port I-Lan County, N.E. Taiwan, commercial trawler, 400–500 m, soft bottom, 10 Aug 1998.—NTOU, 1 ♂ cl. 10.7 mm, Tai-Shi, N.E. Taiwan, 300–400 m, 25 Jan 1999.

*Description.*—Carapace with rostrum reaching beyond eye to level of distal margin of article 1 of antennular peduncle; median carina with 1–5 spines anterior to tubercle; submedian carina well marked, with 0–8 spines; lateral rostral margin and lateral carina together with 6–15 spines; cervical groove prominent; suprabranchial ridge barely detectable. Pleuron of abdominal somite 1 narrow, ventrally rounded; pleura of somites 2–5 ventrally rounded, with tiny tooth on anterior margin of pleura 3–5. Telsonic length 1.4 times basal width, lateral margins with 4 serrations; posterolateral corner with 3 small mobile spines; posterior margin rounded, with median point; 1 pair of small submedian spines on dorsal surface.

Eye reaching to or just beyond midlength of rostrum, unpigmented. Antennal acicle slender, acute, not reaching distal margin of peduncular article 4. Maxilliped 3, ischium with few serrations along mesial margin; merus with 2 teeth plus 2 small serrations on mesial margin. Pereiopod 1, chelipeds variable, subequal or slightly unequal, fingers between half and two-thirds length of propodal palm; ischium with single tooth on posterodistal surface; merus with single tooth on upper margin, lower margin with 2 or 3 strong teeth and row of small rounded tubercles; carpus with irregular band of small rounded tubercles on upper surface, row of tubercles along distal margin; propodus with small rounded tubercles scattered fairly evenly over lateral surface, lower margin with sharp ridge ending distally in row of small tubercles, fixed finger usually with large blunt tubercle on cutting edge proximally, followed by row of tiny tubercles; dactylus with scattered small rounded tubercles, cutting edge with few blunt tubercles proximally followed by row of tiny tubercles, distal half of cutting edge sometimes worn down to blunt rounded structure. Pereiopod 2, ischium with 3 spines on posterior margin; merus with 2 spines on posterior margin; carpus with single spine posterodistally; chela strongly setose. Pereiopods 3–4, subsimilar, distal propodus and dactylus setose. Pereiopod 5 shorter than preceding pereiopod, dactylus twisted, setose. Pleopod 1 in male absent. Pleopod 2, appendix masculina shorter and broader than appendix interna, bearing elongate setae. Lateral ramus of uropod with distal oblique suture bearing about 10 small spines, small mobile spine at articulation of suture and lateral margin; mesial ramus with middorsal ridge bearing 6 small spines.

*Color.*—Body generally orange-red, with lateral carapace lighter in color, tailfan deeper in color. Pereiopods 2 to 5 orange-pink. Eyes golden or yellowish. Some specimens with body color either light yellowish or light pink overall.

*Remarks.*—With ten male specimens of this species available, all from the same locality (Tai-Shi) and ranging in depths from 300 to 500 m, a considerable degree of variation can be seen in the carapace spination and shape of the first pereiopods. The spination of the median carapace carina varies from 1 to 5 spines; the submedian carina from 0 to 8 spines; the lateral carina (which here includes the rostral spines) from 6 to 15 spines, while the body color varies from orange-red to yellowish. This degree of variation in spination is not unknown in *Calocarides;* similar variation has already been documented for *Calocarides quinqueseriatus* (Rathbun, 1902) (see Kensley, 1996b: 61). Variation of the pereiopod 1 chelipeds can be attributed to wear, as well as to loss and replacement. Although the three lighter colored specimens are somewhat less spinose, there is still overlap in carapace spination with the more common orange-red specimens (Table 1), while the light pink specimen (Fig. 7C) is also intermediate in color between the orange-red forms (Fig. 7B) and the light yellowish forms (Fig. 7D). The present specimens are all regarded as the

Table 1. Carapace spination in *Calocarides chani.*

| Carapace length | Median carina | L/R Submedian carina | L/R Lateral carina (incl. rostral spines |
|---|---|---|---|
| 10.2 | 2 | 3/4 | 8/8 |
| 10.3 | 4 | 5/5 | 14/15 |
| 10.6 | 5 | 5/5 | 13/13 |
| 10.6 | 4 | 8/7 | 12/12 |
| 10.7 | 1 | 4/3 | 10/8 |
| 11.0 | 2 | 6/6 | 11/13 |
| 11.0 | 1 | 3/4 | 10/12 |
| 12.0 | 4 | 6/6 | 12/12 |
| 12.2 | 2 | 1/0 | 7/6 |
| damaged | 5 | 8/5 | 11/13 |

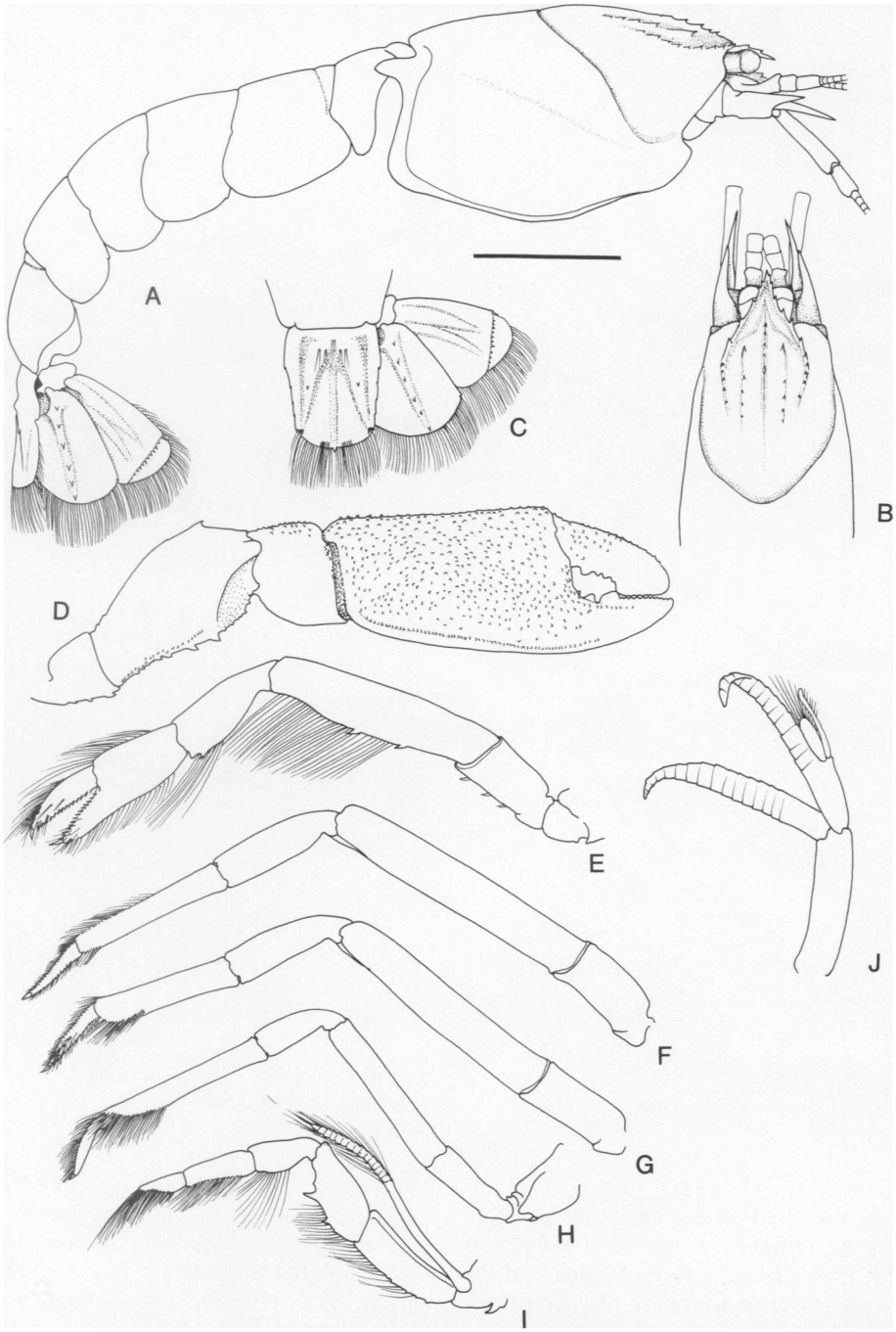


Fig. 3. *Calocarides chani,* new species, holotype. A, lateral view; B, anterior carapace in dorsal view; C, telson and right uropod in dorsal view; D, pereiopod 1; E, F, G, H, pereiopods 2–5; I, maxilliped 3; J, pleopod 2. Scale = 5 mm.

same species, but the types are restricted to the orange-red forms.

While possessing all the general features of a species of *Calocarides, C. chani* bears some resemblance to *Calocarides soyoi* (Yokoya, 1933) (see Kensley and Komai, 1992) from Japan, but differs in several aspects: *C. soyoi* is a larger species at cl. 12.0–18.8 mm (13

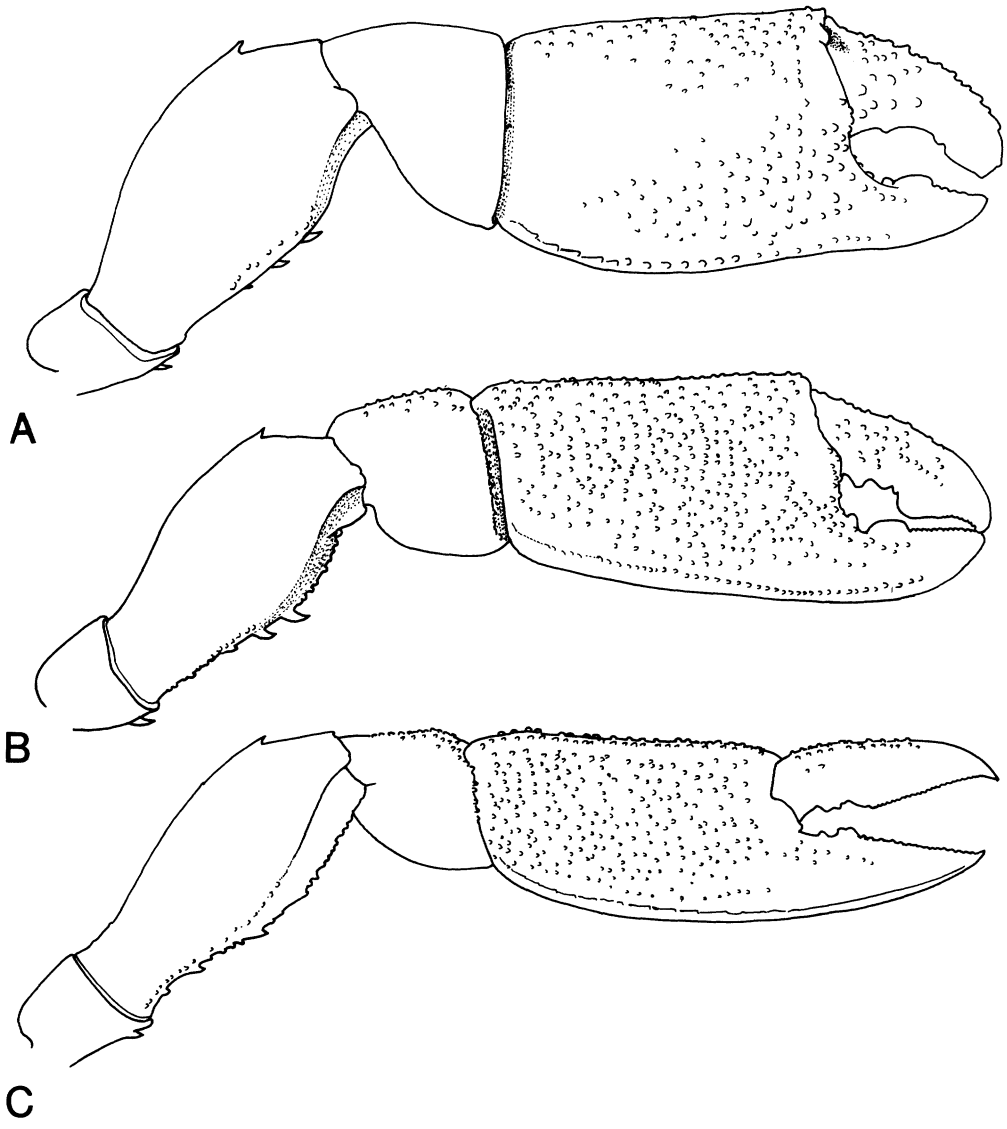


Fig. 4. *Calocarides chani,* new species. A, B, C, pereiopod 1, cl. 11.0 mm, 10.5 mm, 10.9 mm.

specimens) vs. 10.2–12.2 mm (10 specimens); pereiopod 1 chelae are more elongate in *C. soyoi* (fingers about 0.66 length of palm); *C. soyoi* bears a row of spines on the upper and lower margins of the merus of pereiopod 1, whereas *C. chani* has a single spine on the upper margin and about three spines on the lower margin of the merus; the lateral surface of the carpus in *C. soyoi* has numerous small tubercles, whereas in *C. chani* there are only a few along the upper margin; the longitudinal carina of the inner uropodal ramus bears six spines in *C. chani,* five in *C. soyoi.*

*Etymology.*—The species is named for Dr. Tin-Yam Chan of the National Taiwan Ocean University, in recognition of his efforts to document the crustacean fauna of Taiwan, and in gratitude for his assistance in the preparation of this paper.

### *Neaxius acanthus* (A. Milne Edwards, 1879) Figs. 5, 7F

*Neaxius acanthus:* Sakai and de Saint Laurent, 1989: 30 (full synonymy).

*Material Examined.*—NTOU, 3 ♂♂ cl. 14.2–14.8 mm, 1 ♀ cl. 20.3 mm, Kenting, Ping-Tong County, southern Taiwan, coral reef, less than 1 m, 7 Dec 1990.—NTOU, 1 ♀ cl. 19.0 mm, 2 damaged spec. cl. 21.6 mm, 22.5 mm, Kent-

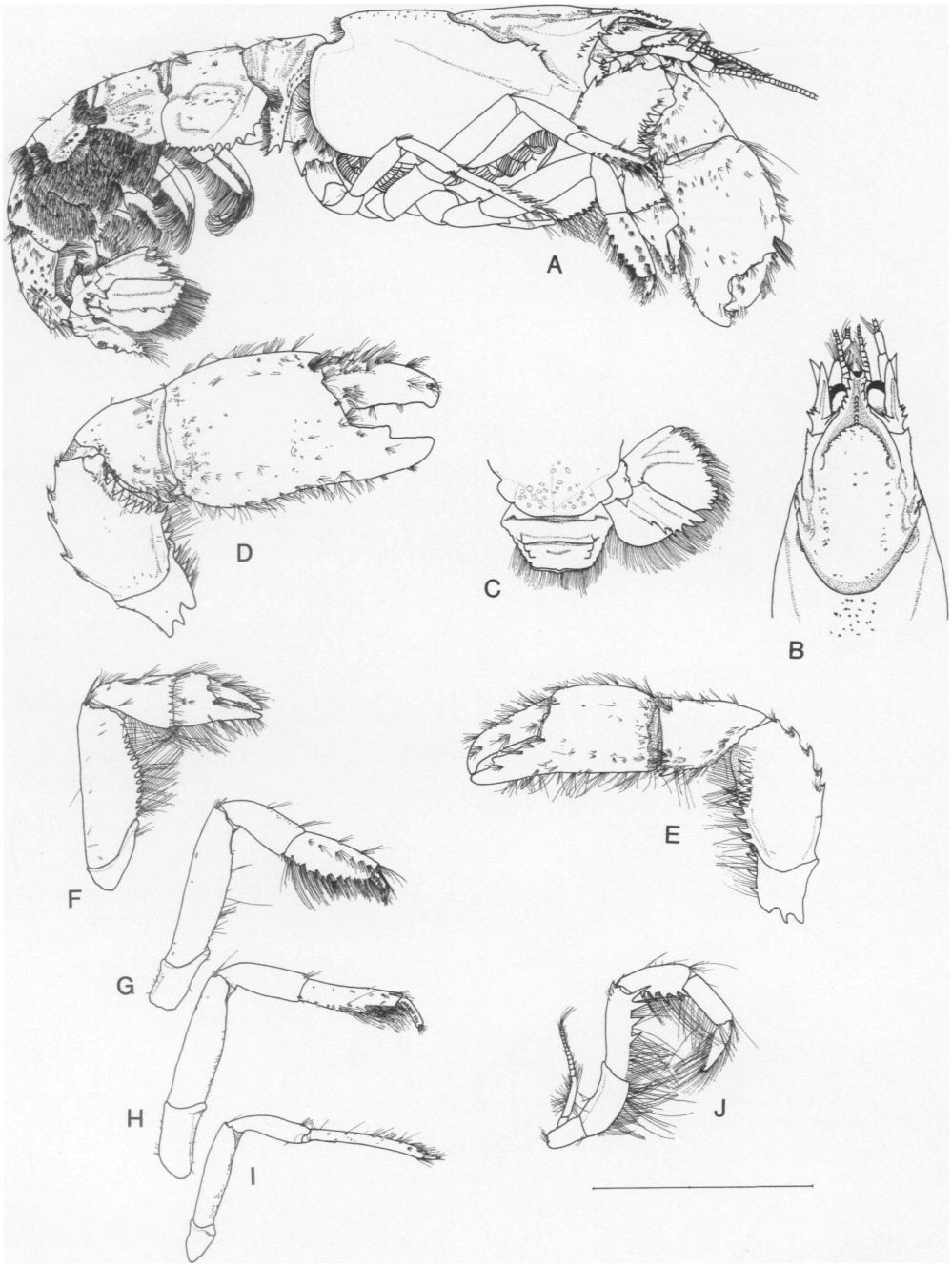


Fig. 5. *Neaxius acanthus,* male cl. 14.8 mm, Ping-Tong County, Taiwan. A, lateral view; B, anterior carapace in dorsal view; C, telson and right uropod; D, pereiopod 1, larger cheliped, lateral view; E, pereiopod 1, smaller cheliped, lateral view; F, pereiopod 2, lateral view; G, pereiopod 3, lateral view; H, pereiopod 4, lateral view; I, pereiopod 5, lateral view; J, maxilliped 3. Scale = 5 mm, left scale: A–C, right scale: D–J.

ing, Ping-Tong County, southern Taiwan, coral reef, less than 1 m, 1 Nov 1996.

*Color.*—Body generally orange-brown. Antennular and antennal flagella, maxilliped 3, and pereiopods 1 and 2 orange-red. Eyes almost black. Eggs reddish. Setae light brown.

*Previous Records.*—Japan; New Caledonia; Bismarck Archipelago, Papua New Guinea;

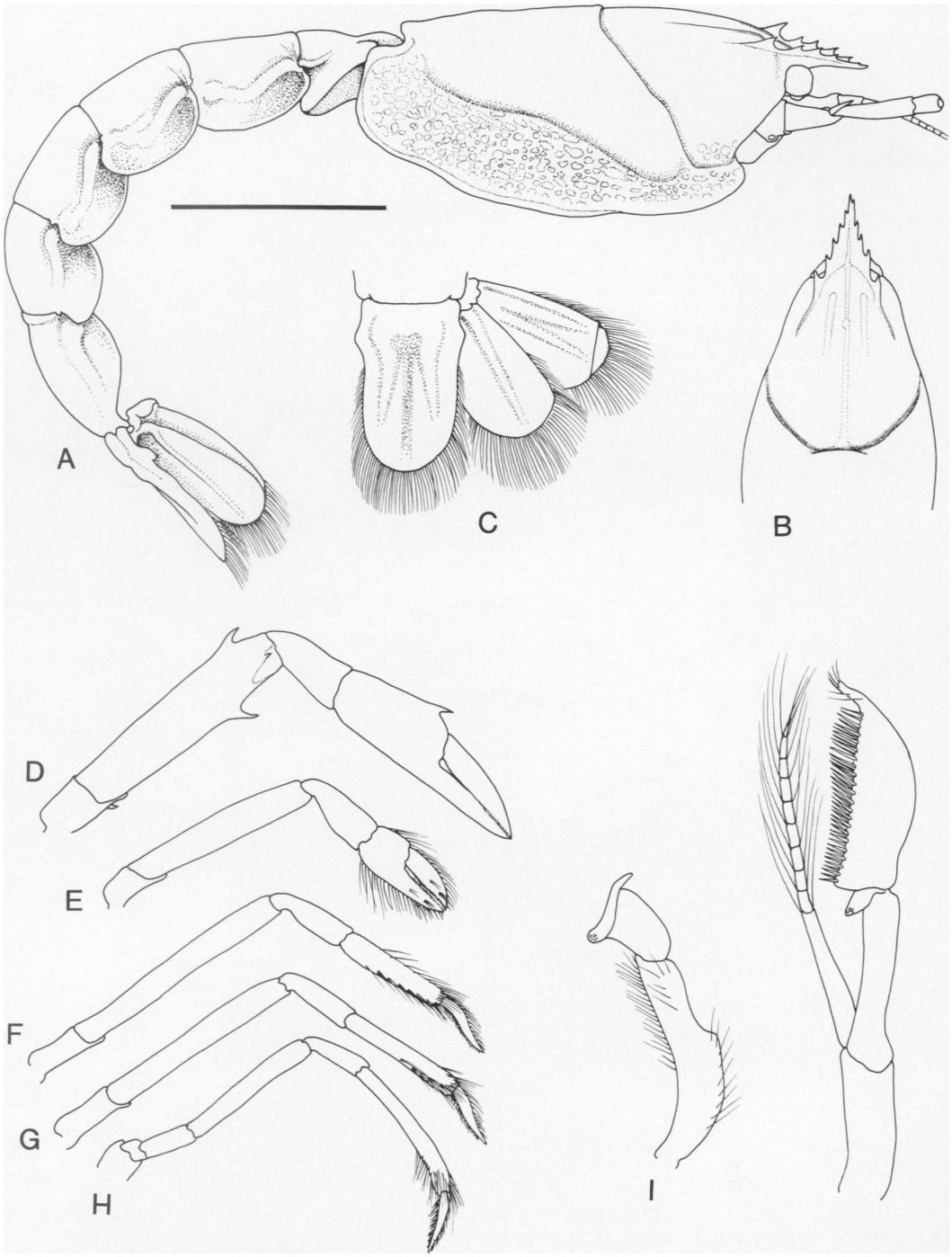


Fig. 6. *Ambiaxius foveolatus,* new species. A, lateral view; B, anterior carapace in dorsal view; C, telson and right uropod in dorsal view; D, E, F, G, H, pereiopods 1–5; I, pleopod 1; J, pleopod 2. Scale = 5 mm.

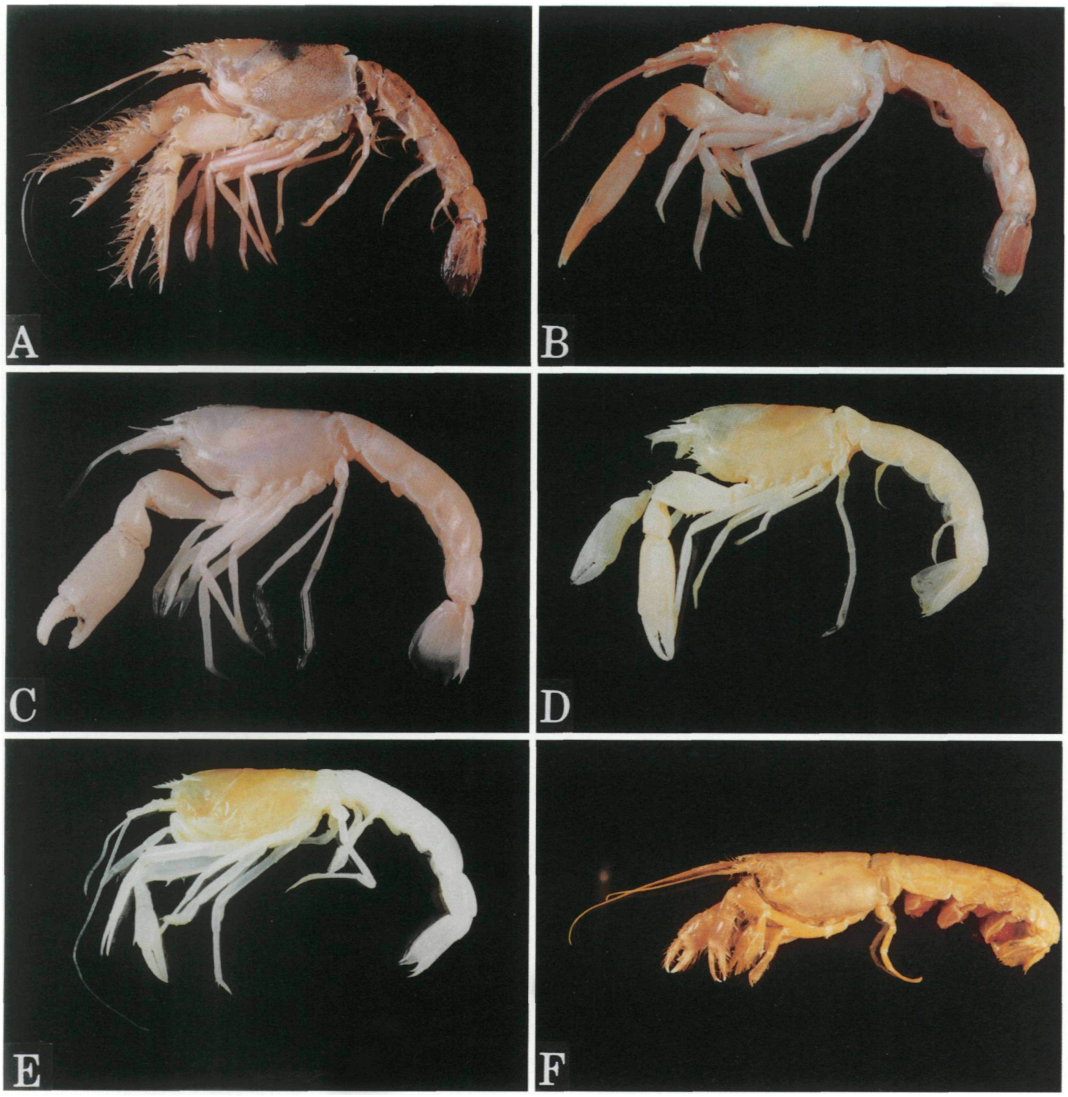


Fig. 7. A, *Calaxius manningi,* holotype; B, *Calocarides chani,* orange-red form; C, *Calocarides chani,* pale pink form; D, *Calocarides chani,* yellow form; E, *Ambiaxius foveolatus,* holotype; F, *Neaxius acanthus.*

western Sulawesi, Indonesia; Saipan, Marianas Islands; Torres Straits; Madagascar; Mauritius; Mombasa, Kenya. Previously unpublished USNM records: Cebu Channel, Philippines; Lizard Island, Australia; Guam.

*Remarks.—Neaxius acanthus,* with its typically Indo-West Pacific distribution, is rather common in the coral reef areas of Taiwan (including northern Taiwan and Peng-Hu Islands), where it lives in hard burrows. At Lizard Island, the shrimp lives in burrows in the mix of coarse sand and coral rubble around the bases of coral heads (BK personal observation), while in Papua New Guinea the animal occurs in seagrass beds (Mukai and Sakai, 1992). The first record of this species in Taiwan appears in a local field guide (Jeng, 1998) containing color photographs of the animal in life.

## Family Calocarididae
## ***Ambiaxius foveolatus,*** new species
## Figs. 6, 7E

*Material Examined.*—Holotype, NTOU H–1998–8–10, hermaphroditic specimen cl. 8.8 mm, Paratype, NTOU

P–1998–8–10, hermaphroditic specimen 8.0 mm, Tai-Shi fishing port, I-Lan County, N.E. Taiwan, commercial trawler, 400–500 m, 10 Aug 1998.

*Description.*—Carapace with dorsal surface smooth, branchiostegite shallowly foveolate; rostrum with 5 pairs lateral teeth; median carina entire, well marked; submedian carina poorly marked; lateral carina barely reaching posterior of posteriormost rostral tooth, cervical and branchiostegal grooves well marked.

Eye lacking pigment. Maxilliped 3, merus with 2 strong distal teeth on posterior margin. Pereiopod 1, chelipeds subequal; ischium with tiny posterodistal spine; merus with single strong distal spine on anterior and posterior margin; carpus unarmed, shorter than propodal palm; latter with single strong distal tooth on anterior margin, 1.8 times longer than width at level of spine; fingers 0.8 times length of propodal palm, cutting edges contiguous. Pereiopod 2, merus unarmed, fingers slightly longer than propodal palm. Pleopod 1 uniramous, of 2 articles, distal article flattened, widening distally to slender folded area having fingerlike lobe laterodistally, patch of tiny hooks mesiodistally. Pleopod 2, appendix interna short, lobe-like, fused basally with appendix masculina, latter bearing mesial irregular double row of setae, distal finger-like lobe bearing basal row of short setae. Lateral uropodal ramus with unarmed distal suture, single articulate spine distolaterally. Telson medial length 1.7 times basal width, posterior margin evenly convex.

*Color.*—Entire body including eyes pale yellow, with carapace slightly deeper in color.

*Remarks.*—Of the three species of *Ambiaxius* described (see Kensley, 1996a), the present material most closely resembles *Ambiaxius japonicus* Kensley, 1996a, from Ose Zaki, Japan. The major differences of the Taiwanese material, compared with *A. japonicus* include: Pereiopod 1 proportionally broader, and with larger spines (propodal palm 2.2 times longer than width at dorsal spine, 1.8 times in *A. foveolatus*); a narrower telson (telson medial length 1.7 times basal width in *A. foveolatus,* 1.5 in *A. japonicus*). Pleopod 1, distal folded area much narrower in *A. foveolatus;* pleopod 2, distal finger-like lobe shorter, broader, and with more setae in *A. foveolatus.* These differences are admittedly subtle, and with only three specimens between the two species, no sense of variation can be obtained. Nevertheless, given the distance of about 1,600 km between the Japanese and Taiwanese localities, the existence of two separate species is not impossible.

*Etymology.*—The specific name refers to the pitted branchiostegites of the carapace seen in this species.

## ACKNOWLEDGEMENTS

Special thanks are extended to Dr. T.-Y. Chan of the National Taiwan Ocean University, for providing us with the material of this study, including some of the color photographs, and for reviewing the manuscript. We also thank S. H. Wu, C. W. Lin, and Y. J. Laio of NTOU for collecting some of the specimens, and P. H. Ho of NTOU for the color photograph and specimens of *Neaxius acanthus.* This work was supported by the National Science Council, Taiwan, R.O.C. (NSC89–2313–B–019–041).

## LITERATURE CITED

Jeng, M. S. 1998. Guide to the shrimps and crabs of the Kenting National Park. Kenting National Park: Ping Tong. 133 pp. [In Chinese.]

Kensley, B. 1996a. New thalassinidean shrimp from the Pacific Ocean (Crustacea: Decapoda: Axiidae and Calocarididae).—Bulletin of Marine Science 59: 469–489.

———. 1996b. Systematics and distribution of the genus *Calocarides* (Crustacea: Decapoda: Axiidae).—Proceedings of the Biological Society of Washington 109: 53–69.

———, and T.-Y. Chan. 1998. Three new species of thalassinidean shrimps (Crustacea, Axiidae and Calocarididae) from Taiwan.—Zoosystema 20: 255–264.

———, and T. Komai. 1992. Redescription of *Calocarides soyoi* (Yokoya, 1933) from Japan (Crustacea: Decapoda: Axiidae).—Proceedings of the Biological Society of Washington 105: 81–85.

Lin, F.-J., B. Kensley, and T.-Y. Chan. 2000. The rare axiid genus *Oxyrhynchaxius* Parisi, 1917 (Decapoda: Thalassinidea), with description of a new species from Australia.—Journal of Crustacean Biology 20 (Special no. 2): 199–206.

Man, J. G. de. 1925. The Decapoda of the Siboga-Expedition. Part 6. The Axiidae of the Siboga-Expedition.—Siboga Expedition monographe 39ª5: 1–127.

Milne Edwards, A. 1879. Additions à la famille des thalassiniens.—Bulletin de la Société Philomathique de Paris (7)3: 110–113.

Mukai, H., and K. Sakai. 1992. Morphology and quantitative characteristics of *Neaxius acanthus* (A. Milne Edwards, 1878) (Thalassinidea: Axiidae) in the Papua New Guinea seagrass bed.—Nihhon Benthos Gatkai 43: 47–52.

Rathbun, M. J. 1902. Descriptions of new decapod crustaceans from the west coast of North America.—Proceedings of the United States National Museum 24(1272): 885–905.

Sakai, K., and M. de Saint Laurent. 1989. A check-list of Axiidae (Decapoda, Crustacea, Thalassinidea, Anomura) with remarks and in addition descriptions of one new subfamily, eleven new genera and two new species.—Naturalists 3: 1–104.

Yokoya, Y. 1933. On the distribution of decapod crustaceans inhabiting the continental shelf around Japan, chiefly based upon the materials collected by S. S. Soyo-Maru, during the years 1923–1930.—Journal of the College of Agriculture, Tokyo Imperial University 12: 1–226.

RECEIVED: 4 May 1999.
ACCEPTED: 26 October 1999.