

## Deep-sea Galatheidae (Crustacea, Decapoda, Anomura) from Tosa Bay and Okinawa Trough, Southern Japan

Masayuki Osawa<sup>1</sup> and Masatsune Takeda<sup>2,3</sup>

<sup>1</sup>Department of Marine and Environmental Sciences, University of the Ryukyus,  
1 Senbaru, Nishihara-cho, Okinawa 903–0213, Japan

<sup>2</sup>Department of Zoology, National Museum of Nature and Science, 3–23–1,  
Hyakunincho, Shinjuku-ku, Tokyo 169–0073, Japan

<sup>3</sup>Faculty of Modern Life, Teikyo Heisei University, 2289–23 Uruido,  
Ichihara, Chiba 290–0193, Japan

**Abstract** Crustaceans of the family Galatheidae are reported from Tosa Bay and Okinawa Trough, southern Japan, at depths ranging from 526 m to 3278 m. The material comprises two species of *Munida* Leach, 1820, two species of *Galacantha* A. Milne-Edwards, 1880, and nine species of *Munidopsis* Whiteaves, 1874. Eight of these species are new to the carcinological fauna of Japan: *Munida tiresias* Macpherson, 1994, *Galacantha bellis* Henderson, 1885, *Munidopsis andamanica* MacGilchrist, 1905, *M. bairdii* (Smith, 1884), *M. bispinocolata* Baba, 1988, *M. centrina* Alcock and Anderson, 1894, *M. pilosa* Henderson 1885, and *M. verrilli* Benedict, 1902. Brief notes on the decapod crustaceans recorded from abyssal depths of Japanese waters are provided.

**Key words:** Crustacea, Decapoda, Galatheidae, Tosa Bay, Okinawa Trough, new records, abyssal depths.

### Introduction

The research project entitled “Study on Deep-Sea Fauna and Conservation of Deep-Sea Ecosystem” has been carried out by the National Science Museum (now National Museum of Nature and Science), Tokyo, in southern Japan since 1993. Investigations during three phases of the project were conducted in Suruga Bay on the Pacific coast of central Honshu mainland from 1993 to 1996, Tosa Bay off Shikoku Island from 1997 to 2000, and the sea around the Nansei (Ryukyu) Islands from 2001 to 2004, respectively (Kubodera and Machida, 1997; Saito *et al.*, 2001; Shinohara *et al.*, 2005). Although Takeda (1997) reported on the decapod crustaceans, including galatheids, from Suruga Bay based on the material collected during the research, no reports have been made on the deep-water galatheids from Tosa Bay and the Nansei Islands. Osawa (2006) described only a single species, *Galathea patae*, from the shallow depth of ap-

proximately 80 m in the northern Nansei Islands.

The present paper reports on the Galatheidae based on the material of the research project and some additional specimens from Tosa Bay and Okinawa Trough located along the Nansei Islands, southern Japan, at lower bathyal and abyssal depths ranging from 526 m to 3278 m. The material includes two species of *Munida* Leach, 1820, two species of *Galacantha* A. Milne-Edwards, 1880, and nine species of *Munidopsis* Whiteaves, 1874. Eight species are new to Japan.

The specimens examined are deposited in the National Museum of Nature and Science, Tokyo (NSMT) and the Natural History Museum and Institute, Chiba (CBM). The size of the specimens is indicated by postorbital carapace length (cl), which is measured from the orbital margin (posterior lateral end of the ocular peduncle in dorsal view) to the posterior margin of the carapace on the dorsal midline. The general terminol-

ogy follows that of Baba (2005).

### Taxonomy

Family Galatheidae

*Munida parvioculata* Baba, 1982

(Fig. 1A, B)

*Munida parvioculata* Baba, 1982: 104, figs. 1, 2b.

*Material examined.* Tosa Bay: R/V *Tansei-Mar*, KT00-08, st. BT-6 (32°30.6'–32°30.6'N, 133°56.3'–133°55.4'E, 1227–1360 m), 26 June 2000, beam trawl, 2 males (cl 10.2, 14.1 mm), NSMT-Cr 17835.

*Remarks.* The present specimens agree well with the original description of *Munida parvioculata* in the diagnostic respects including that the lateral margins of the carapace are somewhat convex with the anterior second lateral spine well developed, and the dactylus of the second pereopod is approximately half as long as the propodus. Some minor morphological differences, which could be treated as intraspecific variations, are found in the present material. The second abdominal segment is armed with four or five spines on the anterior transverse ridge, but the original description cites as having only two median spines or a tubercular process in addition to the two spines. The third article of the antennal peduncle has a minute or small distolateral spine in the present specimens unlike in the type material. Also the smaller specimen examined is not armed with a distomesial spine on the third antennal article, whereas the spine is present in the larger specimen examined and the type material.

*Distribution.* Known only from Japan: Izu Islands and Tosa Bay; 430–1400 m.

*Munida tiresias* Macpherson, 1994

(Fig. 1C, D)

*Munida tiresias* Macpherson, 1994: 545, fig. 57.

*Material examined.* Okinawa Trough: R/V *Tansei-Mar*, KT02-03, st. A-2 (25°23.16'–25°22.28'N, 127°14.29'–127°12.97'E, 2027–2063 m), 24 April 2002, beam trawl, 2 females (cl 6.1,

6.9 mm), NSMT-Cr 17836.

*Remarks.* The two specimens examined agree well with the original description and illustrations of *Munida tiresias*. In the larger specimen, the first article of the antennal peduncle has a distomesial spine barely reaching the midlength of the second article, and the second article lacks a distomesial spine. In the type material and smaller specimen examined, the first antennal article possesses a short distomesial spine never reaching the midlength of the second article and a small but distinct distomesial spine is present on the second article.

*Distribution.* Previously known only from New Caledonia, 1140–2049 m, and presently from Japan (Okinawa Trough), 2027–2063 m. The present record greatly extends its distribution to the Northern hemisphere.

*Galacantha bellis* Henderson, 1885

(Fig. 2A, B)

*Galacantha bellis* Henderson, 1885: 418; Macpherson, 2007: 9 (synonymy and references), figs. 1–4.

*Material examined.* Tosa Bay: R/V *Tansei-Mar*, KT00-08, st. BT-9-2 (32°09.3'–32°08.9'N, 134°03.4'–134°06.0'E, 2739–3278 m), 26 June 2000, beam trawl, 2 males (cl 13.6, 18.6 mm), 2 females (cl 17.7, 18.1 mm), 1 ovigerous female (cl 19.4 mm), NSMT-Cr 17837; R/V *Hakuho-Mar*, KH02-03, st. TE (32°12.67'N, 133°55.64'E, 2445 m), 10 September 2002, beam trawl, 1 ovigerous female (cl 19.0 mm), NSMT-Cr 17838.

Okinawa Trough: R/V *Tansei-Mar*, KT02-03, st. C-4 (25°24.47'–25°25.03'N, 124°57.58'–124°59.41'E, 2133–2125 m), 24 April 2002, beam trawl, 1 male (cl 14.6 mm), NSMT-Cr 17839; st. D-2 (1) (27°02.33'–27°02.88'N, 126°58.24'–126°59.08'E, 1557–1540 m), 28 April 2002, beam trawl, 1 ovigerous female (cl 18.7 mm), NSMT-Cr 17840.

*Coloration.* Carapace, abdomen, and pereopods entirely light red.

*Remarks.* The present material agrees well with the recent description of *G. bellis* provided

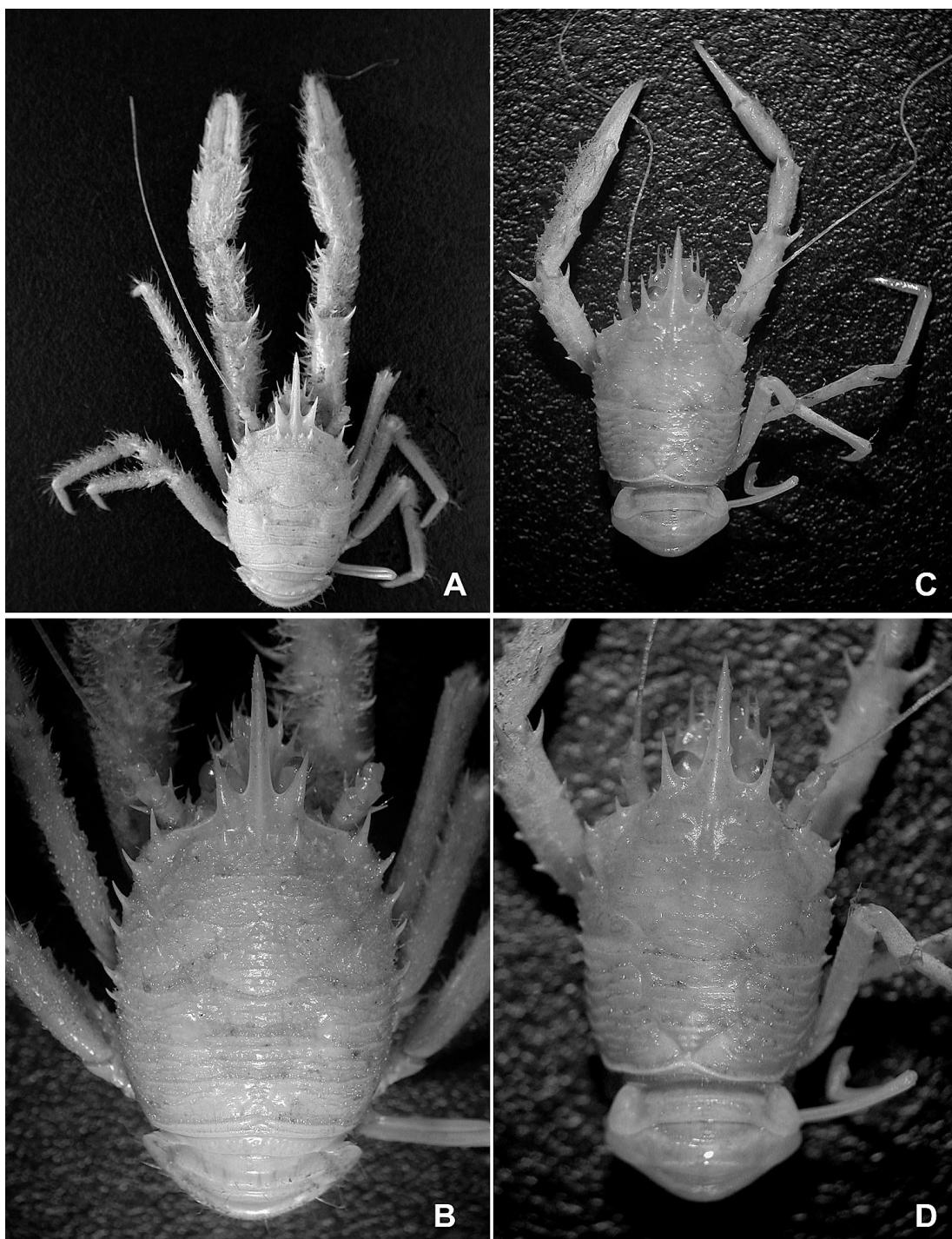


Fig. 1. Dorsal view. A, B, *Munida parvioculata* Baba, 1982, male (cl 14.1 mm), NSMT-Cr 17835, Tosa Bay; C, D, *Munida tiresias* Macpherson, 1994, female (cl 6.1 mm), NSMT-Cr 17836, Okinawa Trough.

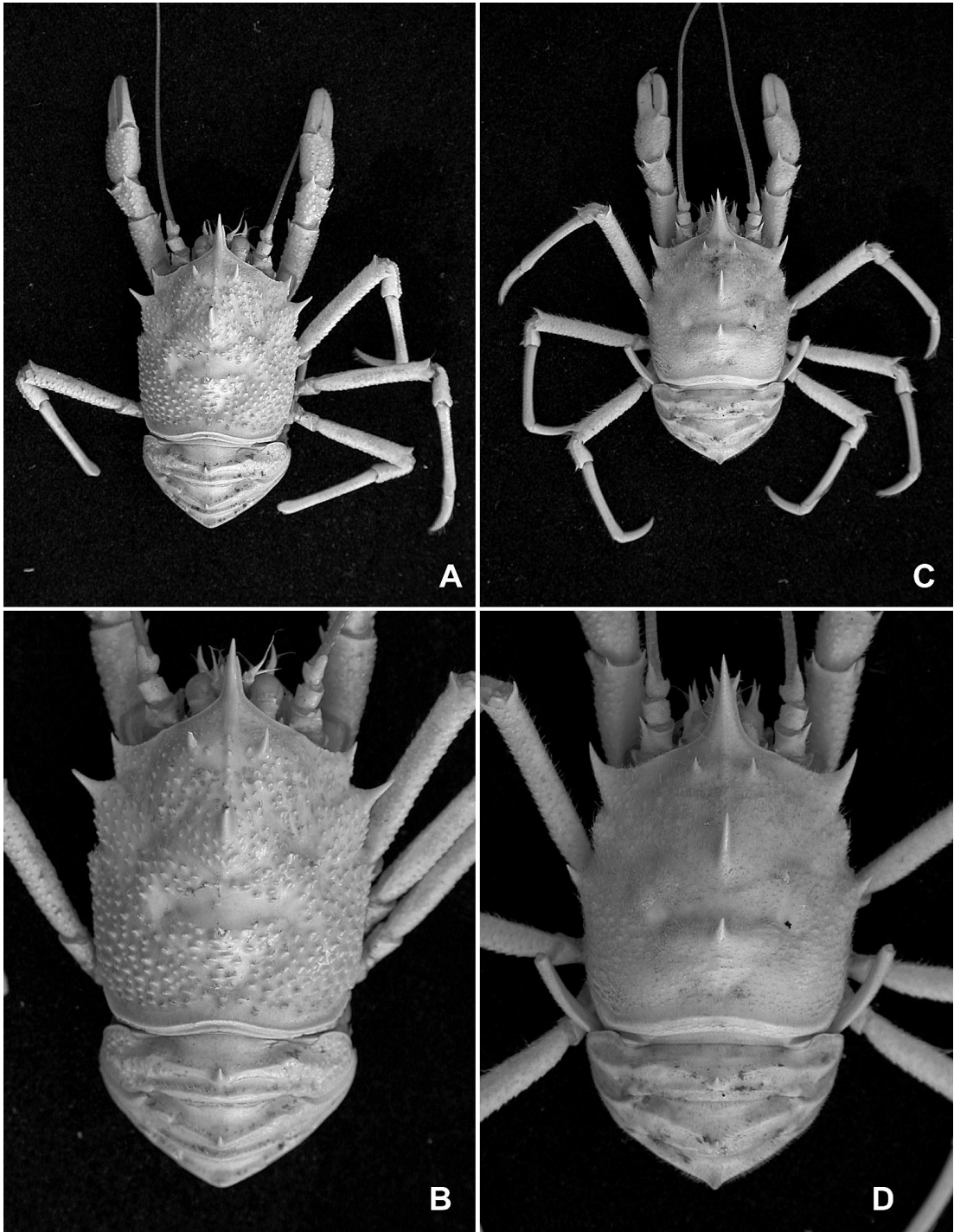


Fig. 2. Dorsal view. A, B, *Galacantha bellis* Henderson, 1885, ovigerous female (cl 18.7 mm), NSMT-Cr 17840, Okinawa Trough; C, D, *Galacantha valdiviae* Balss, 1913, ovigerous female (cl 15.2 mm), NSMT-Cr 17841, Okinawa Trough.

by Macpherson (2007) except that the dorsal transverse groove of the fourth abdominal segment is interrupted medially in some specimens. Macpherson (2007) mentioned that the groove is not interrupted in his specimens of *G. bellis* and the interruption is characteristic of its close relative *G. subrostrata* Macpherson, 2007 from the northeast Atlantic. However, Macpherson (2007) also suggested that the morphological variations observed in his specimens of *G. bellis* require further study in order to confirm the existence of a single or several species. The Japanese specimens can be assigned to *G. bellis* until further detailed study is made.

*Distribution.* Madagascar, Bay of Bengal, Laccadive Sea, Arabian Sea, Sri Lanka, central Indian Ocean, Makassar Strait (Indonesia), Solomon Islands, New Caledonia, Wallis and Futuna area, off Valparaiso in Chile, and presently Japan (Tosa Bay and Okinawa Trough); 1035–3800 m.

***Galacantha valdiviae* Balss, 1913**

(Fig. 2C, D)

*Galacantha valdiviae* Balss, 1913; 224; Macpherson, 2007; 29 (synonymy and references), figs. 15, 16.

*Material examined.* Okinawa Trough: R/V Tansei-Marui, KT02-03, st. E-2 (26°15.10'–26°13.85'N, 125°17.22'–125°18.43'E, 991–955 m), 26 April 2002, beam trawl, 1 young female (cl 7.3 mm), 1 ovigerous female (cl 15.2 mm), NSMT-Cr 17841.

*Remarks.* The present specimens agree well with the recent diagnosis provided by Macpherson (2007). No distinct differences are found.

*Distribution.* Off east coast of Somali Republic, Madagascar, Mozambique Channel, Moluccas, off northwest Sulawesi, Palawan Passage, off Kii Peninsula and Okinawa Trough in Japan, off Central Queensland, and Solomon Islands; 991–1644 m.

***Munidopsis andamanica* MacGilchrist, 1905**

(Fig. 3A, B)

*Munidopsis Wardeni* var. *andamanica* MacGilchrist, 1905; 245.

*Munidopsis andamanica*: Baba, 1988: 140, fig. 53; 2005; 284 (synonymy and references); Macpherson, 2007; 37.

*Material examined.* Tosa Bay: R/V *Kotaka-Marui*, K98-12, st. K98-12-600 (33°12.1'–33°11.8'N, 133°44.4'–133°45.4'E, 654–686 m), 10 December 1998, otter trawl, 1 male (cl 15.0 mm), NSMT-Cr 17842; st. K98-12-800 (33°11.4'–33°10.6'N, 133°53.8'–133°55.3'E, 744–786 m), 11 December 1998, otter trawl, 1 female (cl 14.2 mm), NSMT-Cr 17843.

*Remarks.* The specimens examined agree well with the original description and an account provided by Baba (1988). *Munidopsis andamanica* is closely allied to *M. cylindrops* Benedict, 1902 from Japan and Mindanao Sea, but distinguished by the corneas of the ocular peduncles being cylindrical rather than oval.

*Distribution.* Andaman Sea, west coast of Sumatra, Indonesia, Philippines, South China Sea, Taiwan, Solomon Islands, New Caledonia, Vanuatu and Fiji Islands, and presently Japan (Tosa Bay); 333–1598 m.

***Munidopsis antonii* (Filhol, 1884)**

(Fig. 3C, D)

*Galathodes antonii* Filhol, 1884: 230, fig. 2.

*Munidopsis antonii*: Baba, 2005: 132, 284 (synonymy and references), figs. 52–54; Macpherson, 2007: 38.

*Material examined.* South of Tosa Bay: R/V *Tansei-Marui*, KT00-08, st. BT-9-2 (32°09.3'–32°08.9'N, 134°03.4'–134°06.0'E, 2739–3278 m), 26 June 2000, beam trawl, 1 ovigerous female (cl 34.4 mm), NSMT-Cr 17844.

*Remarks.* The taxonomy and morphological variations of this species are fully discussed by Baba (2005). Jones and Macpherson (2007) recently described *Munidopsis segonzaci*, a close relative of *M. antonii*, from off California. *Munidopsis segonzaci* can be differentiated from *M.*

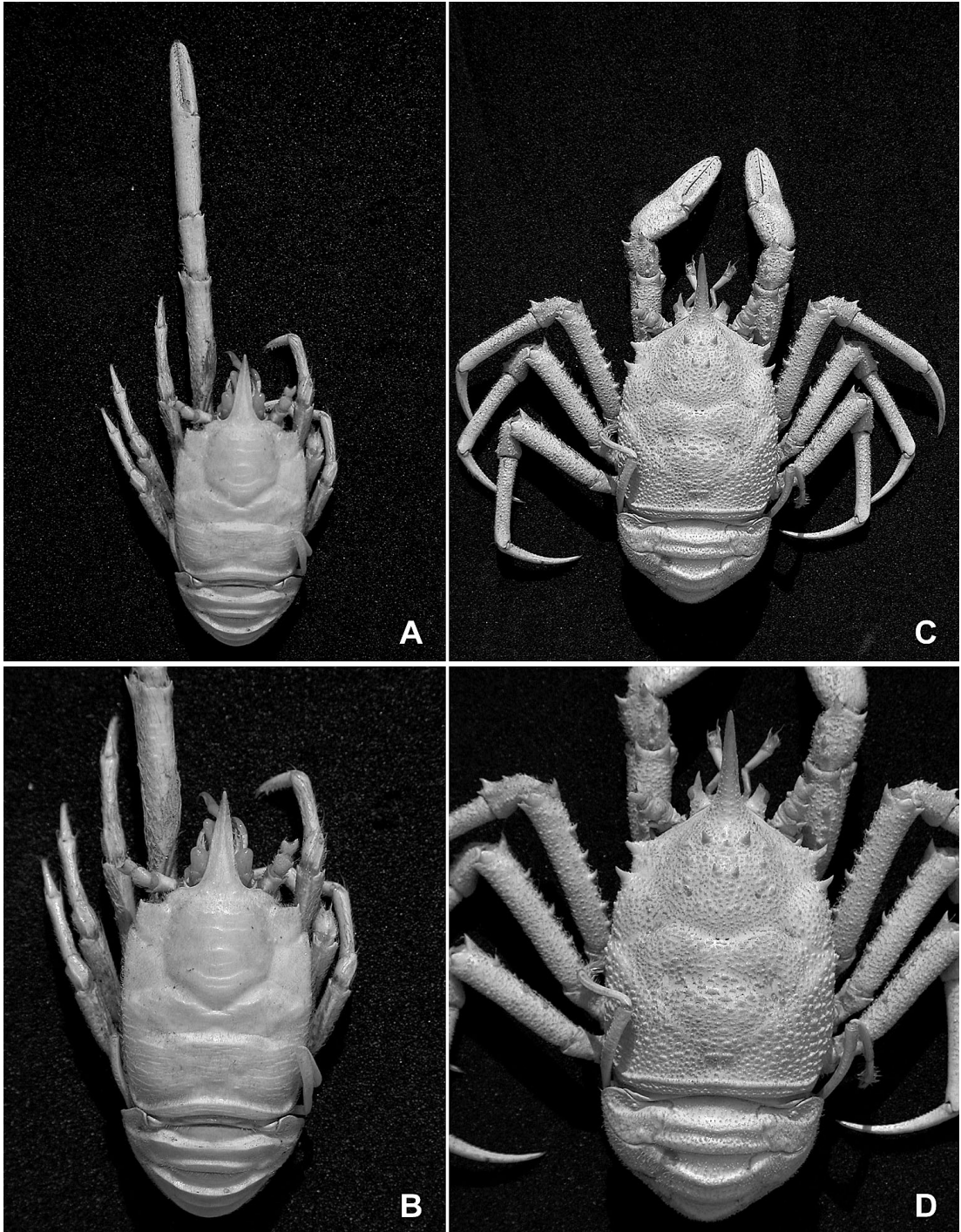


Fig. 3. Dorsal view. A, B, *Munidopsis andamanica* MacGilchrist, 1905, male (cl 15.0 mm), NSMT-Cr 17842, Tosa Bay; C, D, *Munidopsis antonii* (Filhol, 1884), ovigerous female (cl 34.4 mm), NSMT-Cr 17844, Tosa Bay.

*antoni*, which is widely distributed in the world oceans, by the shorter rostrum and the eyespine strongly concave on the mesial margin (straight or slightly concave in *M. antonii*).

*Distribution.* Atlantic Ocean—From northwestern Atlantic and Bay of Biscay to off South Africa, southeastern Atlantic; Pacific Ocean—Eastern Pacific from off Oregon to Juan Fernandez, Bering Sea, Japan (Izu Islands and Tosa Bay), off Zamboanga, Tasman Sea; Indian Ocean—Southwestern Australia, Mozambique, and off Sri Lanka; 366–458 m and 2516–4460 m.

***Munidopsis bairdii* (Smith, 1884)**

(Fig. 4A, B)

*Galacantha bairdii* Smith, 1884: 356.

*Munidopsis bairdii*: Baba, 2005: 285 (references); Macpherson and Segonzac, 2005: 17, fig. 4; Macpherson, 2007: 43 (synonymy).

*Material examined.* Okinawa Trough: R/V *Tansei-Maru*, KT02-03, st. C-4 (25°24.47'–25°25.03'N, 124°57.58'–124°59.41'E, 2133–2125 m), 24 April 2002, beam trawl, 2 males (cl 17.1, 19.6 mm), 1 female (cl 17.0 mm), NSMT-Cr 17845; st. D-2 (2) (26°30.63'N, 127°04.16'E, 1900–1920 m), 17 April 2002, beam trawl, 1 female (cl 23.6 mm), CBM-ZC 7643.

*Remarks.* The present specimens show a certain variation in the arrangement of the submedian spines and number of the posterior marginal spines on the carapace, as found in the material reported by Macpherson and Segonzac (2005) and Macpherson (2007). The arrangement of the submedian spines varies in the three specimens as follows: 2-0-2-0-2-1, 2-1-2-2-2-1, 2-2-3-0-3-1, and 2-1-2-0-2-2. Those spines are situated in the epigastric, protogastric, mesogastric, anterior cardiac (just behind the cervical groove), posterior

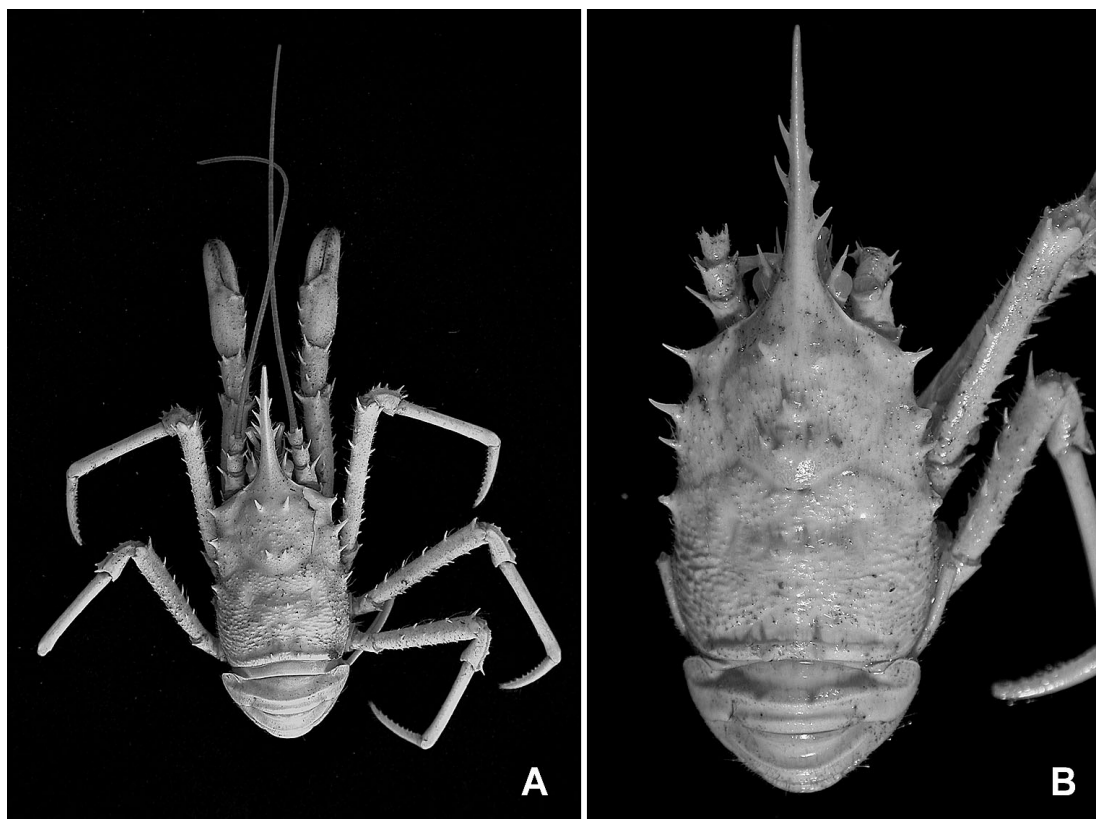


Fig. 4. Dorsal view. *Munidopsis bairdii* (Smith, 1884), male (cl 19.6 mm) (A), female (cl 17.0 mm) (B), NSMT-Cr 17845, Okinawa Trough.

cardiac, and intestinal regions, respectively. The specimens examined also have two to five spines (two or three median spines, or two median and two or three lateral spines) on the posterior marginal ridge of the carapace.

The specimens examined agree well with the diagnosis of *M. bairdii* noted by Macpherson and Segonzac (2005) in every respect including the carapace armed with four distinct spines on each lateral margin and the eyespine directed straight forward.

**Distribution.** Atlantic Ocean—Off Delaware Bay, off New England, Middle Atlantic Bight, from off British Isles to Bay of Biscay, west of Cape Point in South Africa; Eastern Pacific—Gulf of Panama, Ecuador, Baja California, off Oregon; Indian Ocean—Sri Lanka; 1986–4260 m. The present specimens represent the first record in the western Pacific (Okinawa Trough, Japan).

***Munidopsis bispinocolata* Baba, 1988**

*Munidopsis bispinocolata* Baba, 1988: 142, fig. 54; 2005: 137, 285; Baba and Poore, 2002: 232, fig. 1; Macpherson, 2007: 44, fig. 55D.

**Material examined.** Tosa Bay: R/V *Kotaka-Maru*, K00-08, st. K00-08-800 (32°59.9′–33°00.3′N, 133°37.4′–133°37.9′E, 820–840 m), 23 August 2000, otter trawl, 1 male (cl 8.5 mm), 1 female (cl 12.5 mm), NSMT-Cr 17846.

**Remarks.** As Baba and Poore (2002) and Baba (2005) noted for their specimens from the southeastern Australia and Mindanao Sea, the present material also has numerous, weak transverse ridges on the carapace and two or four, comparatively small spines on the anterior margin of the third thoracic sternite.

**Distribution.** Madagascar, Philippines, Indonesia, New South Wales, Solomon Islands, Vanuatu, Fiji, and presently Japan (Tosa Bay); 443–2363 m.

***Munidopsis centrina* Alcock and Anderson, 1894**

(Fig. 5A, B)

*Munidopsis centrina* Alcock and Anderson, 1894: 170; Baba, 2005: 139, 286 (synonymy and references), fig. 57; Macpherson, 2007: 49.

**Material examined.** South of Tosa Bay: R/V *Tansei-Maru*, KT00-08, st. BT-9-2 (32°09.3′–32°08.9′ N, 134°03.4′–134°06.0′E, 2739–3278 m), 26 June 2000, beam trawl, 1 male (cl 19.1 mm), NSMT-Cr 17847.

**Remarks.** The specimen examined generally agrees with the diagnosis recently provided by Baba (2005). The distolateral spine of the first article of the antennal peduncle barely reaches the distal margin of the second article. The second pereopod terminates at the tip of the first pereopod. These intraspecific variations are noted in the small “Galathea” specimen by Baba (2005).

**Distribution.** Madagascar, Mozambique Channel, Reunion Island, Bay of Bengal, Tasman Sea, New Caledonia, and presently Japan (Tosa Bay); 2300–3485 m.

***Munidopsis pilosa* Henderson, 1885**

*Munidopsis pilosa* Henderson, 1885: 415; Baba, 2005: 293 (references); Macpherson, 2007: 93.

**Material examined.** Tosa Bay: R/V *Kotaka-Maru*, K00-08, st. K00-08-800 (32°59.99–33°00.3′N, 133°37.4′–133°37.9′E, 820–840 m), 23 August 2000, otter trawl, 1 male (cl 9.3 mm), NSMT-Cr 17848.

**Remarks.** The diagnosis and detailed illustrations of this species are provided by Baba (1988) on the basis of the “Albatross” material. There are no clear differences in the present specimen.

**Distribution.** Madagascar, Andaman Sea, Indonesia, Philippines, Solomon Islands, Vanuatu, Tonga Islands, and presently Japan (Tosa Bay); 732–1640 m.

***Munidopsis subchelata* Balss, 1913**

(Fig. 5C, D)

*Munidopsis subchelata* Balss, 1913: 222; Baba, 2005: 296 (synonymy and references); Macpherson, 2007: 110.

**Material examined.** Okinawa Trough: R/V *Tansei-Maru*, KT02-03, st. E-2 (26°15.10′–



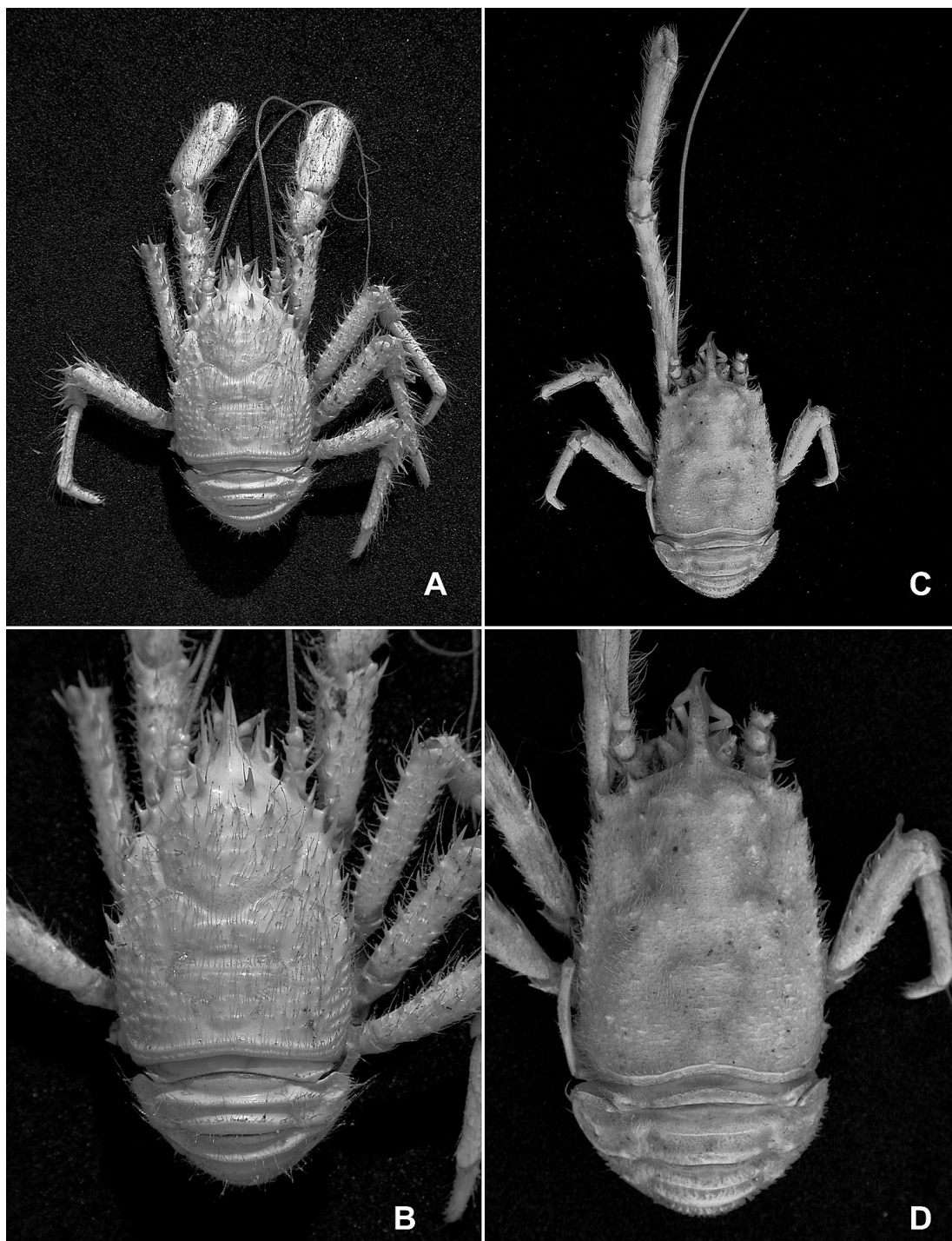


Fig. 5. Dorsal view. A, B, *Munidopsis centrina* Alcock and Anderson, 1894, male (cl 19.1 mm), NSMT-Cr 17847, Tosa Bay; C, D, *Munidopsis subchelata* Balss, 1913, male (cl 21.6 mm), NSMT-Cr 17849, Okinawa Trough.

26°13.85'N, 125°17.22'–125°18.43'E, 991–955 m), 26 April 2002, beam trawl, 1 male (cl 21.6 mm), NSMT-Cr 17849.

*Remarks.* Baba and Williams (1998: 154) mentioned that *Munidopsis plana* Baba, 1986, appears to be a junior synonym of the Balss' species. The present specimen obtained from the Okinawa Trough, the type locality of *M. plana*, agrees well with the type material of this species as well as *M. subchelata* in the diagnostic respects.

*Distribution.* West of Sumatra, Makassar Strait, Okinawa Trough in Japan, and Solomon Islands, at depths of 560–1080 m.

#### ***Munidopsis trifida* Henderson, 1885**

(Fig. 6A, B)

*Munidopsis trifida* Henderson, 1885: 415; Baba, 2005: 193, 298 (synonymy and references); Macpherson, 2007: 115.

*Material examined.* Tosa Bay: R/V *Kotaka-Maru*, K99-03, st. K99-03-500 (33°12.5'–33°11.7'N, 133°41.9'–133°41.4'E, 526–539 m), 3 March 1999, otter trawl, 2 males (cl 17.3, 17.6 mm), NSMT-Cr 17850.

*Remarks.* The specimens examined have the body and pereopods covered with fine setae and the palm of the first pereopod unarmed on the mesial margin. These characters agree with the observations of the western Pacific material by Baba (1969, 2005) and Macpherson (2007).

*Distribution.* Madagascar, Laccadive Sea, southern Arabian coast, Gulf of Aden, Bay of Bengal, Indonesia, South and East China Seas, Okinawa Trough, Suruga Bay, Sagami Bay, Solomon Islands, New Caledonia, Straits of Magellan, and south of Chile; 280–1270 m.

#### ***Munidopsis verrilli* Benedict, 1902**

(Fig. 6C, D)

*Munidopsis verrilli* Benedict, 1902: 291, fig. 34; Baba, 2005: 194, 298 (references).

*Material examined.* Okinawa Trough: R/V *Tansei-Maru*, KT02-03, st. E-1 (26°11.34'–26°

12.65'N, 124°54.27'–124°55.47'E, 991–955 m), 26 April 2002, beam trawl, 1 female (cl 20.3 mm), NSMT-Cr 17851.

*Remarks.* The sole specimen examined agrees well with the diagnosis recently provided by Baba (2005). The fixed finger of the first pereopod lacks a denticulate carina on the distolateral margin. The propodus of the second pereopod is unarmed on the dorsal surface.

*Distribution.* Eastern Pacific—Off Oregon, San Nicolas Island, Santa Cruz Basin, from Monterey Bay to off Cerros Island, and off San Diego; Western Pacific—Makassar Strait, Tasmania, and presently Japan (Okinawa Trough); 732–4169 m.

#### **Abyssal galatheids and other decapod crustaceans from Japanese waters**

Only two galatheid species, *Munidopsis antonii* and *M. subsquamosa* Henderson, 1885, have been recorded from Japanese waters at abyssal depths of over 3000 m (Baba, 1982, 2005). The present material contains two species, *Galacantha bellis* and *M. centrina*, as additions to Japanese abyssal galatheid fauna.

Osawa *et al.* (2006) reported four *Munidopsis* species, *M. panamae* Baba, 2005, *M. profunda* Baba, 2005, *M. tafrii* Osawa, Lin and Chan, 2006, and *M. teretis* Baba, 2005, from depths of 3564–4455 m off Taiwan, which is adjacent to Japanese waters. Examination of the material newly obtained during the recent research cruises around Taiwan has revealed the presence of several additional *Munidopsis* species from abyssal depths (Osawa *et al.*, in press). Among the four species recorded from Japanese abyssal depths, only *M. centrina* is found in the Taiwanese material. The other three species have been known from the eastern and western Pacific and even from Indian Ocean or Atlantic Ocean (Baba, 2005; Macpherson, 2007). Thus the apparent differences between the faunas of Japan and Taiwan may simply reflect the differences of sampling effort or technical difficulties in collecting particular species.

Besides these galatheids, only seven decapod

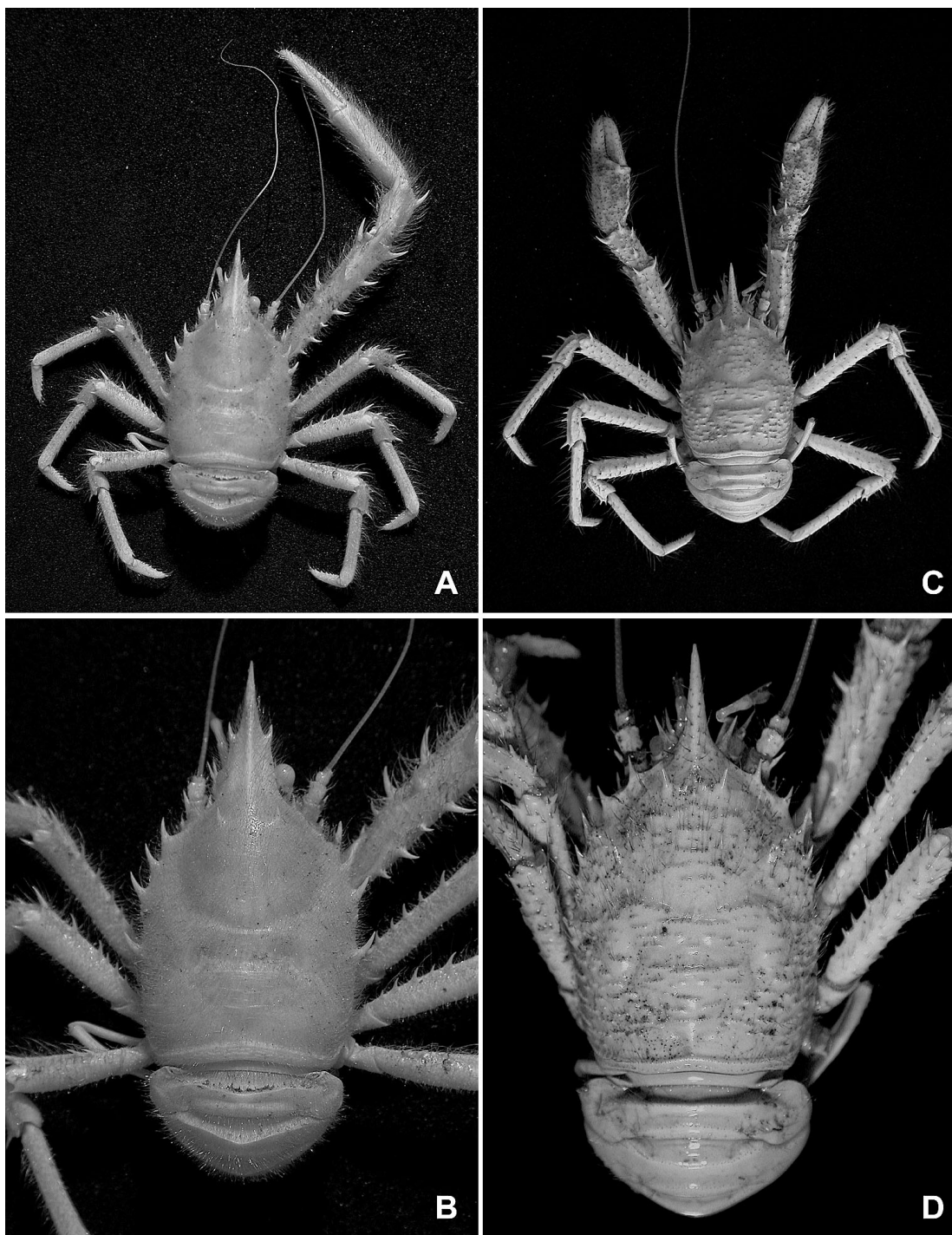


Fig. 6. Dorsal view. A, B, *Munidopsis trifida* Henderson, 1885, male (cl 17.6 mm), NSMT-Cr 17850, Tosa Bay; C, D, *Munidopsis verrilli* Benedict, 1902, 1 female (cl 20.3 mm), NSMT-Cr 17851, Okinawa Trough.

crustaceans are known from the abyssal zone of Japanese waters. The dorippid crab, *Ethusina challengerii* (Miers, 1886), was originally recorded from off the Pacific coast of central Japan at the depth of 3429 m and recently reported from the Northwest Pacific Basin and Indian Ocean (Castro, 2005). Kim *et al.* (2000) recorded three penaeoid shrimps, *Hemipenaeus spinidorsalis* Bate, 1881, *Plesiopenaeus armatus* (Bate, 1881), and *Benthescymus crenatus* Bate, 1881, and two caridean shrimps, *Sclerocrangon zenkevitchi* Birstein and Vinogradov, 1953 and *Neocrangon abyssorum* (Rathbun, 1902), as benthic inhabitants from depths of 3100–6350 m. Two of the three penaeoids, *H. spinidorsalis* and *P. armatus*, are known from the Pacific, Indian, and Atlantic Oceans, whereas the record of *B. crenatus* is restricted in the Pacific Ocean. The two species of the Crangonidae are known with much narrower distributions. *Sclerocrangon zenkevitchi* and *N. abyssorum* have been recorded from the Northwest Pacific and Bering Sea, and from the northern North Pacific from southern California to the Pacific coast of Hokkaido, respectively. Asakura *et al.* (2004) reported a hermit crab of the Parapaguridae, *Tylaspis anomala* Henderson, 1885, from off southern Japan at depths of 3444–4464 m. This unusual species has been also recorded from some scattered localities in the Pacific Ocean (Lemaitre, 1998).

The published reports and information on the deep-sea decapod crustacean fauna of Japanese waters are still limited and incomplete, especially on those of the lower bathyal and abyssal zones. Further research and study may well reveal the existence of more species new to the Japanese fauna and of new species.

### Acknowledgements

We are grateful to the research project members of the National Museum of Nature and Science, Tokyo, and the staff and crew of R/V *Kotaka-Maru* of the National Research Institute of Fisheries Science, and of R/Vs *Tansei-Maru* and *Hakuho-Maru* of the Japan Agency for Marine-

Earth Science and Technology (formerly belonging to the Ocean Research Institute, University of Tokyo), for their efforts in sampling on board. Dr. Tin-Yam Chan of the National Taiwan Ocean University kindly allowed the first author to examine rich galatheid material collected during recent deep-sea expeditions off Taiwan. Our knowledge on the deep-sea species in the north-western Pacific is increasing thanks to his invaluable help and efforts. The manuscript benefited from the review by Dr. Colin L. McLay of the Canterbury University.

### References

- Alcock, A. and A. R. S. Anderson, 1894. Natural history notes from H. M. Indian marine survey steamer "Investigator," commander C. F. Oldham, R. N., commanding. Series II, no. 14. An account of a recent collection of deep sea Crustacea from the Bay of Bengal and Laccadive Sea. *Journal of the Asiatic Society of Bengal (II-Natural Sciences)*, **63**: 141–185, pl. 9.
- Asakura, A., S. Ohta and H. Watabe, 2004. Recent topics on taxonomy of hermit crabs from Japanese waters—Family Parapaguridae. *Aquabiology*, **155**: 583–588. (In Japanese, with English abstract)
- Baba, K., 1969. Chirostyliids and galatheids from dredgings and trawlings operated in the East China Sea by the Japanese Fisheries Research Vessel "Kaiyo Maru" in 1967. *OHMU*, **2**: 41–57.
- Baba, K., 1982. Deep-sea galatheidean Crustacea (Decapoda, Anomura) taken by the R/V *Soyo-Maru* in Japanese waters. II. Galatheidae. *Bulletin of the National Science Museum, Tokyo*, Series A, **8**: 103–118, pls. 1, 2.
- Baba, K., 1986. Reptantia Macrura, Anomura and Brachyura. Pp. 148–231, 279–316. In: K. Baba, K. Hayashi, and M. Toriyama (eds.), *Decapod Crustaceans from Continental Shelf and Slope around Japan. Intensive Research of Unexploited Fishery Resources on Continental Slopes*. 336 pp. Japan Fisheries Resource Conservation Association, Tokyo.
- Baba, K., 1988. Chirostyliid and galatheid crustaceans (Decapoda: Anomura) of the "Albatross" Philippine Expedition. *Researches on Crustacea*, Special No. 2: i–v, 1–203.
- Baba, K., 2005. Deep-sea chirostyliid and galatheid crustaceans (Decapoda: Anomura) from the Indo-Pacific, with a list of species. *Galathea Report*, **20**: 1–317.
- Baba, K. and G. C. B. Poore, 2002. *Munidopsis* (Decapoda, Anomura) from south-eastern Australia. *Crus-*

- taceana*, **75**: 231–252.
- Baba, K. and A. B. Williams, 1998. New Galatheoidea (Crustacea, Decapoda, Anomura) from hydrothermal systems in the West Pacific Ocean: Bismarck Archipelago and Okinawa Trough. *Zoosystema*, **20**: 143–156.
- Balss, H., 1913. Neue Galatheiden aus der Ausbeute der deutschen Tiefsee-Expedition 'Valdivia.' *Zoologischer Anzeiger*, **41**: 221–226.
- Bate, C. S., 1881. On the Penaeoidea. *Annals and Magazine of Natural History*, Series 5, **8**: 169–196.
- Benedict, J. E., 1902. Descriptions of a new genus and forty-six new species of crustaceans of the family Galatheidae, with a list of the known marine species. *Proceedings of the United States National Museum*, **26**: 243–334.
- Birshtein, Y. A. and L. G. Vinogradov, 1953. New data on the decapod crustacean fauna in the Bering Sea. *Zoologicheskii Zhurnal*, **32**: 215–228. [In Russian]
- Castro, P., 2005. Crabs of the subfamily Ethusinae Guinot, 1977 (Crustacea, Decapoda, Brachyura, Dorippidae) of the Indo-West Pacific region. *Zoosystema*, **27**: 499–600.
- Filhol, H., 1884. Explorations sous-marines. Voyage du Talisman. *La Nature, Paris*, **12**: 119–122, 134–138, 147–151, 161–164, 182–186, 198–202, 230–234, 278–282, 326–330, 391–394.
- Henderson, J. R., 1885. Diagnoses of the new species of Galatheoidea collected during the "Challenger" Expedition. *Annals and Magazine of Natural History*, Series 5, **16**: 407–421.
- Jones, W. J. and E. Macpherson, 2007. Molecular phylogeny of the East Pacific squat lobsters of the genus *Munidopsis* (Decapoda: Galatheidae) with the descriptions of seven new species. *Journal of Crustacean Biology*, **27**: 477–501.
- Kim, J. N., K. Hayashi, Y. Natsukari and K. Yoshida, 2000. Abyssobenthic shrimps (Crustacea, Decapoda, Penaeoidea and Caridea) from the northwest Pacific collected by RV *Soyo-Maru*. *Biogeography*, **2**: 3–20.
- Kubodera, T. and M. Machida, 1997. An outline of "Study on Deep-Sea Fauna and Preservation of Deep-Sea Ecosystem" conducted by the National Science Museum, Tokyo. *National Science Museum Monographs*, (12): 1–9.
- Leach, W. E., 1820. Galateadees. *Dictionnaire des Sciences Naturelles, Paris*, **18**: 48–56.
- Lemaitre, R., 1998. Revisiting *Tylaspis anomala* Henderson, 1885 (Parapaguridae), with comments on its relationships and evolution. *Zoosystema*, **20**: 289–305.
- MacGilchrist, A. C., 1905. Natural history notes from the R. I. M. S. "Investigator," Capt. T. H. Heming, R. N. (retired), commanding.—Series III, No. 6. An account of the new and some of the rarer decapod Crustacea obtained during the surveying seasons 1901–1904. *Annals and Magazine of Natural History*, Series 7, **15**: 233–268.
- Macpherson, E., 1994. Crustacea Decapoda: Studies on the genus *Munida* Leach, 1820 (Galatheidae) in New Caledonian and adjacent waters with descriptions of 56 new species. In: A. Crosnier (ed.), Resultats des Campagnes MUSORSTOM, Volume 12. *Mémoires du Muséum national d'Histoire naturelle, Paris*, **161**: 421–569.
- Macpherson, E., 2007. Species of the genus *Munidopsis* Whiteaves, 1784 from the Indian and Pacific Oceans and reestablishment of the genus *Galacantha* A. Milne-Edwards, 1880 (Crustacea, Decapoda, Galatheidae). *Zootaxa*, **1417**: 1–135.
- Macpherson, E. and M. Segonzac, 2005. Species of the genus *Munidopsis* (Crustacea, Decapoda, Galatheidae) from the deep Atlantic Ocean, including cold-seep and hydrothermal vent areas. *Zootaxa*, **1095**: 1–60.
- Miers, E. J., 1886. Report on the Brachyura collected by H.M.S. *Challenger* during the years 1873–76. In: Report on the Scientific Results of the Voyage of H.M.S. *Challenger* During the Years 1873–76 Under the Command of Captain George S. Nares, R.N., F.R.S. and the Late Captain Frank Tourle Thompson, R.N., *Zoology*, **17** (49): I–L, 1–362, pls 1–29.
- Milne-Edwards, A., 1880. Reports on the results of dredging under the supervision of Alexander Agassiz, in the Gulf of Mexico and in the Caribbean Sea, etc. VIII. Etudes preliminaries sur les Crustacés. *Bulletin of the Museum of Comparative Zoology at Harvard College, in Cambridge*, **8**: 1–68, pls. 1, 2.
- Osawa, M., 2006. A new species of *Galathea* Fabricius, 1793 (Crustacea, Decapoda, Anomura, Galatheidae) from Japan. *Zoosystema*, **28**: 435–441.
- Osawa, M., C.-W. Lin and T.-Y. Chan, 2006. *Munidopsis* (Decapoda: Anomura: Galatheidae) from the abyssal depths of Taiwan, with description of one new species. *Journal of Crustacean Biology*, **26**: 420–428.
- Osawa, M., C.-W. Lin and T.-Y. Chan, in press. Species of *Galacantha* and *Munidopsis* (Crustacea: Decapoda: Anomura: Galatheidae) from the deep-waters off Taiwan, with the description of two new species. *Scientia Marina*.
- Rathbun, M. J., 1902. Description of new decapod crustaceans from the west coast of North America. *Proceedings of the United States National Museum*, **24**: 885–905.
- Saito, H., T. Fujita, H. Sakaji and M. Takeda, 2001. An outline of "Research on Deep-Sea Fauna and Pollutants in Tosa Bay, 1997–2000". *National Science Museum Monographs*, (20): 1–9.
- Shinohara, G., K. Hasegawa, A. Go, K. Nakaguchi, H. Horikawa and M. Takeda, 2005. An outline of "Research on Deep-Sea Fauna and Pollutants in Nansei Is-

- lands, 2001–2004”. *National Science Museum Monographs*, (29): 1–15.
- Smith, S. I., 1884. Report on the decapod Crustacea of the Albatross dredgings off the east coast of the United States in 1883. *Reports of the U. S. Commission on Fish and Fisheries*, **10**: 345–426, pls. 1–10.
- Takeda, M., 1997. Deep-sea decapod crustacean fauna of Suruga Bay, central Japan. *National Science Museum Monographs*, (12): 229–255, pls. 1–5.
- Whiteaves, J. F., 1874. On recent deep-sea dredging operations in the Gulf of St. Lawrence. *American Journal of Science*, Series 3, **7**: 210–219.