

Three rare mantis shrimps collected from Osaka Bay, Japan (Crustacea: Stomatopoda)*

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大阪湾で採集されたシャコ類3稀種 (甲殻亜門: 口脚目)

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抄録: 2012~2013年に大阪湾からシャコ類の3稀種が採集された。ヒメトラフシャコ *Acanthosquilla multifasciata* は13個体が成ヶ島から、1個体が阪南市尾崎の沿岸から採集されたが、日本における近年の採集記録はわずかである。また、サヌキメボソシャコ *Clorida japonica* 2個体 (1976年に採集された1個体を含む) とスベスベシャコ *Levisquilla inermis* 1個体が大阪湾の海底から採集された。前者は西日本に広く分布するが、採集例は多くなく、後者も近年は瀬戸内海西部からの報告があるのみである。採集個体に基づいて形態および色彩の記載を行った。これら3種の発見により、大阪湾のシャコ類の種数は10種となった。

Abstract: Three rare mantis shrimps were collected from Osaka Bay in 2012 and 2013. Thirteen and one individuals of *Acanthosquilla multifasciata* were collected from the coasts of Narugashima Island and Ozaki in Hannan, respectively. There were few records of the species in recent years in Japan. Two individuals of *Clorida japonica* (including one individual collected in 1976) and one individual of *Levisquilla inermis* were collected from the bottom of Osaka Bay. Although the former was distributed widely in the western Japan, records of the species are not many. Record of the latter in Japan was only from the western Seto Inland Sea in recent years. Descriptions of morphological characters and coloration are given based on these materials. From these findings, number of the stomatopod species in Osaka Bay increased to ten.

Key Words: Mantis shrimp; Stomatopoda; *Acanthosquilla multifasciata*; *Clorida japonica*; *Levisquilla inermis*; Osaka Bay; Japan.

Mantis shrimp or Stomatopoda is a group of Crustacea and includes edible species. Biodiversity of the stomatopod is high in Japan and 68 species were recorded (Ahyong, 2012). In Osaka Bay, our study field, there are seven stomatopod species (Ariyama, 1997, 2001, 2004): *Anchisquilla fasciata* (de Haan, 1844); *Erugosquilla woodmasoni* (Kemp, 1911); *Harpiosquilla harpax* (de Haan, 1844); *H. melanoura* Manning, 1968; *Lophosquilla costata* (de Haan, 1844); *Oratosquilla oratoria* (de Haan, 1844); and *Oratosquillina perpensa* (Kemp, 1911). Recently three species were newly collected there and number of the stomatopod species increased to ten. In the present paper, we describe their morphological characters and coloration

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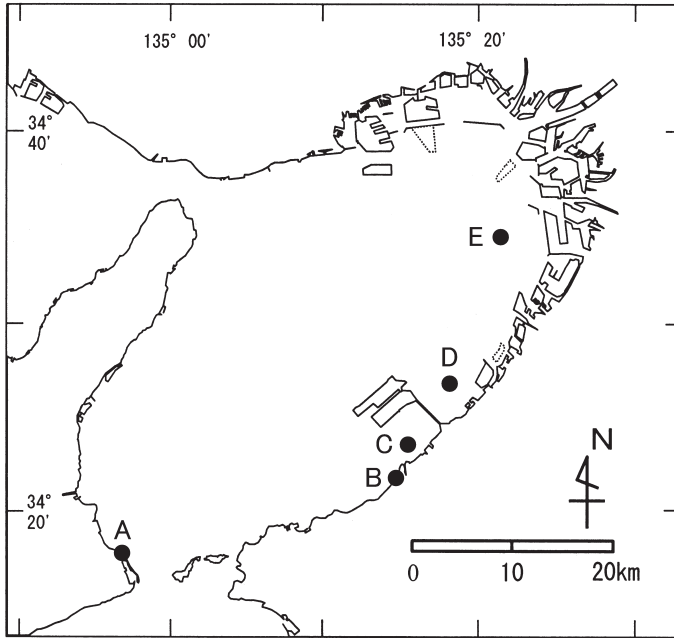


Fig. 1. Collecting sites of three rare mantis shrimps. A, B, *Acanthosquilla multifasciata* (Wood-Mason, 1895); C, D, *Clorida japonica* Manning, 1978; E, *Levisquilla inermis* (Manning, 1965).

in detail. The total length (TL) and carapace length (CL) are measured according to Ahyong (2001) and morphological terminology also follows Ahyong (2001). The specimens examined are deposited in the Osaka Museum of Natural History (OMNH) and the Natural History Museum, Kishiwada City (KSNHM).

Family Nannosquillidae Manning, 1980

Genus *Acanthosquilla* Manning, 1963

***Acanthosquilla multifasciata* (Wood-Mason, 1895)**

(Japanese name: Hime-torafu-shako)

(Figs. 1A, B, 2 and 3)

Lysiosquilla multifasciata Wood-Mason, 1895: 1-2, figs. 22-24 [type locality: Bombay, India]. –Kemp, 1913: 122-124. –Kemp, 1915: 175-176, pl. 1, figs. 2, 3. –Serène, 1952: 11-12, figs. 22-24. –Komai, 1927: 332-333. –Schmitt, 1931: 144, 147, pl. 19, figs. 15-18. –Komai, 1938: 271.

Lysiosquilla biminiensis var. *pacificus* Borradaile, 1900: 395, 398, 403 [type locality: Blanche Bay, New Britain].

Lysiosquilla Valdiviensis Jurich, 1904: 372, pl. 26, fig. 2 [type locality: unknown].

Lysiosquilla acanthocarpus. –Fukuda, 1908-1909: 59-60, pl. 1, fig. 3, pl. 2, fig. 3. –Fukuda, 1910: 146. [Not *Lysiosquilla acanthocarpus* Miers, 1880].

Acanthosquilla multifasciata. –Manning, 1963: 320. –Utinomi, 1965: 726, unnumbered fig. –Lee and Wu, 1966: 54. –Hamano, 1990: 49-50, figs. 35c, g-i, 36i-k. –Manning, 1995: 143-147, figs. 78b, 80b, 81a,

b, e, f, 82a, b, 83-86, pls. 25, 26. –Wang and Liu, 1998: 136 (list). –Liu and Wang, 1999: 577 (list). –Moosa, 2000: 431. –Ahyong, 2001: 144-146, fig. 71. –Hamano, 2005: 43, fig. 2-11e-j. –Ahyong et al., 2008: 47-48, figs. 35-37. –Ahyong, 2012: 247 (list).

Material examined. One male (OMNH-Ar-9570, TL 15.7 mm, CL 3.7 mm) and one female (OMNH-Ar-9571, TL 17.0 mm, CL 3.3 mm; Fig. 2A); north side of Narugashima Island (Fig. 1A), subtidal, sandy mud bottom with a seagrass *Halophila ovalis*; dredge, 29 Sep. 2012, coll. T. Wada. One male (OMNH-Ar-9572, TL 41.1 mm, CL 7.6 mm; Fig. 2B) and one female (OMNH-Ar-9573, TL 32.3 mm, CL 5.8 mm); Narugashima Island; dredge, 8 Jun. 2013, coll. K. Hanano. One male (OMNH-Ar-9574, TL 23.2 mm, CL 3.9 mm); Narugashima Island; dredge, 22 Jun. 2013, coll. K. Hanano. Six males (TL 15.4-45.1 mm, CL 3.3-7.8 mm) and two females (TL 17.4-22.8 mm, CL 3.8-4.2 mm) (OMNH-Ar-9578); Narugashima Island, subtidal; dredge, 23 Nov. 2013, coll. T. Wada. One male (KSNHM-C00206, TL 40.4 mm, CL 7.0 mm; Fig. 2C); Ozaki in Hannan, southwest of fishing port (Fig. 1B), intertidal, sandy mud bottom; 3 Aug. 2012, coll. H. Miyake. One female (OMNH-Ar-6335, TL 58.9 mm, CL 9.5 mm); Chudo in Aio, Yamaguchi Pref.; 2 Apr. 2003, coll. K. Takagi.

Description [based on male (OMNH-Ar-9572, TL 41.1 mm)]. Cephalon (Fig. 3A): eye small, cornea broadened; rostral plate longer than broad, subpentagonal, with single median spine; dorsal process of antennule somite elongate, acute; carapace roundish rectangular, with pair of gastric grooves. Raptorial claw (Fig. 3B, B1): carpus with dorsal spine; propodus swelled posteriorly, with 4 movable spines; dactylus with 6

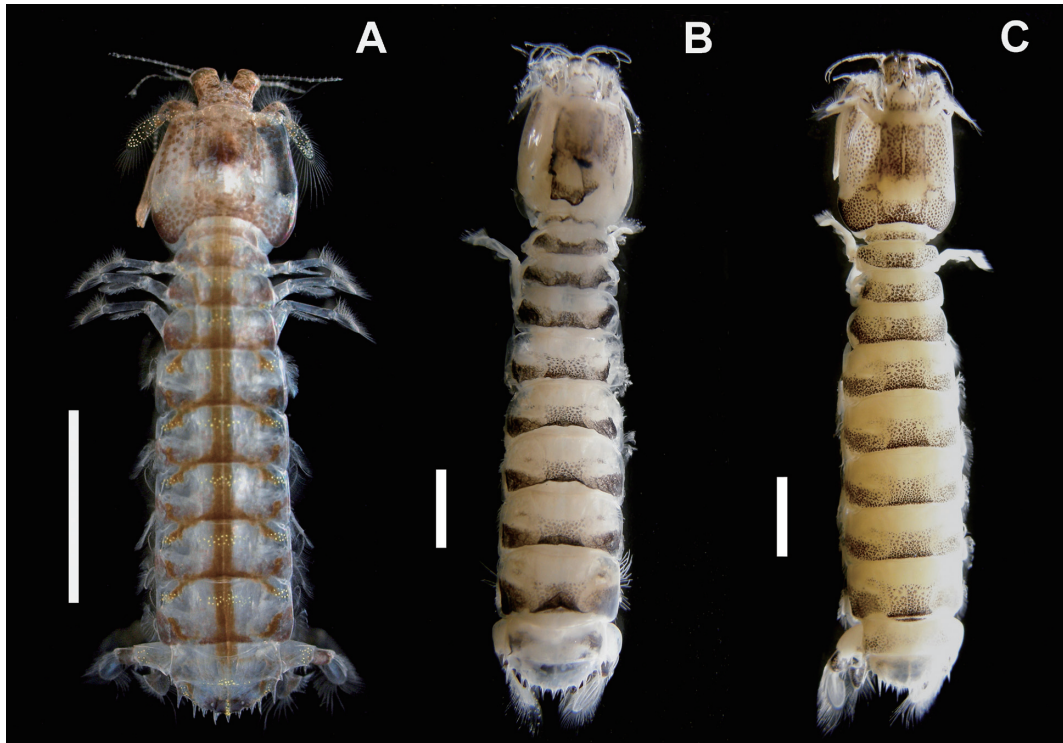


Fig. 2. Photographs of *Acanthosquilla multifasciata* (Wood-Mason, 1895). A, female (OMNH-Ar-9571, TL 17.0 mm), fresh condition; B, male (OMNH-Ar-9572, TL 41.1 mm), preserved in ethanol; C, male (KSNHM-C00206, TL 40.4 mm), preserved in ethanol. Scales: 5 mm.

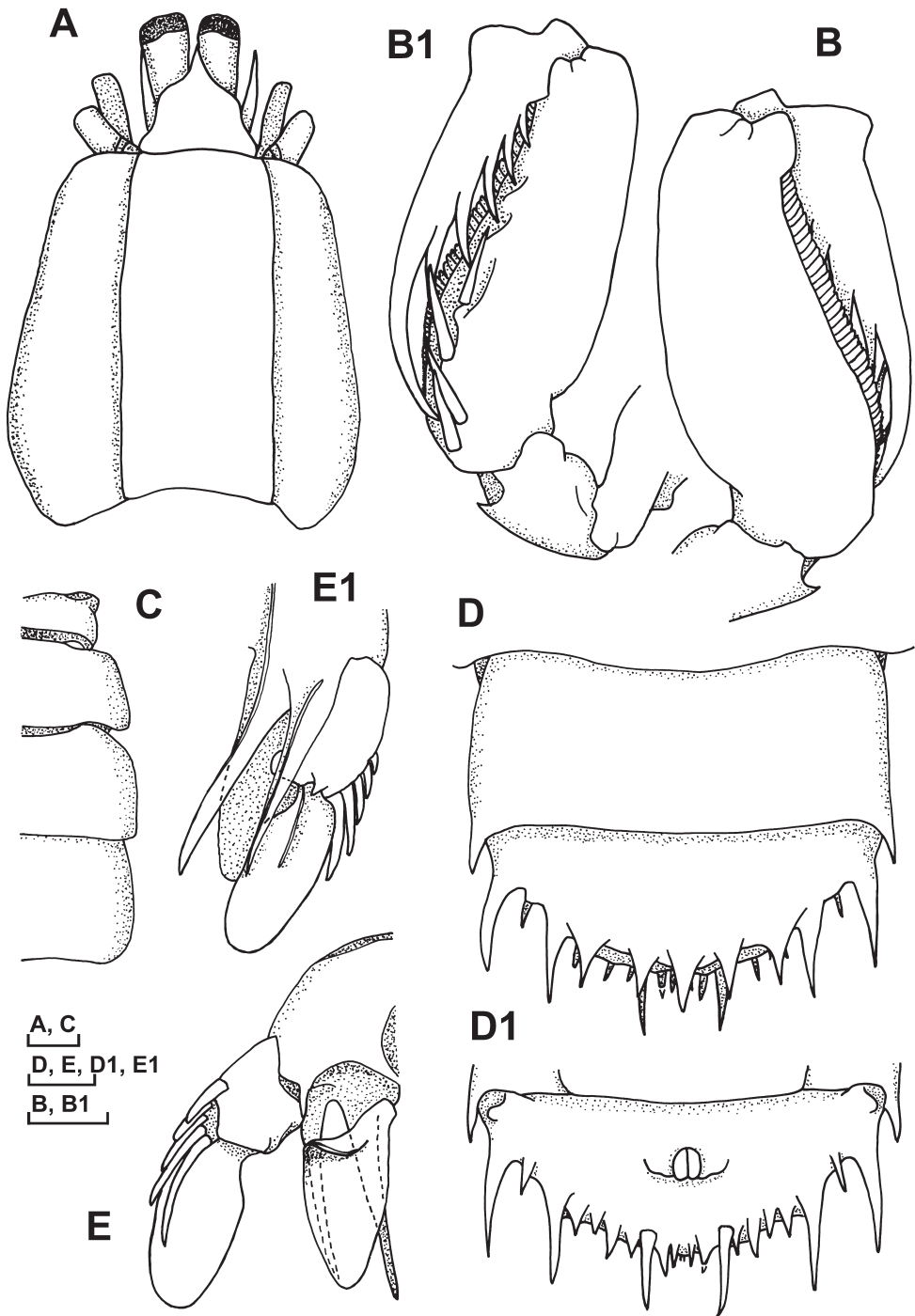


Fig. 3. *Acanthosquilla multifasciata* (Wood-Mason, 1895), male (OMNH-Ar-9572, TL 41.1 mm). A, cephalon; B, left raptorial claw (lateral surface); B1, same (medial surface); C, lateral processes of 5-8th thoracic somites; D, 6th abdominal somite and telson (dorsal view); D1, telson (ventral view); E, left uropod (dorsal view); E1, same (ventral view). Scales: 1 mm.

teeth, outer margin with 2 lobes, distal lobe triangular, distinctly larger than proximal lobe. Thoracic somites (Fig. 3C) without carinae; 5th somite with small lateral process, 6-8th somites absent. Abdominal somites lacking carinae, 6th somite (Fig. 3D) with posterolateral spines. Telson (Fig. 3D, D1) short; dorsal surface with 5 posteriorly directed spines in fan-shaped row; posterior margin with 2 pairs of fixed primary teeth and pair of movable submedian teeth, and with 3 submedian, 4 intermediate and 1 lateral denticles on either half; anterolateral corners of ventral surface each with small protuberance. Uropod (Fig. 3E, E1): endopod with strong dorsal fold; protopod terminating in 2 slender spines, inner longer, ventrally carinate; exopod with 5 movable spines on outer margin of proximal segment.

Coloration in life (Fig. 2A). Eye and eye stalk brown. Antennal scale with gold pigments. Rostral plate, anterior half and posterior quarter of carapace brown. Posterior parts of thoracic and abdominal somites brown, anterior parts of them scattered with gold pigments. Posterior margin of telson with large dark brown mark on either side of midline. Uropodal endopod and exopod distal segment brown.

Remarks. *Acanthosquilla multifasciata* is characterized by the body coloration with brown stripes and the spination of telson. The morphological characters and coloration of the specimens are quite similar to those of the descriptions and figures of Wood-Mason (1895), Fukuda (1908-1909), Kemp (1915), Manning (1995), Ah Yong (2001) and Ah Yong et al. (2008). However, shape of the spines and denticles on the posterior margin of the telson is a little different from the descriptions and figures of Hamano (1990, 2005); viz., tips of them are curved dorsally in Hamano (1990, 2005).

Except for old records by Fukuda (=Komai), there are few records of *Acanthosquilla multifasciata* in Japan: Fukuoka in 1965 (Hamano, 1990), Yamaguchi in 2003 (OMNH-Ar-6335) and Osaka Bay. Because of the few records, population size of this species is probably small in Japan.

Distribution. Red Sea to Vietnam, Taiwan, Japan, Hawaii and Australia (Ah Yong et al., 2008). Distribution in Japan: Tateyama in Awa (Fukuda, 1908-1909, 1910; Komai, 1927), Seto in Kii (Komai, 1927, 1938), Nagasaki (Komai, 1927), Chikuzen-shingu beach in Fukuoka Pref. (Hamano, 1990); Chudo in Aio, Yamaguchi Pref. and Osaka Bay (present study).

Habitat in Japan. Intertidal to upper subtidal, sandy mud bottom.

Family Squillidae Latreille, 1802

Genus *Clorida* Eydoux and Souleyet, 1842

***Clorida japonica* Manning, 1978**

(Japanese name: Sanuki-meboso-shako)

(Figs. 1C, D, 4A, B, B1, B2 and 5)

Squilla latreillei. –Komai, 1927: 308-309. –Utinomi, 1965: 724, unnumbered fig. –Inaba, 1988: 150. [Not *Clorida latreillei* Eydoux and Souleyet, 1842].

Clorida microphthalmalma. –Lee and Wu, 1966: 44-45, fig. 3. –Dong et al., 1983: 84, pl. 4, figs. 4, 5. –Wang and Liu, 1998: 137 (list). –Liu and Wang, 1999: 578 (list). [Not *Squilla microphthalmalma* H. Milne Edwards, 1837].

Clorida japonica Manning, 1978: 25-26, fig. 12 [type locality: Sanuki, Japan]. –Inaba, 1988: 150. –Hamano, 1989a: 61-62, fig. 25a-d, g. –Ah Yong and Naiyanetr, 2000: 320-322, fig. 3. –Hamano, 2005: 62,

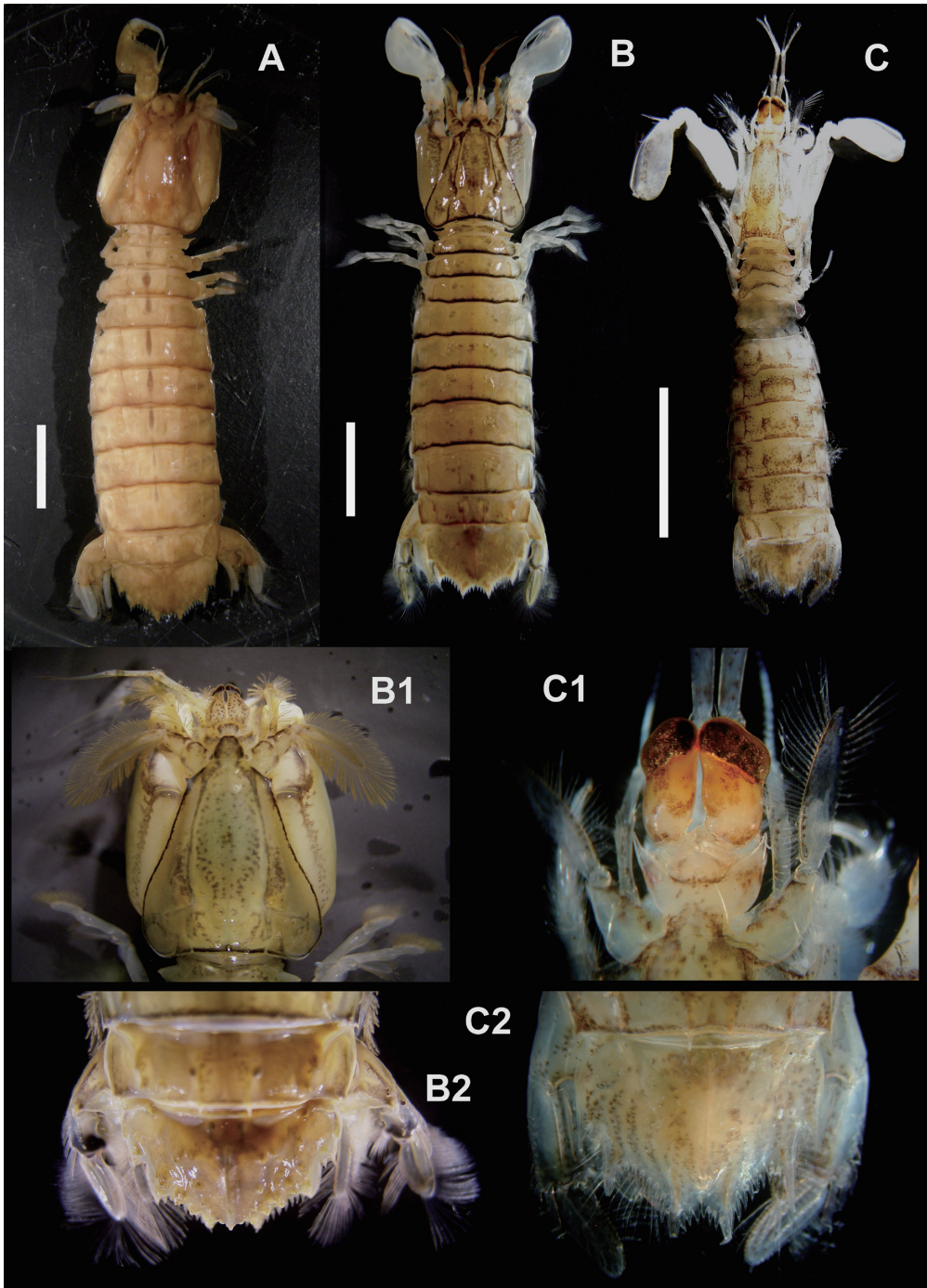


Fig. 4. Photographs of *Clorida japonica* Manning, 1978 and *Levisquilla inermis* (Manning, 1965). A, *Clorida japonica*, female (OMNH-Ar-9575, TL 63.9 mm), preserved in ethanol; B, same, male (OMNH-Ar-9576, TL 51.7 mm), fresh condition (B1, 2) or preserved in ethanol for 2 months (B); C, *Levisquilla inermis*, male (OMNH-Ar-9577, TL 29.9 mm), fresh condition, broken between thoracic and abdominal somites. A-C, body (scales: 10 mm); B1, cephalon; B2, 6th abdominal somite, telson and uropods; C1, anterior part of cephalon; C2, telson and uropods.

fig. 2-19. –Ahyong et al., 2008: 85-86, fig. 65. –Ahyong, 2012: 248 (list). –Ariyama, 2012: 176, unnumbered fig.

Material examined. One female (OMNH-Ar-9575, TL 63.9 mm, CL 12.3 mm; Fig. 4A); Osaka Bay, 1.5 km off Okada (Fig. 1C), 12 m in depth; Ishigeta dredge, 17 Jun. 1976, coll. Osaka Prefectural Fisheries Experimental Station. One male (OMNH-Ar-9576, TL 51.7 mm, CL 10.0 mm; Fig. 4B); Osaka Bay, east of Kansai International Airport (Fig. 1D), ca. 15 m in depth; Ishigeta dredge, 13 Dec. 2012, coll. Marine Fisheries Research Center, Osaka Prefecture.

Description [based on male (OMNH-Ar-9576, TL 51.7 mm)]. Cephalon (Figs. 4B1, 5A): eye small, pyriform, cornea bilobed, narrower than stalk; ocular scales fused; rostral plate broader than long; carapace spread posteriorly, with anterolateral spines, reflected marginal and indistinct lateral carinae, without median and intermediate carinae. Raptorial claw (Fig. 5B, B1): propodus swelled posteriorly, with 3 movable spines; dactylus with 4 large and 1 rudimentary teeth, outer proximal margin angular. Mandibular palp present. Thoracic somites 5-8 lacking submedian carinae, 6-8th somites with intermediate carinae; 5th somite with short, triangular lateral process, 6-7th lateral processes rounded, 8th lateral process bluntly pointed (Fig. 5C). Abdominal somites 1-4 with not-armed intermediate and lateral carinae, lacking submedian carinae; 5th somite with posteriorly-armed intermediate and lateral carinae, lacking submedian carinae; 6th somite (Fig. 5D) with posteriorly-armed submedian carinae, oblique intermediate carinae and lateral carinae. Telson (Figs. 4B2, 5D, D1) somewhat short, inflated; dorsal surface with median carina and many various-sized tubercles; posterior margin with 2 pairs of fixed primary teeth and pair of movable submedian teeth, and with 3 submedian, 6-7 intermediate and 1 lateral denticles on either half; ventral surface with short, low postanal carina. Uropod (Fig. 5E, E1): endopod slender; protopod terminating in long inner and short outer spines, ventrally carinate, with rounded lobe on outer margin of inner spine, inner margin with 8 acute spines; exopod with 5 small and 1 large crescent movable spines on outer margin of proximal segment.

Coloration in life (Fig. 4B, B1, B2). Body olive green. Eye dark brown. Eye stalk with brown dots. Margins of rostral plate and carapace and posterior margins of thoracic and abdominal somites dark brown. Distal part of proximal segment of uropodal exopod black.

Remarks. *Clorida japonica* is distinctive among Japanese stomatopods in the pyriform eye with small cornea. The morphological characters of the present specimen almost agree with the descriptions and figures of Manning (1978), Hamano (1989a, 2005), Ahyong and Naiyanetr (2000) and Ahyong et al. (2008). Although Manning (1995) synonymized this species with *Clorida latreillei*, Ahyong and Naiyanetr (2000) revised the *Clorida latreillei* species complex and reinstated this species.

This species was distributed widely in the western Japan as shown below; however, records of the species are not many (Ariyama, 2012).

Distribution. Japan and Taiwan (Ahyong et al., 2008), China (Dong et al., 1983). Distribution in Japan: Fukui Pref., Japan Sea coast in Yamaguchi Pref., the Seto Inland Sea, from Fukuoka Pref. to Kumamoto Pref., the Ariake Sound (Hamano, 1989a; Ariyama, 2012); Osaka Bay (present study).

Habitat in Japan. Tidal flat to shallow waters, sandy mud bottom (Ariyama, 2012); 12-15 m in depth (present study).

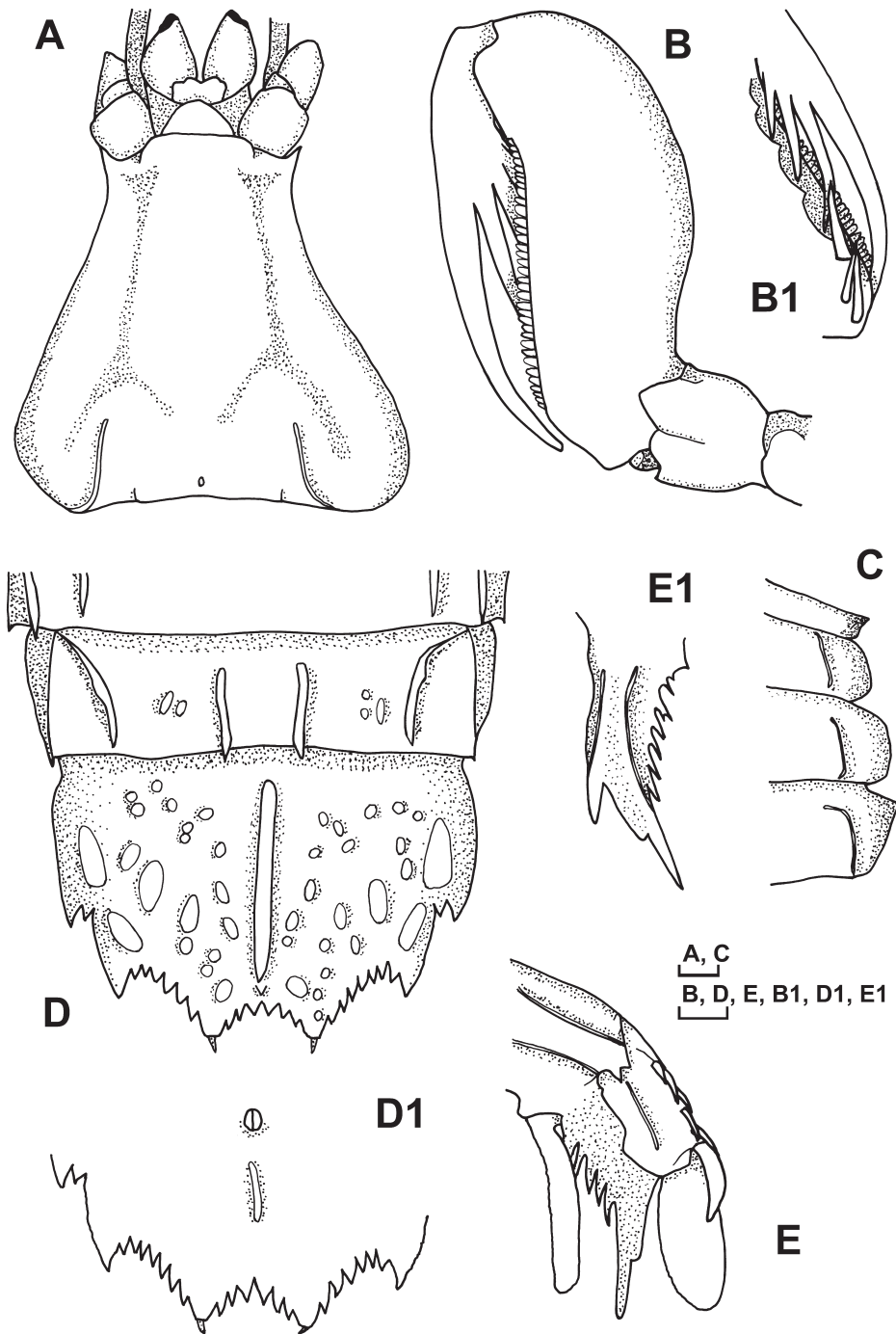


Fig. 5. *Clorida japonica* Manning, 1978, male (OMNH-Ar-9576, TL 51.7 mm). A, cephalon; B, right raptorial claw (lateral surface); B1, same (medial surface); C, lateral processes of 5-8th thoracic somites; D, 6th abdominal somite and telson (dorsal view); D1, telson (ventral view); E, right uropod (dorsal view); E1, right protopod (ventral view). Scales: 1 mm.

Genus *Levisquilla* Manning, 1977

***Levisquilla inermis* (Manning, 1965)**

(Japanese name: Subesube-shako)

(Figs. 1E, 4C, C1, C2 and 6)

Squilla lata. –Komai, 1914: 459-460, pl. 6, figs. 1, 1a, 1b. –Komai, 1927: 310-311, pl. 14, figs. 1, 1a, 1b. [Not *Squilla lata* Brooks, 1886].

Squilla inermis Manning, 1965: 255-257, fig. 2 [type locality: Enoshima, Japan].

Anchisquilla inermis. –Blumstein, 1974: 115.

Levisquilla inermis. –Manning, 1977: 422. –Hamano, 1989b: 234-236, fig. 27e-h. –Manning, 1995: 210. –Wang and Liu, 1998: 137 (list). –Liu and Wang, 1999: 578 (list). –Moosa, 2000: 444. –Ahyong, 2001: 271, fig. 132. –Hamano, 2005: 73-74, fig. 2-25. –Ahyong et al., 2008: 131-132, fig. 105. –Ahyong, 2012: 248 (list).

Squilloides lata. –Dong et al., 1983: 85, pl. 2, fig. 10. [Not *Squilla lata* Brooks, 1886].

Material examined. One male (OMNH-Ar-9577, TL 29.9 mm, CL 6.0 mm; Fig. 4C); Osaka Bay, off Sakai (Fig. 1E), 16 m in depth; Ishigeta dredge, 6 Jun. 2013, coll. Marine Fisheries Research Center, Osaka Prefecture.

Description [based on male (OMNH-Ar-9577, TL 29.9 mm)]. Cephalon (Figs. 4C1, 6A): eye small, elongate, cornea broader than stalk; anterior margin of ophthalmic somite rounded; ocular scales broad, partially fused; rostral plate longer than broad; dorsal process of antennule somite not greatly elongate, with acute apex; carapace somewhat broadened posteriorly, with pair of gastric grooves, without median, intermediate and lateral carinae. Raptorial claw (Fig. 6B, B1): carpus with dorsal spine; propodus straight, with 3 movable spines; dactylus with 6 teeth. Thoracic somites 5-8 lacking submedian carinae, 6-8th somites with intermediate carinae; 5th somite with short, anteriorly recurved spine, 6-7th lateral processes rounded, 8th lateral process bluntly angular (Fig. 6C). Abdominal somites 1-4 with not-armed intermediate and lateral carinae, lacking submedian carinae; 5th somite with posteriorly-armed intermediate and lateral carinae; 6th somite (Fig. 6D) with posteriorly-armed submedian carinae, oblique intermediate carinae and lateral carinae. Telson (Figs. 4C2, 6D) slightly shorter than broad, flattened; dorsal surface with median carina; posterior margin with 2 pairs of fixed primary teeth and pair of movable submedian teeth, and with 3 submedian, 8 intermediate and 1 lateral denticles on either half; ventral surface without postanal carina. Uropod (Fig. 6E, E1): endopod slender; protopod terminating in long inner and short outer spines, ventrally carinate, with rounded lobe on outer margin of inner spine, inner margin with 6 acute spines; exopod with 7 small and 2 large spatulate movable spines on outer margin of proximal segment.

Coloration in life (Fig. 4C, C1, C2). Body pale brown. Eye reddish brown. Anterior part of eye stalk orange. Anterior, middle and posterior parts of carapace brown. Ventrolateral part of raptorial claw, lateral processes of thoracic somites and lateral margins of abdominal somites pale pink. Posterior margins of thoracic and abdominal somites, central parts of abdominal somites and anteromedian part of telson brown. Distal part of proximal segment of uropodal exopod brown.

Remarks. *Levisquilla inermis* is a small slender species with smooth abdomen. The morphological characters and coloration of the specimens are quite similar to those of the descriptions and figures of Komai

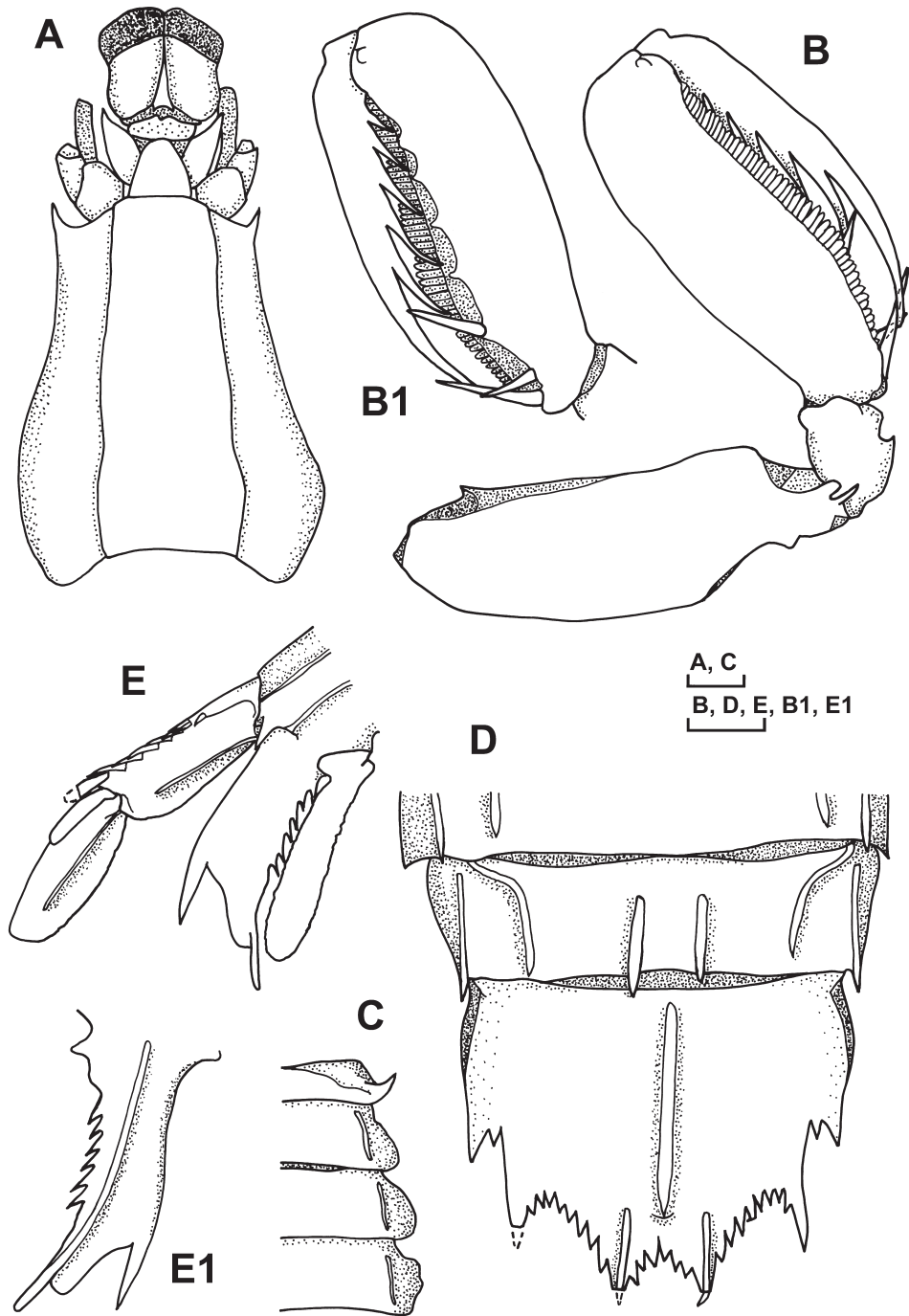


Fig. 6. *Levisquilla inermis* (Manning, 1965), male (OMNH-Ar-9577, TL 29.9 mm). A, cephalon; B, left raptorial claw (lateral surface); B1, same (medial surface); C, lateral processes of 5-8th thoracic somites; D, 6th abdominal somite and telson (dorsal view); E, left uropod (dorsal view); E1, left protopod (ventral view). Scales: 1 mm.

(1914, 1927), Manning (1965), Hamano (1989b, 2005), Ahyong (2001) and Ahyong et al. (2008).

Except for old records by Komai and Manning, there are few records of this species in Japan: Iyonada (Hamano, 1989b) and Suonada (Uchida, pers. comm.) in the Seto Inland Sea and Osaka Bay. Therefore, this species is estimated to be rare in Japan out of the western Seto Inland Sea.

Distribution. Japan, Vietnam, northern Australia and Taiwan (Ahyong et al., 2008), China (Dong et al., 1983). Distribution in Japan: Nagasaki (Komai, 1914, 1927), Enoshima (Manning, 1977), the Seto Inland Sea (Hamano, 1989b, 2005); Osaka Bay (present study).

Habitat in Japan. 16-70 m in depth, sandy mud bottom.

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