

ON THE IDENTITY OF THE INDO-WEST PACIFIC LITTORAL XANTHID CRAB,  
*LEPTODIUS EXARATUS* (H. MILNE EDWARDS, 1834)  
(CRUSTACEA: DECAPODA: BRACHYURA: XANTHIDAE)

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**ABSTRACT.** — The xanthid crab *Leptodius exaratus* (H. Milne Edwards, 1834) has been widely reported from the Indo-West Pacific, where it is a ubiquitous component of the intertidal and shallow subtidal fauna. The taxonomy of this species, however, is complex and there are many synonyms, most of which have not been adequately treated or discussed in the past. A close examination of a series of specimens throughout its range shows that *L. exaratus* should be restricted to the western Indian Ocean. Populations from the eastern Indian and western Pacific oceans should be referred to *Leptodius affinis* (De Haan, 1835), a species originally described from Japan. While their carapaces are superficially similar, the male first gonopod structure is a reliable character to distinguish these two species. *Cancer (Xantho) lividus* De Haan, 1835, *Leptodius nigromaculatus* Serène, 1962, as well as some of the varieties of *L. exaratus* established by Stimpson (1907), are considered to be junior subjective synonyms of *L. affinis* (De Haan, 1835). Where necessary, lectotypes or neotypes are designated to stabilise the taxonomy of the two species treated herein.

**KEY WORDS.** — Xanthidae, *Leptodius exaratus*, *Leptodius affinis*, *Leptodius nigromaculatus*, Indo-West Pacific

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## INTRODUCTION

The genus *Leptodius* A. Milne-Edwards, 1863, has 12 recognised species, all of which are found in the Indo-West Pacific region, where they are often common and ubiquitous components of the intertidal and shallow subtidal fauna (Serène, 1968, 1984; Ng et al., 2008). The type species, *Chlorodius exaratus* H. Milne Edwards, 1834, was described using material collected from somewhere along the shores of the Indian subcontinent. Subsequently, this species has been reported from many localities around the Indian and western Pacific oceans (e.g., Dana, 1852; A. Milne-Edwards, 1868, 1873; Kossmann, 1877; Haswell, 1882; Ortman, 1893; Nobili,

1906a, 1906b). Although not often discussed at length, the taxonomy of this species is actually quite complicated as a number of synonyms have never been recognised and/or treated (see Stimpson, 1907; Buitendijk, 1960; Forest & Guinot, 1961; Serène, 1984). There is also some degree of variation: Stimpson (1907) discussed the taxonomy of *L. exaratus* (as *Chlorodius exaratus*) and recognised several varieties from the western Pacific (particularly southern Japan and China), although he commented that he observed some overlap in characters.

Recently, the authors had independently observed some differences between the populations of *L. exaratus* in the

central and western Indian Ocean, and in the western Pacific. Exhaustive examination of the available material shows that *L. exaratus* should be restricted to the form found in the central and the western Indian Ocean, and that the “*L. exaratus*” widely reported from the western Pacific should instead be referred to *Leptodius affinis* (De Haan, 1835). The main morphological characters that can be used to distinguish the species are the armament and relative lengths of the apical lobes of the G1. Furthermore, it is also shown that *L. affinis* has several synonyms in the literature, and the attending nomenclatural questions are resolved herein.

## MATERIAL AND METHODS

The material examined in this study is deposited in the Natural History Museum and Institute, Chiba (CBM); the Marine Arthropod Depository Bank of Korea, Seoul National University (MADBK); the Muséum national d’Histoire naturelle, Paris (MNHN); the Natural History Museum, London (NHM); the National Museum of Nature and Science, Tokyo (NMST); and the Zoological Reference Collection, Raffles Museum of Biodiversity Research, National University of Singapore (ZRC). Measurements are expressed as carapace width by carapace length, in millimetres. The abbreviation “CL”, “CW”, “coll.”, and “G1” refer to the median carapace length, the maximum carapace width, the collector, and the male first gonopods, respectively. The terminology used for carapace regions follows that of Dana (1852) and Serène (1984). For brevity, the International Code for Zoological Nomenclature (ICZN, 1999) is referred to as the “Code”. Drawings were made with the aid of camera lucida attached to a Nikon SMZ800 stereomicroscope. Images were recorded using digital SLR camera (Nikon D200, D7000), and were developed with software (Model Helicon Focus®). For the morphometric analysis, the frontal width, maximum width of sternite 4, combined length of sternites 3 and 4, total length of the G1, and length of the G1 apical lobe were measured (see Fig. 1) using either metric dial calipers or ocular micrometres, where applicable, to the nearest 0.1

mm. The statistical tests were performed with IBM® SPSS® Statistics package (version 20).

## TAXONOMY

### Superfamily Xanthoidea MacLeay, 1838

### Family Xanthidae MacLeay, 1838

### Subfamily Xanthinae MacLeay, 1838

### *Leptodius exaratus* (H. Milne Edwards, 1834), *sensu stricto* (Figs. 2, 4A–D)

*Cancer inaequalis*, Audouin, 1826: 86 [Egypt]; Savigny, 1809: pl. 5 fig. 7 [Egypt] [not *Cancer inaequalis* Olivier, 1791]

*Chlorodius exaratus* H. Milne Edwards, 1834: 402; 1849: pl. 11 fig. 3 [India]

*Leptodius exaratus*, A. Milne-Edwards, 1868: 71 [Madagascar]; Richters, 1880: 148 [Mauritius, Seychelles]; Nobili, 1906a: 121 [Persian Gulf]; 1906b: 240 [Red Sea]; Rathbun, 1911: 215 [Saya de Malha Bank, Madagascar]; Lenz, 1912: 3 [Africa]; Klunzinger, 1913: 209, pl. 3, fig. 6, pl. 5, fig. 16 [Red Sea]; Bouvier, 1915: 284 [Mauritius]; Balss, 1924: 10 [Red Sea]; Pesta, 1928: 72 [Sudan]; Maccagno, 1936: 174 [Red Sea]; Ramadan, 1936: 32 [Red Sea]; Chopra & Das, 1937: 398 (in part) [Arabian Sea, Persian Gulf]; Forest & Guinot, 1961: 63, fig. 54 [Aldabra Is.]; Guinot, 1964: 11 [Aldabra Is., Madagascar]; 1967: 265 [Indian Ocean]; Serène, 1968: 75 (in part) [Indian Ocean]; Khan, 1977: 181, pl. 1D [Pakistan]; Kensley, 1981: 44 [South Africa]; Serène, 1984: 184, fig. 106, pl. 26 fig. A [Madagascar, Aldabra]; Tirmizi & Ghani, 1996: 48, fig. 18 [Pakistan]; Guinot & Cleva, 2009: 106, with figures [Egyptian Red Sea]

*Actaeodes lividus* Paul’son, 1875: 35, pl. 5 fig. 2 [Red Sea]

*Chlorodius (Leptodius) exaratus*, Kossmann, 1877: 32, pl. 2, figs. 1–6 [Red Sea]

*Xantho exaratus* var. *typica* Ortmann, 1893: 445 (in part) [Red Sea]

*Xantho (Leptodius) exaratus*, Alcock, 1898: 118 [353] (in part) [western India, Pakistan, Persian Gulf]; Stephensen, 1946: 149, fig. 37c [Persian Gulf]; Guinot, 1958: 92 [Mayotte Is.]; Michel, 1964: 32 [Mauritius]

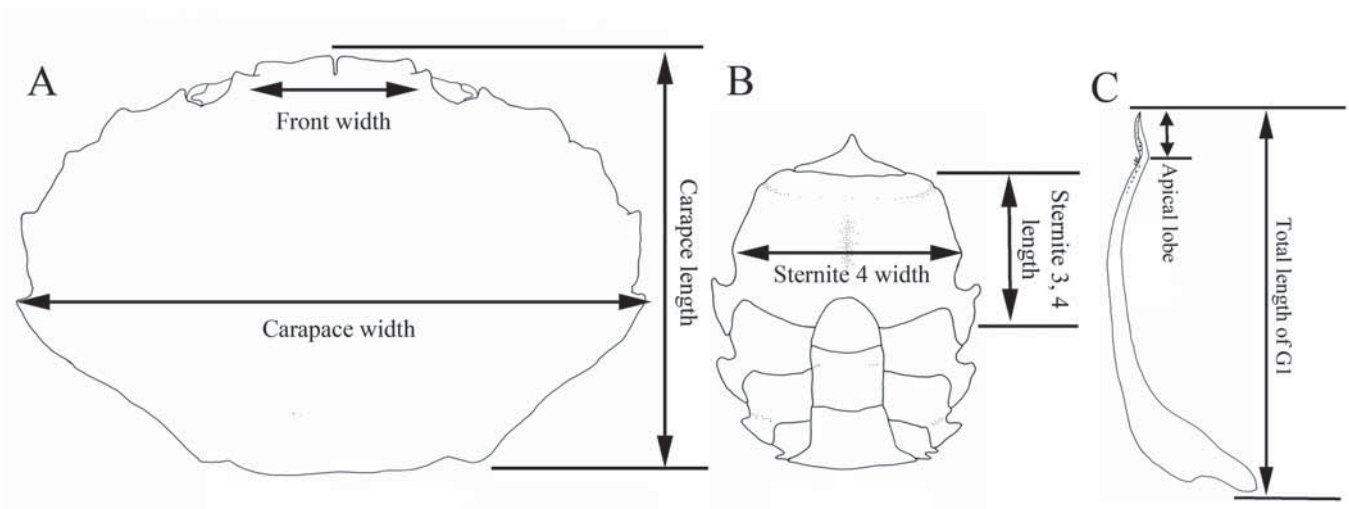


Fig. 1. Schematic diagram showing dimensions measured: A, carapace, dorsal view; B, male thoracic sternum, ventral view; C, left G1, external view.

*Xantho hydrophilus*, Laurie, 1915: 444, pl. 43, fig. 1 [Sudan] [not *Cancer hydrophilus* Herbst, 1790]

*Xantho exaratus*, Monod, 1938: 125, fig. 17B [Egyptian Red Sea]; Vatova, 1943: 19 [Somalia]; Buitendijk, 1960: 331 (in part) [South Africa]

*Xantho (Leptodius) hydrophilus*, Barnard, 1950: 223, fig. 41c, 42c–e [South Africa] [not *Cancer hydrophilus* Herbst, 1790]

**Type locality.** — Coasts of India (H. Milne Edwards, 1834: 402).

**Material examined.** — Neotype (here designated): male (23.7 × 16.1 mm; NHM 1881.10), Karachi, Pakistan.

Others: **Pakistan** – 1 ovig. female (29.4 × 19.1 mm; NHM 1881.10), Karachi; 1 male (30.0 × 19.4 mm), 1 female (23.4 × 14.9 mm) (ZRC 2010.0073), Buleji, 24 Feb.1982. **Western India** – 3 males (23.3 × 13.3 mm – 35.7 × 23.2 mm), 1 female (24.1 × 15.5 mm; NHM 1889.6.17.112–115), Bombay (?), no further data. **Persian Gulf** – 1 female (26.6 × 17.3 mm; NHM 1979.272), Fairlakka Is., Kuwait, coll. D.A. Clayton, 5 May 1979; 2 males (26.3 × 17.8 mm, 29.5 × 19.0 mm; NHM 1985.55), Bandar-e-Abbas, Iran, coll. H. Fakow, 22 Feb.1976; 2 males (20.6 × 13.9 mm; 25.8 × 17.1 mm, with sacculinid), 1 female (20.3 × 13.7 mm; NHM 2012.1027–1029), Ras Al Jlay'ah, Kuwait, coll. D. Clayton, 25 Oct.1979; 2 males (25.4 × 16.7 mm, with sacculinid; 25.5 × 16.4 mm), 1 female (17.1 × 11.8 mm; NHM 2012.1030–1032), Al-Wusail, Qatar, coll. 25 Mar.1983, don. G. Bradley; 9 males (12.2 × 8.0 mm – 29.9 × 18.9 mm), 7 females (15.5 × 11.1 mm – 20.4 × 13.2 mm; ZRC 2012.0111), Qushm Is., Iran, coll. M. Asgari, 19 Nov.2008. **Madagascar** – 2 males (13.6 × 9.1 mm, 21.5 × 14.2 mm; MNHN-B6640), Nosy Be, coll. P. Opic, 20 May 1923; 4 females (10.0 × 6.8 mm – 14.0 × 9.0 mm; MNHN-B15992), Nosy Be, coll. A. Crosnier, Sep.1958. **Seychelles** – 2 males (17.6 × 12.0 mm, 18.6 × 12.5 mm), 2 females (17.4 × 11.6 mm, 17.6 × 11.2 mm) (MNHN-B8623), Aldabra, coll. Calypso Expedition, May 1954.

**Description.** — Carapace (Fig. 2A) transversely subovate, about 1.5–1.6 times as broad as long; dorsal surface somewhat convex, finely granular, rugose particularly at anterior and lateral regions; regions well defined, separated by distinct grooves; 2F separated from 1M by shallow, transverse groove; 2M partly divided longitudinally, 1M fused to inner branch of 2M; 3M, 2L, 3L, 4L, 5L, 6L distinct, entire; 4M indistinct; 1L very small; 1R, 2R fused, separated from 3R by indistinct oblique groove; 1P, 2P indistinct. Front about 0.2–0.3 times as broad as carapace breadth, not much protruded; margin deeply sinuous medially, almost quadridentate; separated from inner orbital tooth by notch. Orbit small, oval; superior margin with 2 fissures; inferior margin bearing 2 blunt teeth on either side; exorbital angle separated from first anterolateral tooth on anterolateral margin by shallow concavity. Anterolateral margin with 4 broad, triangular teeth behind exorbital angle: first small, acute; second broad, large; third similar to second, slightly more produced; last small, most acute. Posterolateral margin somewhat concave. Posterior margin granular, central region straight. Pterygostomian region granular, setose.

Antennules (Fig. 2B, C) folding transversely, slightly obliquely. Basal article of antenna sub-rhomboidal, short, broad; antennal flagellum entering orbital hiatus. Epistome narrow; central region with median projection, separated from lateral regions by distinct notches. Third maxilliped completely covering buccal orifice; merus subquadrate, granular, anterolateral angle slightly produced, anterior

margin with wide V-shaped notch medially; ischium subrectangular with submedian sulcus, smooth to punctate; exopod stout, length about 4 times width.

Thoracic sternum (Fig. 2B) finely granular, glabrous. Sternites 1, 2 completely fused, separated from sternite 3 by distinct suture; sternites 3, 4 almost completely fused except for short notches laterally, sternite 3 distinguishable from sternite 4 by shallow groove; sternite 4 large, inflated; sternites 5–8 distinct, separate, sternite 8 not visible externally. Median longitudinal line visible externally only on central portion of sternite 4; within sternoabdominal cavity, visible only at posterior portion of sternite 4, complete at level of sternites 6, 7, 8. Sternal press-button situated on sternite 5, equidistant from sutures 4/5, 5/6.

Chelipeds (Fig. 2A) unequal. Merus with long setae on anterior and posterior borders. Carpus finely granular, rugose on external surface, with blunt tooth on inner angle. Palm

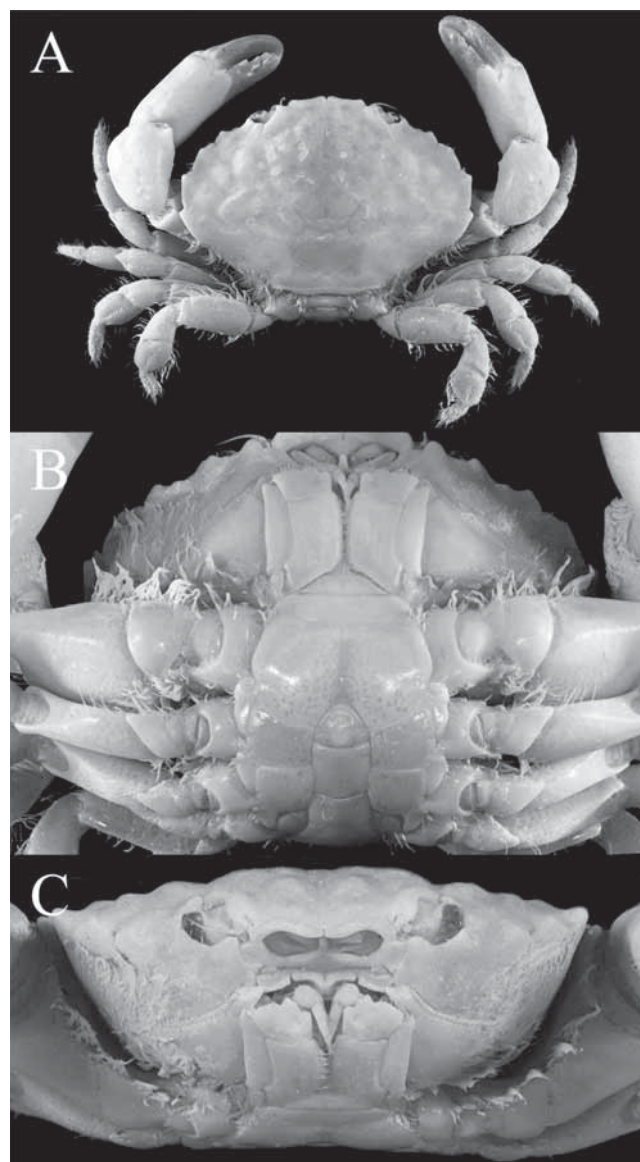


Fig. 2. *Leptodius exaratus* (H. Milne Edwards, 1834), neotype, male, 23.7 × 16.1 mm (NHM 1881.10), Karachi, Pakistan. A, dorsal view; B, ventral view; C, anterior view.

inflated, rugose dorsally, smooth ventrally. Fingers stout, darkly pigmented throughout length, except at tips with white colour, pigment on fixed finger extending minimally into palm; gape moderately wide; cutting margins irregularly dentate; finger tips spoon-shaped, hollowed out, with tufts of setae.

Ambulatory legs (Fig. 2A) short, stout; anterior margins finely granular; anterior and posterior margins of meri with long setae; carpi, propodi subequal in length, sparsely setose; dactyli tomentose, spinose, ending distally in long, chitinous claw.

Male abdomen (Fig. 2B) narrow; somites 3–5 fused, sutures vaguely discernible; somite 6 long, median length about 1.6 times that of telson, distal half slightly broader than proximal half, lateral margins slightly concave. Telson subtriangular, tip broadly rounded; tip not reaching level of sternal condyles of P1 coxae.

G1 (Figs. 4A–D) long, slender, with 6–8 stout, curved subdistal spines; with elongate apical lobe set at slight angle with rest of G1, with 8–10 mushroom-shaped marginal outgrowths; apical lobe about 0.05–0.07 times total length. G2 about quarter length of G1.

**Remarks.** — Henri Milne Edwards (1834: 402) described *Chlorodius exaratus* from an unspecified number of specimens collected from “les côtes de l’Inde”. He later provided an illustration of this species (H. Milne Edwards, 1849: pl. 11 fig. 3), presumably of the type or from the type series. The genus *Leptodius* was later established by A. Milne-Edwards (1863) for the species.

The present specimens agree with the description and illustrations of *Leptodius exaratus* (e.g., H. Milne Edwards, 1849: pl. 11 fig. 3; Barnard, 1950: 223, figs. 41c, 42c, e; Serène, 1984: 180, pl. 26 fig. A), particularly in the form of the G1 (e.g., Stephensen, 1946: fig. 37C, Barnard, 1950: fig. 42d; Forest & Guinot, 1961: fig. 54; Serène, 1984: fig. 106). The type, thus far, has not been found in the MNHN, where H. Milne Edwards’ types are deposited, despite repeated attempts to locate it. It is reasonable to assume that the type is lost and, therefore, a neotype must now be selected to stabilise the complex taxonomy of this species (see Discussion). A topotypic specimen (a male, 23.7 × 16.1 mm; NHM 1881.10) from the western coast of the Indian subcontinent (Karachi, Pakistan) is hereby selected as the neotype for *Chlorodius exaratus* H. Milne Edwards, 1834. Differences between *L. exaratus* s. str. and its close sibling *L. affinis* (De Haan, 1835) are discussed under the Remarks for the latter.

**Distribution.** — *Leptodius exaratus* s. str. is found in the Western Indian Ocean, ranging from the eastern and southern coasts of Africa, including Madagascar, to the western coast of India; and also in the Red Sea and the Persian Gulf. It has been reported from the following localities:

*Western Indian Ocean:* Western India (H. Milne Edwards, 1834; Alcock, 1898); Madagascar (A. Milne-Edwards, 1868);

Mauritius (Richters, 1880; Bouvier, 1915; Michel, 1964); Seychelles (Richters, 1880; Bouvier, 1915; Forest & Guinot, 1961; Guinot, 1964; Michel, 1964; Serène, 1984); Pakistan (Alcock, 1898; Khan, 1977; Tirmizi & Ghani, 1996); Saya de Malha (Rathbun, 1911); Africa (Lenz, 1912); Somalia (Vatova, 1943); South Africa (Barnard, 1950; Buitendijk, 1960; Kensley, 1981); Mayotte (Guinot, 1958)

*Persian Gulf:* Persian Gulf (Alcock, 1898; Nobili, 1906a; Chopra & Das, 1937; Stephensen, 1946)

*Red Sea:* Egypt (Savigny, 1809; Audouin, 1826; Monod, 1938; Guinot & Cleva, 2009); Red Sea (Paul’son, 1875; Kossmann, 1877; Ortmann, 1893; Nobili, 1906b; Klunzinger, 1913; Balss, 1924; Maccagno, 1936; Ramadan, 1936); Sudan (Laurie, 1915; Pesta, 1928)

### *Leptodius affinis* (De Haan, 1835)

(Figs. 3, 4E–I)

*Cancer (Xantho) affinis* De Haan, 1835: 48, pl. 13 fig. 8 [Japan]; Krauss, 1843: 30 [Japan]

*Cancer (Xantho) lividus* De Haan, 1835: 48, pl. 13 fig. 6 [Japan] [not *Cancer lividus* Latreille, in Milbert, 1812].

*Chlorodius exaratus*, Dana, 1852: 208 [Pacific] [not *Chlorodius exaratus* H. Milne Edwards, 1834]

*Leptodius exaratus*, A. Milne-Edwards, 1873: 222 [New Caledonia]; Miers, 1879: 31 [Korea and Japan]; Haswell, 1882: 60 [Australia]; De Man, 1887a: 33 [Mergui Archipelago]; 1887b: 285 [Nordwacher Island, Java Sea]; 1892: 278 [Sulawesi]; Alcock & Anderson, 1894: 200 [Bay of Bengal, Laccadive Sea]; Balss, 1922: 127 [Japan]; Shen, 1932: figs. 57, 58c, d; 1937: 307 (list) [northern China]; Yokoya, 1933: 189 [Japan]; Sakai, 1934: 309; 1936: 151, pl. 45, fig. 3; 1965: 140, pl. 70, fig. 6; 1976: 423, pl. 153, fig. 1 [Japan]; Chopra & Das, 1937: 398 (in part) [Bay of Bengal, Mergui Archipelago]; Sankarankutty, 1962: 129 [Andaman Is.]; 1966: 351 [Sri Lanka]; Kim, 1970: 14 [Korea]; 1973: 380, fig. 144, pl. 82, fig. 109 [Korea]; Takeda & Nunomura, 1976: 70 [New Caledonia]; Takeda, 1976: 74 [Palau]; 1978: 39 [Amakusa, Japan]; Takeda & Miyake, 1976: 109 [Ogasawara, Japan]; Yamaguchi et al., 1976: 37 [Amakusa, Japan]; Garth & Kim, 1983: 570 [Philippines]; Dai et al., 1986: 271, figs. 154(3), 155A(1), pl. 37(4), 37(5) [China]; Dai & Yang, 1991: 292, pl. 37(4), fig. 154(3) [China]; Yamaguchi & Baba, 1993: 446, figs. 164A, B [Japan]; Jones & Morgan, 1994: 166, 167, with figure [Australia]; Minemizu, 2000: 260, with figure [Japan]; Davie, 2002: 550–551 [Australia]; Ng & Davie, 2002: 374 [Thailand]; Paulay et al., 2003: 504 [Marianas]; Poore, 2004: 472, fig. 150b [Australia]; Davie, 2011: 233, with figure [Australia] [not *Chlorodius exaratus* H. Milne Edwards, 1834]

*Xantho exaratus* var. *typica* Ortmann, 1893: 445 (in part) [Samoa; Japan; Fiji; Caroline Is.; Australia] [not *Chlorodius exaratus* H. Milne Edwards, 1834]

*Chlorodius exaratus* var. *pictus* Stimpson, 1907: 54, fig. 6 [Simoda, Japan] [not *Chlorodius exaratus* H. Milne Edwards, 1834]

*Chlorodius exaratus* var. *typicus* Stimpson, 1907: 55 [China; Japan] [not *Chlorodius exaratus* H. Milne Edwards, 1834].

*Xantho (Leptodius) exaratus*, Alcock, 1898: 118 [353] (in part) [Mergui, Andamans, Sri Lanka, Burma, Malaysia]; Laurie, 1906: 402 [Sri Lanka]; Gravely, 1927: 146 [Gulf of Mannar]; Gordon, 1931: 528, 543, fig. 22b; 1934: fig. 16b [China]; Boone, 1934: 110, pl. 58 [Australia, French Polynesia]; Balss, 1935: 133 [SW Australia]; 1938: 41 [Nauru, Marshall Is.]; Estampador, 1937:

525; 1959: 79 [Philippines]; Sakai, 1939: 464, pl. 58, fig. 3, pl. 91 [Japan]; Miyake, 1939: 209; 1940: 155 [Micronesia]; Chang, 1963: 99 [Taiwan]; McNeill, 1968: 58 [Australia] [not *Chlorodius exaratus* H. Milne Edwards, 1834]

*Xantho exaratus*, Holthuis, 1953: 27 [Gilbert Is.; Tuamotu Archipelago]; Buitendijk, 1960: 331, fig. 9 k–m (in part) [Indonesia; China; Fiji; Japan; Myanmar; Philippines; Samoa; Society Is.; Thailand] [not *Chlorodius exaratus* H. Milne Edwards, 1834]

*Leptodius nigromaculatus* Serène, 1962: 255, figs. 1A–H; 1984: 182 (key) [Vietnam]; Dai et al., 1986: 272, fig. 155A [China]; Dai & Yang, 1991: 293, pl. 37(5), fig. 155A [China]; Yeh et al., 2006: 70, figs. 1C, F, 2C–D [Taiwan]

**Type locality.** — Japan (De Haan, 1835: 48).

**Material examined.** — **Australia** – 2 males (21.1 × 13.8 mm; ZRC 2012.0112), (23.4 × 15.1 mm; ZRC 2012.0113), Ningaloo Reef, Western Australia, R. Lasley coll., 19 May 2010. **China** – 1 male (32.5 × 20.0 mm; ZRC 2012.0114), 3 males (13.0 × 8.5 mm – 23.5 × 15.0 mm; ZRC 1998.542), Changpo, Hong Kong, coll. P. K. L. Ng & S. Y. Lee, 6 Jun.1998; 2 males (30.2 × 18.6 mm, 30.7 × 19.0 mm; ZRC 1999.0625), 1 female (22.8 × 14.1 mm; ZRC 1999.0458), Nanao Is., Guangdong, coll. Y. Cai & N. K. Ng, 13 Nov.1998; 2 males (15.4 × 10.0 mm, 19.6 × 13.1 mm), 1 female (14.2 × 9.3 mm; ZRC 2012.0115), Hainan Is., coll. Y. Cai & N. K. Ng, 1 Dec. 1998; 2 males (17.0 × 11.6 mm, 13.2 × 8.1 mm), 2 females, (23.1 × 13.5 mm, 18.0 × 11.8 mm; ZRC 2010.0352), Shi Jing Village, Xiamen County, Fujian Province, coll. Z. Jaafar & N. K. Ng, 17 Nov.2005. **Eastern India** – 1 male (23.9 × 15.4 mm; ZRC 2012.0110), Tranquebar, Tamil Nadu, coll. N. K. Ng, B. Y. Lee & R. M. Lasley, Nov.2011. **Indonesia** – 1 female (15.8 × 10.3 mm; ZRC 1999.1203), Bintan Is., coll. Riau, J. B. Sigurdsson, 27 Mar.1993; 1 female (13.9 × 9.5 mm; ZRC 2003.0548), Anambas Is., stn EA-2jc7, 15 Mar.2002. **Japan** – 1 male (25.9 × 16.6 mm), 1 female (16.1 × 10.6 mm; NMST-Cr 6425), Shibasaki Hayama, Kanagawa, coll. M. Takeda, 25 Jul.1980; 2 males (23.7 × 15.2 mm, 29.4 × 19.0 mm), 1 female (21.2 × 13.5 mm; CBM-ZC 143), 2 males (12.9 × 8.6 mm, 35.0 × 21.7 mm), 1 female (20.3 × 13.3 mm; CBM-ZC 559), Ogasawara Is.; 1 female (22.6 × 14.2 mm; ZRC 2009.0145), Iriomote Is., Yaeyama Group, southern Ryukyu Islands, coll. N. K. Ng, 16 Jun.2000; 2 males (14.6 × 9.2 mm, 23.3 × 15.0 mm; ZRC 2011.0170), Amakusa, Kyushu, J. C. Y. Lai coll., 3 Apr.2011. **Korea** – 2 males (32.0 × 20.3 mm, 36.8 × 23.2 mm; MADBK 173012\_011), Iho-ri, Jejudo Is., coll. H. S. Kim, 11 Aug.1969; 3 male (19.7 × 12.7 mm – 30.6 × 19.3 mm; MADBK 173012\_012), Sindo-ri, Jejudo Is., coll. S. K. Lee 25 Oct.2005; 1 male (15.7 × 10.4 mm; MADBK 173012\_013), Aewel-eup, Jejudo Is., coll. S. K. Lee, 16 Oct.2006; 2 males (20.5 × 13.2 mm, 23.1 × 14.7 mm; MADBK 173012\_014), Jo-Iri, Udo Is., Jejudo, coll. S. K. Lee, 14 Dec.2006. **Malaysia** – 1 male (19.4 × 12.6 mm; ZRC 1991.461), Pulau Tioman, coll. P. K. L. Ng, 30 Mar.1982; 1 male, (26.4 × 16.0 mm), 3 females (13.6 × 8.9 mm – 16.8 × 11.3 mm; ZRC 1985.1722-1725), Tanjong Bidara, Malacca, coll. P. K. L. Ng, 16 Feb.1985. **New Caledonia** – 2 males (15.8 × 10.5 mm, 17.0 × 11.4 mm), 2 females (18.3 × 12.8 mm, 17.4 × 11.4 mm; MNHN-B8631), coll. Balansa, no date. **Philippines** – 2 males (23.5 × 15.6 mm, 27.7 × 18.0 mm), 1 female (21.8 × 14.1 mm; ZRC 2012.0116), 8 males (13.6 × 9.0 mm – 29.5 × 19.3 mm), 2 females (12.6 × 8.4 mm, 23.8 × 15.5 mm; with sacculinid; ZRC 2012.0117), Punta Taytay, Bacolod, Negros Is., coll. J. C. E. Mendoza, 27–28 Dec.2011. **Singapore** – 7 males (12.0 × 7.6 mm – 31.0 × 20.2 mm; ZRC 2012.1232), Changi Beach Park, Singapore, 4 May 2012; 2 males (24.7 × 15.0 mm, 27.1 × 17.0 mm), 2 females (21.0 × 13.5 mm, 22.8 × 14.5 mm; ZRC 1993.33-51), Labrador Beach, Jan.1987; 3 males (19.0 × 12.1 mm – 22.7 × 14.0 mm; ZRC 1995.339), Semakau, coll. P. K. L. Ng, 8 Feb.1993; 3 males (23.6 × 15.0 mm – 29.0 × 18.3 mm;

ZRC 2000.1197), Pulau Seringat, coll. C. M. Yang & S. L. Goh, 22 Jul.1997. **Taiwan** – 1 male (29.3 × 18.5 mm; ZRC 1995.620), Shihmen, Taipei, coll. C. H. Wang, 24 May 1987; 1 male (29.2 × 18.2 mm; ZRC 1999.0590), 5 males (18.9 × 12.1 mm – 26.3 × 16.5 mm), 2 females (18.8 × 12.1 mm, 22.1 × 14.1 mm; ZRC 1999.0591), Keelung, Magang, coll. H. H. Tan, 3 Aug.1996; 2 males (29.0 × 18.5 mm, 23.0 × 15.1 mm; ZRC 1999.0581), He Ping Tao, coll. Keelung, H. H. Tan, 4 Aug.1996. **Thailand** – 9 males (14.8 × 9.7 mm – 24.5 × 15.5 mm), 4 females (13.0 × 8.4 mm – 16.7 × 11.2 mm; ZRC 2000.1034), Cape Panwa, Phuket, coll. H. H. Tan, 17 Jan.2000; 1 male (19.3 × 12.5 mm; ZRC 2001.1076), Phuket, coll. P. K. L. Ng, 17 Feb.2001. **Vanuatu** – 1 male (17.9 × 11.8 mm; ZRC 2012.1233), stn. H6, rocky intertidal area near wharf of Vanuatu Maritime College, Luganville, Espiritu Santo, coll. P. Clark, 17 Sep.2006. **Vietnam** – 2 males (12.7 × 8.4 mm, 22.4 × 14.0 mm), 2 females (18.7 × 12.3 mm, 28.7 × 17.9 mm; ZRC 2012.0118), Con Dau Is., coll. H. H. Tan et al., 12 Apr.2010; 8 males (9.8 × 6.3 mm – 13.9 × 9.0 mm), 13 females (6.4 × 4.2 mm – 12.8 × 8.6 mm; ZRC 2012.0119), Con Dau Is., 14 Apr.2010.

**Description.** — Carapace (Fig. 3A) transversely subovate, about 1.4–1.6 times as broad as long; dorsal surface depressed, finely granular, anterior, lateral regions varying from distinctly to faintly rugose; regions well defined,

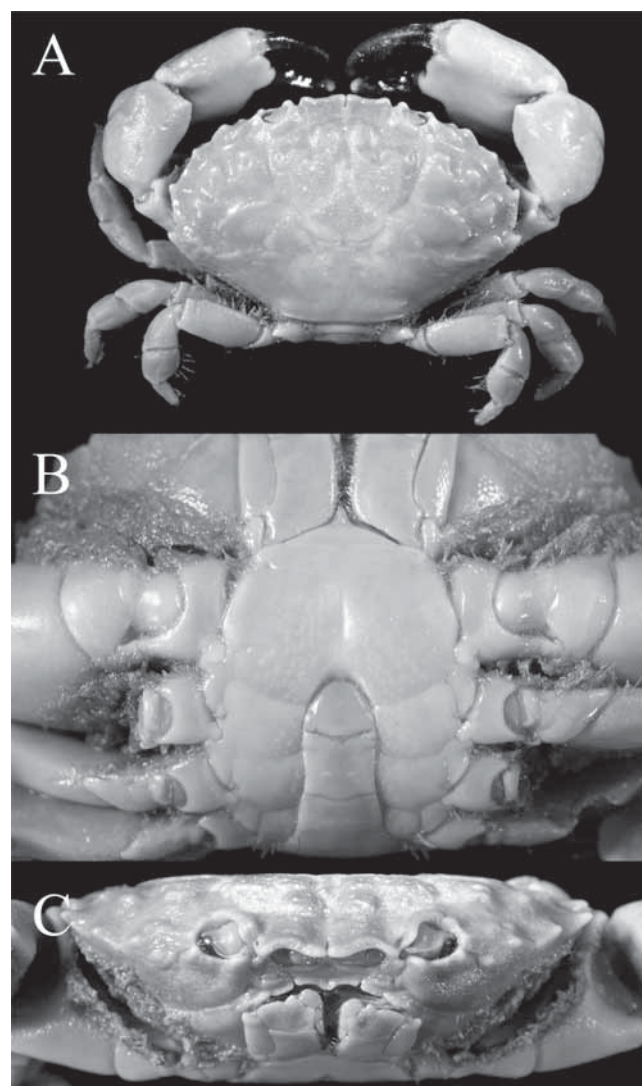


Fig. 3. *Leptodius affinis* (De Haan, 1835), male, 25.9 × 16.6 mm (NSMT-Cr6425), Shibasaki, Kanagawa, Japan. A, dorsal view; B, ventral view; C, anterior view.

separated by narrow, shallow grooves; 2F separated by groove from 1M; 2M partly divided longitudinally, 1M fused to inner branch of 2M; 3M, 2L, 3L, 4L, 5L, 6L distinct, entire; 4M indistinct; 1L very small; 1R, 2R fused, separated from 3R by indistinct oblique groove; 1P, 2P indistinct. Front about 0.3 times as broad as carapace breadth, not much protruded, cut into 2 lobes, each one slightly concave near outer side, separated from internal orbital tooth by notch. Orbit smaller, transverse oval; superior margin with 2 fissures; inferior margin bearing 2 blunt teeth on either side; exorbital angle separated from first anterolateral tooth by concavity. Anterolateral margin with 4 lobes behind exorbital angle: first small, almost indistinguishable, depressed; second broad, large; third similar, more prominent than second; last smallest but most produced; separation between teeth indicated by small sinus. Posterolateral margin somewhat concave, with pubescence. Posterior margin granular, central region straight. Pterygostomial region granular, setose.

Antennules (Fig. 3C) lying transversely, slightly obliquely. Basal article of antenna sub-rhomboidal, short, broad. Antennular flagellum occupied orbit hiatus. Epistome narrow; central region with median projection, separated from lateral regions by distinct notches. Third maxilliped completely filled buccal orifice; merus subquadrate, granular, anterolateral angle slightly produced, anterior margin with wide V-shape notch medially; ischium subrectangular with submedian sulcus, smooth to punctuate; exopod stout, length about 4 times width.

Thoracic sternum (Fig. 3B) finely granular, glabrous. Sternites 1, 2 completely fused, separated from sternite 3 by distinct suture; sternites 3, 4 almost completely fused except for short notches laterally, sternite 3 distinguishable from sternite 4 by shallow groove; sternite 4 large, slightly convex; sternites 5–8 distinct, separate, within not visible externally. Median longitudinal line visible externally only on central portion of sternite 4, complete at level of sternites 6, 7, 8. Sternal press-button situated on sternite 5, equidistant from sutures 4/5, 5/6.

Chelipeds (Fig. 3A) asymmetrical, with a granular coating single ended, more or less curved and pointed. Merus with long setae on anterior and posterior borders, covered with fine corrugation on dorsal surface. Carpus covered with microscopic granules and fine corrugation on outer surface; inner-distal angle bluntly round. Fingers black coloured, with somewhat gaping between them closed, with distinctly toothed and contiguous within; inner margins provided with obtuse teeth, tips spoon-shaped with bristles.

Ambulatory legs (Fig. 3A) smooth; meri of first to third with setae on anterior and posterior margin; carpi, propodi subequal in length, sparsely setose; dactyli densely covered with short hairs, chitinous claw.

Male abdomen (Fig. 3B) narrow and long; somites 3–5 fused, sutures vaguely discernible; somite 6, median length about 1.6 times that of telson. Distal half slightly broader than proximal half, lateral margins slightly concave. Telson

subtriangular, tip broadly rounded; tip not reaching level of sternal condyles of P1 coxae.

G1 (Figs. 4E–I) slender, long, with 5 or 6 stout, curved subdistal spines; elongated apical lobe bordered on ventral margin by 5 or 6 mushroom-shaped outgrowths proximally and in distal half with 6–8 tongue-shaped outgrowths, simple, pointed, diminishing gradually near tip. Length of apical lobe measured from tip to subdistal region 0.11–0.14 times to total length; angle formed between apical lobe and rest of structure relatively G1 more bent. G2 about quarter length of G1.

**Remarks.** — De Haan (1835) described two species, *Cancer (Xantho) affinis* and *C. (X.) lividus*, from Japan. These two names were both simultaneously synonymised under *Xantho exaratus* (H. Milne Edwards, 1834) var. *typica* by Ortman (1893: 445) (see also Yamaguchi & Baba, 1993). The type material for these two names is still extant: the lectotype (RMNH D 44644) and paralectotypes (RMNH D 42334, RMNH D 42335, RMNH D 44646) of *Cancer (Xantho) affinis* De Haan, 1835, as well as the lectotype (RMNH D 42333) and paralectotype (RMNH D 42336) of *Cancer (Xantho) lividus* De Haan, 1835, are all deposited at the Nationaal Natuurhistorisch Museum at Leiden, The Netherlands, and have been well documented by Yamaguchi & Baba (1993: 446, fig. 164A, B) and Fransen et al. (1997: 116). Stimpson (1907) noted the morphological variations among different populations of *L. exaratus* in the Pacific region, and established varieties within this species to distinguish these populations. Serène (1962) described another species, *Leptodius nigromaculatus*, from southern Vietnam, which he thought to be more closely allied to *L. gracilis* (Dana, 1852), perhaps due to the less rugose carapace and less projecting anterolateral teeth. The holotype of *L. nigromaculatus* could not be located; it has not been found in the MNHN, despite several attempts, and it may still be in Serène's former institution in Nhatrang, Vietnam. Several topotypic specimens from southern Vietnam were examined instead in order to confirm the synonymy. Besides these, the literature is rife with several records of "*Leptodius exaratus*", or variants thereof, from the western Pacific and eastern Indian Ocean.

Based on differences in G1 morphology, however, it is clear that these records are not of *L. exaratus* s. str. Both *L. exaratus* s. str. and the similar *L. affinis* (De Haan, 1835) have a broad, transversely subovate carapace, which has four broadly triangular anterolateral teeth, a rugose dorsal surface and well-defined regions. There is much variability and overlap in the carapace morphology within each species. Features of the mouthparts, thoracic sternum, abdomen and pereopods are also not useful, and morphometric analyses of the carapace and thoracic sternum (Fig. 5A, B) reveal no significant difference between the two species.

The main difference between *L. exaratus* s. str. and *L. affinis* can be seen in the G1 morphology (Figs. 4, 5C), where: 1) the apical lobe is proportionally shorter in *L. exaratus* than in *L. affinis*; 2) it is also more tightly curled, nearly a closed cylinder (vs. more open and expanded in *L. affinis*);

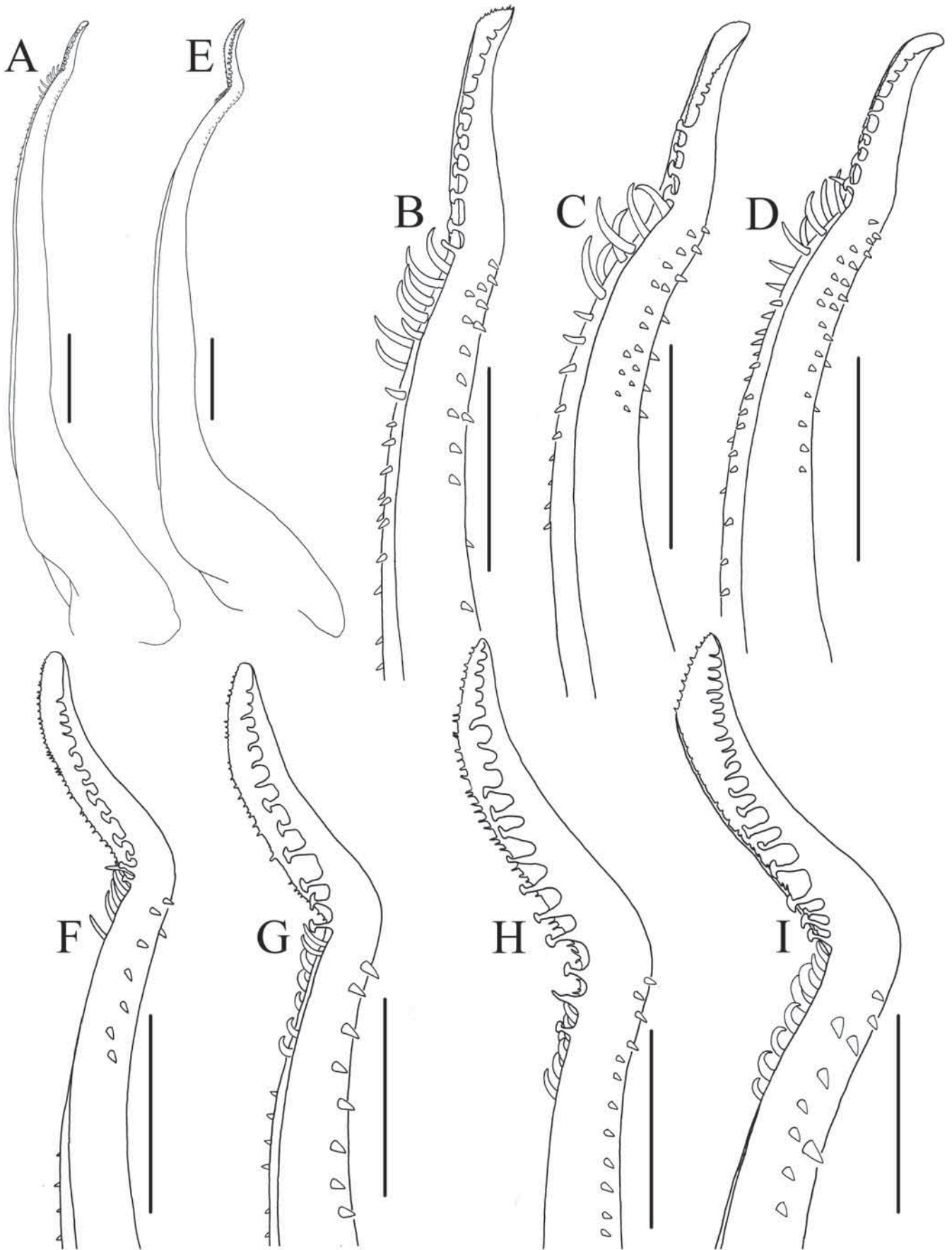


Fig. 4. Left G1. A–D, *Leptodius exaratus* (H. Milne Edwards, 1834): A, B, neotype, 23.7 × 16.1 mm (NHM 1881.10), Karachi, Pakistan; C, 23.6 × 15.5 mm (ZRC 2012.0111), Qushm, Persian Gulf; D, 21.5 × 14.2 mm (MNHN-B6640), Nosy Be, Madagascar. E–I, *Leptodius affinis* (De Haan, 1835): E, H, 25.9 mm × 16.6 mm, (NMST-Cr 6425), Shibasaki Hayama, Japan; F, 13.9 × 9.0 mm (ZRC 2012.0119), Con Dau, Vietnam; G, 23.9 × 15.4 mm (ZRC 2012.0110), Tranquebar, S. E. India; I, 29.5 × 19.3 mm, (ZRC 2012.0117), Negros, Philippines.

3) the angle formed between the apical lobe and the rest of the G1 is larger (vs. less in *L. affinis*, giving it a more bent appearance); and 4) the ventral lip of the apical lobe has fewer outgrowths in *L. exaratus* than in *L. affinis* (for *L. exaratus* see Forest & Guinot, 1961: 62, fig. 54; Serène, 1984: 180, fig. 106; for *L. affinis* see Serène, 1962: 258, fig. 1; Yeh et al., 2006: 73, fig. 2C, D).

The following discussion in this paper shows that these records refer to *L. affinis* (De Haan, 1835), and that at least some of the various synonyms in the literature are justified. Concerning records of “*L. exaratus*” from the Hawaiian islands in the central Pacific (viz. Stimpson, 1858; Rathbun, 1906; Edmondson, 1925, 1946, 1962; Titgen, 1987; Castro, 2011), it is clear after examining the published figures and material collected from there that these are not *L. exaratus* or *L. affinis* as defined at present, and belong to other species. They will be treated and discussed elsewhere.

**Distribution.** — *Leptodius affinis* (De Haan, 1835) is found in the eastern Indian Ocean and in the western and central Pacific Ocean, ranging from the eastern coast of India all the way to the oceanic islands of French Polynesia; extending northward to central Japan and southward to southwestern and southeastern Australia. It has been recorded from the following localities:

**Eastern Indian Ocean:** Mergui Archipelago (De Man, 1887a; Alcock, 1898; Chopra & Das, 1937); Bay of Bengal (Alcock & Anderson, 1894; Chopra & Das, 1937); Laccadive Sea (Alcock & Anderson, 1894); Andamans (Alcock, 1898; Sankarankutty, 1962); Gulf of Mannar (Gravelly, 1927); Myanmar (Alcock, 1898; Buitendijk, 1960); Penang (Alcock, 1898); Sri Lanka (Alcock, 1898; Laurie, 1906; Sankarankutty, 1966); western Thailand (Ng & Davie, 2002).

**Western Pacific:** Japan (De Haan, 1835; Krauss, 1843; Miers, 1879; Ortman, 1893; Stimpson, 1907; Balss, 1922; Yokoya, 1933; Sakai, 1934, 1936, 1939, 1965, 1976; Takeda & Miyake, 1976; Yamaguchi et al., 1976; Takeda, 1978; Yamaguchi & Baba, 1993; Minemizu, 2000); Australia (Haswell, 1882; Ortman, 1893; Boone, 1934; Balss, 1935; McNeill, 1968; Jones & Morgan, 1994; Davie, 2002, 2011; Poore, 2004); Korea (Miers, 1879; Kim, 1970, 1973); Indonesia (De Man,

1892; Buitendijk, 1960); China (Stimpson, 1907; Gordon, 1931; Shen, 1932, 1937; Dai et al., 1986; Dai & Yang, 1991); Hong Kong (Stimpson, 1907); Philippines (Estampador, 1937, 1959; Buitendijk, 1960; Garth & Kim, 1983); Micronesia (Miyake, 1939, 1940); Gilbert Is. (Holthuis, 1953); Thailand (Buitendijk, 1960); Vietnam (Serène, 1962); Taiwan (Chang, 1963; Yeh et al., 2006).

**Central Pacific:** Pacific (Dana, 1852); Samoa, Fiji, Caroline Is. (Ortmann, 1893; Buitendijk, 1960); Nauru, Marshall Is. (Balss, 1938); Tuamotu Archipelago (Holthuis, 1953); Palau (Takeda, 1976); Marianas (Paulay et al., 2003).

**South Pacific:** New Caledonia (A. Milne-Edwards, 1873; Takeda & Nunomura, 1976); French Polynesia (Boone, 1934).

## DISCUSSION

The taxonomy of one of the most common intertidal Indo-West Pacific xanthid crab species, *Leptodius exaratus* (H. Milne Edwards, 1834) has generally been regarded as stable and most recent syntheses do not question its identity (e.g., Serène, 1984). Following the general consensus, Ng et al. (2008: 203) listed just four junior synonyms under *L. exaratus*: *Cancer inaequalis* Olivier, 1791, *Cancer inaequalis* Audouin, 1826, *Leptodius lividus* Paulson, 1875, and *Xantho exaratus* var. *typica* Ortmann, 1893. However, *Cancer inaequalis* Olivier, 1791, is now regarded as a species of *Xanthodius* Stimpson, 1859, an American genus. This confusion probably arose from material identified as *Cancer inaequalis* from the Red Sea by Audouin (1826) but is today believed to be *L. exaratus* instead (see Guinot & Cleva, 2009).

The problems associated with *L. exaratus* and allied taxa, however, have been understated. Stimpson (1907) discussed the taxonomy of *Leptodius exaratus* (as *Chlorodius exaratus*) and commented that while he chose to recognise a number of varieties, they also appeared to intergrade. He commented:

“... one would scarcely be prepared to find so much variety in the character of the surface, the number and shape of the lateral teeth, and the sculpture of the feet, as we see in the

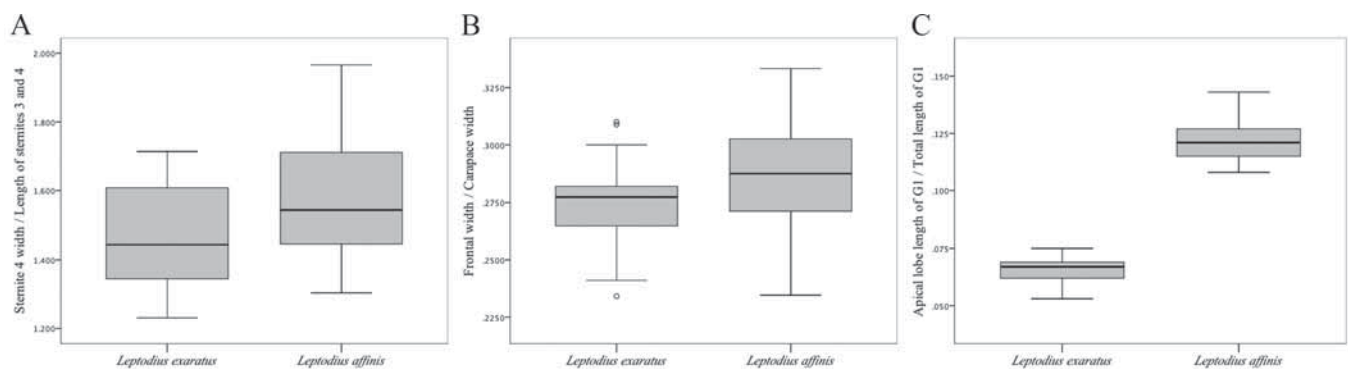


Fig. 5. Results of morphometric analysis of *Leptodius exaratus* (H. Milne Edwards, 1834) (A–C: n = 28) and *L. affinis* (De Haan, 1835) (A, B: n = 99; C: n = 64). Box plots depicting maxima, minima, median, and quartile values for: A, ratios of the sternite 4 width and combined length of sternites 3 and 4; B, ratios of the frontal and carapace widths; C, ratios of the apical lobe length and total length of the G1.



present instance, these characters being in other genera and species of the highest specific importance. The varieties described below, however, are found to run into each other in all the characters which at first sight strike the examiner as specific, and several of them are often found living together under circumstances which do not fail to impress the collector with the idea that they are one and the same species.” (Stimpson, 1907: 52)

He noted that *Chlorodius sanguineus* H. Milne Edwards, 1834, is probably not a good species and chose to only recognise it as a variety of *L. exaratus*. In addition, he recognised eight other varieties (here listed in the order Stimpson named them): *rugosus* (Bonin Islands), *pictus* (Simoda, Japan), *latifrons* (Loo Choo), *typicus* (Japan and China), *acutidens* (Loo Choo), *cupulifer* (Bonin Islands), *latus* (Hong Kong), and *granulosus* (Hong Kong). All these names are nomenclaturally available as they were all named before 1960 (ICZN, 1999) and were accompanied by descriptions, figures and/or comparisons. Bonin Islands are today known as the Ogasawara Islands, while Loo Choo is the old name for the Ryukyu Islands (particularly, Okinawa).

With regard to “*Chlorodius exaratus* var. *typicus*”, Castro et al. (2004: 39) discussed the use of the epithet “*typica*” for various species of Trapeziidae, either used as a form or variety. It was a common practice in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries for taxonomists to name the typical or nominate form or variety (nomenclaturally equivalent to the modern subspecies) as “*forma typica*”. However, the Code (1999) allows for all forms and varieties to be recognised as available names equivalent to species if they were described before 1960. The use of “var. *typicus*” for one of Stimpson’s forms therefore makes this an available name. Ortmann (1893) first used the name *Xantho exaratus* var. *typica*, so this name has priority over *Chlorodius exaratus* var. *typicus* Stimpson, 1907. Ortmann’s (1893) “var. *typica*” was based on material he had from the West Pacific region, with only one male specimen from the Red Sea; and he also listed De Haan’s (1835) two taxa under his synonymy for the form. Ortmann’s (1893) var. *typica* can therefore be referred to either *L. exaratus* s. str. or *L. affinis*, depending on which specimen is selected (see later).

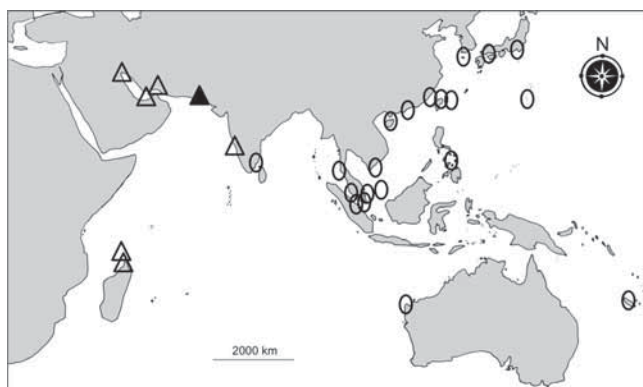


Fig. 6. Distribution map of material examined for this study. Legend: triangles = *Leptodius exaratus* (black triangle, locality of neotype); ovals = *Leptodius affinis* (type locality: Japan).

Stimpson (1907) compared his varieties to three other species described by De Haan from Japan: *Cancer (Xantho) affinis* (cf. De Haan, 1835: 48, pl. 13, fig. 6), *Cancer (Xantho) distinguendus* (cf. De Haan, 1835: 48, pl. 13, fig. 7), and *Cancer (Xantho) lividus* (cf. De Haan, 1835: 48, pl. 13, fig. 8). *Cancer distinguendus* is now in the genus *Macromedaeus* Ward, 1942. *Cancer (Xantho) lividus* De Haan, 1835, however, is a junior homonym of *Cancer lividus* Latreille, in Milbert, 1812 (presently in the genus *Juxtaxanthias* Ward, 1942), although these species are clearly different taxa. The name *Cancer (Xantho) affinis* De Haan, 1835, on the other hand, seems to have been largely forgotten. Stimpson (1907), however, did not make any firm decisions on the validity of *Cancer affinis* nor of *Cancer lividus*. Ortmann (1893) considered both *Cancer (Xantho) affinis* De Haan, 1835, and *Cancer (Xantho) lividus* De Haan, 1835, as junior subjective synonyms of *Xantho exaratus* var. *typica*. This has been followed by other authors, e.g., Buitendijk (1960), as *Xantho exaratus*, and Barnard (1950), as *Xantho (Leptodius) hydrophilus*. Likewise, Yamaguchi & Baba (1993: 446, 447, fig. 164A, B), who examined De Haan’s material in Leiden and figured the types, regarded both names as junior subjective synonyms of *Leptodius exaratus*, but without comment. Interestingly, both of De Haan’s names have generally been missed in most treatments of Japanese and East Asian taxa (e.g., Sakai, 1965, 1976; Dai et al., 1986; Dai & Yang, 1991; Ng et al. 2001, 2008).

Serène (1962) added to the confusion when he described a new species from Vietnam, *L. nigromaculatus*. He noted that his new species was different from typical *L. exaratus* from the Indian Ocean, but that it was very close to the variety “*pictus*” of Stimpson (1907) (Serène, 1962: 259). In fact, he commented:

“Stimpson (1907) définit 9 variétés d’*exaratus*, réduisant *sanguineus* au rang de variété d’*exaratus*; s’il laisse *gracilis* comme espèce distincte, il écrit « qu’elle n’est peut-être qu’une variété lisse de *exaratus* ». Il pense toutefois que de futures observations permettront sans doute « la reconnaissance de caractères constants définissant des espèces vraies dans ce qu’il ne considère encore que comme des variétés » Il est possible que *waiakuanus* Rathbun, 1906 soit la var. *latus* Stimpson; *australis* Ward, 1939, la var. *rugosus* Stimpson; *leptodon* Forest et Guinot, 1961, la var. *acutidens* ou la var. *cupulifer* Stimpson, *nigromaculatus* nov. sp., la var. *pictus* Stimpson.” (Serène, 1962: 260)

However, from his discussion, it is clear that he believed that none of the new names proposed by Stimpson could be used. He also did not discuss the validity of De Haan’s two names noted above. He probably took the advice of Barnard (1950) who remarked about *L. exaratus* (as *Xantho (Leptodius) hydrophilus*):

“Stimpson (1907, Smiths. Misc. Coll., xlix, pp. 52 sqq., pl. 6, figs. 3, 4, 6–9) discusses this species and several varieties, some of which have a “supplementary tooth” on the anterolateral margin, making 5 in all (as in *quinquedentatus*). At that time the importance of male 1st gonopod as a specific

character was not realized, so that it is not only impossible to recognize any of his varieties from the descriptions, but it is also quite probable that several distinct species are confused.” (Barnard, 1950: 225)

While this is true and Barnard’s observations are valid, the fact remains that all of the new names proposed by Stimpson (1907) are actually nomenclaturally available. And because of their date, some may be senior synonyms of *Leptodius* species names established since 1907, including *L. nigromaculatus* Serène, 1962. The problem is compounded by the fact that none of Stimpson’s specimens are extant (see Evans, 1967; Deiss & Manning, 1981; Manning, 1993; Manning & Reed, 2006). The only solution is to examine a good series of specimens in the area where Stimpson (1907) obtained his specimens (East Asia), find topotypes when possible, match them against his descriptions and figures, and designate the appropriate neotypes to fix the identity of these names.

The present authors have gathered a large collection of “*Leptodius exaratus*” from China, Japan, Korea, Taiwan, the Philippines, Singapore and adjacent areas, and they believe that all of Stimpson’s nominal varieties can be identified from this collection. The “supplementary” anterolateral tooth mentioned by Stimpson (1907) is, in fact, a reliable character and not as variable as he had indicated. Two varieties have this feature: var. *rugosus* and var. *latus*, both of which are allied to, or synonymous with what is currently known as *L. sanguineus* (H. Milne Edwards, 1834) and/or *L. philippinensis* Ward, 1941. Six varieties have four anterolateral teeth: var. *pictus*, var. *latifrons*, var. *typicus*, var. *acutidens*, var. *cupulifer*, and var. *granulosus*. On the basis of Stimpson’s (1907) description and figure, var. *granulosus*, is likely to be synonymous or very close to *Macromedaeus distinguendus*. Two taxa, var. *acutidens* and var. *cupulifer* may be synonymous, and because both have a strongly projecting front with acuminate anterolateral teeth, they are unlikely to be *L. exaratus* or *L. affinis* as presently defined. From Stimpson’s description and figures, these two taxa are closely allied or synonymous with *L. davaoensis* Ward, 1941, and/or *L. leptodon* Forest & Guinot, 1961 (see Takeda, 1976). The two latter species were regarded as synonyms by Takeda (1980), but comparisons by Mendoza (2010) suggest they may be separate taxa. A third Stimpson variety, *latifrons*, is probably also synonymous with var. *acutidens* and var. *cupulifer*. According to his description (no figure was provided), Stimpson’s (1907) var. *latifrons* differs from var. *typicus* and var. *pictus* only in its slightly wider front and angular carapace anterolateral teeth and little else. His description and comments, however, are far too brief to ascertain much. The present authors are of the opinion that var. *latifrons* is unlikely to be var. *typicus* nor var. *pictus* because the most common form present in Okinawa (on the basis of the extensive material collected and examined) is actually not *L. affinis* which has yet to be collected from the island. In terms of the carapace and G1 morphology, these Okinawan specimens are much closer to his var. *acutidens*/var. *cupulifer*, as well as *L. davaoensis*/*L. leptodon*. All the other specimens examined share the same carapace features as well as the same G1 structure and we believe they are synonymous.

The remaining two varieties, var. *pictus* and var. *typicus* cannot be effectively separated. Stimpson (1907; as well as Ortmann, 1893) recognised a typical common form in the Chinese and Japanese seas and other parts of the Pacific Ocean, and this variety agrees very well with what is recognised here as *Leptodius affinis*. As discussed above, Serène (1962) had already commented that his species, *L. nigromaculatus*, is very close to var. *pictus*, sharing a smooth posterior carapace region, broad and non-projecting triangular anterolateral teeth and the yellowish colour of the carapace. As such, the oldest names available for this entire group should be *Cancer (Xantho) affinis* De Haan, 1835, and *Cancer (Xantho) lividus* De Haan, 1835. Both names are regarded by the current Code as simultaneously published as they appeared in the same publication, and seniority must be chosen by First Reviser action. We hereby select *Cancer (Xantho) affinis* De Haan, 1835, as having priority over *Cancer (Xantho) lividus* De Haan, 1835, whenever the two names are regarded as synonyms. This is mainly because *Cancer (Xantho) lividus* De Haan, 1835, may be confused with the unrelated *Cancer lividus* Latreille, in Milbert, 1812, which is now in the genus *Juxtaxanthias*.

Four names: *Xantho exaratus* var. *typica* Ortmann, 1893, *Chlorodius exaratus* var. *typicus* Stimpson, 1907, *Chlorodius exaratus* var. *pictus* Stimpson, 1907, and *Leptodius nigromaculatus* Serène, 1962, now become junior subjective synonyms of *Cancer (Xantho) affinis* De Haan, 1835. To stabilise the taxonomy of this species, it is necessary to select a lectotype and neotypes for Ortmann’s (1893) and Stimpson’s (1907) varieties, respectively. The lectotype of *Cancer (Xantho) affinis* (a female, RMNH D 44644) is hereby selected as also the simultaneous lectotype of *Xantho exaratus* var. *typica* Ortmann, 1893, by reason of this De Haan name being included in the synonymy of Ortmann’s “var. *typica*”, and in accordance with Article 72.4 of the Code (1999) concerning type series. Both names now become objective synonyms. Ortmann (1893), in listing down various names in his synonymy for *Xantho exaratus* var. *typica* (e.g., *Chlorodius exaratus* H. Milne Edwards, *Cancer (Xantho) affinis* De Haan, *Cancer (Xantho) lividus* De Haan, etc.), effectively used the type material for these species as syntypes of his “var. *typica*” by indication, therefore making them available for selection as lectotypes by subsequent workers. The specimens examined by Ortmann from East Asia (Ortmann, 1893: 446) are now paralectotypes. The lectotype of *C. (X.) affinis* is also selected as the simultaneous neotype of *Chlorodius exaratus* var. *typicus* Stimpson, 1907, and *Chlorodius exaratus* var. *pictus* Stimpson, 1907, in accordance with the Code (1999). While Stimpson (1907) recognised several varieties, the present authors find that these two varieties, at least, are conspecific due to the lack of differences in the morphology (especially that of the G1) of topotypic specimens examined in this study. Since the type localities of *Cancer (Xantho) affinis* De Haan, *Chlorodius exaratus* var. *typicus* Stimpson, and *Chlorodius exaratus* var. *pictus* can be considered to be generally the same (all within the vicinity of mainland Japan), they are unlikely to be different species, hence one name-bearing type is sufficient for the three names. Selecting separate neotypes for Stimpson’s varieties does not serve the cause

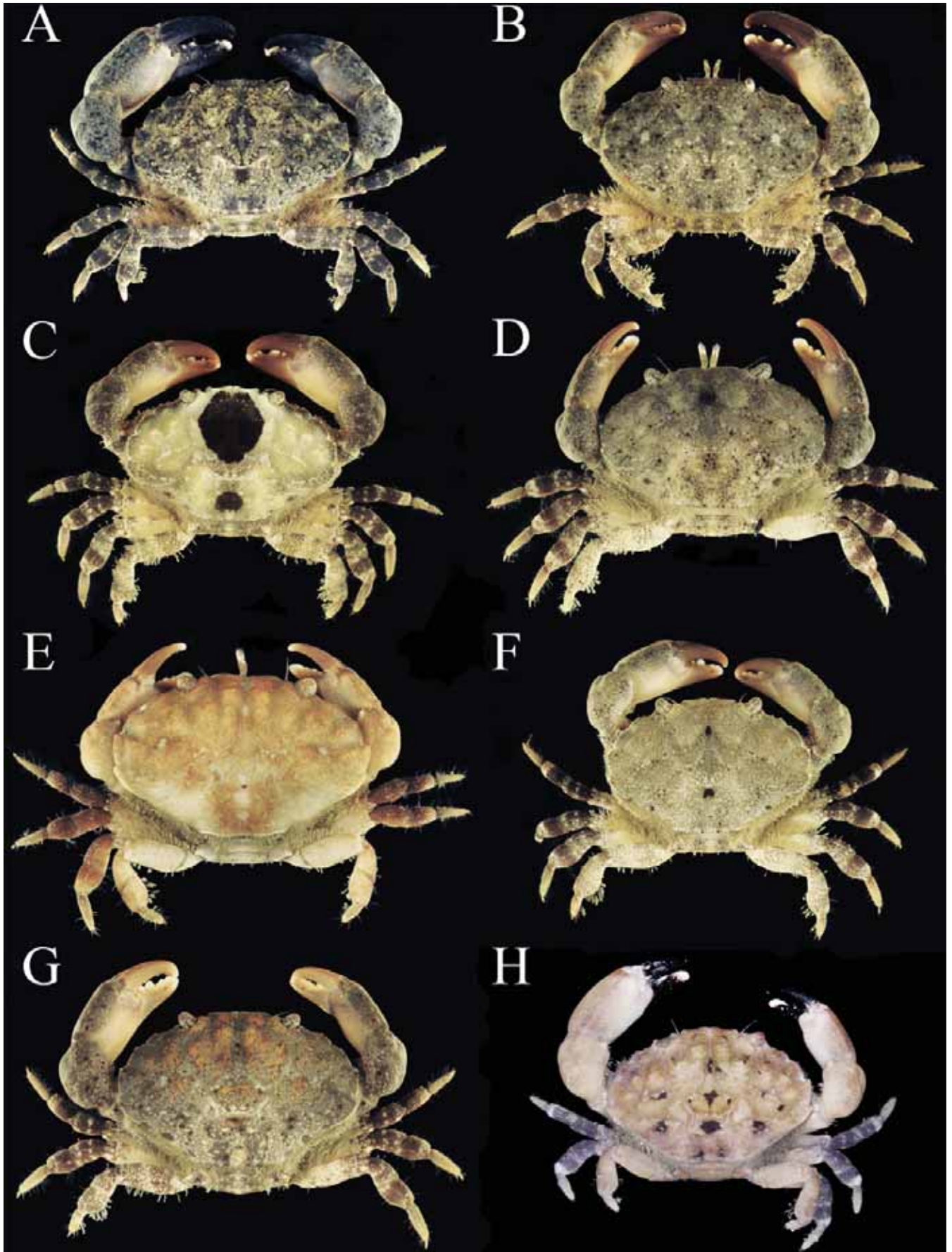


Fig. 7. Variation in live colouration of male *Leptodius affinis* (De Haan, 1835). A–G, Changi Beach Park, Singapore, (ZRC 2012.1232), H, Espiritu Santo, Vanuatu (ZRC 2012.1233). A, 31.0 × 20.2 mm; B, 26.8 × 16.9; C, 24.0 × 15.1 mm; D, 12.5 × 7.8 mm; E, 12.0 × 7.6 mm; F, 18.6 × 12.3 mm; G, 22 × 14.2 mm. H, 17.9 × 11.8 mm.

of nomenclatural stability for this species, especially since the taxonomy has been rather confused. While the discovery of cryptic species within this group in the future cannot be discounted, the best available evidence does not suggest this. As discussed, since Stimpson's taxa are almost impossible to ascertain with confidence, it is better to objectively fix their identities through designation of appropriate neotypes and move on with their taxonomy. As for Stimpson's (1907) remaining varieties, each of those have been matched by the present authors with available topotypic material with the help of his descriptions and illustrations, but these will be discussed in a larger separate work dealing with a complete revision of *Leptodius*.

The colour of what has been called "*Leptodius exaratus*" in East Asia is extremely variable and is not a reliable distinguishing character (see Todd et al., 2009). The large series of specimens examined for this study demonstrates this (Fig.7).

Finally, it is important to state that the taxonomy of the genus *Leptodius* is far from satisfactorily resolved (see Ng et al., 2008). In addition to Stimpson's varieties, several names, viz. *Chlorodius hombronii* Lucas, in Lucas & Jacquinot, 1853, *Leptodius efferens* Rathbun, 1906, *Leptodius waialuanus* Rathbun, 1906 [the holotype of this species has been examined by two of the authors (JCEM, PKLN), it actually belongs in the genus *Etisus* H. Milne Edwards, 1834], *Leptodius planus* Ward, 1934, *Leptodius australis* Ward, 1936, and the types thereof (if extant) need to be re-examined in greater detail. This will be part of a more substantial work, now in progress, which will revise the entire genus.

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