

A revision of the swimming crabs of the Indo – West Pacific
Xiphonectes hastatooides (Fabricius, 1798) species complex
(Crustacea: Brachyura: Portunidae)

Ревизия комплекса видов крабов-плавунцов *Xiphonectes*
hastatooides (Fabricius, 1798) (Crustacea: Brachyura: Portunidae)
из Индо-Вестпаифики

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КЛЮЧЕВЫЕ СЛОВА: Portunidae, *Xiphonectes hastatooides*, видовой комплекс, систематика, ревизия, новые виды, синонимии.

ABSTRACT. The *Xiphonectes hastatooides* (Fabricius, 1798) species complex (Brachyura: Portunidae) is revised from a study of the types. Members of this species group are defined by the structures of the anterolateral margin, posteroexternal margin of the carapace, shape of the third maxilliped merus, as well as armatures of the carpus and merus of the cheliped, and carpus of the swimming leg. Of the seven currently known species four are recognised here: *X. hastatooides* s.str., *X. arabicus* (Nobili, 1905), *X. unidens* (Laurie, 1906), and *X. pseudohastatooides* (Yang et Tang, 2006). Three species, *Neptunus (Hellenus) tweediei* Shen, 1937, *Portunus trilobatus* Stephenson, 1972, and *P. dayawanensis* Chen, 1986, are synonymised under *X. unidens*, a species previously incorrectly synonymised under *X. hastatooides*. In addition, two new species are described, *X. vassilyi* sp.n. and *X. subtilis* sp.n., and can be distinguished from *X. hastatooides* s.str. by the structure of the median frontal teeth, posteroexternal spine on the carapace and structure of the male first gonopod.

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РЕЗЮМЕ. Видовой комплекс *Xiphonectes hastatooides* (Fabricius, 1798) (Brachyura: Portunidae) пересмотрен на основе изучения типового материала. Представители этой группы видов характеризуются структурой переднебокового края, заднего наружного края панциря, формой третьего меруса

верхней челюсти, а также вооружением карпуса и меруса хелипеда и карпуса плавательных ног. В настоящее время признаны четыре вида рода *Xiphonectes*: *X. hastatooides* s.str., *X. arabicus* (Nobili, 1905), *X. unidens* (Laurie, 1906) и *X. pseudohastatooides* (Yang et Tang, 2006). Три вида, *Neptunus (Hellenus) tweediei* Shen, 1937, *Portunus trilobatus* Stephenson, 1972, и *P. dayawanensis* Chen, 1986, синонимизированы с *X. unidens*, видом, ранее неправильно синонимизированным с *X. hastatooides*. Кроме того, описаны два новых вида, *X. vassilyi* sp.n. и *X. subtilis* sp.n., и их можно отличить от *X. hastatooides* s.str. по строению средних передних зубов, задне-наружному позвоночнику на панцире и строению первого гонопода самца.

Introduction

Even with the substantial systematic revisions proposed by Schubart & Reuschel [2009], Spiridonov *et al.* [2014], Evans [2018] and Spiridonov [2020], the Portunoidea is still considered a heterogeneous superfamily. In particular, the subgeneric system widely used for *Portunus* Weber, 1795, has been questioned. In their world checklist, Ng *et al.* [2008] followed this convention and recognised five subgenera of *Portunus*: *P. (Achelous)* De Haan, 1833; *P. (Lupocycloporus)* Alcock, 1899; *P. (Monomia)* Gistel, 1848; *P. (Portunus)* Weber, 1795; and *P. (Xiphonectes)* A. Milne-Edwards, 1873. In a genetic study of American portunids, Mantelatto *et al.* [2009] argued that *P. (Achelous)* should be recognised as a distinct genus (see also Mantelatto *et al.* [2018]). Following on this, as well as

the observations in Mantelatto *et al.* [2007], Karasawa *et al.* [2008], Schubart & Reuschel [2009]; Chertoprud *et al.* [2012b] argued that the subgeneric system used, e.g., *P. (Monomia)*, was not practical, and gave *Monomia* generic status. Spiridonov *et al.* [2014], in their broad overview of the Portunoidea, treated all the subgenera as full genera, and transferred *Lupocycloporus* from the Portuninae to the Lupocyclinae Alcock, 1899. Koch & Đuriš [2018, 2019], Koch *et al.* [2015a, b, 2019] and Windsor *et al.* [2019] also treat *Monomia* and *Xiphonectes* as distinct genera. The various *Portunus* subgenera recognised are certainly relatively distinct and giving them genera status, at least based on their respective type species, does not pose serious problems. The challenge, however, will be to revise the constituent species assigned to *Achelous*, *Monomia*, *Portunus* and *Xiphonectes*, and to ascertain their intrageneric relationships.

Among *Xiphonectes* taxa, one of the more often reported species is *X. hastatooides* (Fabricius, 1798), a relatively small-sized (adult carapace width less than 50 mm) taxon typically characterised by having a dark black spot on the dactylus of the swimming leg. It has been widely reported from the Indo-West Pacific region from South Africa to New Caledonia and Japan. The present study finds that *X. hastatooides* as presently recognised contains three different species, two of which are here recognised as new. *Neptunus (Hellenus) hastatooides unidens* Laurie, 1906, is also shown to be distinct from *X. hastatooides* and not a junior synonym, but is instead, the senior subjective synonym of *X. tweediei* (Shen, 1937). In addition, *Portunus trilobatus* Stephenson, 1972, and *P. dayawanensis* Chen, 1986, are also junior synonyms of *N. unidens*. The redefinition of *X. hastatooides*, diagnoses of the two new species and other members of the species in the group (*X. arabicus*, *X. pseudohastatooides*, *X. trilobatus* and *X. unidens*) form the basis of the present paper.

Material and methods

Specimens examined are deposited in The Natural History Museum (NHM), London, U.K.; Queensland Museum (QM), Brisbane, Australia; Zoological Museum, University of Copenhagen (ZMUC), Copenhagen, Denmark; Zoological Museum of Kiel University (ZMK), Kiel, Germany; The Marine Biological Museum of the Chinese Academy of Sciences (MBMCAS) in the Institute of Oceanology, Qingdao, China; Ryukyu University Museum, Fujukan (RUMF), Okinawa, Japan; and Zoological Reference Collection (ZRC) of the Lee Kong Chian Natural History Museum, National University of Singapore. The abbreviation SRFRS is used for the now Singapore Regional Fisheries Research Station.

Measurements provided (in millimeters) are of the carapace width and length, respectively. In the occasional instance where the last anterolateral tooth is broken, only the carapace length is given. The abbreviations CW, CL, coll., G1, G2, ovig., fms, s.lat., s.str., stn and juv. are used for carapace width, carapace length, collected, male first gonopod, male second gonopod, ovigerous, fathoms, sensu lato,

sensu stricto, station and juvenile, respectively. The term swimming leg is used for the last leg or pereopod 5.

The shape of the G1 is a critical character, and as such, photographs of these structures are standardised: they are detached at the base, positioned to ensure the basal and distal parts are on the same plane and parallel with the camera/microscope lens surface. One key character used in this study is the form of the junction between the posterolateral margin and posterior carapace margin. In all the species in the present group, this junction forms a distinct right angle or is armed with a spine. For ease of discussion, this character is here referred to as the posteroexternal carapace angle.

The recognised species in the *X. hastatooides* species group are superficially similar in morphology, so only diagnostic characters will be given to avoid repetition. A complete description is only provided for the first species, *X. hastatooides* s.str. When various species are listed, names will be arranged by the year the taxon was described. Many previous workers have recorded *X. hastatooides* from Indo-West Pacific region but not all of them provided good descriptions and/or figures. Where material could not be re-examined, we have attempted to attribute literature records based on the descriptions, figures and/or geography. Where the identification of *Xiphonectes* taxa cannot be clarified, these specimens are referred to an incertae sedis section and discussed in full.

Taxonomy

Superfamily Portunoidea Rafinesque, 1815

Family Portunidae Rafinesque, 1815

Genus *Xiphonectes* A. Milne-Edwards, 1873

Xiphonectes A. Milne-Edwards, 1873.

TYPE SPECIES. *Amphitrite vigilans* Dana, 1852.

REMARKS. *Xiphonectes* A. Milne-Edwards, 1873, currently contains 34 species and subspecies: *X. aculeatus* Koch et Đuriš, 2019, *X. alcocki* (Nobili, 1906), *X. andersoni* (De Man, 1887), *X. arabicus* (Nobili, 1905) (= *P. (H.) acerbiterrimalis* Stephenson et Rees, 1967), *X. brockii* (De Man, 1887), *X. dayawanensis* (Chen, 1986), *X. gracillimus* (Stimpson, 1858), *X. guinotae* (Stephenson et Rees, 1961), *X. hainanensis* (Chen, 1986), *X. hastatooides* (Fabricius, 1798) (= *P. hastatooides* Weber, 1795), *X. iranjae* (Crosnier, 1962), *X. latibrachium* (Rathbun, 1906), *X. longispinosus* var. *bidens* (Laurie, 1906), *X. l. longimerus* (Spiridonov, 1994), *X. longispinosus longispinosus* (Dana, 1852) (= *A. vigilans* Dana, 1852; *P. (X.) leptocheles* A. Milne-Edwards, 1873), *X. l. obtusidentatus* Miers, 1884, *X. macrophthalmus* (Rathbun, 1906), *X. mariei* (Guinot, 1957), *X. paralatibrachium* (Crosnier, 2002), *X. pseudohastatooides* (Yang et Tang, 2006), *X. pseudotenuipes* (Spiridonov, 1999), *X. pulchricristatus* (Gordon, 1931) (= *Neptunus (H.) alcocki* Gordon, 1930), *X. rugosus* (A. Milne-Edwards, 1861), *X. spiniferus* (Stephenson et Rees, 1967), *X. spinipes* (Miers, 1886), *X. stephensoni* (Moosa, 1981) (= *P. (H.) emarginatus* Stephenson et Campbell, 1959), *X. tenuicaudatus* (Stephenson, 1961), *X. tenuipes* (De Haan, 1835), *X. tridentatus* (Yang, Dai et Song, 1979), *X. trilobatus* (Stephenson, 1972), *X. tuberculosus* (A. Milne-Edwards, 1861), *X. tuerkayi* Spiridonov, 2016, *X. tweediei* (Shen, 1937), and *X. unidens* (Laurie, 1906) (cf. Ng *et al.* [2008]; Koch, Đuriš [2019]). All are characterised by the posteroexternal carapace angle being distinctly angular and/or armed with a spine.

There is one group of species in *Xiphonectes* which is characterised by the dorsal carapace surface only has small granules (not distinct spinules and sharp tubercles); the anterolateral margin has nine distinct teeth of which the last one is the largest; the supraorbital margin is smooth or with a notch (not with a small tooth); the junction between the posterior and posterolateral borders of the carapace is armed with a spine; the anteroexternal angle of the merus of the third maxilliped is strongly produced, curved and arches over the tip of the exopod; the carpus of the cheliped possessing one spine or tooth on the outer margin; the posterior margin of the merus of the cheliped has two distinct spines; the posterior margin of the merus of the swimming leg has several spinules or is serrated (not one prominent spine) and the male pleon is distinctly T-shaped. This is here referred to as the *X. hastatooides* species-group, and six taxa are recognised: *X. hastatooides* Fabricius, 1798, *X. arabicus* (Nobili, 1905) (= *P. (H.) acerbiterminalis* Stephenson et Rees, 1967), *X. unidens* (Laurie, 1906) (= *Portunus tweediei* Shen, 1937; *P. trilobatus* Stephenson, 1972; *P. dayawanensis* Chen, 1986), *X. pseudohastatooides* (Yang et Tang, 2006), *X. vassilyi* sp.n., and *X. subtilis* sp.n. (cf. Laurie [1906]; Shen [1937]; Apel, Spiridonov [1998]; Wong *et al.* [2010]). Two recent studies have clarified the taxonomy of some of these species: *X. hastatooides* and *X. arabicus* were discussed by Apel & Spiridonov [1998], while *X. hastatooides*, *X. dayawanensis* and *X. pseudohastatooides* were studied by Wong *et al.* [2010]. Wong *et al.* [2010] noted that their specimens of “*X. hastatooides*” from Hong Kong and Taiwan were different from the types of the species from India and *X. hastatooides* was a cryptic species complex. The present paper revises the taxonomy of *X. hastatooides* and its allied species.

Xiphonectes hastatooides (Fabricius, 1798) s.str.

Figs 1, 3A, 3E, 4A, 6A.

Portunus hastatooides Fabricius, 1798: 368; Stephenson, Rees, 1967a: 27; Chhappar, 1968: 612; Chhappar, 1969: 612, pl. 2 fig. h; Zarenkov, 1969: 14; Thomas, 1969: 45; Stephenson, 1972a: 136 (part); 1972b: 14 (key), 40; Devi, 1993: 536; Bhadra, 1995: 255; Bhadra, 1998: 410; Deb, 1999: 352; Dev Roy, Nandi, 2007: 176; Kumar *et al.*, 2007: 286; Wong *et al.*, 2010: fig. 3A, B.

Neptunus (Amphitrite) hastatooides — Miers, 1886: 175; De Man, 1895: 557.

Neptunus hastatooides — Henderson, 1893: 368.

Neptunus (Hellenus) hastatooides — Alcock, 1899: 38; Laurie, 1906: 414, fig. 8; Shen, 1937: 107, text-figs 5, 8g, h.

Neptunus (Hellenus) hastooides (sic) — Chopra, 1935: 477, 478, text-fig 4.

Portunus (Xiphonectes) hastatooides — Sethuramalingam, Khan, 1991: pl. 19 fig. 5; Davie, 2002: 468; Dev Roy, Nandi, 2008: 198, 204; 2012: 204; Ng *et al.*, 2008: 152; Dev Roy, 2013: 153, 157; Dev Roy *et al.*, 2017: 1; Dev Roy, Rath, 2017: 96; Naderloo, 2017: 202, fig. 20.22e, fig. 20.39.

Xiphonectes hastatooides — Trivedi *et al.*, 2018: 70.

MATERIAL EXAMINED. Lectotype (here designated): 1♂ (41.7×20.5 mm) (ZMUC), Tranquebar, southeast India. Paralectotypes (here designated): 4♂♂ (35.0×17.0 mm; 38.5×20.0 mm; 32.0×14.0 mm; 39.0×19.0 mm) (ZMUC), 2♂♂ (36.0×19.0 mm; 39.0×17.0 mm) (ZMK), same data as lectotype. Others — **India**: 1♂ (ZRC 2019.0527), Tranquebar port, from fishermen, shallow waters, Tamil Nadu, India, coll. R. Ravinesh, 02.2019; **Peninsular Malaysia**: 13♂♂ (40.6×22.4 mm; 39.6×22.5 mm; 38.2×20.9 mm; 40.2×21.2 mm; 36.1×19.7 mm; 41.2×22.7 mm; 37.7×20.6 mm; 36.1×19.6 mm; 38.4×21.2 mm; 39.6×22.1 mm; 38.4×20.7 mm; 40.8×22 mm; 40.7×20.6 mm), 9♀♀ (38.8×20.5 mm; 36.2×20.1 mm; 35.0×19.7 mm; 34.4×19.0 mm; 34.1×18.8 mm; 35.8×17.9 mm; 36.5×20.4 mm; 38.8×21.1 mm; 32.6×17.0 mm), 8 ovig.♀♀

(38.8×21.0 mm; 37.2×20.1 mm; 36.9×20.0 mm; 36.8×19.4 mm; 35.2×19.5 mm; 33.5×17.9 mm; 32.9×17.7 mm; 38.8×20.7 mm) (ZRC 2000.1396), Penang, Teluk Bahang port, trawler (coastal catch from sea off northwestern Penang), coll. N. Sivasothi & K.L. Yeo, 25.04.2000; 2♂♂ (ZRC 1965.10.21.21–22), in fish trap, Penang, 4–5 fms, coll. M.W.F. Tweedie, 06.1934; 3♂♂, 6♀♀ (all poorly preserved) (ZRC 1985.869–877), Batu Maung, Penang, coll. SRFRS, 1960s; 1♂ (38.9×20.7 mm) (ZRC 2000.1418), southwestern Penang, fishing village at Gertak Sanggul, gill-net, coll. N. Sivasothi & K.L. Yeo, 26.04.2000; 6♂♂, 9♀♀ (ZRC 2021.0432), Johor, Pontian, coll. P.K.L. Ng, 02.1993; 6♂♂, 3♀♀ (ZRC 2021.0437), Johor, Pontian, 31 m, coll. D. Wee, 13.07.1993; **Singapore**: 8♂♂ (largest 40.2×21.6 mm), 3♀♀ (ZRC 1965.10.21.1–10), Siglap, coll. M.W.F. Tweedie, 12.1933, 07.1934; 1♂ (damaged) (ZRC 1985.886), station B50, mud, off Tanjong Rhu, coll. SRFRS, 1960s; 1♀ (soft) (ZRC 1985.864), Bedok, coll. D.S. Johnson, 1960s; 1♀ (soft) (ZRC 1985.885), clean substrate, stn B79, off Tanjong Stapa, 23 fms, coll. SRFRS, 06.1963; 1♂, 1 small♀ (soft) (ZRC 1985.867–868), hard substrate with gorgonians, off Damar Laut, 5–8 fms, coll. SRFRS, 06.1963; 2♂♂ (ZRC 1985.1910–1911), off Changi Point, coll. P.K.L. Ng, 9.05.1982; 1♂ (ZRC 1985.881), mud substrate, station B43, Angler’s Beach, off Changi, coll. SRFRS, 06.1963; 2♂♂, 1♀ (ZRC 1985.887–889), muddy-sandy substrate, off Tanah Merah and Johore Shoal, coll. J.R. Hendrickson, 06.1963; 1♂, 1♀ (ZRC 2021.0429), stn DW27, substrate with *Placuna*, east of Chek Jawa, Pulau Ubin, Singapore, 01°24.927’N 103°59.980’E to 01°25.273’N 103°59.692’E, 9.9–19.1 m, coll. Comprehensive Marine Biodiversity Survey, 18.10.2012; 1 ovig.♀ (ZRC 2021.0430), stn DW28, sand and mud substrate, eastern side of Chek Jawa, Pulau Ubin, 1°25.295’N 103°59.645’E to 1°25.082’N 103°59.774’E, trawl, coll. Comprehensive Marine Biodiversity Survey, 18.10.2012; 1♀ (ZRC 2021.0440), stn T21, off Coney Island, 10–15 m, coll. Comprehensive Marine Biodiversity Survey, 8.03.2012; 1♂, 2 juv.♀♀ (ZRC 1985.878–880), stns B74 and B75, on clean bottom, south of Singapore, coll. SRFRS, 06.1963; 1 juv.♂ (ZRC 1993.7464), Southern Islands, coll. P.K.L. Ng, 03.1985; 1 juv.♂ (ZRC 1993.136), Johor Shoal, coll. P.K.L. Ng, 05.1992; 2♂♂ (ZRC 1985.865–866), Singapore, 18 fms, coll. SRFRS, 11.1955; 1 ovig.♀ (ZRC 1965.10.21.24), off Changi, coll. N. Shark, 21.01.1926; 2 juv.♂♂, 1 juv.♀ (ZRC 1985.882–884), station B49, muddy-sand substratum with *Enhalus*, off Siglap Obelisk, 1–4 fms, coll. SRFRS, 06.1963; 1♂ (ZRC 2000.1180), off Changi, coll. Kah Wee & Siow Koon, 7.06.2000; 5♂♂ (43.7×24.3 mm; 41.9×23.4 mm; 45.9×24.4 mm; 43.0×23.1 mm; 41.5×22.3 mm), 2 ovig.♀♀ (44.8×23.0 mm; 39.7×20.2 mm) (ZRC 1984.349–362), South China Sea near Horsburgh Lighthouse, coll. H. Huat, 26.11.1982 – 15.12.1982; 1♂ (ZRC 1984.6390), South China Sea near Horsburgh Lighthouse, coll. H. Huat, 28.08.1983; **Indonesia**: 2 juv.♂♂ (ZRC 1999.0293), Pu Maoi, Pulau Bintan, Riau Islands, coll. P.K.L. Ng *et al.*, 07.1995; **Thailand**: 1♀ (31.9×16.3 mm) (ZRC 2000.0843), Phuket, Pichai port (from Andaman Sea), coll. P.K.L. Ng *et al.*, 3–6.05.2000; 10♂♂ (44.1×22.4 mm; 43.8×23.5 mm; 44.5×23.6 mm; 46.5×24.2 mm; 41.9×22.9 mm); 7♀♀ (36×18.7 mm; 35.6×18.7 mm; 33.5×17.6 mm; 31.9×16.2 mm; 36.5×18.6 mm; 32.8×16.9 mm; 25.8×13.2 mm), 2 ovig.♀♀ (34.0×17.1 mm; 31.4×15.3 mm) (ZRC 2000.0780), Phuket, Pichai port (from Andaman Sea), coll. N.K. Ng et K.L. Yeo *et al.*, 17–20.01.2000; 2♂♂, 2♀♀ (ZRC 1998.1128), Phuket, Pichai port (from Andaman Sea), coll. P. Chaitiamvong *et al.*, 12.1998; 1♂, 2 ovig.♀♀ (ZRC 1999.0217), Phuket, Pichai port (from Andaman Sea), coll. H.H. Tan, 04.1999; 5♂♂, 3♀♀ (ZRC 1992.10332–10339), Pattaya port, from trawlers, coll. P.K.L. Ng & L.B. Holthuis, 25.12.1991; 1♂ (ZRC 1999.0425), Songkhla port, Thailand, coll. H.H. Tan, 27.10.1998; 2♀♀ (ZRC 1998.1169), Angsila port, Chonburi Province, coll. P.K.L. Ng, 29.09.1998; 3♂♂ (2 with rhizocephalan), 2♀♀, 1 ovig.♀ (ZRC 2021.0438), Si Racha port, Chonburi Province, 20 m, coll. P.K.L. Ng, 22.02.2000; **Cambodia**: 1♂ (ZRC 2021.0378), Tropaing Sangke commercial fishery, 10°34’7.01”N 104°14’33.21”E, coll. D. Yeo & T. Naruse, 27.12.2010; **Vietnam**: 1♂ (ZRC 2018.1280), Phu Quoc Island, Duong Dong market, 10°13.249’N 103°57.531’E, coll. D. Yeo *et al.*, 30.11.2010.



Fig. 1. *Xiphonectes hastatoides* (Fabricius, 1798), lectotype ♂ (41.7×20.5 mm) (ZMUC), India: A — overall habitus; B — thoracic sternum and pleon.

Рис. 1. *Xiphonectes hastatoides* (Fabricius, 1798), лектотип ♂ (41,7×20,5 мм) (ZMUC), Индия: А — общий вид; Б — грудные стерниты и плеон.

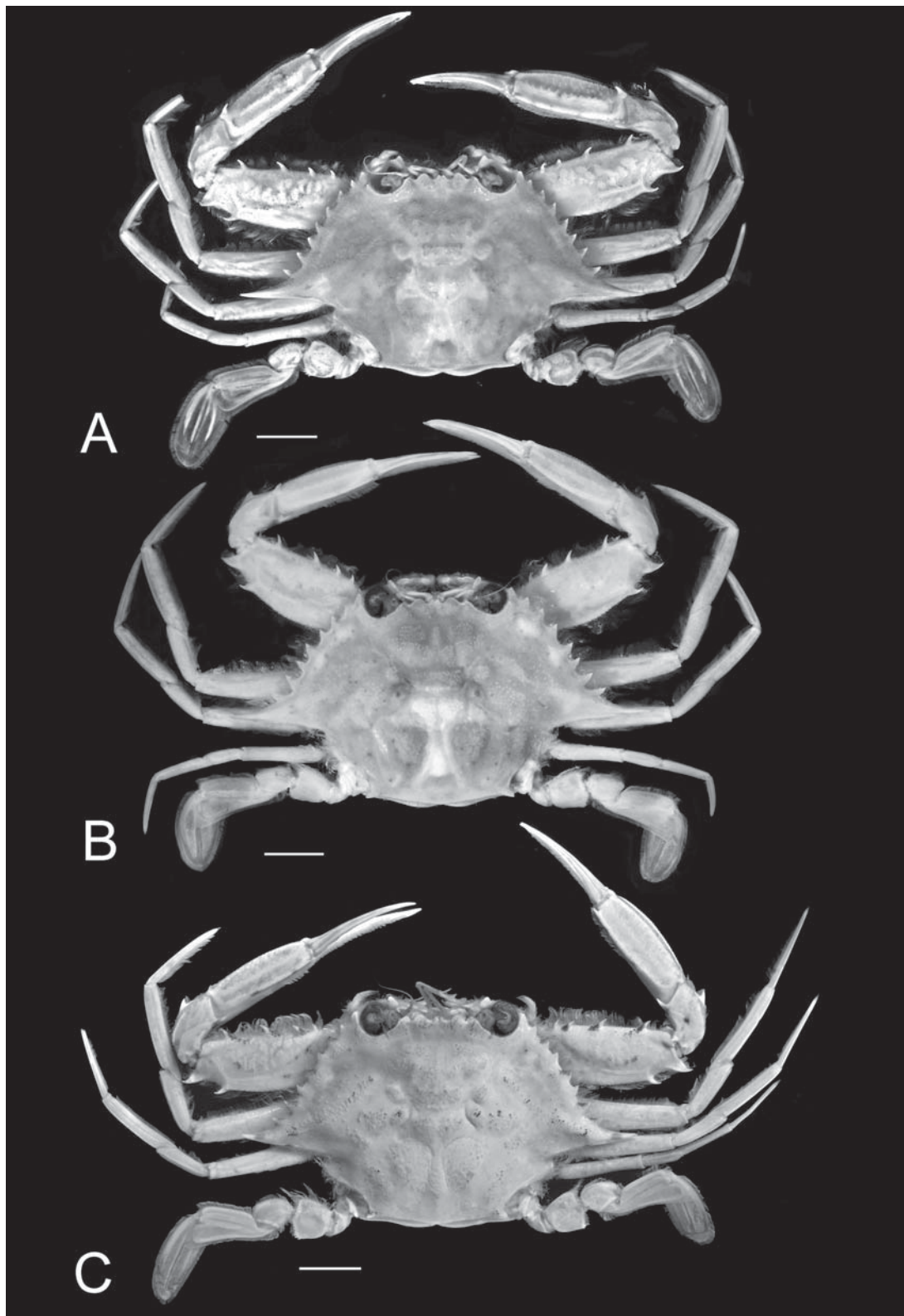


Fig. 2. Overall habitus: A — *Xiphonectes vassilyi* sp.n., holotype ♂ (33.4×16.0 mm) (ZRC 2009.0888), South Africa; B — *X. subtilis* sp.n., holotype ♂ (35.1×17.3 mm) (ZRC 2003.0527), Indonesia; C — *X. subtilis* sp.n., ♂ (32.0×16.7 mm) (ZRC 1995.629), Taiwan. Scales = 5.0 mm.

Рис. 2. Общий вид: А — *Xiphonectes vassilyi* sp.n., голотип ♂ (33,4×16,0 мм) (ZRC 2009.0888), Южная Африка; В — *X. subtilis* sp.n., голотип ♂ (35,1×17,3 мм) (ZRC 2003.0527), Индонезия; С — *X. subtilis* sp.n., ♂ (32,0×16,7 мм) (ZRC 1995.629), Тайвань. Масштаб 5.0 мм.

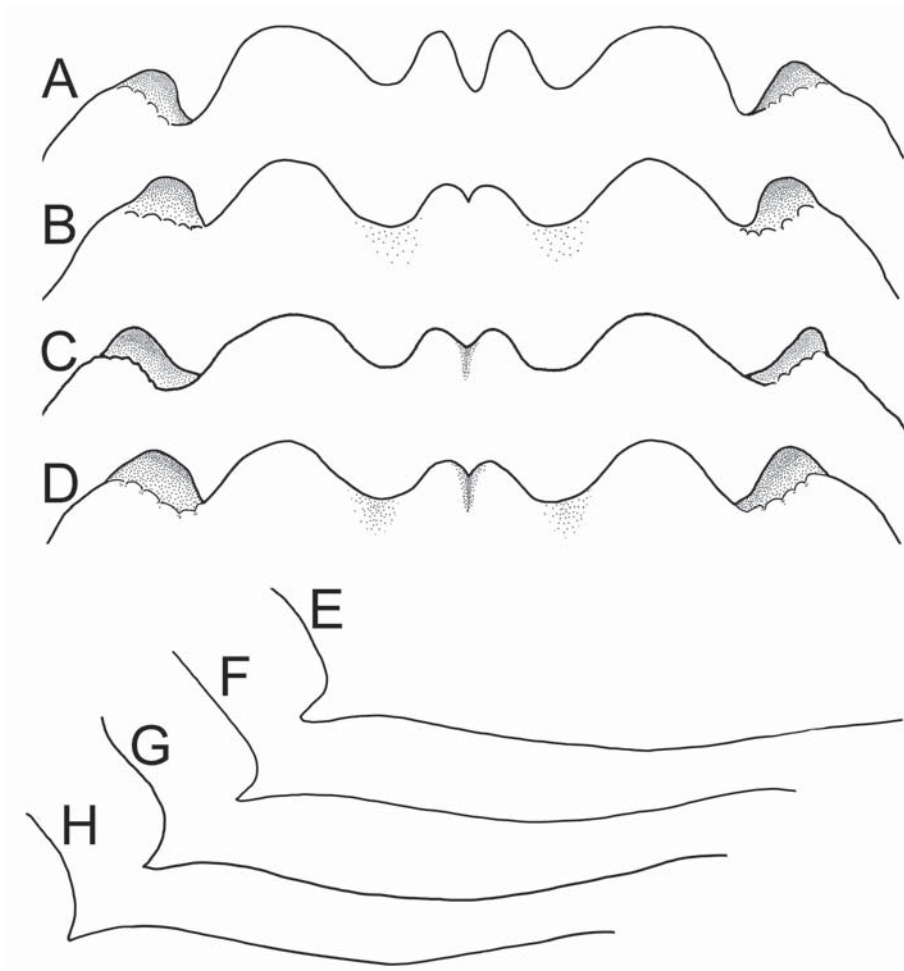


Fig. 3. Dorsal view of frontal margin (A–D), dorsal view of posterior carapace margin and posteroexternal carapace angle (E–H): A, E — *Xiphonectes hastatoides* (Fabricius, 1798), s.str., lectotype ♂ (41.7×20.5 mm) (ZMUC), India; B, F — *X. vassilyi* sp.n., holotype ♂ (33.4×16.0 mm) (ZRC 2009.0888), South Africa; C, G — *X. subtilis* sp.n., holotype ♂ (35.1×17.3 mm) (ZRC 2003.0527), Indonesia; D, H — *X. subtilis* sp.n., ♂ (32.0×16.7 mm) (ZRC 1995.629), Taiwan.

Рис. 3. Дорсальный вид лобного края (A–D), дорсальный вид заднего края и заднего наружного угла карапакса (E–H): A, E — *Xiphonectes hastatoides* (Fabricius, 1798) s.str., лектотип ♂ (41,7×20,5 мм) (ZMUC), Индия; B, F — *X. vassilyi* sp.n., голотип ♂ (33,4×16,0 мм) (ZRC 2009.0888), Южная Африка; C, G — *X. subtilis* sp.n., голотип ♂ (35,1×17,3 мм) (ZRC 2003.0527), Индонезия; D, H — *X. subtilis* sp.n., ♂ (32,0×16,7 мм) (ZRC 1995.629), Тайвань.

DIAGNOSIS. Small-sized species, largest specimen 46.5 mm in carapace width (ZRC 2000.0780). Dorsal surface of carapace covered with small rounded granules, scattered short pubescence. Frontal margin with 4 lobes, median pair acute, subequal to submedian pair but relatively narrower; separated by deep V-shaped notch (Fig. 3A). Anterolateral margin gently convex, with 9 teeth, last tooth longest, spini-form (Fig. 1A). Posterior carapace margin appears straight in posterior view (Fig. 4A); posteroexternal carapace angle with spine directed obliquely laterally, usually directed laterally, rarely curving upwards (Figs 3E, 4A). Tip of dactylus of swimming leg with prominent dark spot. G1 short, stout, tapering, strongly curved at about 2/3 length from basal part, forming ca. 90° angle (Fig. 6A).

DESCRIPTION. Dorsal surface of carapace slightly pubescent. Regions moderately well defined; gastric, cardiac, lateral, and median postcardiac regions elevated, separated by distinct grooves, with rounded granules (Fig. 1A). Front with 4 teeth; median teeth quite acute, tip rounded, as prom-

inent as lateral teeth, separated by deep V-shaped notch; lateral pair distinctly broader, rounded (Fig. 3A). Supraorbital margin with 2 fissures.

Anterolateral margin gently convex, with 9 teeth, increasingly more acute from first to last; last tooth longest, sharpest, directed laterally; in smaller specimens, ratio of length of last anterolateral tooth to body width larger, becoming relatively shorter in large specimens. In dorsal view, posterior margin of carapace gently convex posteriorly, appears almost straight or gently convex from posterior view; posteroexternal carapace angle produced to form spine, usually directed obliquely laterally, rarely curved upwards (Figs 1A, 3E, 4A); spine varies from blunt to acute. Antero-external angle of merus of third maxilliped strongly produced laterally.

Chelipeds slender, palm slightly less massive than arm. Merus with 4 spines on anterior border, 2 long sharp spines on posterodistal end. Upper surface of carpus with granulated carinae, with 2 spines and 2 beaded ridges. Manus slen-

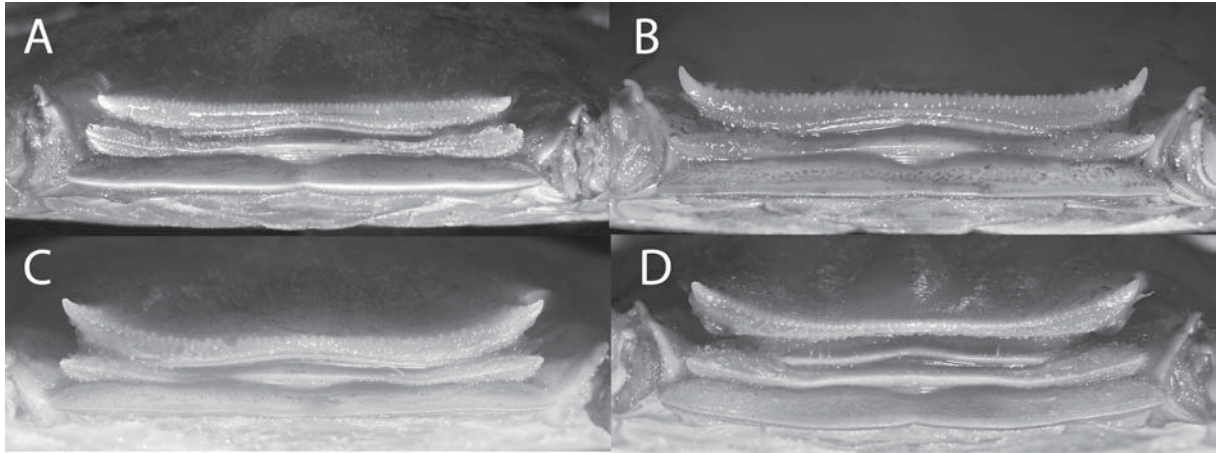


Fig 4. Rear view of posterior border of carapace: A — *Xiphonectes hastatooides* (Fabricius, 1798) s.str. (40.6×22.4 mm) (ZRC 2000.1396), India; B — *X. vassilyi* sp.n., holotype ♂ (33.4×16.0 mm) (ZRC 2009.0888), South Africa; C — *X. subtilis* sp.n., holotype ♂ (35.1×17.3 mm) (ZRC 2003.0527), Indonesia; D — *X. subtilis* sp.n., ♂ (32.0×16.7 mm) (1995.629), Taiwan.

Рис. 4. Вид сзади задней границы карапакса: А — *Xiphonectes hastatooides* (Fabricius, 1798) s.str. (40,6×22,4 мм) (ZRC 2000.1396), Индия; В — *X. vassilyi* sp.n., голотип ♂ (33,4×16,0 мм) (ZRC 2009.0888), Южная Африка; С — *X. subtilis* sp.n., голотип ♂ (35,1×17,3 мм) (ZRC 2003.0527), Индонезия; D — *X. subtilis* sp.n., ♂ (32,0×16,7 мм) (1995.629), Тайвань.

der, upper surface with 3 low granulated carinae, with only inner one terminating in spine. Outer surface of hand with 1 well-developed carina. Fingers with inner margins dentate, teeth interlocking when closed.

Swimming leg with short merus, posterodistal border serrated. Remaining segments unarmed, bearing only setae. Distal portion of dactylus with a dark spot.

Thoracic sternum almost flat; anterior sternites (sternites 1–4) of large males with several transverse rows of larger granules, granules relatively smaller in females and juvenile specimens. Male pleon inverted T-shape; somite 6 and telson twice as long as broad (Fig. 1B).

G1 short, stout, tapering, strongly curved at about two-thirds from basal part, forming ca. 90° angle, tip directed laterally (Fig. 6A). G2 short.

REMARKS. Fabricius [1798] described the species from an unspecified number of specimens from Tranquebar, south-east India (I.K. Daldorff collection), but he did not designate any types. In ZMUC and ZMK are seven specimens, all of which are syntypes. The best preserved specimen, a male measuring 41.7 by 20.5 mm from the ZMUC is here selected as the lectotype. The remaining six male specimens are paralectotypes (35.0×17.0 mm; 38.5×20.0 mm; 32.0×14.0 mm; 39.0×19.0 mm; 36.0×19.0 mm; 39.0×17.0 mm).

Xiphonectes hastatooides s.str. can be distinguished from the two new species described here in having the median frontal teeth acute and as long as the submedian ones, and in having the spine at the posteroexternal carapace angle straighter and not prominently curved upwards (Figs 1A, 3A, 4A). It also has the proportionately stoutest G1 of the three species with the distal slender part curving at almost right angles and the tip directed laterally (Fig. 6A). All the specimens examined, including the type series, also have a prominent dark spot on the swimming dactylus. *Xiphonectes vassilyi* sp.n. from South Africa is easily distinguished from *X. subtilis* sp.n. in having the spine at the posteroexternal angle of the carapace prominently curving upwards (Fig. 4B), its G1 is more relatively more slender and gently curved (Fig. 6B), and its swimming dactylus is not pigmented. *Xiphonectes subtilis* sp.n. has the spine at the posteroexter-

nal angle of the carapace distinctly curving upwards (Fig. 4C, D) and has a more slender G1 which is less curved and with the distal part gently curved upwards (Fig. 6C, D).

The records from Singapore are all *X. hastatooides* s.str. Shen [1937: fig. 5a] shows clearly that Singapore specimens have a spine at the posteroexternal carapace angle but this is still relatively lower than those on *X. subtilis*. The G1 he figured [Shen, 1937: fig. 8g, h] appears somewhat slender but it is not accurate as it is actually stout like in typical *X. hastatooides* from India (Fig. 6A). There are also specimens clearly referable to *P. hastatooides* s.str. from southern Vietnam and Cambodia.

DISTRIBUTION. This species has been recorded from all over the Indo-West Pacific region, South Africa [Barnard, 1950], Madagascar [Crosnier, 1962], Persian Gulf [Stephenson, 1946; Apel, Spiridonov, 1998] to Australia, New Caledonia [Moosa, 1995], Gulf of Thailand [Stephenson, 1967], up to China and Japan [Sakai, 1939, 1976; Stephenson, Rees, 1967; Dai, Yang, 1991]. In this study, *X. hastatooides* s.str. is restricted from waters from central Indian Ocean to parts of Southeast Asia. Western Indian Ocean, India, Sri Lanka, west coast of Peninsular Malaysia, Singapore, Thailand, Cambodia and southern Vietnam.

Xiphonectes vassilyi sp.n.
Figs 2A, 3B, 3F, 4B, 6B.

Hellenes hastatooides — Barnard, 1950: 158–159. [not *P. hastatooides* Fabricius, 1798]

Portunus hastatooides — Crosnier, 1962: 68–69, figs 96, 109, 117, 122–123; Stephenson, 1972a: 136 (part); Kensley, 1981: 42.

Portunus (Xiphonectes) hastatooides — Emmerson, 2016: 608, unnumbered figure.

MATERIAL EXAMINED. Holotype, ♂ (33.4×16.0 mm) (ZRC 2009.0888a), South Africa, coll. S. Fennessy, 7.12.2006. Paratypes: 2♂♂ (35.2×16.4 mm, 33.4×15.6 mm), 1♀ (29.0×13.2 mm) (ZRC 2021.0374), same data as holotype. Others — **South Africa**: 3♂♂, 2♀♀ (ZRC 2013.1539), 18 m, trawl, coll. S. Fennessy, 19.03.2010.

DIAGNOSIS. Frontal margin with 4 rounded tip teeth. Median pair smaller, length about half of submedian pair, notch between median teeth shallow, about half of length of

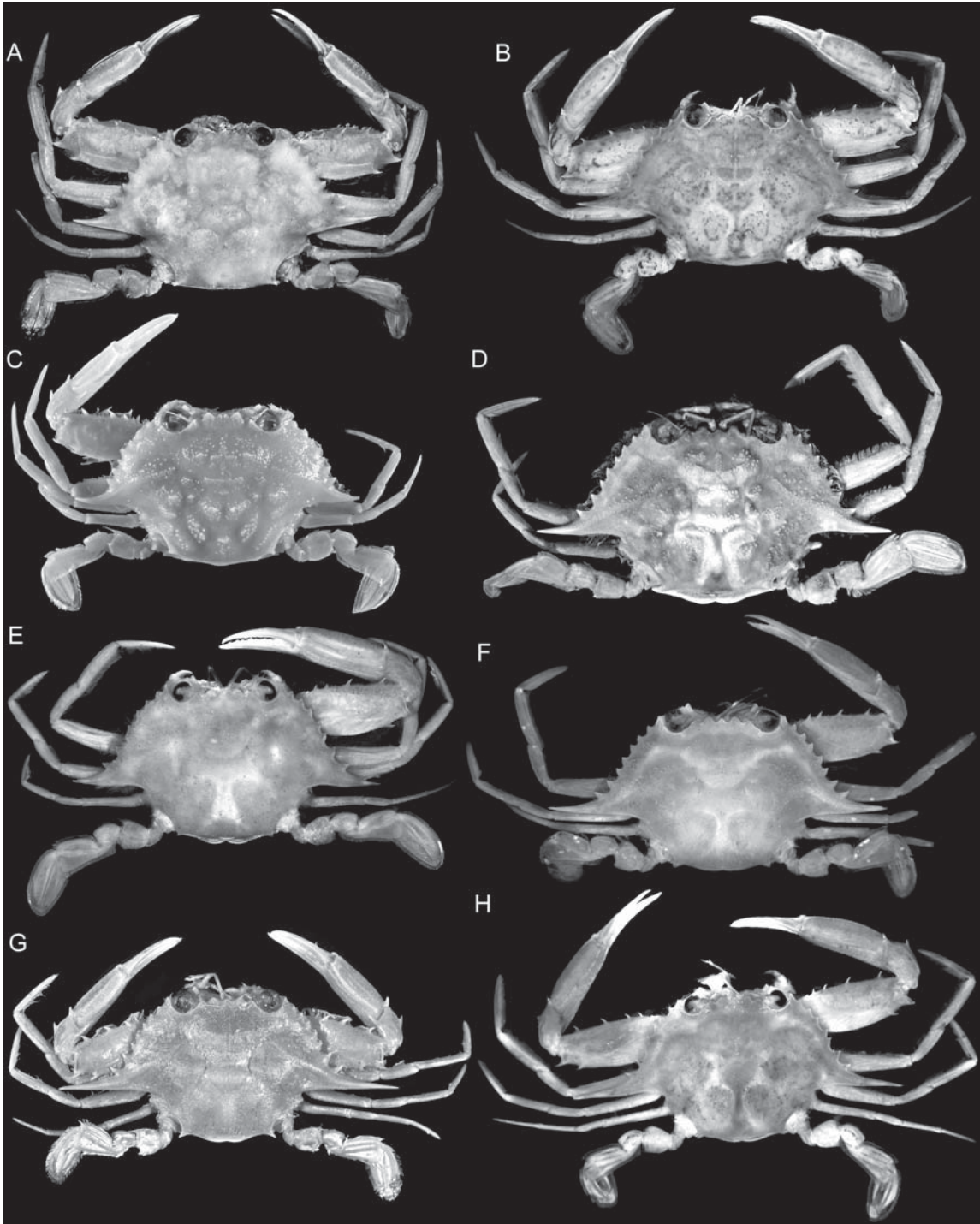


Fig 5. Overall habitus: A — *Xiphonectes pseudohastatooides* (Yang et Tang, 2006), ♂ (36.8×18.7 mm) (ZRC 1994.10.3), Taiwan; B — *X. pseudohastatooides*, ♂ (36.8×18.5 mm) (ZRC 2019.1727), Taiwan; C — *X. arabicus* (Nobili, 1905), paralectotype ♀ (24.4×13.0 mm) (MNHN-IU-2014-4048 = MNHN B.5927), United Arab Emirates (photograph T. Naruse); D — *X. unidens* (Laurie, 1906), holotype ♂ (24.5×11.5 mm) (NHM 1907.5.22.309), Sri Lanka; E — *X. unidens*, ♂ (29.1×15.7 mm) (ZRC 1992.10347), Thailand; F — *X. unidens*, ♂ (26.3×11.6 mm) (ZRC 2021.0424), Malaysia; G — *X. unidens* (holotype of *Portunus dayawanensis* Chen, 1986), ♂ (26.4×11.3 mm) (MBMCAS C00989), China; H — *X. unidens*, ♂ (31.2×14.1 mm) (ZRC 2019.1728), Hong Kong.

Рис. 5. Общий вид А — *Xiphonectes pseudohastatooides* (Yang et Tang, 2006), ♂ (36,8×18,7 мм) (ZRC 1994.10.3), Тайвань; В — *X. pseudohastatooides*, ♂ (36,8×18,5 мм) (ZRC 2019.1727), Тайвань; С — *X. arabicus* (Nobili, 1905), паралектотип ♀ (24,4×13,0 мм) (MNHN-IU-2014-4048 = MNHN B.5927), Объединенные Арабские Эмираты (фото Т. Нарусэ); D — *X. unidens* (Laurie, 1906), голотип ♂ (24,5×11,5 мм) (NHM 1907.5.22.309), Шри-Ланка; E — *X. unidens*, ♂ (29,1×15,7 мм) (ZRC 1992.10347), Таиланд; F — *X. unidens*, ♂ (26,3×11,6 мм) (ZRC 2021.0424), Малайзия; G — *X. unidens* (голотип *Portunus dayawanensis* Chen, 1986), ♂ (26,4×11,3 мм) (MBMCAS C00989), Китай; H — *X. unidens*, ♂ (31,2×14,1 мм) (ZRC 2019.1728), Гонконг.

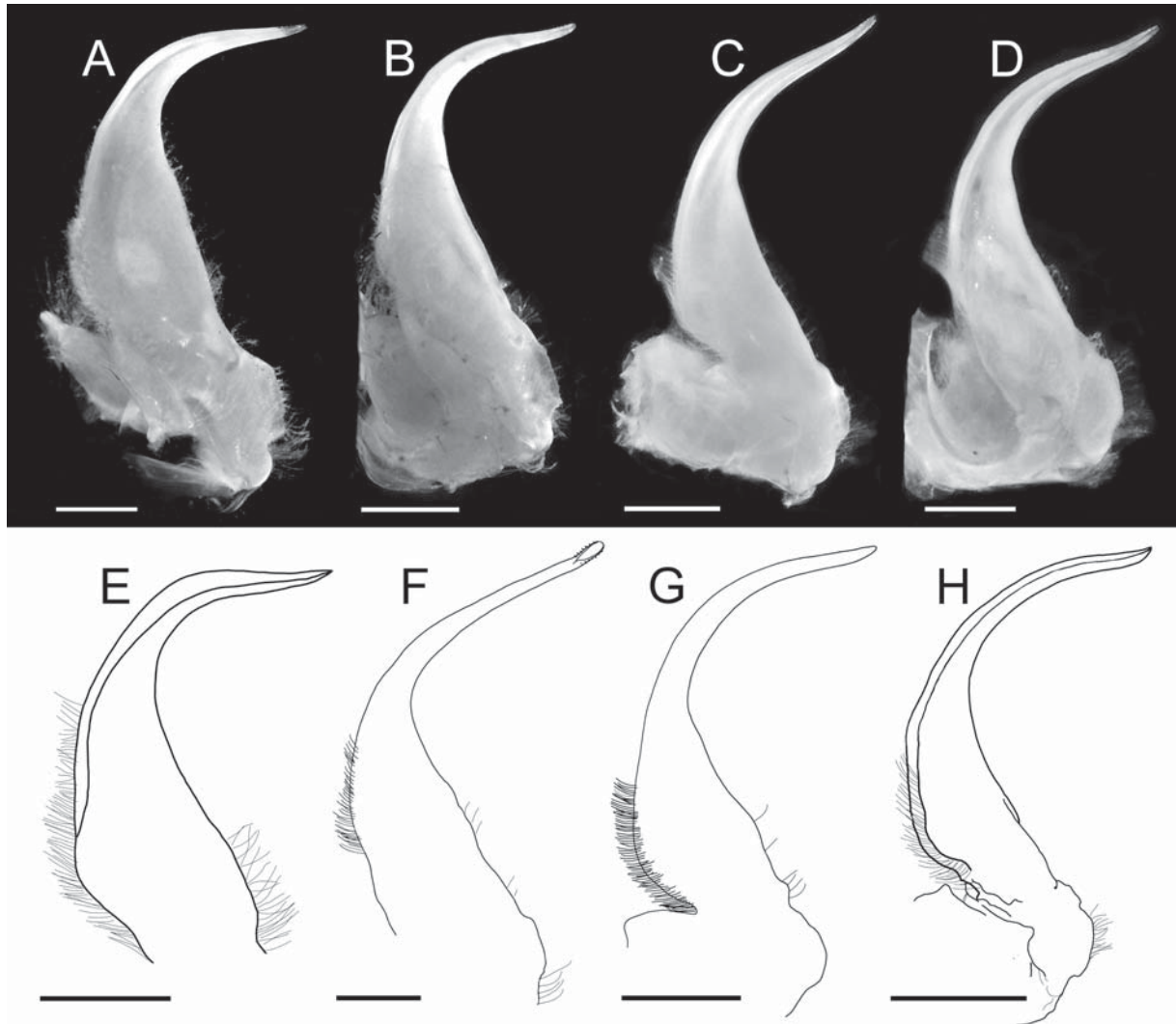


Fig 6. Left G1s: A — *Xiphonectes hastatooides* (Fabricius, 1798) s.str., ♂ (40.6×22.4 mm) (ZRC 2000.1396), Malaysia (Penang); B — *X. vassilyi* sp.n., holotype ♂ (33.4×16.0 mm) (ZRC 2009.0888a), South Africa; C — *X. subtilis* sp.n., holotype ♂ (35.1×17.3 mm) (ZRC 2003.0527), Indonesia; D — *X. subtilis* sp.n., ♂ (32.0×16.7 mm) (ZRC 1995.629), Taiwan; E — *X. arabicus* (Nobili, 1905), lectotype ♂ (CW = 28 mm), United Arab Emirates [Apel, Spiridonov, 1998: fig. 95e]; F — *X. pseudohastatooides* (Yang et Tang, 2006) (43.0×21.5 mm) (ZRC 1997.762), China; G — *X. unidens* (Laurie, 1906) (30.2×13.3 mm) (ZRC 2000.0934), Thailand; H — *X. unidens* (holotype of *Portunus dayawanensis* Chen, 1986), ♂ (26.4×11.3 mm) (MBMCAS C00989), China [Chen, 1986: fig. 1.6]. Scales = 1.0 mm.

Рис. 6. Левый G1s: A — *Xiphonectes hastatooides* (Fabricius, 1798) s.str., ♂ (40,6×22,4 мм) (ZRC 2000.1396), Малайзия (Пенанг); B — *X. vassilyi* sp.n., голотип ♂ (33,4×16,0 мм) (ZRC 2009.0888 a), Южная Африка; C — *X. subtilis* sp.n., голотип ♂ (35,1×17,3 мм) (ZRC 2003.0527), Индонезия; D — *X. subtilis* sp.n., ♂ (32,0×16,7 мм) (ZRC 1995.629), Тайвань; E — *X. arabicus* (Nobili, 1905), лектотип ♂ (CW = 28 мм), Объединенные Арабские Эмираты [Apel, Spiridonov, 1998: рис. 95e]; F — *X. pseudohastatooides* (Yang et Tang, 2006) (43,0×21,5 мм) (ZRC 1997,762), Китай; G — *X. unidens* (Laurie, 1906) (30,2×13,3 мм) (ZRC 2000.0934), Таиланд; H — *X. unidens* (голотип *Portunus dayawanensis* Chen, 1986), ♂ (26,4×11,3 мм) (MBMCAS C00989), Китай [Chen, 1986: рис. 1.6]. Масштаб 1,0 мм.

teeth (Fig. 3B). Anterolateral margin gently convex (Fig. 2A). Posterior carapace margin appears almost straight in posterior view (Fig. 4B); posteroexternal carapace angle with spine directed obliquely laterally, prominently curves upwards (Figs 3F, 4B). Dactylus of swimming leg without dark spot. G1 tapering, strongly curved at about two-thirds length from basal part; distal portion gently curved upwards (Fig. 6B).

ETYMOLOGY. The species is named after the late Vassily Albertovich Spiridonov, whose many contributions to portunoid systematics have led us to a much better understanding of their classification and diversity.

REMARKS. The figures and description of *X. hastatooides* by Barnard [1950: 158, figs 30e–g] agree well with the present material of *X. vassilyi* sp.n., especially in the structure of the acute and distinctly upturned posteroexternal carapace spine (Fig. 4B); which is a diagnostic feature for this species. Crosnier's [1962] specimens of *X. hastatooides* from Madagascar probably also belong to *X. vassilyi* sp.n. because he noted that the posteroexternal carapace angle has a prominent spine, and his figure of the G1 [Crosnier, 1962: fig. 117] matches that of *X. vassilyi* sp.n. from South Africa.

DISTRIBUTION. South Africa and Madagascar.

Xiphonectes subtilis sp.n.

Figs 2B, C, 3C, D, 3G, H, 4C, D, 6C, D.

Portunus hastatooides — Stephenson, Campbell, 1959: 101, figs 2D, 3D, pl. 1 fig. 4, pl. 4 figs 4D, 5D; Sakai, 1965: 119, pl. 58, fig. 2; McNeill, 1968: 55; Dai *et al.*, 1986: 196, pl. 26(3), fig. 114(2); Chen, 1991: 356, fig. 356; Dai, Yang, 1991: 212 (key), 216, pl. 26 (3), fig. 114 (2); Moosa, 1995: 522; Huang, Yu, 1997: 68 (part); Lai *et al.*, 1997: 229, fig. 3E; Spiridonov, 1999: 76; Yang, Tang, 2006: 695, fig. 3; Wong *et al.*, 2010: 669, figs 1A–D, 2A, 2B, 3C, 3D; Yang *et al.*, 2012: 139–143, fig. 52, pl. 9: 2. [not *P. hastatooides* Fabricius, 1798]

Amphitrite hastatooides — Stimpson, 1858: 38; 1907: 78.

Neptunus (Amphitrite) hastatooides — De Haan, 1833: pl. 1 fig. 3; 1835: 39.

Neptunus (Hellemus) hastatooides — Yokoya, 1933: 178; Sakai, 1934: 303; 1935: 130, pl. 36, fig. 1; 1939: 391, pl. 47 fig. 1.

Portunus (Amphitrite) hastatooides — Maki, Tsuchiya, 1923: 138, pl. 11(5).

Portunus (Xiphonectes) hastatooides — Sakai, 1976: 344, pl. 119 fig. 2.

MATERIAL EXAMINED. Holotype, ♂ (35.1×17.3 mm) (ZRC 2003.0527), stn. EA-TT06, Indonesia, Anambas, Teluk Tarempa, coll. Anambas Expedition, 14.03.2002. Paratype: 1♀ (34.8×17.2 mm) (ZRC 2021.0373), same data as holotype. Others – **Borneo:** 3♂♂ (28.3×12.6 mm; 28.3×12.8 mm; 31.2×13.2 mm), 1 juv.♀ (20.4×13.5 mm) (RUMF), 1♂ (28.8×14.4 mm, left anterolateral tooth broken) (ZRC 2021.0367), Sepilok Laut Troll, eastern Sabah, Malaysia, coll. T. Naruse, 17.11.2015; **Peninsular Malaysia:** 1♂ (ZRC 1965.10.21.21–23), in fish trap, Penang, 4–5 fms, coll. M.W.F. Tweedie, 06.1934; 1♂, 2♀♀ (ZRC 2021.0434), Johor, Pontian, coll. P.K.L. Ng, 02.1993; **Singapore:** 1♂, 1♀, 1 juv.♂ (ZRC 2021.0433), southeast of Pulau Ubin, in sandy mud, 5–6 m, coll. R. von Cosel & S.K. Tan, 21.11.2008; 2♀♀ (ZRC 1965.10.21.12–13), Sultan Shoals, coll. A.M., 07.1934; 1 juv.♂ (ZRC 2013.1466), on fine shell gravel with sponges, off Pulau Semakau, north side, 13–15 fms, coll. 3.01.1969; 1 juv.♂ (ZRC 1991.9465), Pulau Semakau, south side, sledge E4, coll. 14.03.1989; 1 juv.♂ (19.0×8.7 mm), 1 juv.♀ (ZRC 1993.134-135), Pulau Semakau, coll. P.K.L. Ng, 1991; 1 juv.♂ (ZRC 1993.143), Pulau Bukom, coll. T.L. Koh, 02.1992; 1♂ (ZRC 1985.1608), Bedok, 15 m, coll. P.K.L. Ng, 27.04.1982; 2 juv.♂ (ZRC 1990.8406–8407), station 6, sledge 2, Kallang Basin, coll. 23.02.1989; 1 juv.♀ (ZRC 1993.7457), Singapore, coll. 13.05.1986; 1 juv.♂ (ZRC 7453), stn D8, Singapore, coll. 25.04.1986; 1 juv.♂ (ZRC 1993.7444), Southern Islands, coll. D. Lane, 1992; 1 juv.♀ (ZRC 1965.10.21.11), Telok Siang, east coast of Johor, coll. M.W.F. Tweedie, 28.08.1933; 1♂, 1♀ (ZRC 2000.1376), off Singapore, coll. 1960s; **Thailand:** 1 damaged juv.♂ (ZRC 2000.0020), Chonburi Province, Siracha port, coll. P.K.L. Ng, 11.1999; **Indonesia:** 4♂♂ (36.5×18.8 mm; 37.3×18.0 mm; 30.4×15.1 mm; 32.5×15.2 mm), 2♀♀ (32.5×15.5 mm; 35.1×17.9 mm), 1 broken♀, 2 ovig.♀♀ (33.8×15.6 mm; 32.0×14.8 mm) (ZRC 2003.0528), stn. EA-TT08, Indonesia, Natunas, westcoast of Pulau Bunguran, coll. Anambas Expedition, 18.03.2002; **Australia:** 3♂♂ (41.7×20.0 mm, 46.7×23.5 mm; 38.0×18.3 mm), 2♀♀ (45.0×22.1 mm; 40.2×20.2 mm) (ZRC 2012.0005), Queensland, Morton Bay; 5♂♂ (largest 36.1×17.3 mm), 1♀ (QM 2197-2203), Queensland, Gulf of Carpentaria, southeast of Wellesley Islands, trawled (Gulf prawn survey), coll. I. Kirkegeerd, 13.11.1964; 1♀ (36.0×15.5 mm) (ZRC 1965.10.21.25), Linderman I., 08.1935; **Mainland China:** 1♂ (36.9×16.7 mm), 1 juv.♂ (ZRC 1999.0219.2), China, Tungdu market, Fujian Province, coll. Y. Cai & N. K. Ng, 18.11.1998; **Hong Kong:** 1♂, 3♀♀ (ZRC 2019.1719), station S2, off Po Toi Island, University of Hong Kong Trawling Surveys, coll. K. Wong, 6.08.2018; 2♂♂, 2♀♀ (ZRC 2019.1726), stn S2, south of Po Tai, University of Hong Kong Trawling Surveys, coll. K. Wong, 19.07.2018; **Taiwan:** 1♂ (32.0×16.7 mm) 4♀♀ (32.6×16 mm; 30.2×15.6 mm; 29.6×14.8 mm; 27.6×13.8 mm) (ZRC 1995.629), Mi-Tou (southwestern Taiwan), trawled at 20 m, 08.1994 – 07.1995; 1♂ (26.4×13.4 mm), 4♀ (largest 27.2×14.1 mm) (ZRC 1995.5.20), Jong-Yun (southwestern coast of Taiwan), trawled at 10 m, 08.1994 – 07.1995; 2♂♂ (30.8×15.7

mm; 28.4×14.4 mm), 2♀♀ (33.0×16.5 mm; 26.7×12.8 mm) (ZRC 2021.0368), Pingtung county, Donggang fish market, 4.06.1992.

DIAGNOSIS. Frontal margin with 4 median teeth, median pair short, half as long as lateral teeth, notch between median pair shallow (Fig. 3C, D). Anterolateral margin gently convex to almost straight (Fig. 2B, C). Posterior carapace margin appears straight to sinuous in posterior view (Fig. 4C, D); posteroexternal carapace angle with spine directed obliquely laterally to laterally, clearly curves upwards (Figs 3G, H, 4C, D). Dactylus of swimming leg sometimes with dark spot, occasionally not visible. G1 tapering, gently curved anterolaterally at middle of length, relatively more slender (Fig. 6C, D).

ETYMOLOGY. This species is the closest to *X. hastatooides* s.str., and has an overlapping distribution in South-east Asia. The differences between the two species are relatively small but consistent; consequently, the new species is named *subtilis* meaning “slightly”. Gender masculine.

REMARKS. The present series of *X. subtilis* sp.n. belong to approximately two groups. One group of specimens, all from Taiwan, do not have a dark spot on their swimming dactylus, the spine at the posteroexternal carapace angle is directed laterally (Fig. 3H) and the anterolateral margin (from the external orbital tooth to the base of the last tooth) is almost straight (Fig. 2C). The second group, which occurs from Hong Kong to Southeast Asia and Australia, usually have some indication of a dark spot on their swimming dactylus but this is often not visible, the spine at the posteroexternal carapace angle is directed laterally and gently curves upwards (Fig. 3G) and the anterolateral margin (from the external orbital tooth to the base of the last tooth) is gently convex (Fig. 2B). At present, however, these characters are not reliable, and the two groups cannot be distinguished as separate taxa with confidence. The form of their frontal median teeth and G1s are identical (Figs 3C, D, 6C, D). The problem with relying on the dark spot on the dactylus of the swimming leg is that there appears to be some variation, even for fresh specimens. Wong *et al.* [2010] had reported that all the “*X. hastatooides*” specimens they examined from Taiwan and Hong Kong have no dark spot on the dactylus of the swimming leg. In one lot (ZRC 2019.1726) from Hong Kong, however, one pair has a visibly dark coloured spot on the dactylus of the swimming leg while the other two has no almost no trace of any dark pigmentation. All four specimens are about the same size.

Specimens from mainland China (ZRC 1999.0219) have a straighter posterior margin in posterior view, resembling the condition in *X. vassilyi* sp.n. (Fig. 4B), rather than the more sinuous condition in typical *X. subtilis* sp.n. (Fig. 4C, D). They are nevertheless, clearly *X. subtilis* sp.n., as the rest of their characters are of this species. Yang and Tang [2006] compared *X. pseudohastatooides* (as a *Portunus*) to specimens of “*P. hastatooides*” from the South China Sea which are deposited in the Beijing Natural History Museum. Based on the figure by the authors [Yang, Tang, 2006: fig. 3], their “*P. hastatooides*” is considered to be *X. subtilis* sp.n., which also agrees with the known range.

The material referred to “*N. (A.) hastatooides*” by De Haan [1833, 1835] from Japan should be *X. subtilis* sp.n., at least from the figures and description. The same is probably true for material of Stimpson [1858, 1907] from Japan. Japanese specimens which have been referred to “*P. hastatooides*” also probably belong to *X. subtilis* sp.n. The figures in Sakai [1939: pl. 47, fig. 1; 1976: pl. 119, fig. 2] agree with *X. subtilis* sp.n. as defined here (see also Sakai [1935, 1965]; Yokoya [1933]), with the dark spot on the dactylus of the swimming leg not distinct.

The present collection has five specimens from Queensland, Australia (ZRC 2012.0005) with no spot on the dactylus of swimming leg. The absence of a dark spot on the dactylus of swimming leg might be a species variation or possibly the pigmentation has faded with preservation, but this can only be confirmed after the collection of fresh specimens.

DISTRIBUTION. South China Sea to Singapore, mainland China, Hong Kong, Taiwan, Japan, Peninsular Malaysia (including Penang in Indian Ocean), Sabah, Singapore, eastern Thailand, Indonesia to northern Australia.

Xiphonectes arabicus (Nobili, 1905)

Figs 5C, 6F.

Neptunus (Hellenus) arabicus Nobili, 1905: 163; 1906a: 115, pl. 5 figs 22–22a; 1906b: 190 (key), 191; Stephensen, 1946: 121, figs 26A–C.

Neptunus (Hellenus) andersoni — Alcock, 1899: 39; Stephensen, 1946: 122. [not *N. (H.) andersoni* De Man, 1887].

Lupa arabica — Laurie, 1915: 411 (list).

Portunus acerbiterminalis Stephenson, Rees, 1967a: 14, fig. 1 pl. 1B; 1967b: 287; Stephenson, 1972b: 15 (key), 38 (part: records from Saudi Arabia and East Africa).

Portunus arabicus — Stephenson, 1976: 15; Apel, Spiridonov, 1998: 281, figs 95, 98, 99, 106.

Not *Portunus acerbiterminalis* — Stephenson, 1972a: 134; 1972b: 38 (part: record from India). [= *P. hastatooides* Fabricius, 1798].

Portunus (Xiphonectes) arabicus — Ng *et al.*, 2008: 152. Naderloo, 2017: 201 fig. 20.22c, 20.36.

MATERIAL EXAMINED. Paralectotypes: 1♀ (24.4×13.0 mm), 1 juv.♀ (23.6×11.8 mm) (MNHN-IU-2014-4048 = MNHN B.5927), 1 ovig.♀ (23.3×12.3 mm) (MNHN-IU-2008-12826 = MNHN B.5926), 1♀ (18.2×9.3 mm) (MNHN-IU-2014-4050 = MNHN B.5928), United Arab Emirates, off the coast of Abu Dhabi (BP Stn. XLVII), 25°00'N 55°00'E, 1901, coll. J. Bonnier & Ch. Perez.

DIAGNOSIS. Carapace pubescent, with conspicuously elevated granular regions, median post-cardiac region with distinct tubercles (Fig. 5C). Anterolateral margin with 9 teeth (Fig. 5A). Frontal margin with 4 teeth, median pair smaller, less prominent than submedian pair (Fig. 5C). Posteroexternal carapace angle forming obtuse or right angle, without spine; posterior carapace border appears convex from dorsal view (Fig. 5C). G1 curved, tapering with pointed tip slightly curved upwards (Fig. 6F).

REMARKS. *Xiphonectes arabicus* is distinguished from *X. hastatooides* s.lat. by the relative coarser granulation of the carapace (vs granules small and rounded to indistinct at times) and the obtuse or right angled posteroexternal carapace angle which does not have spine (vs angle always forming a sharp right angle with a spine in *X. hastatooides* s.lat.).

DISTRIBUTION. From the north-east coast of Somalia, the Gulf of Aden, southern Red Sea and Socotra to the Arabian Gulf [Apel, Spiridonov, 1998].

Xiphonectes pseudohastatooides (Yang et Tang, 2006)

Figs 5A, B, 6F.

Portunus pseudohastatooides Yang et Tang, 2006: 691, figs 1, 2; Wong *et al.*, 2010: 676, figs 1E–N, 2E, F.

Portunus (Xiphonectes) pseudohastatooides — Ng *et al.*, 2008: 152.

Portunus hastatooides — Yu, 1979: 48, fig. 5; Huang, Yu, 1997: 68 (part.). [not *P. hastatooides* Fabricius, 1798]

Xiphonectes pseudohastatooides — Koch *et al.*, 2015: 643, figs 1, 2.

MATERIAL EXAMINED. **Taiwan:** 5♂♂ (36.8×18.7 mm, 35.0×18.7 mm, 36.2×18.3 mm, 35.7×18.1 mm, 36.2×19.5 mm)

(ZRC 2021.0366), Taichung (northwestern coast), trawled at 20 m, coll. 3.10.1994; 2♂♂ (larger 32.6×16.6 mm), 2♀♀ (35.0×17.2 mm; 29.7×14.9 mm), 1 ovig.♀ (32.0×15.8 mm) (ZRC 2021.0365), Bort-Zae-Liau (northwestern coast), trawled at 10 m, coll. 21.07.1995; 3♂♂ (38.6×19.5 mm, 37.4×18.2 mm, 33.5×17.0 mm), 2♀♀ (34.0×16.8 mm; 32.4×16.0 mm) (ZRC 2021.0370), Ma-Sha-Gou (western coast), trawled at 70 m, coll. 20.08.1994; 3♂♂, 2 ovig.♀♀ (36.5×18.0 mm, 32.1×15.1 mm) (ZRC 2021.0369), Ma-Sha-Gou (western coast), trawled at 70 m, coll. 14.09.1994; 6♂♂, 2♀♀ (ZRC 2021.0423), Dasi, Ilan Province (northern coast), coll. T.-Y. Chan *et al.*, 20–22.12.2001; **Hong Kong:** 3♂♂, 1♀ (ZRC 2019.1727), station S3, south of Lantau Island, University of Hong Kong Trawling Surveys, coll. K. Wong, 6.08.2018; **Macau:** 1♂ (43.0×21.5 mm) (ZRC 1997.0762), near Macau, coll. Hong Kong Chinese University staff, 1996; **Vietnam:** 1♂ (39.4×19.2 mm) (ZRC 2021.0376), Nam Dinh Province, from fishermen near Xuan Thy National Park, 7.08.2007; **Peninsular Malaysia:** 1♂ (28.1×14.3 mm) (ZRC 2021.0371), Johor, Pontian, coll. P.K.L. Ng, 02.1993; 1♂ (ZRC 2021.0377), Johor, Pontian, coll. P.K.L. Ng, 02.1993; 3♂♂ (27.9×12.5 mm, 24.2×11.0 mm, 26.0×12.3 mm), 2♀♀ (27.2×12.6 mm, 27.5×12.0 mm), 2 juv.♂♂ (ZRC 1965.10.21.14–20), Selangor, Morib; **Singapore:** 1♂ (ZRC 1984.5616), off Bedok, coll. P.K.L. Ng, 18.11.1981; 2♂♂ (damaged), 4♀♀ (1 damaged) (ZRC 1985.890–895), on sand with shell and gravel, off Siglap-Bedok, 5 fms, coll. D.S. Johnson, 4.04.1952; 1 juv.♀ (ZRC 1990.8369), stn 4, Kallang Basin, coll. 23.02.1989; 1♂, 1♀ (ZRC 2000.1263), off Bedok, 1°18.34'N 103°56.69'E, 5–10 m, coll. D.G.B. Chia *et al.*, 19.08.1994.

DIAGNOSIS. Frontal margin with 4 teeth. Median teeth as long as submedian pair, separated by a V-shape notch, notch depth is about half length of median teeth (Fig. 5A, B). Posteroexternal carapace angle with spine directed obliquely laterally, gently curved upwards (Fig. 5A, B). Dactylus of swimming leg with dark spot (Fig. 5A, B). G1 stout; neck slender, tapering; tip with spoon-shaped opening, surrounded by about 10 spinules directed slightly backwards on each side of opening (Fig. 6F).

REMARKS. All specimens used in this study have dark spot on dactylus of swimming leg. Wong *et al.* (2010) noted that the dark spot is inconsistent in their material, with the pigment absent from some specimens. This may be due to pigment leaching during preservation and/or they may have two species including some specimens of *X. subtilis* sp.n.

Yang and Tang [2006] compared *X. pseudohastatooides* with the “*X. hastatooides*” figured in Crosnier [1962: figs 96, 109, 122, 123] and Stephenson & Campbell [1959: figs 2D, 3D, pl. 1, fig. 4, pl. 4, fig. D]. As discussed earlier, these old records of “*X. hastatooides*” belong to two different species, *X. vassilyi* sp.n. [in Crosnier, 1962] and *X. subtilis* sp.n. [in Stephenson et Campbell, 1959]. According to Yang & Tang [2006], the posterolateral margin is convex in *X. pseudohastatooides* but concave in *X. hastatooides*. This margin however, is actually convex in our specimens of *X. hastatooides* s. str. (Fig. 1A), *X. vassilyi* sp.n. (Fig. 2A), and *X. subtilis* sp.n. (Fig. 2C, D). Wong *et al.* [2010] keyed out the differences between *X. pseudohastatooides* and *X. subtilis* sp.n. (as “*P. hastatooides*”), noting that the former species has the median frontal teeth as long as the laterals (vs median teeth shorter than laterals) and with a slender G1 that has an opening which is spatuliform (Fig. 6F) (vs proportionately less slender with a tapering tip G1). The frontal median teeth character is correct for *X. vassilyi* sp.n. and *X. subtilis* sp.n. (Fig. 3B–D), but not *X. hastatooides* s.str. (Fig. 3A). Therefore, the G1 structure remains the most reliable character to distinguish *X. pseudohastatooides* from 6 species in the *X. hastatooides* species group.

DISTRIBUTION. Guangxi Province, Guangdong Province (South China: type locality), Hong Kong, Macau, west

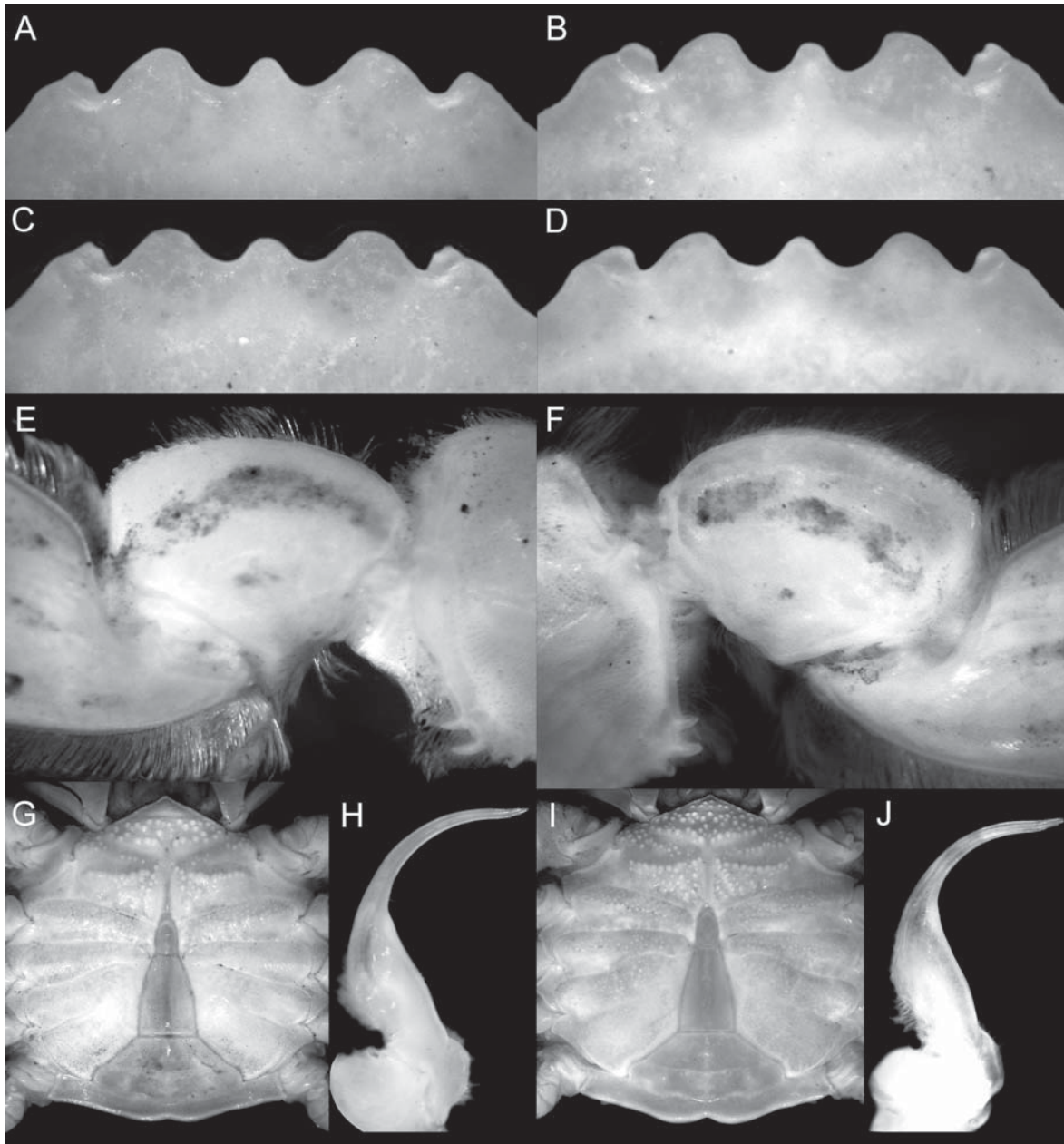


Fig. 7. *Xiphonectes unidens* (Laurie, 1906). A — ♂ (25.5×11.7 mm) (ZRC 1992.10347), Thailand; B — ♂ (29.3×14.8 mm) (ZRC 1992.10347), Thailand; C — ♂ (23.6×11.0 mm) (ZRC 1992.10347), Thailand; D — ♀ (24.6×12.0 mm) (ZRC 1992.10347), Thailand; E–H — *X. trilobatus* (Stephenson, 1972a), ♂ (31.2×14.1 mm) (ZRC 2019.1728), Hong Kong; I, J — *X. unidens* (Laurie, 1906), ♂ (29.1×15.7 mm) (ZRC 1992.10347), Thailand. A–D — frontal teeth; E — left carpus of swimming leg; F — right carpus of swimming leg; G, I — thoracic sternum and pleon; H, J — right G1 (laterally transposed for comparative purposes).

Рис. 7. *Xiphonectes unidens* (Laurie, 1906). А — ♂ (25,5×11,7 мм) (ZRC 1992.10347), Таиланд; В — ♂ (29,3×14,8 мм) (ZRC 1992.10347), Таиланд; С — ♂ (23,6×11,0 мм) (ZRC 1992.10347), Таиланд; D — ♀ (24,6×12,0 мм) (ZRC 1992.10347), Таиланд; E–H — *X. trilobatus* (Stephenson, 1972a), ♂ (31,2×14,1 мм) (ZRC 2019.1728), Гонконг; I, J — *X. unidens* (Laurie, 1906), ♂ (29,1×15,7 мм) (ZRC 1992.10347), Таиланд. А–D — передние зубы; E — карпус левой плавательной ноги; F — карпус правой плавательной ноги; G, I — грудные стерниты и плеон; H, J — правый G1 (установлен боком для сравнения).

coast (Taiwan Strait) and northeastern Taiwan, Vietnam, Peninsular Malaysia and Singapore.

Xiphonectes unidens (Laurie, 1906)
Figs 5D–H, 6G, H, 7.

Neptunus (Hellenus) hastatooides var. *unidens* Laurie, 1906: 414.

Neptunus (Hellenus) tweediei Shen, 1937: 109, figs 6, 8c, 8d.
Portunus dayawanensis Chen, 1986: 84, fig. 1; Wong *et al.*, 2010: 674, figs 1E–I, 2C, D.
Portunus trilobatus Stephenson, 1972a: 139, figs 1, 2; Davie, 1992: 488, 495.
Portunus tweediei — Stephenson, 1972b: 14.
Portunus (Xiphonectes) dayawanensis — Ng *et al.*, 2008: 152.
Portunus (Xiphonectes) trilobatus — Ng *et al.*, 2008: 152.

Portunus (Xiphonectes) tweediei — Ng *et al.*, 2008: 153.

MATERIAL EXAMINED. Holotype, ♂ (24.5×11.5 mm, chelipeds missing) (NHM 1907.5.22.309), Gulf of Manaar, Sri Lanka, coral reefs, coll. W.A. Herdman. Others — **Singapore:** 1♂ (29.9×14.3 mm), 1♀ (25.0×12.2 mm) (NHM 1937.11.15.170–171) (paratypes of *P. tweediei* Shen, 1937), Siglap; 1♂ (ZRC 1993.7455), station D11, coll. 15.05.1986; 1♀ (ZRC 1990.7321), station 5, Kallang Basin, in dredge, coll. 6.02.1987; 13♂♂, 2♀♀, 1 ovig.♀ (ZRC 1965.7.5.45–57), Siglap, coll. M.W.F. Tweedie, 12.1933; 2♂♂ (ZRC 1985.898–899), stn B50, on mud, off Tanjong Rhu, 2 fms, coll. SRFRS, 06.1963; 1 ovig.♀ (ZRC 1985.909–911), station B54, on mud with gorgonians, Samar Laut, 5–8 fms, Singapore, coll. SRFRS, 1960s; 2♂♂, 5♀♀ (damaged) (ZRC 1985.900–906), stn B49, on muddy-sand with *Enhalus*, off Siglap Obelisk, coll. SRFRS, 06.1963; 1♂ (ZRC 1985.907), station B45, on mud and stone substrate, 1 mile west of Bedok, 6 fms, coll. SRFRS, 06.1963; 1♂ (ZRC 1985.908), Selat Sinki, Singapore, coll. A.G. Searle, 06.1963; **Peninsular Malaysia:** 2♂♂ (larger 26.3×11.6 mm) (ZRC 2021.0424), Johor, Pontian, coll. P.K.L. Ng, 02.1993; **Thailand:** 3♂♂ (25.4×11.4 mm, 25.9×12.0 mm, 27.7×11.9 mm), 1♀♀ (23.2×10.3 mm) (ZRC 1999.0796), Songkhla port, coll. H.H. Tan, 27.10.1998; 1♀ (ZRC 1999.0796), Songkhla port, southern Thailand, coll. H.H. Tan, 27.10.1998; 7♂♂, 1♀ (25.8×11.2 mm), 2 ovig.♀♀ (28.0×12.2 mm, 22.5×11.0 mm) (ZRC 2000.0934), Gulf of Thailand, Chonburi, Si Racha port, 20 m depth, coll. P.K.L. Ng *et al.*, 22.02.2000; 1♂, 2 ovig.♀♀ (ZRC 2021.0425), Si Racha port, Chonburi Province, coll. P.K.L. Ng, 17.03.2005; 2♀♀ (ZRC 2013.02050), Angsila port, Chonburi Province, coll. S. Panha *et al.*, 3.12.2004; 1♂, 1 ovig.♀ (ZRC 1998.1170), Angsila port, Chonburi Province, coll. P.K.L. Ng *et al.*, 29.09.1986; 2♀♀ (ZRC 2013.02050), Angsila port, Chonburi Province, coll. S. Panha *et al.*, 3.12.2004; 1♂, 1 ovig.♀ (ZRC 1998.1170), Angsila port, Chonburi Province, coll. P.K.L. Ng *et al.*, 29.09.1986; 11♂♂, 9♀♀ (ZRC 1992.10347), Pattaya port, from trawlers, coll. P.K.L. Ng *et al.*, 25.12.1991; **Philippines:** 1♂, 1 juv.♂ (ZRC 2021.0426), mud substrate, stn S25, Ubajan, Bohol, 21 m, Philippines, 9°41.5'N 123°51.0'E, coll. PANGLAO 2004 Expedition, 23.06.2004; 1♀ (ZRC 2021.0427), mud substrate, station S25, Ubajan, Bohol, 21 m, Philippines, 9°41.5'N 123°51.0'E, coll. PANGLAO 2004 Expedition, 23.06.2004; 1♂ (ZRC 2021.0428), station T19, mud substrate, Cortes, Bohol, 10–26 m, Philippines, 9°42.2'N 123°50.8'E, coll. PANGLAO 2004 Expedition, 20.06.2004; **Mainland China:** 1♂ (26.4×11.3 mm) (holotype of *P. dayawanensis* Chen, 1986) (MBMCAS C00989), China, Guangdong Province, Daya Wan Bay, Sanmen Island, 24.12.1980. Paratypes: 3♀♀ (29.2×14.5 mm; 25.0×11.2 mm, 16.8×7.3 mm) (MBMCAS C00990), same data as holotype; **Hong Kong:** 5♂♂, 2♀♀ (ZRC 2019.1728), stn E3, Tolo Channel, University of Hong Kong Trawling Surveys, coll. K. Wong, 23.07.2018.

DIAGNOSIS. Carapace dorsal surface with rounded granules, surface with low setae or almost glabrous. Regions moderately well defined, gastric, cardiac, lateral, and median postcardiac regions gently elevated, separated by deep grooves (Fig. 5D–H). Frontal margin with 3 blunt triangle teeth. Median tooth smaller, less prominent than 2 lateral teeth (Figs 5D–H, 7A–D). Anterolateral border 9 teeth, last one long, slightly arched posteriorly (Fig. 5D–H). Postero-external carapace angle with spine, directed obliquely upwards (Fig. 5D–H). Manus of cheliped with 3 or 4 spines on anterior border, 2 on posterior border. Carpus with 2 spines (Fig. E–H). Merus with 2 spines, 1 at articulation with carpus, 1 at inner distal angle. Posterodistal border of merus of swimming leg serrated, dactylus usually without dark spot (Fig. 7E, F). Male pleonal somite 6 with lateral sides parallel from base to half or two-thirds of length, convergent at distal part (Fig. 7G, I). G1 distinctly becomes narrower after one-third of length from basal part; distal part elongate, extremity with several spines (Figs 6G, H, 7H, J).

REMARKS. *Neptunus (H.) hastatooides unidens* was originally described from one male specimen collected from the

Gulf of Manaar in Sri Lanka. The type specimen is missing both chelipeds, and Laurie had difficulty in deciding its identity, remarking that it may just be a variant of *X. hastatooides* (as a *N. (Hellenus)*). Stephenson & Campbell [1959: 101] treated the *N. (H.) hastatooides unidens* of Laurie [1906], as a junior subjective synonym of *P. (X.) hastatooides*, but did not elaborate. Indeed, most revisions do not even refer to Laurie's taxon as he did not figure it and the description was too brief to use. The present authors re-examined the type specimen of *N. (H.) h. unidens* and confirmed that it is not congeneric with *X. hastatooides* s.str. The male holotype is distinct in having only three frontal teeth (Fig. 5D) (vs four frontal teeth in *X. hastatooides* s.str.), no dark spot on the dactylus of the swimming legs (vs usually with dark spot in *X. hastatooides* s.str.), and it has a more slender and elongate G1 (vs relatively shorter and stouter in *X. hastatooides* s.str.). Thus, *X. unidens* is a valid species. In fact, the species of Laurie is almost identical with what Shen [1937] described as *N. (H.) tweediei* from Singapore. This species was described as follows: “front cut into three teeth, the median one is smaller than the laterals; the last anterolateral tooth is long, directed slightly postero-laterally; and mostly similar to *N. (H.) hastatooides* Fabricius, 1798” [Shen, 1937]. Shen noted that *N. (H.) tweediei* is distinguished by the: a) front cut into three teeth (vs four teeth in *N. (H.) hastatooides*), b) dactylus of swimming legs without dark spot (vs with dark spot in *N. (H.) hastatooides*), and c) the G1 is more curved (vs less curved in *N. (H.) hastatooides*) [Shen, 1937: 109, fig. 8c versus fig. 8g]. Although Shen described the median frontal tooth as smaller than the laterals, his figure [Shen, 1937: fig. 6a] actually shows the median one to be the largest, albeit slightly. The types of *N. (H.) tweediei* were examined, and this is the only difference with the type male of *X. unidens*, which has the median tooth lower (Fig. 5D). Although a specimen with the median tooth largest has not been seen, some specimens examined possessed subequal to the lateral teeth (Fig. 7D), and as a character, these teeth do vary in size (Fig. 7A–C).

Stephenson [1972a] described *X. trilobatus* (as a *Portunus*) from from Sumatra, Java, Sulawesi and Luzon (Philippines). He distinguished *X. trilobatus* from *X. spiniferus*, *X. alcocki* and *X. mariei* by their carapace morphology, armature of their cheliped carpus, form of the median frontal tooth and proportions of the male pleon. Inexplicably, he did not compare his new species with the two taxa closest to it: *X. unidens* and *X. tweediei*.

Chen [1986] named *X. dayawanensis* (as a *Portunus*) from Daya Bay in southern China with three frontal teeth, and she compared her new taxon with *P. trilobatus*, arguing that their carapaces and chelipeds were distinct. Davie [1992: 488, 495], apparently not aware of Chen's [1986] paper, commented that he had numerous specimens *P. trilobatus* from Hong Kong waters, and that earlier records of “*P. hastatooides*” (see Cheung [1990]) from the territory were probably these species, mainly because it only had three frontal teeth. Wong *et al.* [2010: 678] argued that they had a good series of specimens from Hong Kong and all *P. trilobatus* records of Davie [1992] should be referred to *X. dayawanensis*. Wong *et al.* [2010: 678], however, noted that they did not have specimens of *X. trilobatus*, and followed Stephenson [1972a] and Chen [1986] in separating the two species.

In distinguishing *X. trilobatus* from *X. dayawanensis*, Chen [1986: 87, 89] observed that the dorsal carapace surface of *X. trilobatus* has a dense fine pubescence (vs gla-

brous in *X. dayawanensis*), the mesogastric and metagastric regions each has a short ridge (vs without a ridge in *X. dayawanensis*), the mesobranchial region has four granular patches (vs without patches in *X. dayawanensis*), the inner surface of the palm has two rows of setae but no ridges (vs glabrous but with two ridges in *X. dayawanensis*), and the posterodistal margin of the carpus of the swimming leg has small spines (vs absent in *X. dayawanensis*). The problem is that Chen [1986] probably based these carapace and pereopod differences mainly on the description by Stephenson [1972a: 140] as his figure of the holotype [Stephenson, 1972a: fig. 2] is poor. The types of *X. dayawanensis* were examined and they agree very well with the material we have on hand from Hong Kong. The specimens vary too much in the carapace pubescence to make this a useful character. There is always some pubescence, from sparse to denser, but none are completely smooth. The pattern of small granules on the meso- and metagastric regions varies in strength and density. In some specimens where the granules on the mesogastric region are denser, they form an irregular but discernible ridge, in others, it is not obvious. The same is true for the granules on the mesobranchial region, it is not always easy to see four patches of granules as they vary in size, with the anterior patches rather less distinct. Certainly, the figure of the holotype male in Stephenson [1972a: fig. 2] does not show prominent mesogastric and metagastric ridges and the patches of granules on the mesobranchial region. The inner surface of the palm has two rows of setae (sometimes lower and sparser) and there is actually a low ridge adjacent to these setae in the specimens examined. When the setae are denser, the ridge is not easy to see or feel. As for the presence of “spines” on the posterodistal margin on the carpus of the swimming leg, this does vary. Stephenson [1972a: 140] describes these as “small spines”, and in the specimens examined for the present study, it varies from almost unarmed with low granules (Fig. 7F) to distinct spinules which give it a gently serrate appearance (Fig. 7E), even in the same specimen. In all other characters, including the male pleon and G1 structure (cf. Stephenson [1972a: fig. 1]), *X. trilobatus* cannot be distinguished from *X. dayawanensis*.

Comparing *X. trilobatus* (and *X. dayawanensis*) with *X. unidens*, it is apparent their general carapace features are similar, with the G1 structures (including the types) almost identical (Figs 6G, H, 7H, J). Among the larger specimens compared, there appear to be some differences: the last anterolateral tooth in *X. unidens* is usually shorter with the posterior margin gently sinuous (Fig. 5D, E) (vs tooth proportionately longer with a straighter posterior margin in *X. trilobatus*, Fig. 5G, H), the surface of male thoracic sternites 1 and 2 are usually distinctly granulated (Fig. 7I) (vs smoother with few granules in *X. trilobatus*, Fig. 7G), the median part of the posterior margin of male pleonal somite 3 is usually deeply concave (Fig. 7I) (vs gently concave in *X. trilobatus*, Fig. 7G), the male pleonal somite 6 is relatively more slender (Fig. 7I) (vs relatively broader in *X. trilobatus*, Fig. 7G), and the distal slender part of the G1 is slightly shorter (Fig. 7J) (vs slightly longer in *X. trilobatus*, Fig. 7H). None of these differences, however, are consistent, and specimens were examined, even those from one lot, have intermediate characters. The degree granulation on male thoracic sternites 1 and 2 is surprisingly variable. In many specimens of *X. trilobatus*, the area of sternite 2 adjacent to the suture with sternite 3 is lined with low granules (sometimes low and appears almost smooth, e.g., Fig. 7G), with the rest of the surface smooth but sometimes covered with small rounded granules. In typical specimens of *X. unidens*, the surface of

male sternites 1 and 2 is covered with more and stronger granules (Fig. 7I). The variability in the observed differences suggests that they cannot be relied on to separate *X. trilobatus* from *X. unidens*.

The variation in characters observed for the series of specimens of the four species discussed above argue for them to be synonymised, i.e., *N. (H.) tweediei* Shen, 1937, *P. trilobatus* Stephenson, 1972a, and *P. dayawanensis* Chen, 1986, are junior subjective synonyms of *N. (H.) h. unidens*. Interestingly, a label with the two syntypes of *N. (H.) tweediei* states that these specimens are *P. unidens*. Indeed, someone had previously compared the types of both species in the NHM, and realised they were identical, although nothing was published. The synonymising of these taxa is also supported by their known distributions: *P. unidens* was from Sri Lanka, *P. tweediei* from Singapore, *P. trilobatus* was described from Indonesia and Philippines, and *P. dayawanensis* from southern China.

DISTRIBUTION. Sri Lanka (type locality); Singapore; Malaysia; Gulf of Thailand; Sumatra; Java; Sulawesi; Philippines; Sanmen Island, Daya Bay (= Daya Wan), Guangdong, southern China (type locality) and Hong Kong.

Incertae sedis

The three species *X. hastatoides* s.str., *X. vassilyi* sp.n. and *X. subtilis* sp.n. are similar to each other, and the G1 shape is a very important character to identify them apart. In this present study, the angle of view of G1 when examined or photographed had to be standardised or they will look different. *Xiphonectes pseudohastatoides* is also superficially similar and without the G1, one is not always confident to distinguish it from the others. The following records are not sufficiently clear to allow us to be certain and are listed here as incertae sedis:

Neptunus hastatoides — A. Milne-Edwards, 1861: 332, 339 (Japan, China and India). The Indian specimens are probably *X. hastatoides* s.str. but the Chinese and Japanese specimens could be either *X. subtilis* sp.n. or *X. pseudohastatoides*.

Many of the reports of “*P. hastatoides*”, “*P. (X.) hastatoides*” or “*X. hastatoides*” from Taiwan based on fishery catches are probably mixed with three species, *X. pseudohastatoides*, *X. trilobatus* and/or *X. subtilis* sp.n. These would include the reports of Tzeng & Chen [1992: unpaginated], Hsueh *et al.* [2006: 287], Hsueh & Hung [2009: 455] and Wang *et al.* [2013a: 513, 2013b: 2017: Appendix 1, unpaginated]. Old records of “*N. hastatoides*” or “*P. hastatoides*” from China, Taiwan and Hong Kong by Sato [1936: 1954], Shen [1940: 220], Lin [1949: 19], Chang [1963: 4], Morton & Morton [1983], Fang [1991: 352], Huang [1994], Jeng *et al.* [1997: 117, 1998: 122], Ng *et al.* [2001: 16, 2017: 71] and Chou & Fang [2005: 641] are probably similarly mixed. Balss [1922: 108] reported “*N. (H.) hastatoides*” from Japan, Philippines and China, but we cannot be sure if all the material is one species.

Neptunus (Amphitrite) hastatoides — Miers, 1884: 229 (Indian Ocean, Australia and Hong Kong). His specimens from the Indian Ocean ones are probably *X. hastatoides* s.str. but we are less certain about the Pacific material as there are no figures. While Australia probably has *X. subtilis* sp.n., Hong Kong also has *X. pseudohastatoides*.

Portunus hastatoides — Stephenson, 1967: 15 (South-east Asia); Stephenson, Rees, 1967b: 14; (China, Taiwan, Japan, Philippines, Borneo); Stephenson, 1972a: 136 (part) (Singapore, Indonesia, Philippines, Thailand, Japan);

Stephenson, 1975: 178 (Java); Stephenson, 1976: 16 (Philippines). These records by Stephenson are hard to resolve without re-examining his specimens, with most of the East and Southeast Asian records being *X. pseudohastatooides* or *X. subtilis* sp.n. or *X. hastatooides* s.str. His [Stephenson, 1972a] records from India and Sri Lanka are probably *X. hastatooides* s.str. while his South Africa and Madagascar specimens are probably *X. vassilyi* sp.n.; but those from Southeast and East Asia can be *X. pseudohastatooides* or *X. subtilis* sp.n. or even *X. hastatooides* s.str. as the latter is known from Singapore.

The records of *X. hastatooides* by Hashmi [1964: 453], Guinot [1967: 257], Zarenkov [1969: 14], Basson *et al.* [1977: 250], Titgen [1982], Spiridonov [1994: 136], Tirmizi & Kazmi [1996: 21, fig. 9A–F], Apel & Spiridonov [1998: 293, figs 100, 101, 105, 107], Neumann & Spiridonov [1999: 20], Apel [2001: 75], Naderloo & Sari [2007: 343, table 1] and Naderloo [2017: 202, fig. 20.22e, 20.39] from north-eastern Indian Ocean (including Pakistan, Persian Gulf and Red Sea) can either be *X. hastatooides* s.str. or *X. vassilyi* sp.n. The G1 figured by some of these authors appear more slender than *X. hastatooides* s.str. (Fig. 6A) but it may just be how it was drawn, and the drawings and descriptions suggest that the two median frontal teeth are distinct. Various authors also describe the posteroexternal carapace angle as produced into curved spines. Stephenson [1946: 122] records “*N. (H.) hastatooides*” from Iranian Gulf and Gulf of Oman, and although he did not figure the species, he did comment noted that the G1s of his material agreed well with the figure of “*P. hastatooides*” in Shen [1937a: figs 8g–h] from Singapore where *X. hastatooides* s.str. is present. The record of “*P. (H.) hastatooides*” by Nobili [1905: 11] from Zanzibar is probably *X. vassilyi* sp.n., considering the proximity of this location to Madagascar. In any case, all the specimens from the Arabian Sea and northeastern Indian Ocean should be re-examined to confirm the present prognosis and it is possible some contain both species.

Discussion

The large number of incertae sedis (see above) means the actual identities of many of the old records cannot be confirmed. It is somewhat surprising considering the number of species of *Xiphonectes* now recognised that the most widespread species, *X. hastatooides*, has not been properly revised.

The importance of the G1 structure in separating the different species is re-emphasised in this study. The differences in proportions and shape are constant, even for small specimens and remains one of the best ways to distinguish the species. The value of the dark spot on the dactylus of the swimming leg as a taxonomic character remains unresolved. The dark spot, when present, remains for long periods when dried or preserved in formalin, but if specimens are preserved wholly in alcohol, it tends to fade faster. That being said, all fresh specimens and almost all preserved specimens of *X. hastatooides* s.str. possess a distinct dark spot. The closely related *X. vassilyi* sp.n., however, does not have this dark spot even when the specimens were fresh and are absent in the type series. Similarly, every specimen of *X. pseudohastatooides* examined here has a dark spot on

the dactylus of the swimming leg. In the case of *X. unidens*, almost every specimen never has the dark spot, even when freshly collected, but there is at least one specimen, a female (ZRC 1999.796) from southern Thailand that has it. The situation for *X. subtilis* sp.n. is the most confusing as the presence or absence of dark spot on the dactylus of the swimming leg appears to be most variable, even from one geographical area. For example, in the waters around southern Peninsular Malaysia and Singapore, some specimens have a distinct dark spot (e.g., ZRC 1993.143, ZRC 2021.0433) while others have no trace of it (e.g., ZRC 2021.0434). Almost all the fresh specimens in Taiwan and Hong Kong of *X. subtilis* sp.n. do not have this spot while most of those from Indonesia have a visible spot. Furthermore, the spot is absent in Australian material. Wong *et al.* [2010: 678] also discussed the value of this character and were uncertain of its value.

One major difficulty with the species recognised here often have overlapping distributions and their external features are similar. *Xiphonectes hastatooides* s.str. is known for certain from the Indian subcontinent to the eastern Indian Ocean, and reaching into Southeast Asia. It is relatively common in Singapore with records reaching to Cambodia and southern Vietnam. In Singapore and Peninsular Malaysia, *X. pseudohastatooides* is also present, but appears to be less common. *Xiphonectes pseudohastatooides* is the most common species in Taiwan, and is also frequently encountered in mainland China, Macau and Hong Kong. The only species known thus far from the eastern part of Southeast Asia (southern and eastern Indonesia, Moluccas, Gulf of Thailand) and Australia is *X. subtilis* sp.n., and is also common in southern China, Hong Kong and Taiwan. Both *X. pseudohastatooides* and *X. subtilis* sp.n. are probably also present in Japan. The many undetermined records of “*P. hastatooides*” from the western Indian Ocean present some uncertainties. It is possible that all the western Indian Ocean records are actually *X. vassilyi* sp.n. instead, which is now known only from Madagascar and South Africa.

For *X. unidens*, which has been confused with *X. hastatooides* since its description in 1906, it is here considered to be the senior synonym of *P. tweediei*, *P. trilobatus* and *P. dayawanensis*. This species is known from southern India to Southeast Asia, extending northwards to the Gulf of Thailand, Hong Kong and southern China. In the western Indian Ocean, it appears to be replaced by *X. arabicus*.

IDENTIFICATION KEY TO SPECIES OF *X. HASTATOIDES* SPECIES COMPLEX

- 1a. Frontal margin with 4 well demarcated teeth, median 2 may have basal parts fused 2
- 1b. Frontal margin with 3 distinct teeth (Figs 5D–H, 7A–D) *X. unidens*
- 2a. Carapace with conspicuously elevated granular regions, median post-cardiac with tubercles; posteroexternal carapace angle forming obtuse or right angle, without distinct spine (Fig. 5C) *X. arabicus*

Table 1. Morphological differences between species previously confused under *Portunus hastatooides* s.str.
Таблица 1. Морфологические различия между видами, ранее смешанными под названием *Portunus hastatooides* s.str.

Character/species	<i>X. hastatooides</i> s.str.	<i>X. vassilyi</i> sp.n.	<i>X. subtilis</i> sp.n.
Median frontal teeth	As long as submedian teeth, acute; separated by deep V-shape notch (Fig. 3A)	Short, half length of submedian teeth; separated by shallow V-shape notch (Fig. 3B)	Short, half length of submedian teeth; separated by shallow V-shape notch (Fig. 3C, D)
Dark spot on dactylus of swimming leg	Dark spot even on dried and old specimens (Fig. 1)	No dark spot present (Fig. 2A)	With or without dark spot (Fig. 2B, C)
Spine at posteroexternal carapace angle	Straight; directed obliquely laterally, not curving upwards (Figs 3E, 4A)	Curved, directed obliquely laterally, prominently curves upwards (Figs 3F, 4B)	Curved; directed obliquely laterally, gently curves upwards (Figs 3G, H, 4C, D)
Posterior carapace margin in posterior view	Straight (Fig. 4A)	Relatively straight (Fig. 4B)	Straight or sinuous (Fig. 4C, D)
G1	Relatively stout; sharply bent two-thirds length from basal part; distal part almost straight (Fig. 6A)	Relatively slender; sharply bent two-thirds length from basal part; distal part gently curved upwards (Fig. 6B)	Relatively slender; gently curved medially; distal part gently curved upwards (Fig. 6C, D)

- 2b. Carapace with granular regions, without tubercles; posteroexternal carapace angle with prominent acute angle or spine 3
 3a. G1 with slender neck, distal portion rounded to spoon-shaped opening (Fig. 6F) *X. pseudohastatooides*
 3b. G1 stout, tapering to relatively sharp tip 4
 4a. Median frontal teeth as long as submedian teeth, acute; separated by deep V-shape notch (Figs 1A, 3A); spine at posteroexternal carapace angle straight, not prominently curving upwards (Fig. 4A); G1 stout, curving at about 90°, tip directed laterally *X. hastatooides* s.str.
 4b. Median frontal teeth short, half length of submedian teeth; separated by shallow V-shape notch (Figs 3B–D); spine at posteroexternal carapace angle curving upwards (Fig. 4B, C); G1 more slender, gently curving with tip directed obliquely upwards 5
 5a. Spine at posteroexternal carapace angle prominently curving upwards (Fig. 4B); G1 sharply bent two-thirds length from basal part (Fig. 6B); never with dark spot on dactylus of swimming leg *X. vassilyi* sp.n.
 5b. Spine at posteroexternal carapace angle gently curves upwards (e.g., Fig. 4C, D); G1 gently curved medially (Fig. 6C, D); dark spot on dactylus of swimming leg variable *X. subtilis* sp.n.

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