Results of the Rumphius Biohistorical Expedition to Ambon (1990)

Part 8. Swimming crabs of Ambon (Crustacea: Decapoda: Portunidae)

V.A. Spiridonov

Spiridonov, V.A. Results of the Rumphius Biohistorical Expedition to Ambon (1990). Part 8. Swimming crabs of Ambon (Crustacea: Decapoda: Portunidae).
Zool. Med. Leiden 73 (4), 30.iv.1999: 63-97, figs 1-3.— ISSN 0024-0672.
V.A. Spiridonov, Zoological Museum of the Moscow Lomonosov State University, Bolshaya Nikitskaya, 6, 103009, Moscow, Russia.

Key words: Crustacea; Decapoda; Brachyura; Portunidae; Indonesia; Ambon.
During the Rumphius Biohistorical Expedition (RBE) to Ambon, 33 species of swimming crabs were collected in the littoral and upper sublittoral zone by hand on tidal flats, using SCUBA, and using a Holthuis dredge. *Lissocarcinus arkati*, *L. laevis*, *Charybdis (C.) hellerii*, *C. (C.) orientalis*, *C. (C.) variegata*, *Portunus hastatoides*, *P. iranjae*, *P. longispinosus*, *P. stephensoni*, *T. chaptalii*, *T. cooperi*, *T. stephensoni* are recorded at Ambon and in the Moluccas for the first time. The *Portunus tenuipes* complex is partly revised and *P. rugosus* sensu Stephenson (1961) is considered a synonym of *P. tenuipes* De Haan, 1835. A new species, *P. pseudotenuipes* occurring at Ambon, in the Philippines and off South-East Asia is described. The Ambon fauna includes 55 swimming crab species, while for the Moluccas fauna 70 species are known. This makes Ambon probably one of the best studied local portunid faunas in the Indo-Pacific. According to the RBE collection and literature data, several groups of species with certain habitat preferences are discussed. 1) Upper sublittoral dwellers. 2) Shore dwellers occur in the intertidal zone, mostly on tidal flats, and in the upper sublittoral. 3) Primarily rock, rubble and reefflat dwellers belonged mainly to the genus *Thalamita*. 4) Symbiotic species of *Caphyra* are associated with alcyonarians while *Lissocarcinus* are commensals of anthozoans and echinoderms. A new association was recorded for the first time for *Lissocarcinus arkati* (with sea urchins), and the association of *L. laevis* with ceriantharians was confirmed.

Contents

Introduction

The island of Ambon (Amboina) has probably the longest tradition of biodiversity studies carried out in a relatively restricted tropical area. This tradition began with the lifelong efforts of Georg Everhard Rumphius in the 17th century. During the Rumphius Biohistorical Expedition (RBE) to Ambon organised by H. L. Strack in 1990, extensive collections of the littoral and upper sublittoral animals were made (Strack, 1993). The RBE participants (in particular, W. Backhuys, C. van Egmond, A. Fortuin, C.H.J.M. Fransen, J.C. den Hartog, A.F. de Jong, and H.L. Strack) collected a number of swimming crabs (Portunidae), a group whose study at Ambon was also initiated by Rumphius (1705; see Holthuis, 1959) and continued by such prominent carcinologists as de Man (1887), Zehntner (1894) and Stephenson (1972a, b; 1975).

The present collection includes several species not hitherto recorded at Ambon and provides sufficient material to discuss taxonomic problems in the *Portunus tenuipes* complex, a puzzling species group amongst Portunidae. This complex is partly revised in the present study; for that purpose, the collections of the National Natural History Museum in Leiden were also used. As a result, a new species *Portunus pseudotenuipes* is described.

The RBE collection is perfectly documented with regard to habitat data. This enabled me to compile characteristics of habitat preferences of the species under study based on the RBE and literature data.

In most cases, except those connected with taxonomic problems, synonymy is restricted to several references giving an update of current species concepts. When describing the RBE material, I listed the station number with some additional comments of the collectors. Strack (1993: 16-42, figs 6-42) has published detailed information on the stations. With regard to crab size, only carapace length is given, otherwise it is indicated. Notes on coloration of some species are made from colour slides taken by C.H.J.M. Fransen.

Systematic account

Subfamily Caphyrinae Paulson, 1875
Genus *Caphyra* Guérin, 1832

Caphyra laevis (A. Milne-Edwards, 1869)

Caphyra laevis; Crosnier, 1975: 759-762, fig. 5l.

Material. — RBE, Ambon: 1 ♀ (RMNH D 42971), sta. 11, depth ca. 5 m, from Xeniidae, SCUBA, C.H.J.M. Fransen; 3 ♀♀, 1 ♀ ovig. (RMNH D 42969), sta. 15, ca. 2 m, from Xeniidae, snorkelling, C.H.J.M. Fransen.

Size.— Females 5.1-11.2 mm; ovigerous female 7.4 mm.

Recorded habitat.— RBE: bare reef, sand with coral-rubble and algae; associated with alcyonarians. Earlier authors also recorded this species living in association with xeniid alcyonarians, in particular *Heteroxenia* species (Rees & Stephenson, 1966: 30; Crosnier, 1975: 759). The present species, however, is more common than other *Caphyra* species in trawl catches: in the ORSTOM material from New Caledonia, examined by me, it was trawled on sand at 6 m depth.

Distribution.— Tropical West Pacific, eastern and southwestern Indian Ocean.

Genus *Lissocarcinus* Adams & White, 1848

Lissocarcinus arkati Kemp, 1923

Lissocarcinus arkati; Crosnier, 1962: 23, figs 28, 32; Stephenson, 1972: 27 (synonymy); Moosa, 1981a: 143-144.

Material.— RBE, Ambon: 1♂, 3 ♀♀, 1 ♀ ovig. (RMNH D 42968 & 42967), sta. 34, 6 m, from red sea urchin with long spines carried by dorippid crab, SCUBA, C.H.J.M. Fransen; 4 ♂♂, 2 ♀♀, 3 ♀♀ ovig. (RMNH D 42965 & 42966), sta. 41, 4-28 m, Holthuis dredge.

Coloration.— Entirely red.

Size.— Males 5.2-13.0 mm; females 6.5-11.9 mm; ovigerous females 12.2-16.9 mm.

Remarks.— A yet unidentified sea urchin housing 5 specimens of *L. arkati* was carried by a crab *Dorippe quadridens* (Fabricius, 1798). Other commensals of the sea urchin were shrimps *Periclimenes hirsutus* Bruce, 1971 and *Tulеariocaris zanzibarica* Bruce, 1967, and a parasitic gastropod *Eumulidae* gen. spec. (Strack, 1993: 61, pl. 1, fig. 2).

Recorded habitats.— RBE: gently sloping sandy flat. Mud or muddy sand, 10-65 m depth (Stephenson, 1972a: 27), Moosa (1981a: 143) found the species at 130 m depth and commented: "Les charactères des dactyles de ses pattes marcheuses ne montrent pas que l'espèce vive accrochée sur d'autres objets". The present record indicates however for the first time that *L. arkati* may live as a commensal on sea urchins.

Distribution.— Hawaii, Tropical West Pacific, eastern and south-western Indian Ocean.

Lissocarcinus laevis Miers, 1886

Lissocarcinus laevis; Stephenson, 1961: 99, figs 1C, 2I, pl. 1, fig. 4, pl. 4C; Stephenson, 1972a: 27 (detailed synonymy); Stephenson, 1976: 12; Cariaso & Garcia, 1986: 185, fig. 4.
Lissocarcinus laeve; Patzner & Debelius, 1984: 77 (colour photo).
? Unidentified porcellanid, Colin & Arneson: 210, photo 985.

Material.— RBE, Ambon: 1 ♂ (RMNH D 42955), sta. 23, 5 m, under tentacles of *Cerianthus* spec., SCUBA, C.H.J.M. Fransen); 1 ♀, 1 ♀ ovig. (RMNH D 42954 & 42948), sta. 34, 6 m, under tentacles of *Cerianthus* spec., SCUBA, C.H.J.M. Fransen.

Coloration.— Carapace brown, with paired large white spots on either antero- and posterolateral areas, broad white band in middle of anterior part of carapace, white spots between anterolateral teeth. Chelipeds brown with white transversal bands; walking legs proximally brown, distally opaque (Patzner & Debelius, 1984: 77).

Size.— Male 8.4 mm; female 10.3; mm; ovigerous female 9.6 mm.

Recorded habitats.— RBE: the crabs with their hosts were found on sandy bottom with stones and corals. This species has been reported from dredging (Stephenson, 1972a: 27). It has not been previously collected from particular hosts. It has been found on: broken shell and coral with coarse sand, sand, 50-88 m depth (Stephenson, 1976: 12); sandy or shelly bottom, to 85 m depth, apparently "without any commensal relationship compared to other species of the genus" (Cariaso & Garcia, 1986: 185). Recently, the species was collected from live corals in the Red Sea (Neumann & Spiridonov, in prep.). Patzner & Debelius (1984: 77) published a colour photo of a crab sitting on tentacles of a cerianthid; this crab may be with little doubt recognised as *Lissocarcinus laevis*. Probably the same species was presented on the photo by Colin & Arneson (1995: photo 985) as "unidentified porcellanid". They wrote: "This small porcellanid crab lives at the base of cerianthid anemones. It can also enter the top of the cerianthid tube if threatened", thus confirming the observations presented by Patzner & Debelius (1984: 77). This and the present finding on *Cerianthus* indicate that *L. laevis* may be associated with anthozoans.

Distribution.— Wide range in the Indo-Pacific: from the Red Sea to Hawaii and Marquesas.

Lissocarcinus orbicularis Dana, 1852

Lissocarcinus orbicularis; Alcock, 1899: 20-21; Stephenson, 1961: 101, figs 1D, 3A; Crosnier, 1962: 25, figs 26-27; Heath, 1973: 13, fig. 2; Stephenson, 1972: 27 (synonymy); Cariaso & Garcia, 1986: 186, fig. 5; Dai & Yang, 1991: 204, pl. 24 (8), fig. 108(3); Spiridonov, 1994: 129; Colin & Arneson, 1995: 212, photo 998.

Material.— RBE, Ambon: ♀ immat. (RMNH D 42949), sta. 1, 2 m, living on sea cucumber, walking on external skin with parasitic *Eulina* spec., snorkelling, C.H.J.M. Fransen; 1 ♂ (RMNH D 42950), sta. 1, 3 m, on holothurian (near anus or in anus), snorkelling, H.L. Strack; 3 ♂♂ (RMNH D 42947), sta. 3, on purple-yellow sea urchin; 1 ♀ ovig. (RMNH D 42945), sta. 16, 12 m, SCUBA, J. van Egmond; 1 ♂ (RMNH D 42946), sta. 16, on holothurian on outside, C.H.J.M. Fransen; 1 ♂ (RMNH D 42946), sta.42, 4-20 m.

New Guinea: 2 ♂♂, 4 ♀♀, 39 juv. (RMNH D 35789), New Guinea, 1-15 m, on 23 holothurian specimens (belonging to *Bohadschia argus* Jaeger 1833, *B. marmorata*, *Halodeima atra* (Jaeger, 1833), *Synapta maculata* (Chamisso & Eysenhardt, 1821), and *Thelenota ananas* (Jaeger, 1833)), C. Doumen leg., L.B. Holthuis det.

Coloration.— Carapace light-yellow with regularly placed brown spots: 2 rounded spots on protogastric area in line with orbits; 2 on outer supraorbital angle; 4 on mesogastric area: 2 small elongated medians and 2 more broadly separated rounded laterals slightly in front of them; 2 metagastric spots separated by same distance as protogastrics and median mesogastrics; 2 pairs of large spots on branchial areas, 1 cardiac and 1 postcardiac spot close to posterior edge. Legs yellow with brown bands:

broad bands on proximal part of chela, meri, and propodi of walking legs, broad spots on movable fingers of chelipeds and dactyli of walking legs.

Size.— Males: 3.0-16.1 mm; female 7.6 mm; ovigerous female: 12.0 mm.

Remarks.— The present specimens have the front less prominent than the specimen from Tanzania (Heath, 1973: fig. 2) and the Seychelles examined by me earlier (Spiridonov, 1994: 129). Unlike the specimens from Ambon, New Guinea and Philippines (Cariaso & Garcia, 1986: fig. 5) which have brown spots on a white background, the coloration of the above specimens from the Western Indian Ocean and the Hawaiian specimen figured by Edmondson (1954: fig. 6b) and Colin & Arneson (1995: photo 998) may be characterised as white mottling on a brown carapace; the specimens from the Laccadives have the carapace dark maroon with symmetrical yellow markings (Alcock, 1899: 21). Stephenson (1972a: 27) noted: "colour - dark mottling on a pale background, or pale mottling on a dark background". Further investigations are needed to conclude whether the different colour forms are associated with different taxa of hosts, represent an intraspecific polymorphism without relation to hosts, or merit a special taxonomic status.

Recorded habitats.— RBE: the crabs with their hosts were found on various types of bottom: from muddy sand to sand with occasional stones and corals. Earlier this species was reported to live on various holothurians, in particular *Halodeima atra* (Jaeger), *Holothuria pervicax* Selenka, and *Holothuria argus* Jaeger (Sakai, 1939; Trott & Garth, 1970; Stephenson, 1972a: 27; Cariaso & Garcia, 1986: 186; Garth et al., 1987; Dai and Yang, 1991: 204; Spiridonov, 1994: 129) or as collected from sand and coral without mentioning a holothurian host (Stephenson, 1976: 12). All specimens reported by Trott & Garth (1970) from holothurians were found either in the respiratory tree or cloaca, the latter being similar to one of the present records. The material from Ambon includes the first records of *L. orbicularis* on a sea urchin as a host. The number of New Guinean specimens found on a single holothurian varied: there were either 1-6 juveniles, or 1 adult female + 1 male, or an adult female alone.

Distribution.— Wide range in the Indo-Pacific.

Lissocarcinus polybioides Adams & White, 1849

Lissocarcinus polybioides; Stephenson, 1972: 28 (detailed synonymy); Cariaso & Garcia, 1986: 187-188, fig. 7; Spiridonov, 1994: 129.

Material.— RBE, Ambon: 1 ♀ (RMNH D 42956), sta. 41, 4-28 m. Holthuis dredge.

Size.— 5.6 mm.

Recorded habitats.— RBE: sandy bottom off Ambon. Sand, 27-30 m (Zarenkov, 1971: 181), intertidal to ca. 200 m, free living or associated with madreporarian corals (Stephenson, 1972a. 28).

Distribution.— Wide range in the Indo-West-Pacific.

Subfamily Portuninae Rafinesque, 1815
Genus *Charybdis* de Haan, 1833

Charybdis (Charybdis) ? anisodon de Haan, 1835

Charybdis anisodon; Leene, 1938: 64, figs. 29-30; Stephenson, Hudson & Campbell, 1957: 493, pl. 1, fig. 1; Tien, 1970a: 10; Stephenson, 1972a: 30-31; Wee & Ng, 1995: 14-16, figs 5A-H.

Material.— RBE, Ambon: 1 juv. damaged (RMNH D 46544), sta. 32, Holthuis dredge, 12-17 m.

Recorded habitat.— RBE: muddy bottom, 12-17 m depth. Various muddy substrates (Tien, 1970a: 10); muddy substrates, to 15 m depth, sometimes sandy beaches (Wee & Ng, 1995: 15).

Distribution.— Wide range in the Indo-West-Pacific.

Charybdis (Charybdis) hellerii (A. Milne-Edwards, 1867)

Charybdis (Charybdis) hellerii; Leene, 1938: 44-49, figs 15-17 (synonymy); Stephensen, 1945: 117; Stephenson, 1972a: 34; Cariaso & Garcia, 1986: 194-196, fig. 13; Dai & Yang, 1991: 233-234, pl. 28 (6), fig. 126 (1); Lemaitre, 1995: 644-647, figs 1-2; Wee & Ng, 1995: 32-34, figs 14A-G.
Charybdis (Charybdis) helleri; Heath, 1973: 4; Campos & Türkay, 1987: 120-122.

Material.— RBE, Ambon: 2 ♂♂, 2 ♀♀, moult cast ♀ (RMNH D 42963), sta. 36.

Size.— Males: 40.5-46.5 mm; females: 22-33.5 mm.

Recorded habitat.— RBE: littoral, flat of sand and/or mud with scattered stones. Intertidal, under rocks and stones, among live corals, dredged to 38 m (Stephenson, 1972: 32); during low tides from rock pools and under stones (Mustaquim & Rabbani, 1976: 162); *Thalassia* meadow, outer fringe of mangrove, on roots of *Rhizophora* (Campos & Türkay, 1987), sand beach, stones (Neumann & Spiridonov, in press.)

Distribution.— Indo-West-Pacific, eastern Mediterranean, introduced to Colombia, Venezuela, Cuba, and eastern Florida.

Charybdis (Charybdis) orientalis Dana, 1852

Charybdis (Charybdis) orientalis; Leene, 1938: 68, figs 32-34; Stephenson, Hudson & Campbell, 1957: 502, figs 2B, 3B, pl. 3, fig. 1, pls. 4G; Cariaso & Garcia, 1986: 199, fig. 201; Dai & Yang, 1991: 234, pl. 28 (7), fig. 126 (2); Wee & Ng, 1996: 40-44, figs 18A-C, 19A-C, 20A, B, 21A-G.

Material.— RBE, Ambon: 1 ♀ ovig. (RMNH D 42958), sta. 15, depth 2-4 m, snorkelling, J.C. den Hartog; 4 ♂♂, 3 ♀♀ (RMNH D 42960), sta. 36, littoral collecting, C.H.J.M. Fransen; 1 ♂, 1 ♀ (RMNH D 42959 & 46960), sta. 37, littoral collecting, C.H.J.M. Fransen; 1 ♀ (RMNH D 46549), sta. S3, Ambon, Bay of Baguala, Paso, 06.x.1989).

Size.— Males: 25.0-29.0 mm; females: 19.5-25.0 mm, ovigerous female 29.0 mm.

Remarks.— Within this series of specimens there is a full transition from a pilose dorsal surface of carapace to almost smooth one.

Recorded habitat.— RBE: littoral, sand and mud flats with scattered stones; sublit-

toral, sand with some coral rubble and algae. Intertidal, near rocks, under stones (Stephenson, 1972: 33); during low tides, under rocks (Mustaquim & Rabbani, 1976: 162); sandy, pebbles or weedy rocks, 10-50 m (Sakai, 1976: 360); from intertidal rocky shore to sandy or muddy bottom of 20-50 m in depth (Wee & Ng, 1995: 45).

Distribution.— Wide range in the Indo-West-Pacific.

Charybdis (Charybdis) natator natator (Herbst, 1789)

Charybdis (C.) natator; Leene, 1938: 93; Stephenson, Hudson & Campbell, 1957: 501, figs 2G, 3H, pl. 2 (fig. 4), pl. 4J; Heath, 1973: 4; Stephenson, 1972a: 33; Cariaso & Garcia, 1986: 197-199, fig. 15.

Material.— RBE, Ambon: 2 ♀♀ (RMNH D 41180), sta. 34, SCUBA, C.H.J.M. Fransen

Coloration.— Carapace red-orange, in the areas of dense tomentum dirty yellow, branchial areas anterior to mesobranchial ridges densely covered by yellow-white points; carapace ridges, edges of orbits, frontal and antero-lateral margins, and visible granules on branchial area purple; postero-lateral and posterior margins purple but with narrow white stripes. Background colour of chelipeds similar to carapace. Numerous granules on upper surfaces of chelipeds and proximal parts of cheliped spines purple, distal parts of spines white but very tips red. Granules on inner surface of chelae orange, fingers brownish-red. Legs with dark-purple and yellow-orange stripes along length of articles, sometimes broken by short yellow-white bands and spots.

Recorded habitat.— RBE: subtidal part of gently sloping sandy flat with some coral. Rocky, pebbles and sandy bottom (Sakai, 1939: 460); mud, sand, 0-55 m (Crosnier, 1962: 82); at low water, in sand, mud and weeds, also live corals, to 60 m (Stephenson, 1972a: 33).

Distribution.— Wide range in the Indo-West-Pacific. The subspecies *C. natator seychellensis* Crosnier, 1984 is restricted to Seychelles and Saya de Malha (Spiridonov, 1994: 130).

Charybdis (Charybdis) variegata (Fabricius, 1798)

Charybdis (Charybdis) variegata; Leene, 1938: 84, figs 44-45; Stephenson, Hudson & Campbell, 1957: 503, figs 3C, pl. 3, fig. 2; Cariaso & Garcia, 1986: 200-201, fig. 17

Material.— RBE, Ambon: 1 ♀ ovig. (RMNH D 42957), sta. 29, Holthuis dredge, 8-12 m.

Size.— 13.5 mm.

Remarks.— The present specimen belongs to forma typica (Leene, 1938: 44). *Charybdis variegata* var. *brevispinosa* Leene, 1937 is considered now as a separate species, *C. brevispinosa* (see Wee & Ng, 1995: 19).

Habitat.— Muddy bottom, 8-12 m. Mud, sand, 30-50 m (Sakai, 1939: 406).

Distribution.— Indo-West Pacific.

Genus *Thalamita* Latreille, 1829

Thalamita admete (Herbst, 1803)

Thalamita admete; Stephenson & Hudson, 1957: 320, 324, figs 2I, 3I, pl. 1 fig. 1, pls. 7A, 10A; Stephenson, 1972a: 44; Heath, 1973: 14, figs. 9a, 11b, d; Dai & Yang, 1991: 256, pl. 31 (6), fig. 139 (1); Wee & Ng, 1995: 59-62, figs. 29a-F.

Material.— RBE, Ambon: 1 ♂, 1 ♀, 1 ♀ ovig. (RMNH D 46521), sta. 3; 1 ♀ (RMNH D 46553), sta. 5; 2 ♂♂ (RMNH D 46519), Sta. 15; 1 juv. (RMNH D 46551), sta. 20; 1 ♂ (RMNH D 46520), sta. 26; 2 ♀♀ (RMNH D 46552), sta. 35; 21 ♂♂, 19 ♀♀ (RMNH D 46522 & 46550), sta. 37).

Size.— Males: 7-17 mm; females 8-16 mm.

Remarks.— *Thalamita savignyi* A. Milne-Edwards, 1861 which has been included in the synonymy of *T. admete* by Stephenson & Hudson (1957: 320), differs by the strongly granulated inner surface of the manus which is practically smooth in *T. admete*. All present specimens have smooth inner surfaces of the manus like the specimens from Java (Zarenkov, 1969a: 13) and from Singapore (Wee & Ng, 1995: 61). Weak granulation of the inner surface of the manus was observed in the New Caledonia material (collections ORSTOM in the Museum national d'Histoire naturelle, Paris). De Man (1902: 645-646) mentioned *T. savignyi* from the island of Ternate also belonging to the Moluccas group; however, he (op. cit.: 646) noted: "Die konvexe innen Seite des Handgliedes ist glatt..." that characterised *T. admete* s. str., not *T. savignyi*. Wee & Ng (1995: 59, 61) considered *T. savignyi* as a species separate from *T. admete* and restricted to the Red Sea.

Recorded habitats.— RBE: littoral: sandy beaches, sometimes with scattered stones or blocks of dead corals, reefflat, rocky flats. In algal turf and sand-bottomed rock pools (Heath, 1973: 14), intertidal to 13 m, mainland coast and reef areas, under stones and amongst mussel clumps (Stephenson, 1972a: 44), dead and alive corals (Tien, 1970: 10), under rocks (Mustaquim & Rabbani, 1976: 163), on dead corals (Spiridonov, 1994: 142), rocky shores and reefflats (Cariaso & Garcia, 1986), rocky or stony shore, or in coral reef areas (Dai & Yang, 1991: 257), rocky shores and reefflats (Wee & Ng, 1995: 59).

Distribution.— Wide range in the Indo-Pacific.

Thalamita carinata Zarenkov, 1970

Thalamita carinata Zarenkov, 1970: 28-30, fig. 2; Serène et al., 1974: 21; Crosnier, 1975a: 719.

Material.— Holotype, 1 ♂ (Zoological Museum of Moscow University - No Ma2145), Java, Madura Strait, near Pasir puti, O.A. Mokievsky coll.
RBE, Ambon: 1 ♂, recently moulted (RMNH D 46557), sta. 36.

Size.— Length 8.0, width 11.5 mm.

Remarks.— The holotype's carapace has a pilose dorsal surface and more pronounced ridges while in the specimen from Ambon the carapace is almost smooth posterior to the epibranchial ridges.

Recorded habitat.— RBE: a very wide flat of sand and/or mud with only few scattered stones. Littoral (Zarenkov, 1970: 30).

Distribution.— Previously known from Java and from the Rumphius I Expedition to Ambon and the neighbouring island of Moluccas. This is the third record of the species.

Thalamita cf. *chaptali* (Audouin & Savigny, 1825)

Thalamita chaptali; Crosnier, 1962: 111, figs 184, 189, 191; Cariaso & Garcia, 1986: 218, fig. 29; Dai & Yang, 1991: 258, fig. 104A (2), pl. 32 (3); Wee & Ng, 1995: 67, figs 33A-F.

Material.— RBE, Ambon: 1 ♂, (RMNH D 46541), sta. 27, littoral.

Size.— Length 12.5 mm, width 18.0 mm.

Remarks.— *T. chaptali* is difficult to distinguish from *T. parvidens* Rathbun, 1907; the best character for distinction is the morphology of the male pleopods. The present specimen, although very close to *T. chaptali* in general appearance, has the pleopods with the tip seemingly cut, no canal is seen from the anterior. It appears unlikely that this feature is an artefact.

Recorded habitat.— RBE: diverse littoral habitats: from sandy flat with coral blocks to reefflat. Intertidal - 40 m, seagrass, corals (Crosnier, 1962: 111); 5-40 m, near corals (Stephenson, 1972a: 45), crevices of coral reefs or sandy-stony bottom (Dai & Yang, 1991: 258).

Distribution.— Wide range from the Red Sea to the Philippines and Australia. This is the first record for the Moluccas.

Thalamita coeruleipes Jacquinot & Lucas, 1853.

Thalamita coeruleipes; Stephenson & Hudson, 1957: 329, figs 2P, 3P, pl. 2, fig. 1, pls. 7, 9B; Cariaso & Garcia, 1986: 219-220, fig. 30; Dai & Yang, 1991: 248, pl. 30 (5), fig. 135 (1); Poupin, 1994: 32, fig. 28; Spiridonov, 1994: 142.

Material.— RBE, Ambon: 1 ♀ (RMNH D 46530), sta. 15, under *Fungia*, 2 m; 1 ♂ (RMNH D 46531), same station, 2-4 m; 1 ♀ (RMNH D 46529), sta. 20, littoral; 1 ♀ (RMNH D 46528), Moluccas, Saparua, Dessa Booi.

Size.— Males: 11.5 mm; females: 11.5-17.5 mm.

Remarks.— A female from Sta. 15 has the left branchial area swollen probably as a result of a bopyrid infestation; similar deformation of the right branchial area is observed in the specimen from Saparua.

Recorded habitat.— RBE: sublittoral: a gently sloping sandy beach, coral sand and coral formations; littoral: sandy areas with many shallow pools, several covered with seagrass; may be associated with corals. Intertidal, in or near coral, in shingle (Stephenson, 1972a: 46); intertidal, near or on coral boulders and living corals; under stones or on coral structures and under living corals (Dai & Yang, 1991: 248); coral limestone, sand, 30 m (Spiridonov, 1994: 142).

Distribution.— Mauritius, Saya de Malha, China Seas, the Philippines, Australia, Polynesia. This is the first record for the Moluccas.

Thalamita cooperi Borradaile, 1903.

Thalamita cooperi; Crosnier & Thomassin, 1974: 1112, 1114, figs 8b-d; Vannini, 1983: 808-810, figs 2E, 3E, 4E, 7D, 8C, 9D, 10D; Spiridonov, 1994: 142-143.

Thalamita corrugata Stephenson & Rees, 1961: 421-422, figs 1a, c, e, f, 2a-c; Dai & Yang, 1991: 252-253, fig. 137B; Garth et al., 1987: 243.

Material.— RBE, Ambon: 1 ♂ (RMNH D 46542), sta.42, Holthuis dredge, 4-20 m.

Size.— Length 5.0 mm, width 7.8 mm.

Remarks.— This specimens agrees with Vannini's redescription of *T. cooperi* in having 4 anterolateral teeth, a pilose sternal surface, a characteristic basal antennal joint, straight frontal edge, a length/width ratio of 0.64, the lateral to median frontal lobes' ratio of 0.30 and the length/width ratio in the merus of P5 of 2.6.

Recorded habitat.— RBE: muddy sand with many sponges, 4-20 m. Outer reef (Stephenson & Rees, 1961: 421); in crevices among tide pools, among dead corals on reefs (Vannini, 1983: 808); coral reefs, intertidal zone to 11 m depth (Dai & Yang, 1991: 253).

Distribution.— From East Africa and Laccadives to the China Seas, Philippines, Australia. This is the first record for Moluccas.

Thalamita crenata Rüppell, 1830

Thalamita crenata Rüppell, 1830: 6, pl. 1 fig. 1; Stephenson & Hudson, 1957: 332, figs 2Q, 3Q, pl. 2 fig. 3, pls. 7F, 9C; Crosnier, 1962: 130, figs. 220, 226-227, 232-233; Stephenson, 1972a: 46; Heath, 1973: 15, figs. 6a, 8a, 9b, 12a; Cariaso & Garcia, 1986: 221, fig. 31; Dai & Yang, 1991: 246-247, pl. 30 (3), fig. 134 (1); Wee & Ng, 1995: 69-72, figs 34A, 35A,B, 36A-H.

Material.— RBE, Ambon: 1 ♂ (RMNH D 46535), sta. 4, under stones and corals, low tide zone; 1 ♂, 1 ♀ (RMNH D 46534), sta. 14, mangrove forest, mudflat.

Size.— Males: 15-33.5 mm; females: 17.5-27.5 mm.

Remarks.— The history of study of the present species (Holthuis & Fransen, 1997; Türkay & Spiridonov, unpubl.) indicates, that Rüppell and not Latreille nor H. Milne Edwards is the author of *Thalamita crenata*.

Recorded habitat.— RBE: mudflats in a mangrove, beaches or flats of muddy sand with few scattered stones, reef-flats with patches of sand, coral rubble, blocks of dead corals and stones. Lagoon, mangroves, mudflat (Stephenson & Rees, 1968: 295). "Common in all muddy and rocky areas (sometimes also in sand) where fresh water enters the sea", mangroves, estuaries (Heath, 1973: 15). Intertidal, mudflats, under stones, boulders, mussel clamps, on mud banks, in mangroves, occasionally among corals (Stephenson, 1972a: 46). Rocky shores and reefflats with coral debris (Wee & Ng, 1995: 71).

Distribution.— Wide range in the Indo-Pacific.

Thalamita danae Stimpson, 1858

Thalamita danae; Stephenson, 1972a (partim): 46; 1972b: 145-149, figs 6, 7 (partim, excl. *Thalamita foresti*

Crosnier 1962); Cariaso & Garcia, 1986: 222-223, fig. 32; Dai & Yang, 1991: 247, pl. 30 (4), fig. 134 (2); Wee & Ng, 1995: 73-82, figs 37A-C, 38A-C, 39A-C, 40A, B, 41A-D, 42A-I.

Material.— RBE, Ambon: 1 ♂ (RMNH D 46514), sta. 3, littoral; 1 ♂ (RMNH D 46513), sta. 20, littoral collecting; 1 ♂, 1 ♀ (RMNH D 46518), littoral collecting; 1 ♀, immat. (RMNH D 46515), sta. 23, littoral collecting); 1 ♂, 1 ♀ immat. (RMNH D 46554), sta. 26, littoral collecting, in sand; 1 ♀ ovig. (RMNH D 46516), sta. 27, littoral collecting; 1 ♂ (RMNH D 46536), sta. 36; 2 ♂♂ (RMNH D 46517 & 46533), Ambon, locality unknown.

Size.— Males: 15-36 mm; females: 10-11 mm, ovigerous female: 34.5 mm.

Recorded habitat.— RBE: flats of sand or muddy sand, with stones, blocks of dead corals, reefflats, areas with pebbles covered with a thin layer of silt. Intertidal to 40 m, under stones, mussel clamps, on sandy mud flats and on reefs (Stephenson, 1972a: 47); littoral, sand (Starobogatov, 1972: 338); sandy to rocky shores in the intertidal zone (Wee & Ng, 1995: 75).

Distribution.— Wide range in the Indo-West-Pacific.

Thalamita granosimana Borradaile, 1903

Thalamita granosimana; Crosnier, 1962: 103, figs 171-2, 175-7, pl. 8, fig. 2, pl. 13, fig. 3; Stephenson & Rees, 1967: 77, fig. 27; Cariaso & Garcia, 1986: 225, fig. 34.

Material.— RBE, Ambon: 1 ♂ (RMNH D 47788), sta. 35, among stones.

Size.— Female 15 mm.

Recorded habitat.— RBE: muddy substrate with many stones. Sand, to 75 m depth (Stephenson, 1972a: 48); sandy, silty and weedy coast (Cariaso & Garcia, 1986: 226).

Distribution.— From East Africa, Madagascar, and the Maldives to the Philippines. This is the first record for the Moluccas.

Thalamita cf. *mitsiensis* Crosnier, 1962

Thalamita mitsiensis Crosnier, 1962: 127, figs. 212-213, 216-218; Stephenson & Rees, 1967: 80, fig. 29; Stephenson, 1972a: 49; Sakai, 1976: 372, pl. 133, fig. 3.

Material.— RBE, Ambon: 1 ♀ (RMNH D 46547), sta. 20.

Remarks.— The present specimen has not only progastric (as in the holotype) but also distinct frontal ridges on the carapace.

Recorded habitat.— RBE: littoral: sandy areas with many shallow pools, several covered with seagrass. Sandy bottom, 35-80 m (Sakai, 1976: 372).

Size.— 4 mm.

Distribution.— Red Sea, Madagascar, the Philippines, and the Moluccas.

Thalamita picta Stimpson, 1858

Thalamita picta; Stephenson & Hudson, 1957: 344, figs. 2A, 3A, pls. 4 fig. 2, 8K, 10I; Cariaso & Garcia,

1986: 230-232, fig. 38; Dai & Yang, 1991: 250, pl. 30 (8), fig. 136 (1).
? *Thalamita picta*; Zarenkov, 1969a: 17; Moosa, 1981a: 142, 148.

Material.— RBE, Ambon: 1 ♀ (RMNH D 46555), sta.17, littoral collecting.

Size.— 7 mm.

Recorded habitat.— RBE: a very wide reef-flat with patches of sand, coral rubble, and scattered blocks of dead corals. Intertidal, under dead coral boulders, on fringing reef and near coral cays (Stephenson & Hudson, 1957: 344); clean coarse and coral debris, especially on exposed outer reefs (Heath, 1973: 17); under blocks of dead corals (Crosnier, 1962: 139); in algae of semi-beaten regions (Michel, 1964: 19); in alive coral colonies (Tien, 1970: 10); under dead coral boulders and corals, seaweed (Dai & Yang, 1991: 250); in a seagrass meadow on sand and coral debris (Neumann & Spiridonov, in prep.). A majority of records gave evidence that *T. picta* is an intertidal species; the records by Zarenkov (1969a: 17) and Moosa (1981a: 142) from the depth exceeding 150 m are worth noting. The identity of these specimens must be rechecked.

Distribution.— Wide range in the Indo-Pacific.

Thalamita cf. *philippinensis philippinensis* Stephenson & Rees, 1967

Thalamita philippinensis Stephenson & Rees, 1967b: 84-85, fig. 31, pl. 8A.

Material.— RBE, Ambon: 1 juv. (the specimen is probably lost), sta. 41, Holthuis dredge, 4-28 m.

Recorded habitat.— Sandy bottom. Sand, from pearl oysters, corals, 15-48 m depth (Stephenson & Rees, 1967a: 84).

Distribution.— Previously known from the Philippines, this is the first record for the Moluccas.

Thalamita prymna (Herbst, 1803)

Thalamita prymna; Stephenson & Hudson, 1957: 346, figs. 2R, 3R, pl. 4, fig. 3, pls. 8L, 9E; Heath, 1973: 16, figs. 6d, 9e, 12e; Dai & Yang, 1991: 250, fig. 136 (1), pl. 30 (8); Wee & Ng, 1995: 96-106, figs. 51-57.

Material.— RBE, Ambon: 1 ♂ (RMNH D 46523), sta. 20, littoral; 2 ♂♂ (RMNH D 46525), sta. 26, littoral; 1 ♂, 1 ♀ (RMNH D 46524), Sta. 27, littoral; 1 ♂ (RMNH D 46527), sta. 33, Holthuis dredge, 20-23 m; 1 ♂ (RMNH D 46526), Moluccas, Saparua, Dessa Booi, 30.xi.1990.

Size.— Males: 10-24 mm; female: 13.5 mm.

Remarks.— The specimen from Sta. 33 fits the description of *T. prymna* var. *pelsarti* described by Montgomery (1931: 427) and considered as a separate species by Wee & Ng (1995: 87-94, figs. 46-48).

Recorded habitat.— RBE: reef-flats with sandy areas, stones, boulders and blocks of dead corals, pools, several of which covered with seagrass. Var. *pelsarti* was found in the upper sublittoral on a muddy bottom. Intertidal, coral reefs, to 30 m depth

(Stephenson, 1972a: 50); in dead corals (Tien, 1970b: 1990). "Occasional on lower shore in pools and under weed and rocks in those areas which are sheltered without being too muddy. Sometimes in coral" (Heath, 1973: 16). "Reefflats, coral shingle; the young often hidden in coral clamps of *Acropora* spec. " (Dai & Yang, 1991: 250); rocky shores (Wee & Ng, 1995: 98).

Distribution.— Wide range in the Indo-West-Pacific.

Thalamita sima H. Milne-Edwards, 1834.

Thalamita sima; Stephensen; 1945: 126-128, fig. 27; Stephenson and Hudson, 1957: 352, figs. 2C, 3C, pl. 5, fig. 2, 8O, 9G; Crosnier, 1962: 136, figs. 234-236; Dai & Yang, 1991: 254, fig. 138 (1), pl. 31 (4); Wee & Ng, 1995: 110, figs. 60-64.

Material.— RBE, Ambon: 1 ♂ juv., 1 ♀ (RMNH D 47789), sta. 1, 4-28 m. Holthuis dredge; 1 ♂ juv. (RMNH D 46539), sta. 43, 4-6 m, Holthuis dredge.

Size.— Males: 8.0-8.5 mm; female 8.0 mm.

Recorded habitat.— RBE: sandy and muddy sand bottom. Intertidal to 30 m, under stones, rocks, and mussel clamps, low water springs in muddy flats (Stephenson & Hudson, 1957: 352); sand, mud, 35-49 m depth (Stephenson, 1967: 37); littoral, muddy sand (Starobogatov, 1972: 37); intertidal muddy flats or under stones, rocks, to 16 m depth (Dai & Yang, 1991: 254); sublittoral, up to 30 m (Wee & Ng, 1995: 110). Occurs also on the surface (Zarenkov, 1969a: 18).

Distribution.— Wide range in the Indo-Pacific from Mozambique to Japan, Hawaii, and Australia.

Thalamita stephensoni Crosnier, 1962

Thalamita stephensoni Crosnier, 1962: 140, figs. 241-248; Stephenson, 1972a: 52.

Material.— RBE, Ambon: 1 ♀ immat. (RMNH D 46540), sta. 37.

Size.— 6.0 mm.

Recorded habitat.— RBE: sandy beach with few smooth stones. Intertidal species (Stephenson, 1972a: 52).

Distribution.— Wide range from East Africa to Hawaii, this is the first record for the Moluccas.

Genus *Portunus* Weber, 1795

Portunus brockii (de Man, 1887)

Neptunus Brockii de Man, 1887: 328, pl. 13, fig. 4.
Neptunus brockii; Alcock, 1899: 43; Shen, 1937: 111, fig. 7a.
Portunus brockii; Stephenson and Campbell, 1959: 106, fig. 2G, 3G, pl. 2, fig. 3, pls. 4G, 5G; Ow-Yang, 1963: 35, pl. 6A.

Material.— RBE, Ambon: 1 ♂ (RMNH D 42962), sta. 2, littoral collecting; 1 ♂ (RMNH D 46543), sta.

41, Holthuis dredge, 4-28 m.
1 ♂ (RMNH D 16732), Ambon, 1864, E.W.A. Ludeking.

Size.— 10.0-16.0 mm.

Remarks.— In describing *Neptunus Brockii* from Ambon, De Man (1887: 329) noted: "Die wenig vorspringende Stirn ist sechzähnig, aber die zwei Mittelzähne sind ausserordentlich klein und rudimentär und ragen so wenig hervor, das die Stirn auf den ersten Blick nur vierzähnig erscheint". Alcock (1899: 43), Shen (1937: 111, fig. 7a), and Ow-Yang (1963: 35, pl. 6A) mentioned and figured a single-lobed front in the material from India and Malaya. Stephenson in key (1972a: 13) characterised the front as "either indistinctly 3-lobed of flat". Both present specimens and that from the RMNH collected at the type locality have a front as described by De Man. Furthermore, De Man (1887: 330) described the posterior edge of the arm as: "Der Hinterrand des Gliedes trägt, wie bei *tuberculosus*, nur einen einziegen, kurzen Dorn an distalen Ende". Shen (1937: fig. 7b) confirmed this observation while Stephenson and Campbell (1959: 106) noted the presence of 2 lobular teeth. Ow-Yang (1963: 36, pl. 6B) mentioned one "spine at the distal end" but figured also a tubercle proximal to it. The examined Ambonese specimens have 1 blunt tooth and a distal tubercle.

Recorded habitat.— RBE: beach of muddy sand, with few scattered stones and blocks of dead corals, just below low water mark small fields of seagrass; upper sublittoral, 4-28 m, sandy bottom. Sand, up to ca. 20 m depth, mouths of rivers (Stephenson & Rees, 1967: 20). Gurjanova & Chang Hiu Phuong (1972: Table 3) mentioned *P. brockii* as a characteristic species in the Tonking Gulf community dominated by a bryozoan *Retiflustra schonaui*, ophiurans and corals *Caryophyllia* on mud and muddy clay at depths between 60-80 m; according to these authors (Gurjanova & Chang Hiu Phuong, 1972: Table 6) it also occurs in the community on muddy sand with shell dominated by maldanid polychaets and foraminifers at depths between 50-60 m.

Distribution.— Western tropical Pacific to eastern Indian Ocean.

Portunus hastatoides Fabricius, 1798

Portunus hastatoides; Stephenson & Campbell, 1959: 101-102, figs 2D, 3D, 4D, 5D, pl. 1 fig. 4; Stephenson, 1972a: 40; Dai & Yang, 1991: 216, pl. 26 (3), fig. 114 (2); Spiridonov, 1994: 136.

Material.— RBE, Ambon: 1 ♂, 1 ♀ (RMNH D 42961), sta. 33, Holthuis dredge, 20-23 m.

Size.— Male: 15.5 mm; female 14 mm.

Recorded habitat.— RBE: muddy sublittoral, 20-23 m. Sand, clay, 3-49 m (Stephensen, 1945: 122). Mud with sand (Tien, 1970a: 10); dredged in sand, mud and shell, from low water mark to 82 m (Stephenson, 1972a: 42); coral limestone (Neumann & Spiridonov, in press.). Gurjanova & Chang Hiu Phuong (1972: Table 1) recognised this species as subdominant in the Tonking Gulf community on mud and clay dominated by maldanid polychaets, bivalves *Amussium pleuronecta* and *Gari schapmani*, and brachyurans *Charybdis truncata*, *Chasmocarcinus gelasimoides*, and *Scalopidia spinosipes*.

Distribution.— Wide range in the Indo-West-Pacific.

Portunus innominatus Rathbun, 1909
(fig. 1B)

Neptunus (Lupocycloporus) gracilimanus Alcock, 1899: 45 (non *Amphitrite gracilimanus* Stimpson, 1858: 38).

Portunus (Lupocycloporus) innominatus Rathbun, 1909: 114; Ow-Yang, 1963: 54; Stephenson, 1972a: 40; Stephenson, 1972b: 136.

? *Neptunus minutus* Shen, 1937: 115, figs. 9a-c.

? *Portunus minutus*; Stephenson, 1967: 16, pl. 2; 1975: 179 (record only).

Material.— RBE, Ambon: 2 ♀♀ (RMNH D 47790), sta. 41, Holthuis dredge, 6 m.

Description.— Carapace length 9 and 12.5 mm, carapace width 16 and 22 mm. Carapace nearly twice as broad as long, convex. Four frontal lobes somewhat protruding beyond inner supraorbital lobe: acutely rounded medians much narrower than broadly rounded laterals.

Orbits finely granulated, two dorsal and one ventral inclination present; inner supraorbital lobes truncated; suborbital lobe produced beyond frontal margin.

Carapace covered by very short dense tomentum, granular ridges and areas slightly elevated. Following granular areas present: frontal lobes covered by granules, orbitals as patches of sparse granules, median gastric, mesogastrics, metagastrics ridge-like, epibranchials in form of ridges, two pairs of mesobranchials and pair of broad granular patches on cardiac region. Sparse granules on anterolateral teeth and along anterolateral border. Posterolateral borders of carapace form curve with posterior border.

Nine anterolateral teeth, 1st relatively obtuse, reaching level of inner supraorbital lobe, following teeth 2-8 smaller than 1st gradually increasing in size: first three of them obtuse, rest sharp. Last tooth ca. twice longer than longest of preceding teeth, sharp, slightly curved forward.

Subhepatic and pterygostomial areas granulated and hirsute; sternum covered by fine granules.

Maxilliped 3 with hirsute outer surface, rounded anterior edge of merus produces forward, not laterally.

Chelipeds 2.56-2.72 times longer than carapace. Merus ca. twice as broad as carpus and propodus, granulated, bears four spines on anterior border, distalmost separated from others and located near anterodistal angle. Posterior border with two spines in distal quarter. Carpus slender, with two granular costae on upper surface. Innermost of them bifurcates: one line of granules runs to inner spine, other ends near usual proximal propodal spine near carpo-propodal articulation. Besides of this there are granular lines along inner and outer edges of carpus. Upper surface of manus with two granular costae along edges: inner bears large spine on distance of ca. 1/5 before distal end and terminates in smaller spine; outer with one spine in front of proximal outer spine. Two granular costae on both inner and outer surfaces of manus.

Pereopods (P) 2 are longest of ambulatory legs (25 mm), P 4 are shortest. Articles of ambulatory legs bear short hairs. Dorsal surface of carpi of P 2-4 grooved while their propodi and dactyli with grooves on lateral surfaces. Natatory legs with relatively long merus (3.5 × 2), with usual spine on posterodistal border; distal edge ser-

Fig. 1. A, *Portunus pseudotenuipes* spec. nov., allotype, ♀ ovig., 15 × 31.5 mm, RBE, Ambon, Sta. 41; B, *Portunus innominatus* Rathbun, ♀ 12.5 × 22 mm, RBE, Ambon, Sta. 41

rated. Propodus and dactylus of approximately same size, longer than merus. Tip of dactylus pointed but not produced in conspicuous spine.

Abdomen somites 1 and 2 completely fused; somites 3 and 4 partly fused; three proximal somites with usual transverse keels, somite 4 with keel (strong in larger female) in median third.

Female genital pore has oval shape, not covered by projection, occupies ca 3/4 of third sternite width; posterior valve ca. twice as broad as anterior.

Remarks.— The species *P. innominatus* was established by Rathbun (1909: 114) for the specimens mentioned by Alcock (1899: 45) under the name *Neptunus gracilimanus* (Stimpson, 1858) but according to her opinion being different from that species. Alcock (op. cit.: 44-45) mentioned also *Neptunus whitei* A. Milne-Edwards, 1861 which was proven to be a junior synonym of *P. gracilimanus* (Stimpson) by Stephenson and Campbell (1959: 115). Chopra (1935: 481) also confirmed the opinion that Alcock's specimens did not belong to *P. gracilimanus* although Shen (1937: 113) stated the opposite. Shen (op. cit.): 115, fig. 9a-c) described *Neptunus minutus* basing on a single female whose description is very similar to Rathbun's concept of *P. innominatus*. Ow-Yang (1963: 54) thus considered *P. minutus* as a junior synonym of the latter species. The current consensus is that *P. innominatus* is a valid species and Alcock's series of *Neptunus gracilimanus* must be considered as its syntypes. *P. innominatus* was however never illustrated and properly described. Our specimens fit the diagnostic features given by Alcock (1899: 45). Both the specimens described by Alcock and our material differ from *P. minutus* in the absence of the protogastric ridge and more prominent median frontal lobes. Final decision concerning the identity of all specimens identified as *P. innominatus* and the status of *P. minutus* may be made only after re-examination and re-description of the type series.

Recorded habitat.— RBE: sandy bottom, 6 m depth.

Distribution.— The type series originated from Andaman Islands, Burma (Gulf of Martaban and Arakan Coast), and probably the Malay Peninsula (since Alcock (1899: 45) indicated "the east coast of the Peninsula"). Other records are from Thailand, the Java Sea, the Sunda Strait, Kei Is., Ambon (Stephenson, 1972b: 136), and New Caledonia (Moosa, in press). *Portunus minutus* was described from Siglap (Malaya) and recorded from the Gulf of Thailand (Stephenson, 1967: 16), Timor, and northern Sumatra (Stephenson, 1975: 179).

Portunus iranjae Crosnier, 1962

Portunus iranjae; Crosnier, 1962: 61, figs. 107, 110-11, 115, 118-119, pl. 4, fig. 2; Nagai, 1981: 30-31, pl. 2D; Dai & Yang, 1991: 217, pl. 26 (4)

Material.— RBE, Ambon: 1 ♂, 1 ♀ (RMNH D 42962 & 42951), sta. 23, SCUBA, 10 m, sieving from sand, A. Fortuin coll.; 1 ♀ (RMNH D 422953), sta. 31, SCUBA, 10 m, sieving from sand, A. Fortuin coll.

Size.— Male: 4.0 mm; females 6.0-7.0 mm.

Remarks.— The present specimens have 6 anterolateral teeth while specimens from China and Japan have 7-9 teeth (Dai & Yang, 1991: 217, pl. 26 (4); Nagai, 1981: pl. 2D); the anterior edge of the merus of maxilliped III is more oblique than that shown in the figure by Crosnier (1962: fig. 107).

Coloration.— Pear-shaped white area extended in frontal part of carapace and narrowed in mesial mesogastric part is bounded by black triangles on inner frontal lobes; lateral mesogastric areas are white in background but densely covered by yellow dots. On metagastric and anterior cardiac areas butterfly-shaped dark bluish-

grey spot crossed by yellowish cervical groove. From this spot bluish-grey band expands to posterior edge of carapace. Top of cardiac area greyish-yellow laterally bounded by rounded patches of same coloration. A series of merging white spots stretches from the lateral supraorbital lobes and first anterolateral teeth to the mesobranchial areas. From the posterior anterolateral teeth to the posterolateral surface of the carapace there is a succession of white and greyish-yellow, partly limited by black stripes.

Merus of cheliped light blue covered by yellow and white dots. Carpus greenish-blue in background, densely covered by yellow dots, anterior edge of carpus white. Upper surface of manus has colour pattern similar to carpus but with large irregularly shaped black spot in proximal part; distal part white. Fingers white or bluish-white with black spots proximally. Articles of ambulatory and natatory legs with alternating transverse white-bluish and black stripes, dactyli of natatory legs transparent.

Recorded habitat.— RBE: upper sandy sublittoral with stones, corals; burrowed in sand. Coral sand in the intertidal zone (Crosnier, 1962), reefs, to 6 m depth (Stephenson & Rees, 1967: 30).

Distribution.— Madagascar, Japan, China seas, Philippines, Tuamotu and Society Is. This is the first record for the Moluccas.

Portunus cf. *longispinosus* (Dana, 1852)

Portunus longispinosus; Stephenson & Rees, 1967: 29; Crosnier & Thomassin, 1974: 1101; Stephenson, 1976: 16-18.
Portunus longispinosus sensu Rathbun; Stephenson, 1972a: 40

Material.— RBE, Ambon: 1 ♀ immat. (RMNH D 46558), sta.37, sieved from sand.

Size.— Female 3.6 mm.

Recorded habitat.— RBE: sandy bottom variegated with patches of coral, 4-5m; burrowed in sand. The association of *P. longispinosus* complex with sandy upper sublittoral substrates and its ability for quick burrowing was also mentioned earlier, (Edmondson, 1954: 242), it was also recorded on sand with bryozoan remains and shell, 20-35 m (Zarenkov, 1971: 182), internal part of a reef, mud with *Halophila*, coral sand (Crosnier & Thomassin, 1974: 1101).

Distribution.— *P. longispinosus* complex is widely distributed in the Indo-Pacific.

Portunus orbitosinus Rathbun, 1911.

Portunus orbitosinus; Stephensen, 1945: 120; Stephenson & Campbell, 1959, figs. 2A, 3A, pl. 1, fig. 1, pls. 4A, 5A; Crosnier, 1962: 55-57, figs. 88, 90-1, 93; Stephenson & Rees, 1967: 31, fig. 6; Stephenson, 1972a: 41.

Material.— RBE, Ambon: 1 ♀ (RMNH D 42972), sta. 31, Holthuis dredge; 1 ♀ (RMNH D 42973), sta. 41, Holthuis dredge.

Size.— Females: 12.5-13.0 mm.

Recorded habitat.— RBE: sand with few stones, 15 m, 4-28 m. Shell and gravel, 33

m (Stephensen, 1945: 120), sand, muddy sand (Crosnier, 1962: 57), lagoon, 15-25 m, sand flat (Stephenson & Rees, 1968: 294), sand, sometimes with shell and bryozoan debris, 20-48 m depth (Zarenkov, 1971: 183).

Distribution.— Indo-Pacific.

Portunus sanguinolentus sanguinolentus (Herbst, 1783)

Portunus sanguinolentus; Stephenson & Campbell, 1959: 98, figs. 2B, 3B, pl. 1, fig. 2, pls. 4B, 5B; Stephenson, 1972a: 42-43.

Material.— RBE, Ambon: 1 ♂ (RMNH D 41179), sta. 34; 1 ♀ ovig; 1 ♀ (RMNH D 42964), sta. 42, Holthuis dredge, 4-20 m.

Size.— Female 23.5 mm.

Recorded habitat.— RBE: littoral: wide sand beach with stretches covered with pebbles and stones; sublittoral: muddy sand bottom, 4-20 m. Mostly sandy sublittoral, sometimes on mud, 9-28 m, also in estuaries (Sumpton et al., 1989: 112); also pelagic (Zarenkov, 1969b: 16).

Distribution.— Indo-West-Pacific.

Portunus stephensoni Moosa, 1981

Portunus emarginatus Stephenson & Campbell, 1959: 107, figs. 2H, 3H, pl. 2 fig.4, pls. 4H, 5H; Stephenson, 1972a: 39. [name preoccupied by *P. emarginatus* Leach, 1814]
Portunus stephensoni Moosa, 1981b: 108.

Material.— RBE, Ambon: 1 ♀ ovig. (RMNH D 47791), sta. 4; ? 1 juv. damaged (probably lost), sta. 39.

Remarks.— The name *P. stephensoni* was suggested instead of preoccupied *P. emarginatus* Leach, 1814 which itself is probably a junior synonym of *P. arcuatus* Leach 1814 (Moosa, 1981b: 108).

Recorded habitat.— RBE: beach of muddy sand, with few scattered stones and blocks of dead corals, just below low water mark small fields of seagrass.

Distribution.— Madagascar, Mauritius, Australia, and Palau Island. This is the first record of the species from the Moluccas.

Portunus tenuipes complex
Portunus tenuipes de Haan, 1833

Portunus tenuipes de Haan, 1833: fig. 2 (D-H).
Portunus (Amphitrite) tenuipes de Haan 1833: 39, pl. 1, fig. 4
? *Neptunus rugosus* A. Milne-Edwards, 1861: 335, pl. 33, fig. 3.
Neptunus (Amphitrite) tenuipes; Thallwitz, 1891: 48; Sakai, 1939: 389-90, pl. LXXX, fig. 2.
? *Portunus tenuipes*; Stephenson & Campbell, 1959: 103-104, figs 2E, 3E, pl. 2 (fig. 1), pls. 4E, 5E; Ow-Yang, 1963: 44-47, pl. 8.
Portunus rugosus; Stephenson, 1961: 111, figs. 2B, 3G, pl. 3, fig. 1, pls. 4G, 5E.
Portunus rugosus form I; Stephenson & Rees, 1967b: 37, figs. 8-11 pls. 3B, 4; Stephenson: 1972b: 138; Stephenson, 1975: 179.

? *Portunus rugosus* form II; Stephenson & Rees, 1967b: 37-45, figs. 9c, h, i, 11c, g, pl. 5; Stephenson, 1972b: 138.

Portunus (Monomia) tenuipes; Sakai, 1976: 340-341, pl. 120, fig. 3; Yamaguchi & Baba: 1993: 399, fig. 138 (photograph of the holotype and displayed mouthparts).

Portunus tenuipes; Dai & Yang, 1991: 220-221, fig. 118 (1), pl. 26 (8).

Neptunus (Hellenus) tenuipes; Alcock, 1899: 42.

non *Portunus tenuipes*; Stephenson & Rees, 1967b: 49-50, fig. 15; Stephenson, 1972a (in key): 14 (= *P. pseudotenuipes* spec. nov.).

non *Neptunus (Hellenus) tenuipes*; Shen, 1937: 104, fig. 4 (= *P. pseudotenuipes* spec. nov.).

Material.— Holotype, ♂, (RMNH D 400 and D 42291 (mouthparts)), Japan, 1823-1829, Ph. F. von Siebold; 6 ♂♂, 3 ♀♀ (RMNH D 29997, 30000-30003), Pulau Weh, N. Sumatra (identified as *P. rugosus* by W. Stephenson).

RBE, Ambon: 1 ♀ (RMNH D 47792), sta. 41, Holthuis dredge, 4-28 m; 1 ♀ (RMNH D 47793), sta. 42, Holthuis dredge, 4-20 m; 1 ♂ (RMNH D 47793), sta. 43, Holthuis dredge, 4-6 m.

Description of holotype.— Male, 21.5 × 35.0, left pereopod 4 missing, dactylus of right pereopod 2 missing; mouthparts removed and deposited in dry collection.

Frontal teeth sharply rounded, distinctly producing beyond inner supraorbital lobe so that anterior of maxilliped III can be hardly seen in dorsal view. Median tooth narrower than laterals, their width ratio equals 1:1.29.

Orbits granulated, with rows of granules along supraorbital border. Two dorsal inclinations present with outer one distinct; suborbital lobe produced beyond frontal margin, strongly widened dorsally and hollowed.

Depressions of carapace with rare piles. All groups of granules shown by Stephenson & Rees (1967: fig. 8) present: postfrontals as two separate non-elevated patches, other areas elevated in varying degree. Postorbitals indistinctly divided into three parts, anterior largest, outer smallest; protogastric and metagastric areas separated indistinctly, metagastics larger than mesogastrics. Epibranchials as rows of granules widening proximally and ending under middle of orbital perimeter. Three pairs of mesobranchial areas present, anterolateral largest, posterior smallest. Lateral postcardiacs of approximately same length as cardiacs, posterolateral cardiacs as short elevated rows of granules; isolated small granular patch posterior to medial postcardiacs.

Nine antero-lateral teeth clearly cut but may be hidden in dense pile: 1st truncate and obtuse, 2nd smaller and sharper than 1st, 3d, 5th, 7th and 8th teeth sharp, of approximately same shape and size, 4th and 6th smallest. Last tooth largest, slightly directed forward.

Posterolateral border slightly convex, forming almost right angle with postero-lateral borders but without spiniform process.

Subhepatic and pterygostomial areas finely granulated. Thoracic sternum densely covered with granules arranged in irregular rows, anterior edges of sterna 1-4 granulated.

Chelipeds very long (50 mm): merus bears three spines in distal half of its anterior surface, the distant one close to mero-carpal articulation; posterior surface of merus with spine on distal end. Carpus with two spines, outer smaller, and three indistinct costae on upper surface. Chela almost equal in size. Manus clearly longer than fingers: upper surface with two costae, inner of them ending in blunt spine, one costa on

outer surface; no distinguishable costae on densely granulated inner and lower surface. Upper surface of movable finger with two granulated costae; three costae on ventral surface of immovable finger.

Pereopods (P) 2 (45 mm) slightly longer than P 3, P 4 shorter than P 3. Dactyli and propodi grooved on lateral surfaces. Natatory legs with short merus and relatively long propodus and dactylus. Posterodistal edge of merus finely serrated.

Abdomen smooth or with few granules on somites 1-4, sparse granules close to the outer edge of penultimate somite. Penultimate somite slightly broader than long (length 3.3, width 3.7 mm) with proximal edge slightly sinuous, outer edge convex bearing sparse granules close to outer edge. Ultimate somite longer than broad, acutely rounded.

Coloration.— Irrespective to the time of staying in alcohol (i.e., 150 or 3 years) the crabs have a rather uniform yellow coloration.

Remarks.— The mouthparts of the holotype deposited in the dry collection. Maxillipeds 3 were kindly inspected by Dr C.H.J.M. Fransen. He found the distal part of the merus similar to that of *P. pseudotenuipes* spec. nov. (fig. 3D). The specimens of *P. tenuipes* from Ambon have anterolateral end of the maxilliped 3 strongly produced forward but with the anterior edge somewhat oblique, sloping proximally (fig. 2F).

De Haan (1835: 31) wrote in his description of *P. tenuipes*: "Thorax latus 1'', 4''', longus 6''' pubescens", elevated granular areas were not however shown in his figure (ibid.: tab. 1, fig. 4). Describing Australian specimens of *P. rugosus,* Stephenson (1961: 113) noted that they differ from *P. tenuipes* in: "1). The form of the lateral frontal teeth which in *P. tenuipes* are much broader than the medians and relatively rounded; 2). The much more elevated and conspicuous granular processes in the carapace; 3). The ultimate segment of the male abdomen, which in *P. tenuipes* is more rounded; 4). Details of spinulation of the male pleopod." Later, Stephenson & Rees (1967: 37-45) described two forms of *P. rugosus* differing in roundness of lateral frontal teeth and their ratio to the median tooth, shape of the last antero-lateral tooth, and the length/width ratio of the penultimate abdominal segment of male. They noted furthermore that there is a tendency to bridge the gap between these two forms (Stephenson & Rees, 1967: 44; Stephenson, 1972b: 138). All the carapace characters of the holotype of *P. tenuipes* fall over the range of variation given by the above authors for *P. rugosus* form I. In his key Stephenson (1972a: 14) discriminates between the two species as follows: "Wrist of cheliped with inner spine only - *P. tenuipes*; wrist of chelipeds with both inner and outer spine - *P. rugosus*". However, the type of *P. tenuipes* has both the inner and outer spines. Although I have not studied the spinulation of the pleopod 1 of the *P. tenuipes* type in detail it appears that the pleopod's gross structure is similar to that figured by Stephenson & Rees (1967: fig. 11) for *P. rugosus*. Finally, the specimens from Sumatra identified by Stephenson as *P. rugosus* are apparently conspecific with de Haan's type of *P. tenuipes* and the specimens from Ambon. The latter have an average carapace width/length ratio 1.96 (SD = 0.13, n = 3) while the median to lateral frontal lobes ratio equals 1:1.33 (SD = 0.10, n = 3). Therefore, I conclude that *Portunus rugosus* sensu Stephenson, 1961 is *Portunus tenuipes* De Haan, 1833.

The description of *P. tenuipes* from the China seas by Dai & Yang (1991: 220-221) agrees well with the holotype of this species in most characters. The only difference

concerns the shape of the frontal lobes: the laterals are reported to be "much broader than the median one" (ibid: 220). Such lobes are figured by Stephenson & Rees (1967: fig. 15) for the Philippine material, which has also been identified as *P. tenuipes*. Lateral lobes which hardly protrude beyond the supraorbital lobes and which are more than 1.5 times broader than the median lobe, are characteristic for the closely related species *P. pseudotenuipes* spec. nov., which is described below. I am inclined, however, to consider the Chinese specimens as *P. tenuipes* while those from the Philippines as *P. pseudotenuipes*.

The holotype of *P. rugosus* from Australia is a small specimen, with the length only 16 mm. According to the description of Milne-Edwards (1861: 335), its most distinguishing features are as follows.

"Carapace très-fortement bosselée, les parties sailantes granuleuse, les parties rentrantes lisses." "Cornes latérales très-grandes, très-minces et légèrement dirigées en arrière. Angles postériers de carapace aigus et spiniformes. Front avec cinq dents, la médiane pointue et un peu plus courte que les mitoyennes, les externes courtes et obtuses". *Portunus* species are subject to age-related variation which in particular may be expressed in longer last anterolateral teeth and stronger tuberculosity of the carapace in younger specimens. The only apparently important difference between *P. rugosus* and *P. tenuipes* is the spiniform posterolateral junction in the type of *P. rugosus* and a right-angled one in the latter species. This spiniform junction is shown in Milne-Edwards' figures (Milne-Edwards, 1861: pl. XXXIII, figs 3, 3a), which are however unusually schematic for this author. Milne-Edwards' type may be extant according to his note (op. cit.: 335) in the British Museum (Natural History). Examining this material along with the studies on age-related variability in the swimming crabs, may bring light to the problem of the possible synonymy of *P. rugosus* (A. Milne-Edwards) and *P. tenuipes* De Haan. Thallwitz (1891: 48) has first proposed the suggestion that *P. tenuipes* and *P. rugosus* may represent the same species.

Form II of *P. rugosus* described by Stephenson & Rees (1967: 43) differs in having long last anterolateral teeth which may be directed slightly backward, relatively broad outer frontal lobes which may be directed slightly outward, and "granulated areas of carapace relatively inconspicuous amongst the pile of hairs, not very coarsely granular, and without any tendency to be tubercular". In Australian specimens described by Stephenson & Campbell (1959: 103-104) as *P. tenuipes,* the last anterolateral teeth are also directed backward. Moreover, on their photograph of the species (ibid.: pl. 2, fig. 1) the lateral frontal lobes appear to be directed slightly outward. Thus *P. rugosus* form II seems to be conspecific with the Australian form of *P. tenuipes*. The specimens from Singapore recorded as *P. tenuipes* by Ow-Yang (1963: 44-47, pl. 8) appear to be conspecific with the above two forms as well. There is a remarkable similarity between details of the first male pleopod spinulation between the latter (Ow-Yang, 1963: pl. 8E,F) and the Australian form (Stephenson & Campbell, 1959: fig. 3E). The form from the Philippines has a slightly different spinulation pattern (Stephenson & Rees, 1967: fig. 11g). The question however remains whether these forms belong to *P. tenuipes* in the present concept or constitute a separate taxon.

Size.— Specimens from Ambon: males: 11.5-17.3 mm, female 13.5 mm.

Recorded habitat.— Off Ambon on sandy and muddy sand bottom, sometimes with many sponges, 4-28 m deep. In Western Australia on sandy bottom, ca. 15m, in

the Philippine area on sand, ca. 20-30m deep; in both areas the species was recorded swimming at night having been collected by a dip net or using electric light (Stephenson, 1961: 111; Stephenson & Rees, 1967: 38-39); it was also recorded from the surface in New Caledonia (Stephenson, 1972b: 138). In the China seas the species has been recorded on sandy and stony bottom, 15-35 m deep (Dai & Yang, 1991: 221).

Distribution.— Japan, China seas, Malay Peninsula, the Philippines, Indonesia, Western Australia, New Caledonia.

Portunus pseudotenuipes spec. nov.
(fig. 1A, 2A-C, 3)

Portunus (Hellenus) tenuipes; Shen, 1937: 104, fig. 4 (not *P. tenuipes* de Haan, 1833).
Portunus tenuipes; Stephenson & Rees, 1967: 49-50, fig. 15; Stephenson, 1972a (in key): 14 (not *P. tenuipes* de Haan, 1833).

Material.— RBE: Ambon: Holotype ♂, length 22 mm, width 35.5 mm (RMNH D 46564), sta. 41, Hitu in front of Rumatiga up to river Lela, 10.xii.1990, Holthuis dredge, 4-28 m depth, sandy bottom;
Paratypes: RBE, Ambon: 5 ♂♂, 5 ♀♀, 1 juv., damaged (RMNH D 46560), sta. 29, Hitu, between base camp and Nania, 28.xi.1990, Holthuis dredge, 8-12 m depth, muddy bottom; 2 ♂♂, 2 ♀♀ (RMNH D 46561), sta. 32, Hitu, in front of Hunut, 1.xii.1990, Holthuis dredge, 12-17 m depth, muddy bottom; 1 ♀ (RMNH D 46559), sta. 33, Hitu, in front base camp, 1.xii.1990, Holthuis dredge, 20-23 m depth, muddy bottom); 3 ♂♂, 2 ♀♀ (RMNH D 46563); 1 ♀ allotype (RMNH D 47794), 1 ♂, 1 ♀ (RMNH D 47795), 1 ♂ (Zoological Museum of the Moscow University, MA4737), sta. 41, Hitu in front of Rumatiga up to river Lela, 10.xii.1990, Holthuis dredge, 4-28 m depth, sandy bottom.

Description.— Carapace much broader than long: average width/length ratio 2.41 (SD = 0.11, n = 18). Three frontal lobes slightly producing beyond inner supraorbital lobe so that anteriors of maxilliped III can be seen in dorsal view; median lobes sharply rounded, much narrower than evenly rounded laterals, in holotype their widths ratio equals 1:1.67 (SD = 0.21; n = 14).

Orbits large (width in holotype 4.0 mm) finely granulated along edges, with two dorsal inclinations, outer being bare; suborbital lobe produced beyond frontal margin, strongly inflated dorsally, otherwise similar to *P. tenuipes.*

Meso-, metagastric, proximal parts of epibranchial and mesobranchial areas of carapace slightly elevated. Depressions of carapace covered by short but dense pile. Granular patches reduced to sparsely spaced granules on postorbital, progastric, mesogastric, metagastric, cardiac, median and lateral postcardiac, epibranchial, and mesobranchial areas; few granules along anterolateral margins. Granular areas anterior to epibranchial generally much less developed than posterior areas.

Anterolateral margin hirsute. Nine antero-lateral teeth: 1st low and truncated, teeth 2-7 subequal, smaller than 1st, truncated or rounded. Tooth 8 smallest, almost evenly rounded. Last tooth largest, slightly directed forward.

Posterolateral border similar to *P. tenuipes*.

Subhepatic, pterygostomial areas, and thoracic sternum densely covered by rounded granules. Edges of sterna finely granulated.

Maxilliped III with hairs along edges but smooth in centre. Anteroexternal end of merus strongly produced forward and evenly rounded.

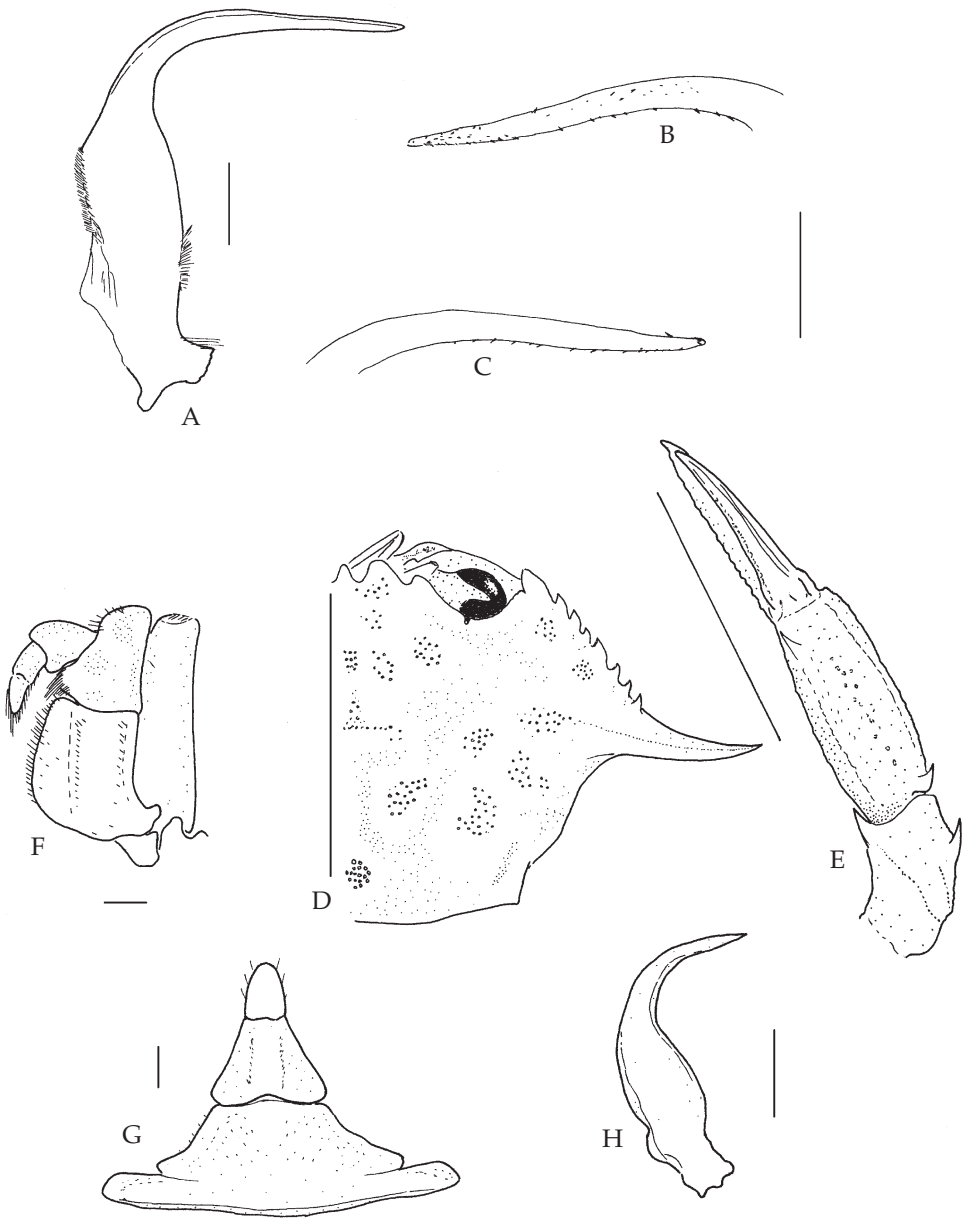

Fig. 2. A, B, C: *Portunus pseudotenuipes* spec. nov., holotype, ♂, 22 × 35.5 mm, RBE, Ambon, Sta. 41: A, gonopod I, right, from outer side; B, distal part of gonopod I, inner surface; C, distal part of gonopod I, outer surface. Scale 1 mm. D, E, F, G, H: *Portunus tenuipes* de Haan, 1835, ♂, 13.5 × 29 mm, RBE, Ambon, Sta. 43: D, half-carapace, scale 10 cm; E, cheliped (right) carpus and manus, scale 1 cm; F, maxilliped III, scale 1 mm; G, abdomen, scale 1 mm; H, right gonopod I, scale 1 mm.

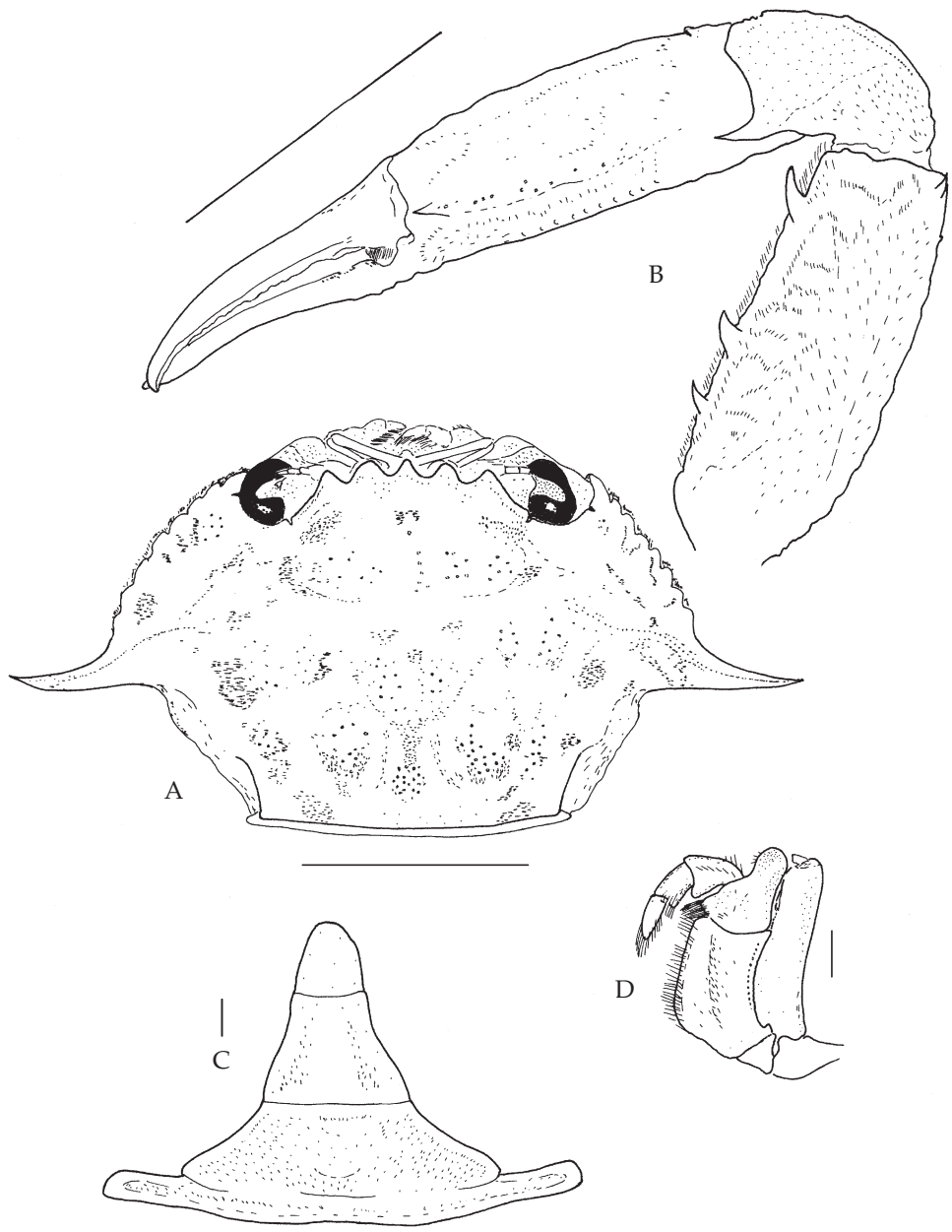

Fig. 3. *Portunus pseudotenuipes* spec. nov., holotype: A, carapace, scale 1 cm; B, right cheliped, scale 1 mm; C, abdomen, scale 1 mm; D, maxilliped III, scale 1 mm.

Chelipeds long (40 mm in holotype): merus bears three spines in distal half of its anterior surface, the distant one close to mero-carpal articulation; posterior surface with spine on distal end. Ventral surface covered by scattered granules. Carpus covered by fine granules has three indistinct granular costae, inner of them terminating in inner carpal spine; outer spine either absent or reduced to tubercle. Chela almost equal in size. Manus with two bare costae along edges of upper surface and in some specimens with grouping granules between them; innermost of costae terminates in blunt spine. Outer surface with bare costa; in some specimens there is vestige of costa on inner surface. Lower surface with squamiform marking. Fingers clearly shorter than manus: upper surface of movable finger has two granulated costae; three costae on ventral surface of immovable finger. Lateral surfaces of fingers grooved.

Pereopods 2 and 3 of almost same size, P 4 shortest of ambulatory legs. Dactyli and propodi grooved on lateral surfaces. Natatory legs as in *P. tenuipes*.

Abdomen smooth. Penultimate somite slightly broader than long (length 3.5 mm, width 4.0 mm) with outer edges slightly convex and converging distally. Ultimate somite broader than long (length 1.5, width 2.0 mm), acutely rounded.

First male pleopod strongly curved, tapering to tip. Tiny, backward directed spinules on external edge of under surface starting in single row, spreading to tip. Beyond curvature spinules form wide band of mostly backward directed terminal bristles on under side, almost up to tip. Outer surface only with marginal bristles visible from under surface.

Genital opening in females bulb-shaped, located nearly in middle of proximal portion of sternite III, with tapering part obliquely directed to longitudinal axis of body.

Coloration.— Carapace (freshly preserved crabs) brownish grey with characteristic dark hatched bounding carapace areas.

Remarks.— Several specimens recorded as *P. tenuipes* in the literature or initially identified so by me in the RBE collection apparently do not fit the concept of that species which have arisen after the examination of de Haan's type of *P. tenuipes*. Stephenson & Rees (1967b: 49) mentioned under this name, specimens differing from the type of *P. tenuipes* in the shape of the frontal teeth. Probably these specimens also have the carpus of the cheliped with the single inner spine as indicated in Stephenson's (1972a: 14) key. Otherwise it would be difficult to explain how this distinction arose: the Australian specimens of *P. tenuipes* sensu Stephenson & Campbell (1959: 103; see above), have the usual two spines on the carpus of chelipeds. This strongly suggests that the specimens from the Philippines, the present RBE material from Ambon, and probably Shen's (1937: 104, fig. 4) specimen are conspecific and belong to the species which is separate from the closely related *P. tenuipes*. The species is described above as *P. pseudotenuipes* spec. nov. and can be distinguished from *P. tenuipes* in the characters listed in table 1. It is also possible that these taxa differ in their coloration as well. Alive, *P. pseudotenuipes* are likely darker than *P. tenuipes,* also possessing brownish bounds of the carapace areas. All the above differences between the two species are rather subtle and part of them may have transitional states in some specimens. I cannot exclude that from the biological species concept point of view, *P. tenuipes* and *P. pseudotenuipes* may belong to the same polymorphic species. Nevertheless, when occurring sympatric at Ambon, they are quite distinct representing thus good morphological species.

Size.— Males: 6.5-22 mm; females: 8.5-20 mm.

Recorded habitats.— Off Ambon the species was recorded on sandy to muddy bottom, 8-28 m depth, sometimes along with a closely related species *P. tenuipes*. In the Philippines region, the species was collected from seine fishing, attracted by electric light and once it was found in a tide pool (Stephenson & Rees, 1967: 50).

Distribution.— Ambon, Philippines, probably Malaya.

Habitat discussion

Galil & Vannini (1990: 49) proposed a simple classification for habitat preferences of the littoral and upper sublittoral xanthoid crabs dividing them into 3 groups: shore dwellers; rock, rubble and reef dwellers (including facultative coral symbionts); obligate coral symbionts. With regard to the swimming crabs, which in general have wider habitat preferences, this scheme was modified and the species found in the present study were relegated to certain groups on the base of the RBE data and the literature records.

Many portunid species live near the shore but have been never or rarely recorded in the littoral zone. I consider them as upper sublittoral dwellers although occasionally some of them may be found on the littoral during low tide. Amongst the Ambonese species, the following crabs may be referred to this group: *Charybdis variegata*, *Portunus hastatoides*, *P. tenuipes*, *P. pseudotenuipes* which are associated with muddy sand or mud bottom; *Portunus iranjae*, *P. orbitosinus*, *P. innominatus*, *P. longispinosus*, and *Thalamita philippinensis* found mainly on sand substrates.

Charybdis natator appears to be a primarily sublittoral species but occurs on very diverse substrates: from mud and sand to corals.

A variety of the swimming crabs are shore dwellers occurring both in the intertidal zone, mostly on tidal flats (but according to the literature data sometimes on the rocky littoral), and in the upper sublittoral. These are the species found at Ambon on tidal flats of muddy sand and sand with scattered stones and dead corals: *Charybdis hellerii*, *C. orientalis*, *Portunus stephensoni*, *Thalamita carinata*, *T. sima*, *T. stephensoni*. *Portunus brockii*, *P. sanguinolentus*, and *Thalamita crenata* also belonging to this group may occur in mouths of rivers, estuaries and/ or mangroves.

Several species are primarily rock, rubble and reefflat dwellers although also occurring on tidal flats. These are: *Thalamita admete*, *T. coeruleipes*, *T. danae*, *T. picta*, and *T. prymna* s. str. Tien (1970: 10) and Garth et al (1987: 236) noted that several species of *Thalamita* use corals as shelter. Peyrot-Clausade (1977:26) and Ribes (1978: 126) found that swimming crabs occurring on coral reefs and reefflats of Madagascar and Reunion belonged mostly to the genus *Thalamita,* while in the reef areas of Hainan Is., Fiege et al. (1994: 86, Tab. 5) observed some species of *Charybdis* and *Thalamita* in coral rubble.

Some species appear to be facultative commensals on coelenterates (*Lissocarcinus laevis*, *L. polybioides*) or echinoids (*L. arcati*).

The group of presumably obligate commensals includes *Caphyra laevis* (on alcyonarians) and *Lissocarcinus orbicularis* (on various holothurians and sometimes on echinoids). It appears that the crabs of the genus *Caphyra*, which are known to live on certain families of corals, are more specific in relation to hosts than *Lissocarcinus* species.

Portunid fauna of Ambon

In the "Amboinsche Rariteitskamer" Rumphius (1705) mentioned four (or five) species of the swimming crabs: *Cancer marinus laevis*, *Pagurus Reidjungan*, *Cancer saxatilis*, and *Cancer marinus sulcatus*. The former three species were referred by Holthuis (1959) to respectively *Charybdis feriata* L., 1758, *Portunus pelagicus*, L., 1758 (or *P. sanguinolentus* Herbst, 1783), and *Scylla serrata* Forskål, 1755. *C. feriata* was not found during the Rumphius I Expedition in 1973 (Serène et al., 1973) and in the RBE material; however a vernacular name of this species (Cattam Ayam) recorded by Rumphius is still used by the Ambonese (Strack, 1993: 69). *Cancer marinus sulcatus* is difficult to refer to a particular taxon because in Rumphius' (1705: 10) book, this species was described only in general words. Important information is that *Cancer marinus sulcatus*, a rather large species with five large anterolateral teeth occurring in the littoral was probably common during Rumphius' time since he wrote that the crab was used for food. Holthuis (1959) considered it to be *Charybdis acutifrons* de Man, 1879, but that species was not recorded from Ambon later. Among relatively large, intertidally living *Charybdis*, *C. orientalis* Dana common at Ambon now could be also mentioned by Rumphius as *Cancer marinus sulcatus*. Another possibility is that he described under this name *Thalamita crenata*, the biggest common *Thalamita* species in the Malay Archipelago.

In the 19th century, Ambon and other island of the Moluccas were relatively often visited by naturalists who made collections of crabs (in particular, J. Brock, C. Pictet and M. Bedot, W. Kükenthal) from mostly the littoral and sublittoral habitats. De Man (1887, 1902), Zehntner (1894), and Leene (1938) described these collections. At the onset of the 20th century, several Dutch and Danish expeditions, in particular the Snellius Expedition, collected material from the lower sublittoral of Ambon Bay. Stephenson (1972b, 1975) reported portunids from these collections. In the 1970s, Ambon and neighbouring islands were studied by the Indonesian Expeditions Rumphius I and II. In table 2, I compiled historical records of the Portunidae from the littoral and sublittoral of Moluccas, also indicating findings of these species in the RBE collection. The Rumphius I Expedition data are presented in a separate column since in the list published (Serène et al., 1974: 20-21) there is no indication whether species were recorded at Ambon or elsewhere in the study area.

Amongst the 33 species of portunids collected by the RBE, the following species were found at Ambon and the Moluccas for the first time: *Lissocarcinus arcati*, *L. laevis*, *C. hellerii*, *C. orientalis*, *C. variegata*, *Portunus hastatoides*, *P. iranjae*, *P. longispinosus*, *P. pseudotenuipes*, *P. stephensoni*, *P. tenuipes*, *T. chaptalii, T. cooperi*, *T. stephensoni*. These records however do not contain anything surprising from the biogeographical point of view since most mentioned species are known from the Indonesian islands outside the Moluccas. Few species not hitherto recorded from Indonesia are known from the Philippines. The total number of species known from Ambon is 55 (belonging to 12 genera). Twenty-eight species have been found in the littoral/upper sublittoral of other islands of the Moluccas, 13 of them being common to the Ambonese fauna and 15 not recorded from Ambon so far. The Moluccan faunas of the swimming crabs share practically the same number of species (ca. 50) with the species-rich faunas of the Indonesian islands to the north of the Moluccas and the Philippines, while they

share less species with the relatively well studied Queensland fauna (North-eastern Australia) (Table 3). Without doubt, Ambon belongs to the Indo-Malayan centre of the portunid taxonomic diversity (Zarenkov, 1970b).

The number of species inhabiting the Moluccas outside Ambon appears to be strongly underestimated and may increase by future faunistic surveys. Ambon has the greatest number of recorded portunid species amongst the Indo-Pacific islands of moderate size. Other islands of that kind with relatively well-studied decapod faunas are Mauritius and Enewetak Atoll (Marshall Is.). The former fauna comprises 47 portunid species (recently corrected estimate by Spiridonov, 1994: 148) while in the latter, 32 species are so far known (Garth et al., 1987: 242-243). However, both absolute and relative frequencies of the species belonging to one of the most species-rich genus, *Thalamita*, recorded at Ambon is lower than the figures from Mauritius and Enewetak (27% of the Ambon fauna vs. 38.4% and 59.5% from correspondingly two other islands). This may reflect real biogeographical differences and different habitat diversity (i.e. reefs and rocks at Mauritius and various coral habitats at Enewetak Atoll vs. tidal flats at Ambon). On the other hand, a greater percentage of *Thalamita* species, some of which facultatively are associated with coral habitats (see above), at Enewetak Atoll may be explained by the use of various collecting methods on reefs and algal ridges (Garth et al., 1987: 237-238) which were not applied at Ambon. Therefore, we may expect new species records at Ambon itself, especially amongst coral associated forms, i.e., several species of *Thalamita*, and some species of *Caphyra*. Dredging along the shelf edge of the deep outer Ambon Bay may also result in several new findings of swimming crabs. Amongst other crab families whose systematics is not as developed as in the Portunidae, there may be many real faunistic discoveries. The brachyuran fauna of Ambon appears to be in no way completely studied yet.

Acknowledgements

I am deeply obliged to Prof. L.B. Holthuis and Dr C.H.J.M. Fransen for their generous support at all stages of this study. My research visit to the Nationaal Natuurhistorisch Museum in Leiden was funded by the Jan Joost ter Pelwijk Fonds. The Soros Biodiversity Programme supported the initial phase of this work in 1993. The major part of this study was done during my research fellowship in Germany in 1994/95 supported by the Alexander von Humboldt Foundation.

Table 1. Distinguishing characters between *Portunus tenuipes* de Haan and *P. pseudotenuipes* spec. nov.

Character	*Portunus tenuipes*	*Portunus pseudotenuipes*
Frontal lobes	sharply rounded, strongly produced beyond inner supraorbitals, partly covering anteriors of maxillipeds 3	only median sharply rounded, almost not producing beyond supraorbitals; anteriors of maxilliped 3 well seen in dorsal view
Lateral to median frontal lobes width ratio	usually < 1.6	usually 1.6-2.0
Granular areas on	distinct	Indistinct, scattered granules instead

carapace		of granular areas on posterior part of carapace
Anterolateral teeth	at least teeth 3-8 sharp	Teeth 2-7 rounded
Cheliped carpus	with 2 normal spines	outer spine reduced to tubercle or absent
Pleopod 1 of male	rather stout, well developed bristles on outer surface	more slender, tapering, few or no bristles on outer surface

Table 2. The species of Portunidae recorded from Ambon and some neighbouring islands of the Moluccas (notes in brackets) before the present study. Literature sources: 1, de Haan, 1835; 2, de Man, 1887; 3, de Man, 1902; 4, Ortmann, 1894; 5, Zehntner, 1894; 6, Leene, 1936; 7, Leene, 1938; 8, Stephenson, 1972b; 9, Stephenson, 1975; 10, Moosa, 1981c. Rumphius I Expedition data are given according to Serène et al., 1974.
Compared to original record the generic names *Goniosoma* A. Milne Edwards, 1860 and *Neptunus* De Haan, 1833, are replaced by their older synonyms *Charybdis* de Haan, 1833 and *Portunus* Weber, 1795. *Goniocaphyra* de Man, 1887 is replaced by *Catoptrus* A. Milne-Edwards, 1870.

Species	Ambon	Rumphius I Expedition	Other islands of Moluccas
Caphyra laevis A. Milne-Edwards, 1869	2, present study	-	-
Caphyra natatrix Zehntner, 1894[1]	5	+	-
Lissocarcinus polybioides Adams & White, 1848	present study	+	-
Lissocarcinus pulchellus Moller, 1887[2]	-	-	3 (Trincomali)
Sphaerocarcinus bedoti Zehntner, 1894	5	-	-
Carupa laeviscula Heller, 1862[3]	2, 5, 7	+	3 (Ternate)
Catoptrus truncatifrons (de Man, 1887)[4]	2, 5?	-	-
Libystes nitidus A. Milne-Edwards, 1867	-	+	-
Charybdis (C.) *amboinensis* Leene, 1938	7, 5?	-	-
Charybdis (C.) *calianassa* (Herbst, 1789)	-	-	9 (Banda)
Charybdis crucifera Fabricius, 1798[5]	2	-	-
Charybdis (C.) *natator* Herbst, 1798	2, present study	+	-
Charybdis (*Goniosupradens*) *acutifrons* de Man, 1879	? (Rumphius, 1705)	-	6 (Moluccas)
Lupocyclus tugelae Barnard, 1950	8	-	-
Portunus argentatus A. Milne-Edwards, 1861	8	-	2 (Ternate)
Portunus brockii de Man, 1887	2, present study	+	-
Portunus convexus de Haan, 1835	-	-	1 (Moluccas); 3 (Halmahera, Ternate)
Portunus dubius (Laurie, 1906)	8	-	-
Portunus gracilimanus (Stimpson, 1858)	8	-	-
Portunus granulatus (H. Milne-Edwards, 1834)[6]	-	+	2, 3 (Halmahera, Ternate
Portunus innominatus Rathbun, 1907	8, present study	-	-
Portunus orbitosinus Rathbun, 1911	8, present study	-	-
Portunus pelagicus Linnaeus, 1766	2	+	-
Portunus pubescens (Dana, 1852)	9	-	-

Portunus pulchricristatus (Gordon, 1931)	8	+	-
Portunus s. *sanguinolentus* (Herbst, 1798)	2, present study	-	3 (Ternate)
Portunus spinipes (Miers, 1886)	8	-	-
Portunus tenuicaudatus Stephenson, 1961	8	+	-
Portunus trituberculatus (Miers, 1876)[7]	4	-	-
Portunus wilsoni Moosa, 1981	-	-	10
Scylla serrata (Forskål, 1756)	2	-	3 (Ternate)
Thalamita admete (Herbst, 1803)	8, 9, present study	-	2 (Pulau Edam), 3 (Ternate - as *T. savignyi*, see text)
Thalamita bilobata de Man, 1925[8]	+	-	-
Thalamita carinata Zarenkov, 1970	present study	+	-
Thalamita coeruleipes Jacquinot & Lucas, 1853	9, present study	+	3 (Ternate)
Thalamita crenata H. Milne-Edwards, 1834	8, 9, present study	+	3 (Ternate)
Thalamita danae Stimpson, 1858	2, 9, present study	+	3 (Ternate)
Thalamita foresti Crosnier, 1962	-	+	9 (Morotai)
Thalamita granosimana Borradaile, 1903	present study	+	-
Thalamita holthuisi Stephenson, 1975	-	-	9 (Morotai)
Thalamita integra Dana, 1852	-	-	3 (Halmahera), 9 (Morotai)
Thalamita kukenthali de Man, 1902	-	-	3 (Ternate)
Thalamita macrospinifera Rathbun, 1906	-	+	-
Thalamita mitsiensis Crosnier, 1962	present study	+	-
Thalamita multispinosa Stephenson & Hudson, 1967	-	+	-
Thalamita picta Stimpson, 1858	9, present study	-	-
Thalamita prymna (Herbst, 1803)	2, 5, 9, present study	+	-
Thalamita pseudopoissoni Stephenson & Rees, 1967	-	+	-
Thalamita sexlobata var. *plicatifrons* de Man, 1902[9]	-	-	3 (Ternate)
Thalamita sima H. Milne-Edwards, 1834	present study	+	-
Thalamita spinimana Dana, 1852	2	-	-
Thalamita spinimera Stephenson & Rees, 1967[10]	-	-	9 (Obi Latoe)
Thalamita taprobanica Alcock, 1898	-	+	-
Thalamita tenuipes Borradaile, 1902[11]	-	+	-
Thalamitoides quadridens A. Milne-Edwards, 1869	2	-	-
Podophthalmus nacreus Alcock, 1899	8	+	-

[1] Possible junior synonym of *Caphyra laevis* see Crosnier, 1975: 760-761.
[2] possible junior synonym of *Lissocarcinus orbicularis* Dana, 1852
[3] junior synonym of *Carupa tenuipes* Dana, 1852
[4] junior synonym of *Catoptrus nitidus* A. Milne-Edwards, 1870
[5] junior synonym of *Charybdis* (*C.*) *feriata* Linnaeus, 1758
[6] as *Achelous granulatus*
[7] as *Portunus pelagicus* var. *trituberculatus*
[8] this is the second record of the species the holotype of which may be however an abberrant specimen of *Thalamita quadrilobata* Miers, 1884
[9] may be considered as a separate species, *Thalamita plicatifrons* De Man, 1902
[10] junior synonym of *Thalamita longifrons* A. Milne-Edwards, 1869
[11] the holotype of *T. tenuipes* deposited in the Zoological museum of the Cambridge University seen by the author appears to be a juvenile of *T. prymna*

Table 3. Number of the swimming crab species shared by the Ambon and the Moluccas fauna with the neighbouring relatively appropriately studied faunas: the fauna of Indonesia outside the Moluccas (estimates after Leene, 1938: Stephenson, 1972a, b, 1975, 1976, Zarenkov, 1969a, b, 1970a, b), Philippines (estimates after Stephenson, 1972a, b, 1975, 1976; Moosa, 1981c; Cariaso & Garcia, 1986), and the fauna of Queensland (Stephenson, 1972a).

	Indonesia	Philippines	Queensland
Number of species in the area	86	89	59
Species common to Ambon	49	48	32
Species common to Moluccas	51	51	37

References

Alcock, A., 1899. Materials for a carcinological fauna of India, no 4. The Brachyura Cyclometopa, Part 2. A revision of the Cyclometopa with an account of the families Portunidae, Cancridae and Corystidae.— Journal of the Asiatic Society of Bengal, 68 (2): 1-104.

Campos N.H. & Türkay, M., 1987. On a record of *Charybdis helleri* from the Caribbean Coast of Colombia.— Senckenbergiana maritima 20 (3/4): 119-123.

Cariaso, B.L. & Garcia, R.G., 1986. Philippine swimming crabs.— Guide to Philippine fauna and flora 8: 166-253.

Chopra, B., 1935. Further notes on Crustacea Decapoda in the Indian Museum. VIII. On the decapod Crustacea collected by the Bengal Pilot Service off the mouth of the River Hooghly. Brachygnatha (Oxyrhyncha and Brachyurhyncha).— Records of the Indian Museum 37: 463-514.

Colin, P.L. & C. Arneson, 1995. Tropical Pacific Invertebrates: 1-296.— Coral Reef press, Beverly Hills, California, U.S.A.

Crosnier, A., 1962. Crustacés décapodes portunides.— Faune de Madagascar 16: 1-154, pls. 1-13.

Crosnier, A., 1975. Sur les *Caphyra* (Crustacea Decapoda Portunidae) de l'ocean Indien occidental et de la mer Rouge.— Bulletin du Muséum nationale d'Histoire naturelle 3e ser., 304: 743-764.

Crosnier, A. & B. Thomassin, 1974. Sur des crabes de la famille des Portunidae (Crustacea Decapoda) nouveaux pour Madagascar ou rares.— Bulletin du Muséum nationale d'Histoire naturelle 3e ser., 241: 1097-1118.

Dai, A.Y. & S.L. Yang, 1991. Crabs of the China Seas: i-xxi, 1-682, pls. 1-74.— China Ocean Press, Beijing and Springer Verlag, Berlin, Heidelberg, New York, Tokyo.

Edmondson, C.H., 1954. Hawaiian Portunidae.— Occasional Papers of the Bernice P. Bishop Museum 21 (12): 217-274.

Fiege, D., V. Neumann & J. Li, 1994. Observations on coral reefs of Hainan Island, South China Sea.— Marine Pollution Bulletin 29: 84-89.

Fransen, C.H.J.M., L.B. Holthuis & J.P.H.M. Adema, 1997. Type-catalogue of the Decapod Crustacea in the collections of the Nationaal Natuurhistorisch Museum, with appendices of pre-1900 collectors and material.— Zoologische Verhandelingen 311: i-xvi, 1-344, figs. 1-79.

Galil, B. & M. Vannini, 1990. Research on the coast of Somalia. Xanthidae, Trapeziidae, Carpilidae, Menippidae (Crustacea Brachyura).—Tropical Zoology 3 (1): 21-56.

Garth, J.S., J. Haig & J.W. Knudsen, 1987. Crustacea Decapoda (Brachyura and Anomura) of Enewetak Atoll. In: Devaney, D.M., E.S. Reese, B.L. Burch & P. Helfrich (eds), Natural History of Enewetak Atoll. Volume II., Biogeography and Systematics: 236-261.— U.S. Department of Energy, Office of Scientific and Technical Information, Oak Ridge, Tennessee, U.S.A.

Gurjanova, E.F. & Chang Hiu Phuong, 1972. Bottom communities of the Tonking Gulf. In: The Fauna of the Tonking Gulf and conditions of life in it.— Explorations of the Fauna of the Seas 10 (18): 147-148.

Haan, W. de, 1833-1850. Crustacea. In: P.F. von Siebold, Fauna japonica: i-xviii, I-XXXI, 1-24, pls. 1-55.— J. Müller & Sons, Amsterdam.

Heath, J.R., 1973. Crabs of Dar es Salaam. Part I. Family Portunidae.—Tanzania Notes and Records 72: 1-17.

Holthuis, L.B., 1959. Notes on Pre-Linnean carcinology (including the study of Xyphosura) of the Malay Archipelago. In: H.C.D. de Wit (ed.), Rumphius Memorial Volume: 63-125, 5 pls.— Baarn.

Leene, J. E., 1936. Notes on *Charybdis erythrodactyla* (Lam.), *Ch. acutifrons* (de Man) and *Ch. obtusifrons* nov. spec.— Zoologische Mededelingen 19: 117-126.

Leene, J.E., 1938. The Decapoda Brachyura of the Siboga Expedition. VII. Brachygnatha: Portunidae.— Siboga-Expeditie Monograph, 39C3, Livre 131: 1-156.

Lemaitre, R., 1995. *Charybdis hellerii* (Milne Edwards, 1867), a nonindigenous portunid crab (Crustacea: Decapoda: Brachyura) discovered in the Indian River lagoon system of Florida.— Proceedings of the Biological Society of Washington 108 (4): 643-648.

Man, J.G. de, 1887. Bericht über die in Indischen Archipel von Dr. J. Brock gesammelten Decapoden und Stomatopoden.— Archiev für Naturgeschichte 53 (1): 215-600, pls. 4-8.

Man, J.G. de, 1902. Die von Herrn Professor Kükenthal im Indischen Archipel gesammelten Decapoden und Stomatopoden.— Abhandlungen Senkenbergische Naturforschende Geselschaft 25: 467-929, pls. 19-27.

Michel, C., 1964. Checklist of the Crustacea Brachyura (Crabs) recorded from Mauritius.— The Mauritius Institute Bulletin 6 (1): 1-48.

Milne-Edwards, A., 1861. Études zoologiques sur les crustacés récent de la famille de Portuniens.— Archives du Muséum d'Histoire naturelle 10: 309-421, pls. 28-38.

Moosa, M.K., 1981a. Crustacés Décapodes: Portunidae. In: Résultats des campagnes MUSORSTOM I - Philippines (18-28 Mars 1976). O.R.S.T.O.M.— Museum National d'Histoire naturelle, Paris: 141-150.

Moosa, M.K., 1981b. *Portunus stephensoni*, a replaced name for *Portunus emarginatus* Stephenson et Campbell, 1959.— Crustaceana 40(1): 108-109.

Moosa, M.K., 1981c. *Portunus* (*Lupocycloporus*) *wilsoni*, a new portunid from the Indo-Australian region (Brachyura, Portunidae).— Crustaceana 40(1): 26-31.

Montgomery, S.K., 1931. Report on the Crustacea Brachyura of the Percy Sladen Trust Expedition to the Abrolhos Is., under the leadership of Prof. W. Dakin, along with other crabs from Australia.— Journal of the Linnean Society of London (Zoology) 37: 405-464, pls. 24-30.

Mustaquim, J. & M.M. Rabbani, 1976. Species of portunid crabs (Decapoda, Brachyura) from Karachi.— Pakistan Journal of Science and Industrial Research 19: 161-164.

Nagai, S., 1981. Notes on *Portunus* (*Xiphonectes*) *longispinosus* (Dana) and some related species from Japan.— Nankiseibutu (The Nanki Biological Society) 23 (1): 27-32, pls. 1-2 (in Japanese).

Neumann, V. & V.A. Spiridonov, in press. Shallow water crabs from the Western Indian Ocean: Portunoidea and Xanthoidea excluding Pilumnidae (Crustacea: Decapoda: Brachyura).—Tropical Zoology.

Ortmann, A., 1894. Crustaceen. In: R. Semon, Zoologische Forschungsreisen in Australiën und der Malayischen Archipel 5: 3-80, pls. 1-5.

Ow-Yang, C.K., 1963. Studies on the systematics and distribution of marine Brachyura in Malaya with special reference to the families Portunidae and Majidae.— Unpublished M. Sc. Thesis. Dept. Zoology, National University of Singapore, 268 pp., 40 pls.

Patzner, R. & H. Debelius, 1984. Partnerschaft im Meer: 1-120.— Engelbert Pfriem Verlag, Wuppertal.

Peyrot-Clausade, M., 1977. Faune cavitaire mobile des platiers coralliens de la région de Tuléar.— Thèse Doct. Sci. nat. Université d'Aix- Marseille II.

Poupin, J., 1994. Quelques crustacés décapodes communes de Polynésie Française.— Rapport Scientifique et Technique du Service Mixte de Surveillance et Biologique de l'homme et de l'environment. 86 pp. 68 figs. 9 pls. Montlhery, France.

Rathbun, M.J., 1909. New crabs from the Gulf of Siam.— Proceedings of the Biological Society of Washington 22: 107-114.

Rees, M. & W. Stephenson, 1966. Some portunids, mostly from Queensland.— Proceedings of the Royal Society of Queensland 78 (3): 29-42, pl. 7.

Ribes, S., 1978. La macrofauna vagile associée a la partie vivante des scleractiniaires sur un récif frangeant de l'ile de la Réunion (Ocean Indien).— Thèse de doctorat de 3-me cycle en oceanologie. Université Aix- Marseille II.

Rumphius, G.E., 1705. D'Amboinsche Rariteitskamer, Behelzende eene Beschryvinge van allerhande zoo weeke als harde Schaalvischen, te weeten raare Krabben, Kreeften, en diergelyke Zeedieren, als mede allerhande Hoorntjes en Schulpen, die men in d'Amboinsche Zee vindt: Daar beneven zommige Mineraalen, Gesteenten, en soorten van Aarde, die in d'Amboinsche, en zommige omleggende Eilanden gevonden worden: 28, 1-340, 43, 60 pls.— Amsterdam.

Rüppell, E., 1830. Beschreibung und Abbildung von 24 kurzschwänzigen Krabben als Beitrag zur Naturgeschichte des Rothes Meeres: 1-28, pls. 1-6.— H.L. Brönner, Frankfurt am Main.

Sakai, T., 1939. Studies on the crabs of Japan. IV. Brachygnatha Brachyurhyncha: 365-741, pls. 42-111.— Yokendo Ltd., Tokyo.

Sakai, T., 1976. Crabs of Japan and the adjacent Seas: 1-725, pls. 1-251.— Kodansha Ltd., Tokyo.

Serène, R., K. Romimohtaro, & M.K. Moosa, 1974. The Hippidea and Brachyura collected by the Rumphius Expedition. In: Report on the Rumphius Expedition I. (January 6 - February 1, 1973).— Oseanologia di Indonesia 1: 17-26.

Shen, C.J., 1937. Notes on a collection of swimming crabs (Portunidae) from Singapore.— Bulletin of the Raffles Museum 13: 96-139.

Spiridonov, V.A., 1994. The swimming crabs (Crustacea, Brachyura, Portunidae) of submerged ridges and insular shelves of the Atlantic and Indian Oceans. In: A.P. Kuznetsov & A.N. Mironov (Eds), Bottom fauna of seamounts.— Proceedings of the P. Shirshov Institute of Oceanology 129: 126-152, figs. 1-7 (in Russian).

Starobogatov, Ya. I., 1972. Crabs of the intertidal zone of the Tonking Gulf. In: The Fauna of the Tonking Gulf and conditions of life in it.— Explorations of the Fauna of the Seas 10 (18): 333-358, figs. 1-14. Nauka, Leningrad (In Russian).

Stephenson, W., 1961. The Australian portunids (Crustacea: Portunidae). V. Recent collections.— Australian Journal of Marine and Freshwater Research 12 (1): 98-128, pls. 1-5.

Stephenson, W., 1967. The portunid crabs (Crustacea Portunidae) collected by the Naga expedition.— Naga Report 4 (1): 1-26, pls. 1-4.

Stephenson, W., 1972a. An annotated checklist and key to the Indo-West-Pacific swimming crabs (Crustacea: Decapoda: Portunidae).— Bulletin of Royal Society of New Zealand 10: 1-64.

Stephenson, W., 1972b. Portunid crabs from the Indo-West-Pacific and Western America in the Zoological Museum, Copenhagen (Decapoda, Brachyura, Portunidae).— Steenstrupia 2: 127-156, figs. 1-8.

Stephenson, W., 1975. Biological results of the Snellius Expedition, XXVI. The Portunidae (Decapoda - Brachyura) of the Snellius Expedition. (Part II).— Zoologische Mededelingen, Leiden 49 (14): 173-209.

Stephenson, W., 1976. Notes on Indo-West-Pacific portunids in the Smithsonian Institution.— Crustaceana 31 (1): 11-26.

Stephenson, W. & B. Campbell, 1959. The Australian portunids (Crustacea: Portunidae). II. The genus *Portunus*.— Australian Journal of Marine and Freshwater Research 10 (1): 84-124, pls. 1-5.

Stephenson, W. & J.J. Hudson, 1957. The Australian portunids (Crustacea: Portunidae). II. The genus *Thalamita*.— Australian Journal of Marine and Freshwater Research 8 (3): 312-368, pls. 1-6.

Stephenson, W., J.J. Hudson & B. Campbell, 1957. The Australian portunids (Crustacea: Portunidae). I. The genus *Charybdis*.— Australian Journal of Marine and Freshwater Research 8 (4): 491-507, pls. 1-5.

Stephenson, W. & M. Rees, 1961. Sur deux nouveaux crustacés Portunidae Indo-Pacifiques.— Bulletin du Muséum national d'Histoire naturelle, (2) 33 (4): 421-427.

Stephenson, W. & M. Rees, 1967. Some portunid crabs from the Pacific and Indian Oceans in the collections of the Smithsonian Institution (Crustacea: Portunidae).— Proceedings of the United States National Museum, 120 (3556): 1-114, pls. 1-9.

Stephenson, W. & M. Rees, 1968. The Endeavour and other Australian Museum collections of portunid crabs.— Records of the Australian Museum 27 (13): 286-298, pls. 35-42.

Strack, H.L., 1993. Results of the Rumphius Biohistorical Expedition to Ambon (1990). Part. 1. General account and list of stations.— Zoologische Verhandelingen, Leiden 289: 1-72, figs. 1-65, pls. 1-4.

Sumpton, W.P., G. Smith & M.A. Potter, 1989. Notes on biology of the portunid crab *Portunus sanguinolentus* in subtropical Queensland waters.— Australian Journal of Marine and Freshwater Research 40: 111-117.

Thallwitz, J., 1891 Decapoden-Studien, inbesondere basiert auf A.B. Meyers-Sammlungen im Ostindischen Archipel nebst einer Aufzälung der Decapoden und Stomatopoden des Dresdener Museums.— Abhandlungen und Berrichte des Koeniglichen Zoologischen und anthropologisch-ethnographischen Museums zu Dresden 3: 1-55, pl. 1.

Tien, D.D., 1970a. Crabs of the family Portunidae of the Bakgbo Gulf and Hainan Island: 1-13.— Ph. D. Thesis. Zoological Institute, Academy Sci USSR, Leningrad (In Russian).

Tien, D.D., 1970b. New data on the crabs genus *Thalamita* (Portunidae) of the Tonking Gulf and Hainan Island.— Zoologicheskiy Zhurnal 49: 986-991 (in Russian).

Trott, L.B. & J.S. Garth, 1970. *Lissocarcinus orbicularis* Dana (Portunidae, Caphyrinae), commensal with *Holothuria argus* Jaeger - a new host record; cohabitation with the pearlfish, *Carapus homei* (Richardson).— Crustaceana 19 (3): 320-321.

Türkay, M., 1981. Die Expedition von K. Möbius nach Mauritius und den Seychellen (1874) und die dort gesammelten Decapoda Reptantia. I. Brachyura excl. Dromiacea, mit Beschreibung von *Menaethiops moebii*.— Mitteilungen des Christian-Albrechts-Universität Kiel 1 (7): 35-64.

Vannini, M., 1983. Description of *Thalamita crosnieri*, a new species from Somalia with notes on *Thalamita cooperi* Borradaile from Somalia and *Thalamita demani* Nobili from Aldabra.—Journal of Natural History 17: 799-812.

Wee, D.P.C. & P.K.L. Ng, 1995. Swimming crabs of the genera *Charybdis* De Haan, 1833 and *Thalamita* Latreille, 1829 (Crustacea: Decapoda: Brachyura: Portunidae) from Peninsular Malaysia and Singapore.— Raffles Bulletin of Zoolology, Supplement 1: 1-128, figs. 1-66.

Yamaguchi, T. & K. Baba, 1993. Crustacean specimens collected in Japan by Ph. von Siebold and H. Bürger and held by the Nationaal Naturhistorisch Museum in Leiden and other museums (in Japanese). In: T. Yamaguchi (Ed.), Ph. von Siebold and Natural History of Japan. Crustacea: 145-570 .— The Carcinological Society of Japan, Tokyo.

Zarenkov, N.A., 1969a. On the crab family Portunidae. 1. Genus *Thalamita* Latreille.— Vestnik Moskovskogo Universiteta, ser. Biol., Pochovedenie 5: 34-41, figs. 1-3 (in Russian).

Zarenkov, N.A., 1969b. On the crab family Portunidae. 2. Genus *Portunus* Weber.— Vestnik Moskovskogo Universiteta, ser. Biol., Pochovedenie 6: 13-18, fig. 1 (in Russian).

Zarenkov, N.A., 1970a. New species of the crabs of the family Portunidae.— Bulletin of the Moscow Society of naturalists, Section Biology 3: 25-30 (in Russian.)

Zarenkov, N.A., 1970b. Crabs of the family Portunidae collected by Soviet Expeditions in the tropical waters of the Pacific and Indian Oceans.— Bulletin of the Moscow Society of naturalists, Section Biology 5: 42-47 (in Russian).

Zarenkov, N.A., 1971. Crustacea Decapoda. In: N.V. Vodianitsky (ed.), The benthos of the Red Sea shelf: 155-203.— Kiev, Naukova Dumka (in Russian).

Zehntner, L., 1894. Crustacés de l'archipel malais. In: Voyage de MM. M. Bedot et C. Pictet dans l'archipel malais.— Revue Suisse de Zoologie et Annales du Musee d'Histoire naturelle de Genève 2 (1): 135-214, pls. 7-9.

Received: 10.xi.1996
Accepted: 20.i.1998
Edited: C.H.J.M. Fransen