

ON THE IDENTITY OF *ATERGATIS FLORIDUS* (LINNAEUS, 1767) AND RECOGNITION OF *ATERGATIS OCYROE* (HERBST, 1901) AS A VALID SPECIES FROM THE INDIAN OCEAN (CRUSTACEA: BRACHYURA: XANTHIDAE)

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ABSTRACT. – *Atergatis ocyroe* (Herbst, 1801) is separated from *Atergatis floridus* (Linnaeus, 1767), with which it has been considered a junior synonym for many years. *Atergatis ocyroe* is the common species of the northern and Western Indian Ocean whereas *A. floridus* occurs in Southeast Asia, Australia and the western Pacific. *Atergatis ocyroe* can be separated from *A. floridus* by marked differences in the carapace colour and patterns, by the degree of swelling of the branchial carapace regions, and by the relative proportions the ischium of the third maxillipeds. In order to stabilise the taxonomy of these two species, a neotype is designated for *A. floridus* (Linnaeus, 1767) and a lectotype for *A. ocyroe* (Herbst, 1801).

KEY WORDS. – Taxonomy, Xanthidae, Indian, Pacific, Ocean, *Atergatis floridus*, *Atergatis ocyroe*, lectotype, neotype.

INTRODUCTION

The identity of the well-known toxic Indo-West Pacific reef xanthid crab, *Atergatis floridus* (Linnaeus, 1767), has not been questioned for many decades, with both *Cancer ocyroe* Herbst, 1801, and *Atergatis compressipes* MacLeay, 1838, long regarded as junior synonyms. Possible nomenclatural problems of *Cancer floridus* with the Atlantic aethrid *Hepatus epheliticus* (Linnaeus, 1763) have been discussed and resolved by Ng & Holthuis (1993) with the selection of a neotype for the latter species. Ng & Ahyong (2001: 90), however, commented that “We have examined specimens from the eastern Indian Ocean which have a different colour pattern to those in Southeast Asia and Pacific, which suggests that *Atergatis floridus*[,] as currently recognised, may be more than one species.” To this effect, a good series of specimens from Phuket (Thailand) in the Indian Ocean and from many parts of Southeast Asia and Western Pacific were examined.

The present note serves to formally recognise two separate species previously synonymised under *Atergatis floridus*. The Southeast Asian and Pacific populations are now regarded as *Atergatis floridus* (Linnaeus, 1767) sensu stricto with the selection of an appropriate neotype. The northern and western Indian Ocean populations are here referred to *Atergatis ocyroe*

(Herbst, 1801) with the selection of a lectotype. Specimens examined are deposited in the Zoological Reference Collection of the Raffles Museum, National University of Singapore (ZRC); Queensland Museum, Brisbane (QM); Phuket Marine Biological Centre (PMBC), Phuket, Thailand; and the Humbolt Museum, Berlin (ZMB).

TAXONOMY

XANTHIDAE MacLeay, 1838

Atergatis floridus (Linnaeus, 1767)
(Figs. 2A–C, 3A, 4A, C)

Cancer floridus Linnaeus, 1767: 1041. (see discussion on synonymy)

Material examined. – Neotype male (42.4 × 29.0 mm) (ZRC 1999.0332), Pulau Seringat, Singapore, S. H. Tan et al., 23 Jul.1997. SINGAPORE: 1 male (ZRC 1998.970), area between Pulau Seringat and Pulau Seringat Kechil mangrove with reef and rocky shoreline, coll. C. M. Yang & S. L. Goh, 22 Jul.1997; 1 male (ZRC 1965.11.4.70), Blakang Mati (= Sentosa), coll. 14 Mar.1934; 6 juveniles (ZRC 1965.11.4.77–82), Horsburg Lighthouse, coll. Apr.1934; 1 male (ZRC 1985.1105), Raffles Lighthouse, coll. 12 Nov.1958; 2 males, 1 female (ZRC 1965.11.4.74–76), Pulau Pawai,

coll. M. W. F. Tweedie, Nov.1933; 1 male (ZRC 1995.0328), Siloso Beach, Sentosa, coll. D. Chia & E. Koh, Oct.1991; 1 female (ZRC 1999.0279), Cyrene Reef, coll. D. Yeo & S. H. Tan, 19 May 1999; 1 female (ZRC 1999.0487), Pulau Seringat, coll. S. Teo, 20 Aug.1997; 1 female (ZRC 1999.1241), Sentosa reef flat south, eastern corner, coll. P. K. L., 26 Feb.1991; 1 ovig. female (ZRC 1999.0790), Cyrene Reefs, coll. S. H. Tan et al., 19 May 1999; 1 male, 1 female (ZRC 2000.1319), Trawlers Baran Darat reef, coll. Purchon, Mar.1952; 2 males (ZRC 2000.1320), Raffles Lighthouse, coll. M. W. F. Tweedie & J. R. Hendrikson, 24–29 Jul.1952; 1 female (ZRC 2000.1321), Sister Islands, coll. University of Malaya, Oct.1954; 1 male (ZRC 2000.1322), Pulau Sudong Laut, amongst rocks and sargassum, coll. University of Malaya, 1950s; 5 males, 4 females (ZRC 1965.11.4.51–59), Pulau Pisang Lighthouse, coll. 1934; 1 male (ZRC 1965.11.4.72), Pulau Pisang, coll. Jan.1934; 6 males, 8 females (ZRC 1965.11.4.60–69), Sultan Shoal, coll. 27 Oct.1930, Feb.–Dec.1933; 1 male (ZRC 2000.1323), coll. University of Malaya, 1950s. PENINSULAR MALAYSIA: 1 female (ZRC 1965.11.4.71), Telok Berhala, Pulau Aor, coll. N. S. May 1927; 1 male, 1 female (ZRC 1984.4012–4013), Pulau Sri Buat, off Pulau Tioman, coll. P. K. L. Ng, 1 May 1983; 1 male, 3 females (ZRC 2000.2244), Pulau Pemanggil, Johor, coll. D. G. B. Chia; 1 male (ZRC 2002.0533), Paya Beach, Pulau Tioman, coll. 7–12 Sep.2002; 2 males, 2 females (ZRC 1984. 4008–4011), Pulau Tioman, Tekek Bay, coll. P. K. L. Ng, 20 Jun.1983; 2 males, 1 ovig. female (ZRC 2007.0101), Paya Bay, exposed reef, Pulau Tioman, coll. H. H. Tan, 25 Feb.2002; 1 male (ZRC 1999.0935), Paya Beach, Pulau Tioman, coll. P. K. L. Ng et al., 24 Jun.1999; 6 males (ZRC 1996.2054), between Telok Bay & Merlin Hotel, Pulau Tioman, coll. P. K. L. Ng, 11–16 Nov.1981. EAST MALAYSIA: 1 male (ZRC 1987.815), Pulau Tiga, Sabah, coll. Lee Nyanti, 10 Oct.1986; 1 male (ZRC 1987.1192), Kuala Menggatal, Sabah, coll. Lee Nyanti, 6 Dec.1986; 1 male (ZRC 1988.2221), Pulau Tiga, Sabah, coll. Lee Nyanti, 15 Apr.1987; 1 male, 2 females (ZRC 1965.11.4.49–50), Pulau Inou, Labuan, coll. Aug.1938. INDONESIA: 5 males, 1 female (ZRC 1996.1902), Tanjung Tondang, Pulau Bintan, Riau Archipelago, coll. Jun.1995; 1 female with zoeae (ZRC 2000.2315), northern Pulau Bintan, Riau Archipelago, coll. T. Tan, May 2000; 1 male, 3 females (ZRC 2000.2597), Pulau Bintan, Riau Archipelago, coll. T. Tan, May 2000; 1 male, 1 female (ZRC 1998.970), Lagois, northern Pulau Bintan, Riau Archipelago, coll. P. K. L. Ng, May 1993. PHILIPPINES: 1 male (ZRC 1989.2114), “Pulong Maliit”, Calapan, Oriental Mindoro, Mindoro Island, coll. D. S. Balet, 10 Oct.1987. TAIWAN: 1 male (ZRC 1999.0746), Tashi fishport, I-Lan County, coll. P. K. L. Ng & K. Lim, May 1999. NEW GUINEA: 1 female (QM W5109), Wewak, New Guinea, 3°35'S 143°35'E, coll. Zoology Department, University of Queensland, Jul.1961. WESTERN AUSTRALIA: 1 male, 1 ovig. female (QM W20072), Sunday Island, SE corner, Kimberley Coast, 16°26'S 123°11'E, limestone terraces, under dead coral, coll. J. W. Short, 15 Nov.1994; 1 male (QM W20102), Sunday Island, SE corner, Kimberley coast, WA, 16°26'S 123°11'E, limestone terraces, coll. J. W. Short, 16 Nov.1994; 1 male (QM W20208), western side of Mermaid Is., Kimberley coast, 16°19'S 123°21'E, muddy reef flat, coll. J. W. Short, 18 Nov.1994; 1 male (QM W20229), Gregory Island, Kimberley coast, WA, 16°19'S 123°19'E, reef flat, coll. J. W. Short, 19 Nov.1994; 1 male, 1 female (QM W21070), Jones Island, N of Vansittart Bay, Kimberley Coast, 13°44'S 126°22'E, coll. J. W. Short, 22 Nov. 1995; 1 female (ZRC 2007.0099), Dampier, coll. N. K. Ng, 3 Aug.2000. NORTHERN TERRITORY: 1 male (QM W12331), Cape Wessel, 11°00'S 136°46'E; 1 male (QM W12332), Pellew Group, 15°00'S 136°00'E. QUEENSLAND: 1 female (QM W7417), Murray Island, Torres Strait, N. Qld, 9°56'S 144°04'E, coll. G. J. Ingram, 19 Jul.1974; 1 ovig. female (QM W12490), Torres Strait, FN. Qld, coll. Tradewinds, Queensland Fisheries Services 6 Apr.1974; 1 male (QM W12472), Dugong Island, northwest side of reef flat, N. Qld, 10°31'S 143°04'E, coll. Qld. Fisheries Service, 17 Jul.1974; 1 male, 1 female

(QM W3860), Low Isles off Port Douglas, NE. Qld, 16°23'S 145°34'E, coll. J. Garth & J. Lucas, 27 Jun.1973; 3 males (QM W955), Fantome Island, NE. Qld, 18°42'S 146°31'E; 2 males (QM W1424), Keeper Reef, off Townsville, NE. Qld, 18°45'S 147°16'E; QM W12330, 1 male, 1 ovig. female, Pandora Reef, near Ingham, NE. Qld, Australia, 18°49'S 146°26'E, coll. H. A. Longman; 1 female (QM W9749), Chesterfield Reefs, near Loop Island, Coral Sea, 19°00'S 158°30'E, coll. D. Berman, 22 Jun.1981; 1 female (QM W16668), Swain Reefs, ME. Qld, 21°38'S 151°35'E, coll. O. K. McCaw, Aug.1990; 1 male (QM W16656), Swain Reefs, ME. Qld, 21°42'S 151°34'E, coll. O. K. McCaw, Aug.1990; 1 male, 2 females (QM W16658), Prong Reef, ME. Qld, 21°42'S 151°42'E, coll. O. K. McCaw, 8 Aug.1990; 2 males, 2 females (QM W16657), Prong Reef, ME. Qld, 21°42'S 151°42'E, coll. O. K. McCaw, 8 Aug.1990; 1 female (QM W12886), Coconut Beach, west side of Lindeman Island, ME. Qld, 20°27'S 149°02'E, coll. P. Davie, 26 Mar.1987; 1 male, 2 juvenile females (QM W12899), Coconut Beach, W. side of Lindeman Island, ME. Qld, 20°27'S 149°02'E, coll. P. Davie, 26 Mar.1987; 2 males (QM W975), Heron Island, ME. Qld, 23°27'S 151°55'E, coll. T. C. Marshall; 1 male (QM W12138), Masthead Island, southwest side, ME. Qld, 23°32'S 151°44'E, coll. P. Davie, 16 Feb.1986; 1 male (QM W23024), Hoskyn Island, Capricorn-Bunker Group, ME. Qld, 23°48'S 152°17'E, reef flat, coll. J. W. Short, 26 Feb.1998; 1 male (QM W12137), Polmaise Reef, 6 km west of Masthead Island, ME. Qld, 23°34'S 151°41'E, coll. P. Davie, 10 Feb.1986; 1 male (QM W11934), Lady Elliott Island, north side, SE. Qld, 24°07'S 152°43'E, coll. B. Sanker, 13 Aug.1985; 1 male (QM W23942), Kings Headland, Caloundra, SE. Qld, 26°48'S 153°08'E, rocky shore, coll. P. Davie, 30 Jul.1997; 1 female (QM W21534), Kings Headland, Caloundra, SE. Qld, 26°48'S 153°09'E, rocky shore, under rocks, coll. J. W. Short, 27 Sep.1996; 1 female (QM W16276), Flinders Reef, off Cape Moreton, SE. Qld, 26°59'S 153°29'E, 6–20 m, coll. P. Davie, 10 Mar.1989; 1 male (QM W12329), Southport, SE. Qld, 27°58'S 153°25'E, coll. M. Ward; 3 females (QM W21581), Myora Reef, North Stradbroke Island, SE. Qld, 27°29'S 153°25'E, 8.9 m, coll. QM party, 7 Mar.1996; 1 ovig. female (QM W21631), Myora Reef, North Stradbroke Island, SE. Qld, 27°29'S 153°25'E, associated with *Acropora* coral, coll. P. Davie, 14 Apr.1992; 1 male (QM W21660), Myora Reef, North Stradbroke Island, SE. Qld, 27°29'S 153°25'E, 3 m, associated with *Acropora* coral, coll. QM party, 5 Mar.1996; 1 male, 1 female (QM G12/80), Myora Banks, Moreton Bay, SE. Qld, coll. J. D. Ogilby; 1 male (QM W15935), Myora, Nth Stradbroke Island, SE. Qld, 27°29'S 153°25'E, coll. J. Stanicic, 22 Mar.1989. GUAM: 3 males (ZRC 2000.0684), outside of University of Guam Marine

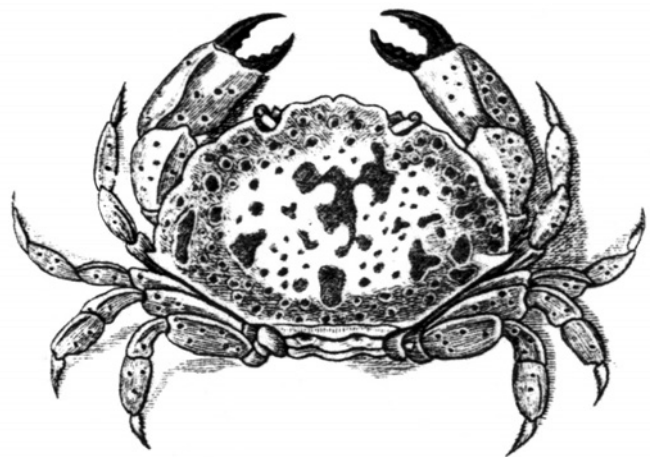


Fig. 1. *Atergatis ocyroe*, original figure from Herbst (1801: Pl. 54 Fig. 2).

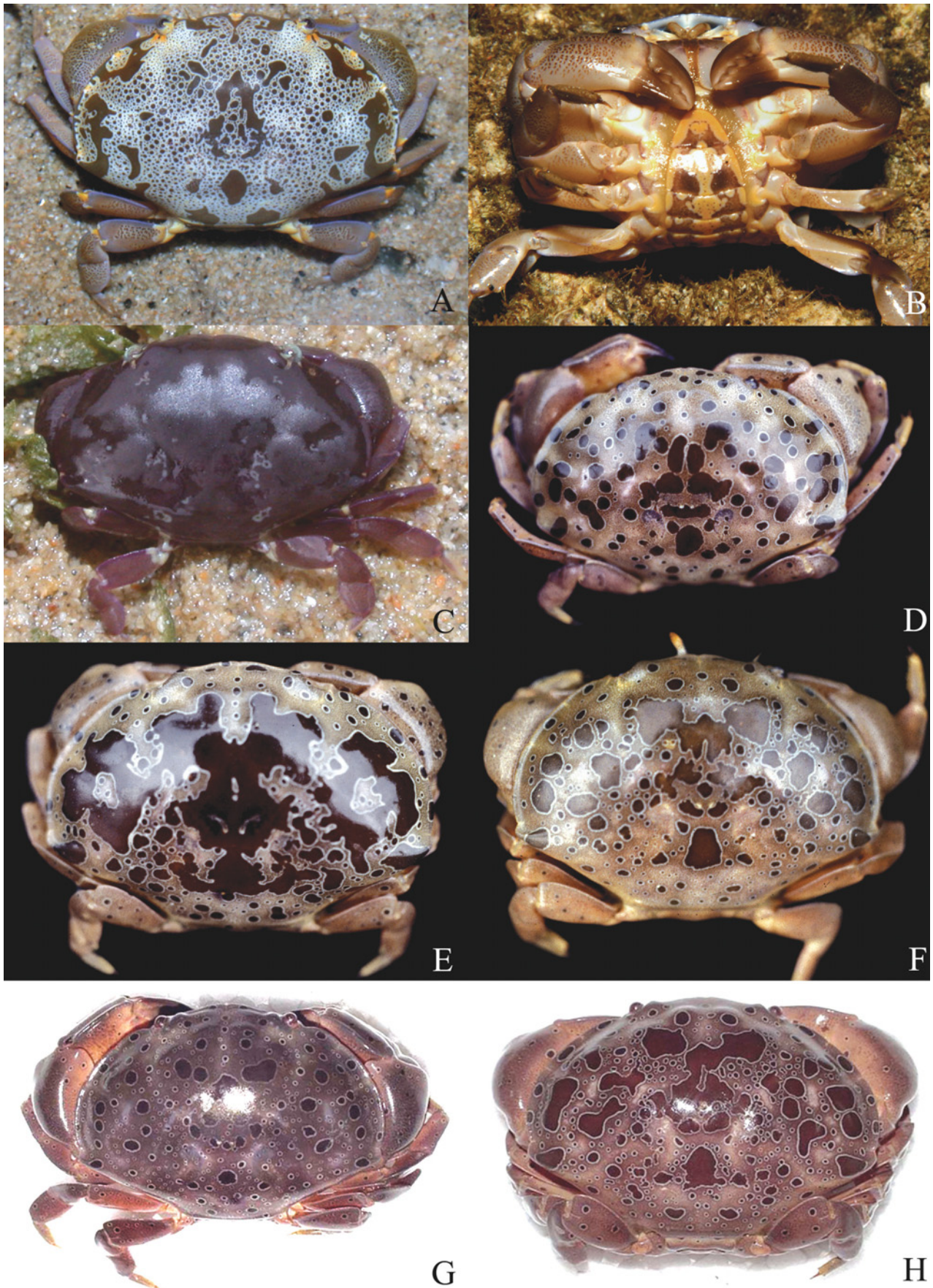


Fig. 2. Living colours of *Atergatis floridus* and *A. ocyroe*. A–C, *A. floridus*; D–H, *A. ocyroe*. A, B, female, ca. 35 mm carapace width, from reef on Pulau Tioman, Peninsular, Malaysia, not preserved; C, juvenile, ca. 10 mm carapace width, from reef on Pulau Tioman, Peninsular, Malaysia, not preserved; D, male (41.8 × 29.1 mm) (ZRC 1999.0317), Phuket, Thailand; E, female (39.5 × 27.2 mm) (ZRC 1999.0317), Phuket, Thailand; F, female (41.0 × 28.4 mm) (ZRC 1999.0317), Phuket, Thailand; G, H, specimens from Sri Lanka, not preserved (courtesy of R. Pethiyagoda).

Laboratory, Pago Bay, coll. P. K. L. Ng & C. H. Wang, 15–18 Apr.2000; 1 male, 2 females (ZRC 2007.0100), Pago Bay, coll. P. K. L. Ng, 2001.

Remarks. – Since the Southeast Asian, Australian, and Western Pacific species has been better studied, especially with regards to its toxicology, it should be this species for which the name *Atergatis floridus* is fixed. *Cancer floridus* was briefly described by Linnaeus (1767: 1041), but without any colour notes or figures to help ascertain its identity. Also Linnaeus' type(s) is/are no longer extant, and the exact type locality is not known. Linnaeus listed “Carolina [Islands?] and East Indian Seas”, but the former locality (in the Americas) is incorrect with specimens from there actually being *Hepatus epheliticus* (Linnaeus, 1763) (Ng & Holthuis, 1993). And “East Indian Seas” could refer to either Indian or Pacific Oceans as during that time, it typically included the broader Indo-Malaysian Archipelago. In any case, Western Australia has the typical green form, not the cream one (see Jones & Morgan, 2002: 168). To stabilise the taxonomy of this species, a male specimen (42.4 × 29.0 mm, ZRC 1999.0332) from Pulau Seringat, Singapore, has been designated as the neotype of *Cancer floridus* Linnaeus, 1767. This will keep the use of the name *Atergatis floridus* for the better known and more widely-studied species.

Atergatis ocyroe (Herbst, 1801)
(Figs. 1, 2D–H, 3B, 4B, D)

Cancer ocyroe Herbst, 1801: 20, Pl. 54 fig. 2.
Atergatis compressipes MacLeay, 1838: 59.
Atergatis floridus Sakai, 1999: 32, Pl. 17C.

Material. – 1 male (41.8 × 29.1 mm), 2 females (39.5 × 27.2 mm) (ZRC 1999.0317), 2 males, 2 females (PMBC), Cape Panwa, coral reefs, southern Phuket, Thailand, coll. P. K. L. Ng, Dec.1998.

Remarks. – Herbst (1801: 21) described *Cancer ocyroe* from “Das Vaterland ift Oftindien”. This vague locality is now generally regarded as probably the east coast of India, although extending as far east as the Indo-Malayan Archipelago. The figure in Herbst (1801: 20, Pl. 54 fig. 2; present Fig. 1) matches well with the Phuket specimens examined (Figs. 2D–H, 3B). In addition, Sakai (1999: 17C) pictured the dried types in the Berlin Museum, showing the relatively flatter carapace characteristic of this species. The female specimen figured by Sakai (1999: Fig. 17C, ZMB 2273-ex) is here designated as the lectotype.

Atergatis compressipes MacLeay, 1838, was described from South Africa, and no colour notes are available, although the type in the University of Sydney has a relatively flat carapace (Ng & Ahyong, 2001: fig. 3D). However, Barnard (1950: 207) described the colour of the South African specimens as “‘yellowish’, orange, or greenish, more or less symmetrically marbled or spotted with darker red or brown, the blotches often surrounded by a fine white line; chelipeds, legs, external maxillipeds, sternum and abdomen also more or less spotted; finger and thumb of cheliped black with white tips”. This agrees with the colours observed on the specimens examined from Thailand.

In their study of the Pakistani xanthid fauna, Tirmizi & Ghani (1996: 21) reported the species as being “Reddish with light yellow blotches” and it is apparent from their figure (Tirmizi & Ghani, 1996: fig. 6B) that the ischium of the third maxilliped is of the more slender type. Jayabaskaram *et al.* (1999: pl. 52) depict a specimen from southern India that agrees very well with the Phuket form. Serène (1984: pl. 21D) also shows a specimen from Madagascar with a similar colour pattern; even though it is a preserved specimen and the figure is in monochrome, the colour patterns are unmistakably that of *A. ocyroe*.

Rohan Pethiyagoda (Wildlife Heritage Trust of Sri Lanka) supplied several colour photographs of an *Atergatis* from Sri Lankan reefs for the present study which were being exported by aquarium dealers, and these too are referable to what is identified as *A. ocyroe* here. Their colour patterns (Fig. 2G, H) are diagnostic for this species.

DISCUSSION

The typical and better studied species, *Atergatis floridus*, from Southeast Asia and the Western Pacific has a characteristic green colouration with flower-like-yellowish to yellowish-white markings on the carapace (Figs. 2A, 3A), the branchial regions of the carapace are relatively more swollen (Fig. 4A)

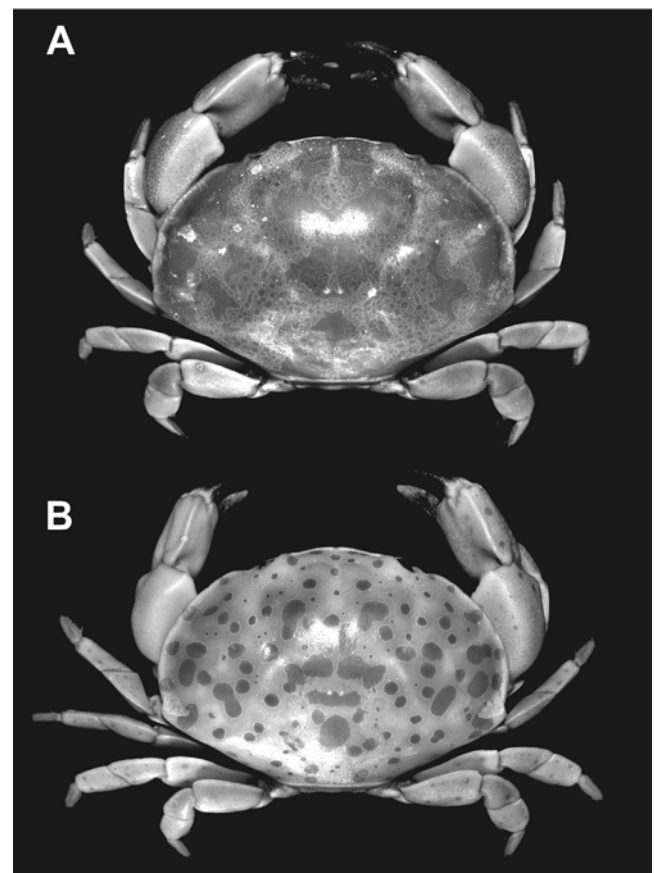


Fig. 3. Dorsal view showing characteristic colour patterns: A, *Atergatis floridus*, neotype male (42.4 × 29.0 mm) (ZRC 1999.0332), Singapore; B, *Atergatis ocyroe*, male (41.8 × 29.1 mm) (ZRC 1999.0317), Phuket, Thailand.

and the ischium of the third maxilliped is relatively more quadrate (Fig. 4C). By contrast, the carapace of the Phuket material has a cream-coloured background with reddish-brown to brown (sometimes greenish-brown) patches and blotches (Figs. 2D–F, 3B), the branchial regions are relatively lower (Fig. 4B) and the ischium of the third maxilliped distinctly more longitudinally rectangular (Fig. 4D). These two morphological features are quite consistent for the series of specimens examined. While the colour pattern of each population does vary, they do not overlap, and it can often be determined in preserved specimens.

From the large series of *A. floridus* specimens examined the degree of variation in form and more importantly in colour and patterns was ascertained. The colour pattern of *A. floridus* is consistent, regardless of sex – the green to greenish blue/brown background colour of the carapace is obvious in all fresh specimens (Figs. 2A, B, 3A). The flower-like pattern of the carapace varies considerably in extent and shape, but is always present. The only significant variation on colour patterning was reported by Nakatsubo & Yasuhara (2000) who found an interesting albinistic *A. floridus*. This specimen had white colouring on the posterior sternum, third maxillipeds, legs, and distal merus and carpus of the left cheliped; and as well, the characteristic “shawl” pattern was largely missing from right side of the carapace dorsal surface. While an obvious mutation, the remaining parts of the carapace showed normal colouring and patterning. Otherwise,

only juvenile specimens of *A. floridus* (carapace width 1 cm or less) differ by having a purplish body with scattered white spots (Fig. 2C). A large number of general colour guides on seashore organisms, habitats and invertebrates (especially from Japan and Taiwan) (too many to list here), were consulted and all the photographs of *A. floridus* from the Western Pacific and Southeast Asia proper were referable to this species. With regards to subadults and adults, no intermediate forms between *A. floridus* and *A. ocyroe* were found during this study. While only a small series of *A. ocyroe* specimens were available for the present study, the reports by previous workers on the colour patterns of Indian Ocean material (e.g., Barnard, 1950; Tirmizi & Ghani, 1996; Serène, 1984), and other specimens we have seen over the years, leave no doubt that the northern and western Indian Ocean species is *A. ocyroe* and not *A. floridus*. In Phuket, *A. ocyroe* is relatively common in the reefs in the south, and while we observed numerous specimens, most were not collected. None of these Phuket specimens had either a colour or pattern like that of *A. floridus*. The material from Pakistan is consistent in the carapace coloration and pattern and never like those of *A. floridus* (Q. Kazmi, pers. comm.). The first author has also observed specimens from the reefs off Galle in southern Sri Lanka in the 1990s (not collected) and they are consistently of the *A. ocyroe* type (see also Fig. 2G, H) (see Ng & Davie, 2002, as *A. floridus*). The background colour of *A. ocyroe* varies from cream-coloured (Fig. 2D, E) to slightly pinkish (Fig. 2G, H) and one female specimen we

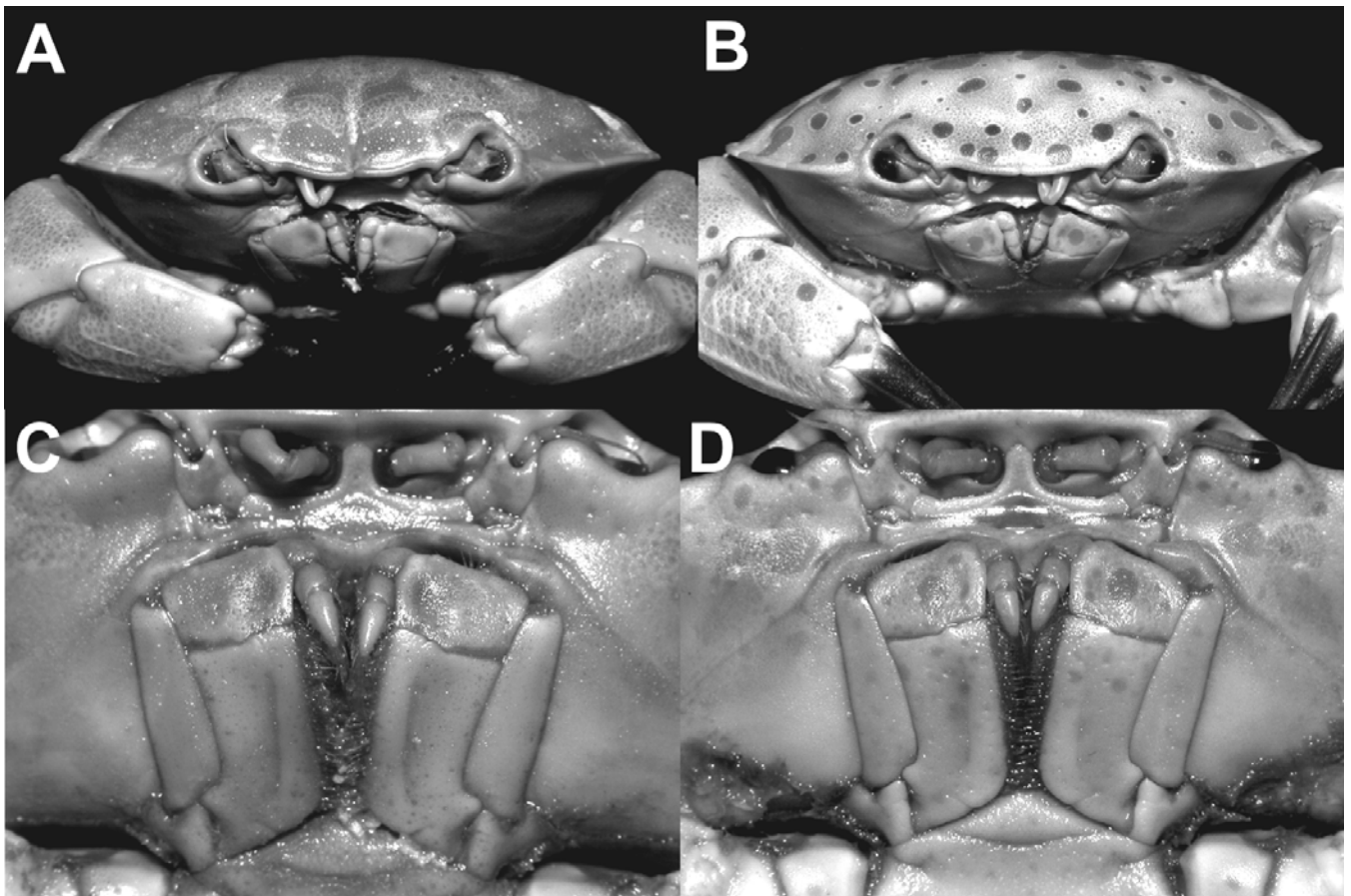


Fig. 4. Frontal views and third maxillipeds: A, C, *Atergatis floridus*, neotype male (42.4 × 29.0 mm) (ZRC 1999.0332), Singapore; B, D, *Atergatis ocyroe*, male (41.8 × 29.1 mm) (ZRC 1999.0317), Phuket, Thailand.

have on hand (Fig. 2F) is slightly more yellow (more or less matching Barnard's, 1950, comments of what he thought was *A. floridus*), but is still distinct from the coloration seen for *A. floridus*. The dark brown to maroon blotches of *A. ocyroe* vary considerably in extent and pattern, but never come close to that seen in *A. floridus*.

The available data thus strongly support the concept of two distinct species – *Atergatis ocyroe* with large spots or blotches, and *A. floridus* with a fine reticulated “shawl-like” colour pattern (hence the often used common Australian name of “Shawl Crab”).

Atergatis ocyroe should thus become the available name for the common northern and western Indian Ocean species, at least those west from western Thailand (our material included Phuket, Indian, Pakistani and South African specimens). A complete synonymy for both species has not attempted as the literature is extensive. The compilation by Serène (1984) is excellent and should be consulted. All Southeast Asia (with the exception of the Andaman Sea and perhaps the west coast of Sumatra), West Pacific and Australia are *A. floridus*. Records from northern and western Indian Ocean are *A. ocyroe*. More work will need to be done to ascertain the precise geographical boundaries between the two species, especially in the area of the Andaman Sea and beginning of the Straits of Malacca, perhaps parts of Northern Australia and more isolated islands in the Indian Ocean. Fortunately, almost all toxicological work done on *A. floridus* over the years has been from Japan, Australia, Taiwan, Philippines, Singapore and various western Pacific islands, so the present study will not affect their work.

The present discovery that *A. floridus* and *A. ocyroe* are separate species with discrete geographic ranges is interesting. It fits into recent realisations that a number of supposedly widespread shallow water crabs from the Indo-West Pacific actually have distinct Indian Ocean and Pacific Ocean distributions (e.g. see Chiong & Ng, 1998; Ng et al., 2002; Lai et al., 2006). It may thus be a more widespread phenomenon and the taxonomy of many supposedly “widespread” species will need to be reappraised in the future.

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