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A NEW SPECIES OF *THALASSINA* (CRUSTACEA: DECAPODA: THALASSINIDAE) FROM MALAYSIA

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ABSTRACT. **–** *Thalassina kelanang*, a new species of *Thalassina* from Malaysia is described, and compared to published descriptions and specimens of *Thalassina anomala* (from Malaysia), *T. squamifera* (from Australia) and *T. gracilis* (from Thailand and Malaysia). A number of morphological features of the carapace, rostrum, scaphocerite, chela, abdominal pleura and sternites, and petasma could be used to distinguish between the new species and *T. anomala*. *Thalassina kelanang* appears to be more similar to *T. squamifera* in general morphology, but can be distinguished from the latter by its distinctive rostrum and male copulatory organ (petasma). *Thalassina kelanang* has a rostrum with a characteristically deep median sulcus that extends behind the adrostral carina; the petasma has 3–4 strong proximal spines. These characters are not found in two other congeners as well.

KEY WORDS. **–** New species, *Thalassina*, mud lobsters, Malaysia.

INTRODUCTION

The family Thalassinidae Latreille, 1831, contains the single genus *Thalassina* Latreille, 1806, which had at one time been considered monotypic (Glaessner, 1969), but Holthuis (1991) suggested that there may be more than one species. *Thalassina anomala* (Herbst, 1804) is the valid type species, first described as *Cancer* (*Astacus*) *anomalus* Herbst, 1804, based on a female type specimen collected from an unknown locality. The species was subsequently redescribed under the following synonyms: *Thalassina scorpionides* Latreille, 1806 (type locality: unknown); *Thalassina scabra* Leach, 1814 (type locality: unknown); *Thalassina talpa* White, 1847 (type locality: Philippines); *Thalassina gracilis* Dana, 1852 (type locality: Telegraph Island, near Singapore); and *Thalassina maxima* Hess, 1865 (type locality: New South Wales, Australia) (in Miers, 1880; De Man, 1928).

De Man (1928) described his specimens of *T. anomala* var. *squamifera* (type locality: Karakelang-islands, Indonesia) as quite different from the typical, widespread *T. anomala*, in that the former had a small movable scaphocerite on its antennal peduncle while the typical *anomala* did not have it. In addition, he also recognized that the shape of the ridge between the second to fifth pleopods is different between the two varieties. Campbell & Woods (1970) elevated *T. anomala* var. *squamifera* to species rank, hence *T. squamifera* De Man, 1915, after examination of the Australian specimens. Support for this assignment came from Poore & Griffin (1979) who examined 32 samples from Australia and one from the Philippines. They further added that *T. squamifera* lacks the oblique tuberculate ridge starting near the base of the fixed finger and running back on the lateral surface of the large cheliped in *T. anomala*. This character was found to be most useful in separating fossil materials of the two species (Campbell & Woods, 1970).

Thalassina emerii Bell, 1844, was first described based on a fossil specimen believed to be likely from the mouth of the Daly River, Northern Territory, Australia, but its recognition in museum specimens from N.W. Australia suggests that this species may be extant (see Davie, 2002, p. 475). Another species, *Thalassina chilensis* Steenstrup & Lütken, 1862, from the coast of Chile was believed to be distinct from *T. anomala*, but De Man (1928) suspected that *T. chilensis* is likely *T. gracilis* Dana, 1852 which he thought was synonymous with *T. anomala*. Holthuis (1991) surmised that the type locality of *T. chilensis* is likely to be incorrect given that it has since never been found in Chile. Dworschak (1992) in personal communication with de Saint Laurent reported *T. gracilis* as likely a valid species. Thus far, world-wide there appears to be at least four extant species of mud lobsters belonging to the genus *Thalassina*. There is however a need to review the taxonomic status of all described species of thalassinid mud lobsters. Such a review has been carried out by the late de Saint Laurent's co-worker, Dr. Ngoc-Ho of the National Museum of Natural History, Paris, and has been published in a supplement of this Journal after the acceptance of this paper. Ngoc-Ho & de Saint Laurent (2009) proposed three new species.

In Malaysia, *Thalassina anomala* was first recorded from the states of Penang and Sarawak (in De Man, 1928), but the species appears quite widespread, appearing also in the states of Selangor (Sasekumar, 1974) and Johor (Ng & Kang, 1988). However, there has been no attempt to examine closely these shy and difficult to catch creatures, to see if there are more than one species. This paper describes two main species found in Selangor, Malaysia; one the typical *T. anomala*, and the other a new species. We compared their morphology to specimens of *T. squamifera* obtained from Natural Sciences Museum & Art Gallery of the Northern Territory (NSMAG), Australia and *T. gracilis* from the Zoological Reference Collection (ZRC) of the Raffles Museum of Biodiversity Research, National University of Singapore, and our collection. Our reasons for a new species are as described below.

MATERIAL AND METHODS

Study sites. **–** Mud lobsters were sampled from two study sites at Kelanang Beach and Carey Island, Selangor, Malaysia. The mud lobster mounds were located inside or near to mangrove forests in the intertidal shore. The sandy-mud beach of Kelanang has a narrow (0.6 km) and degrading fringe of mangrove forests where on the landward side a coastal bund runs along the entire coastline. All specimens of the new species were sampled from Kelanang Beach. In Carey Island, which is located just north of Kelanang, the mud lobster mounds of only *T. anomala* are found on the landward side of perimeter bunds which are built around the entire island to protect the oil palm plantations that occupy former mangrove forests from seawater intrusion.

Sampling. **–** Mud lobsters were trapped by using a 50 cm –long wire with a tethered piece of fish netting (1.5" or 2.5" mesh size) on one end and a T-handle at the opposite end. The wire was inserted into the burrow with the T-handle resting on top of the mound. The traps were laid during dusk and recovered after 15–18 hours. Trapped animals were entangled in the gill netting as they crawled up from the muddy bottom. The animals were also caught by digging below their mounds using a spade. All specimens were identified and measured using a pair of digimatic calipers, with a precision of 0.01mm. Measurements provided are of the total length (measured along the midline from tip of rostrum to tip of telson) and the carapace length (measured along the midline from the tip of the rostrum to the posterior edge of the carapace). Identified specimens are deposited in the Zoological Museum, University Malaya (ZMUM). Two specimens of the new species (male and female) are also deposited in ZRC, Singapore, and NSMAG, Australia.

Comparative material examined. **–** *Thalassina anomala – 13 males and 5 females (TL; 114.6–241.1 mm) (ZMUM), Carey Island, Selangor, Malaysia, coll. H.H.Moh, Jun.–Sep.2006.*

T. squamifera – 1 male (1325, 47.8 mm) (NSMAG, Cr.004775), Micket Creek, Darwin, N.T., Australia, coll. D. Percival, 26 Sep.1983; 1 male (146, 51.7 mm) (NSMAG, Cr.000517), Ludmilla Creek, Darwin, N.T., Australia, coll. J.R.Hanley, 12 Oct.1983; 1 male (139.6, 51.3 mm) (NSMAG, Cr.001475), Ludmilla Creek, Darwin, N.T., Australia, coll. D. Percival, 13 Oct. 1983; 1 female (113.0, 41.9 mm) (NSMAG, Cr.009965), near bridge Channel Island, N.T., Australia; coll. M. Burke, 19 Feb. 1992; 1 female (70.3, 26.1mm) (NSMAG, Cr. 013891), Port Keats, N.T., Australia, coll. K. Metcalfe & party, undated.

T. gracilis – 1 male (69.8, 25.8 mm) and 1 female (57.3, 21.8 mm) (ZRC 2007.0512), Ranong mangroves, South Thailand, coll. P. Naiyanetr; 1 male (69.8, 25.5 mm) (ZMUM), Carey Island, Kuala Langat [=District], Selangor, Malaysia, coll. H.H.Moh, 19 Sep.2008.

TAXONOMY

Thalassina kelanang, new species
(Figs. 1, 2A, 3A, 4A, 5A, 5B, 6A, 7A, 7B, 8A)

Material examined. **–** Holotype – male (150.0, 54.1 mm) (ZMUM), from mound in mangrove forest, Kelanang Beach, Kuala Langat, Selangor, Malaysia, coll. H.H. Moh, Apr.2007.

Paratypes – 1 female (141, 50.3 mm) (ZMUM), Kelanang Beach, Kuala Langat, Selangor, Malaysia, coll. H.H.Moh, Oct. 2006; 1 male, (140, 52.0 mm), 4 females (120, 44.6 mm), (162, 58.9 mm), (167, 60.8 mm), (150, 55.4 mm), (ZMUM), Kelanang Beach, Kuala Langat, Selangor, Malaysia, coll. H.H.Moh, Nov. 2006; 1 male, (114, 42.9 mm), 2 females (163, 58.4 mm), (140, 51.5 mm), (ZMUM), Kelanang Beach, Kuala Langat, Selangor, Malaysia, coll. H.H.Moh, Mac. 2007; 2 males (143, 51.9 mm), (133, 48.8 mm), 2 females (120, 43.7 mm), (119, 45.4 mm), (ZMUM), Kelanang Beach, Kuala Langat, Selangor, Malaysia, coll. H.H.Moh, Apr. 2007; 1 female (161, 59.1 mm), (ZMUM), Carey Island, Kuala Langat, Selangor, Malaysia, coll. H.H.Moh, Oct. 2006; 1 male (183, 63.6 mm), (ZMUM), Carey Island, Kuala Langat, Selangor, Malaysia, coll. H.H.Moh, Nov. 2006.

Description of holotype. **–** Carapace elongate oval in dorsal aspect; sculptured by circular depressions or punctae, the largest pair (gastric pits) associated with post-cervical groove; upper lateral sides heavily covered with short anteriorly-directed spines; short posteriorly-directed spine on dorsal median margin not reaching first abdominal tergite (Fig. 2A). Rostrum flat, narrowly triangular and waisted

Fig. 1. *Thalassina kelanang*, new species, holotype-male, TL = 150 mm, CL = 54.1 mm (ZMUM).

near base (Fig. 3A), with lateral margins that continue posteriorly as short divergent ridges (adrostral carina) extending half length of gastro-orbital carina; median sulcus or groove deep, extending beyond adrostral carina; 3–11 blunt marginal spinules or tubercles on adrostral carina. Supra-orbital, antennal and branchiostegal spines strong and sharp; orbital and sub-orbital spines short; 4–8 sharp spines at curved anterior end of branchiocardiac groove. Oblique groove with 10–14 spines on dorsal margin, anterior-most spine largest, thinly setose. Anterior margin of antennal region armed with series of short spines. Numerous tubercles on anterior margin of branchiostegite.

Antenna with highly reduced antennal scale or scaphocerite on the outer side, scaphocerite large, setose on inner margin (Fig. 4A). Antennal flagellum when stretched backward reached first or second abdominal somite, length more than five times length of antennular flagellum.

Pereopods 1 (chelipeds) asymmetrical and subchelate, left chela larger than right (but see Paratypes below). Meri large, flattened laterally on dorsal surface, but broad or triangular on ventral surface; right merus with 17 dorsal spines, left with 18 dorsal spines, anterior-most 4 spines large and decurved, inner and outer ventral margins serrulate with numerous subequal denticles on ventral surface. Carpi relatively small, inner dorsal margin with a row of 7–8 strong spines, outer ventral margin armed with a row of spines, anterior-most being most prominent. Propodi granulated on entire surface, granules on the posterior half of inner ventral surface comparatively larger than those on anterior half, dorsal surface with two ridges: inner ridge armed with row of 10 strong spines (Fig. 5A, 5B), outer ridge on proximal three-quarters distance, armed with row of small tubercles, outer surface with long fine setae occurring in tufts along rows, ventral surface with two serrated ridges. Dactyli twice as long as fixed finger, narrow and laterally flattened, right dorsal margin armed with row of 13–15 spines and numerous long fine setae, ventral surface with two serrated ridges and two rows of fine setae, a few punctae present along dorsal surface.

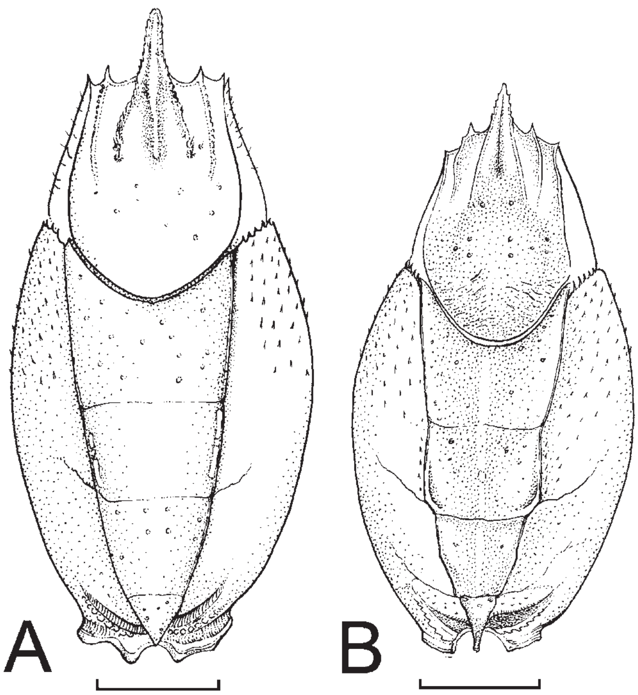

Fig. 2. Dorsal view of carapace. A, *Thalassina kelanang* (holotype, 150.0, 54.1 mm); B, *T. anomala*-Male (151.4, 51.1 mm). Scale bar = 10 mm.

Pereopod 2 subchelate, smaller than pereopod 1; basi-ischium laterally flattened with ventral margin armed with 6–9 strong spines and a row of setae; merus laterally flattened, dorsal margin with row of 4–6 strong decurved spines, ventral surface densely setose; carpus setose on dorsal and ventral margins, dorsal margin with 2–3 strong, decurved spines; propodal length slightly longer than width, dorsal margin of fixed finger armed with a longitudinal row of blunt teeth; dactylus with two rows of setae on dorsal margin, outer surface with medial longitudinal row of setae, ventral margin serrated with row of blunt teeth, postero-ventral margin setose.

Pereopod 3 narrow and flattened laterally; coxa armed with 4–6 spines on inner surface; ischium armed with 4–6 spines on ventral margin; merus with row of 6–10 decurved spines on dorsal margin, ventral margin serrated with two rows of 10–12 spines; carpus armed with 4–5 strong spines on dorsal margin, ventral margin spineless; propodus small and laterally compressed, with setae on dorsal and ventral surfaces; dactylus slender as long as propodus, ventral margin with row of setae, dorsal margin with seven short spines and row of setae.

Pereopod 4 similar but slightly smaller than pereopod 3; dactylus slender, longer than propodus.

Pereopod 5 smaller than pereopod 4, not compressed; coxae with gonopores facing each other on either side of mid-ventral line; outer margin armed with a row of spines.

Male abdomen elongate and narrow; somite width as wide as length; first abdominal somite smallest and narrowest; third and fourth somites largest. Dorsal tergite of first abdominal somite raised as a distinct rectangular piece, with inverted Y groove (Fig. 6A).

Base of pleuron of second and third abdominal somites, each with two longitudinal, serrated ribs or carinae occupying anterior three-quarters distance to posterior end of segment (Fig. 7A). Abdominal sternite of second to fifth somites with distinct bicuspid sternal ridge between opposite pleopods; each cusp bearing 3–6 teeth (Fig. 7B).

Mature male pleopod 1 uniramus, with opposing endopods modified and united to form petasma or intromittent organ; distal end of petasma narrowly oval to pointed, setal row on outer and inner margins reaching or almost reaching tip; inner distal setae modified to form fine interlocking hooks on disc-like, subterminal keel of petasma; outer proximal end of petasma armed with 3–4 strong spines (Fig. 8A). Pleopods 2–5 biramous; pleopods 3–5 of equal size, but shorter than pleopod 2. Uropods styliform.

Telson broadly triangular, about as long as previous somite.

Variation. **–** Although our holotype male has a larger right cheliped than the left, the left cheliped can be larger than the right for both male and female, but in some of our specimens the difference was not obvious. Our specimens had 14 of the former type and 11 of the latter type. Merus of right cheliped with 12–17 dorsal spines, left 15–18, anterior 3–5 spines large and decurved. In female, gonopores on inner ventral surface of coxa of pereopod 3; pleopod 1 uniramus; pleopods 2–5 larger and biramous, bearing long setae which are particularly well-developed for carrying eggs during breeding season.

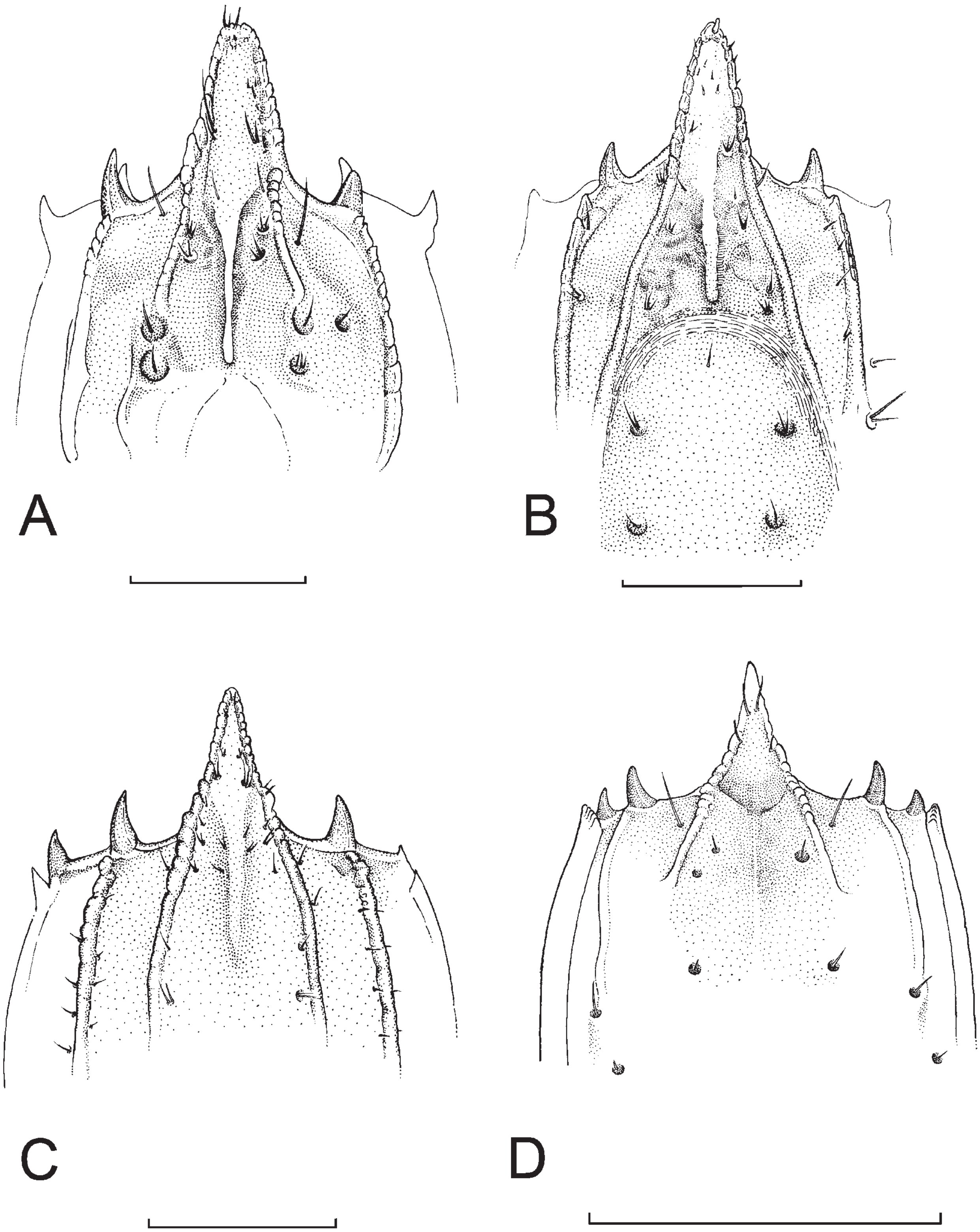

Fig. 3. Dorsal view of anterior region of cephalothorax. A, *T. kelanang* (holotype, 150.0, 54.1 mm); B, *T. anomala*-Male (151.4, 51.1 mm); C, *T. squamifera*-Male (132.5, 47.8 mm); D, *T. gracilis*-Male (69.8, 25.8 mm). Scale bar = 5 mm.

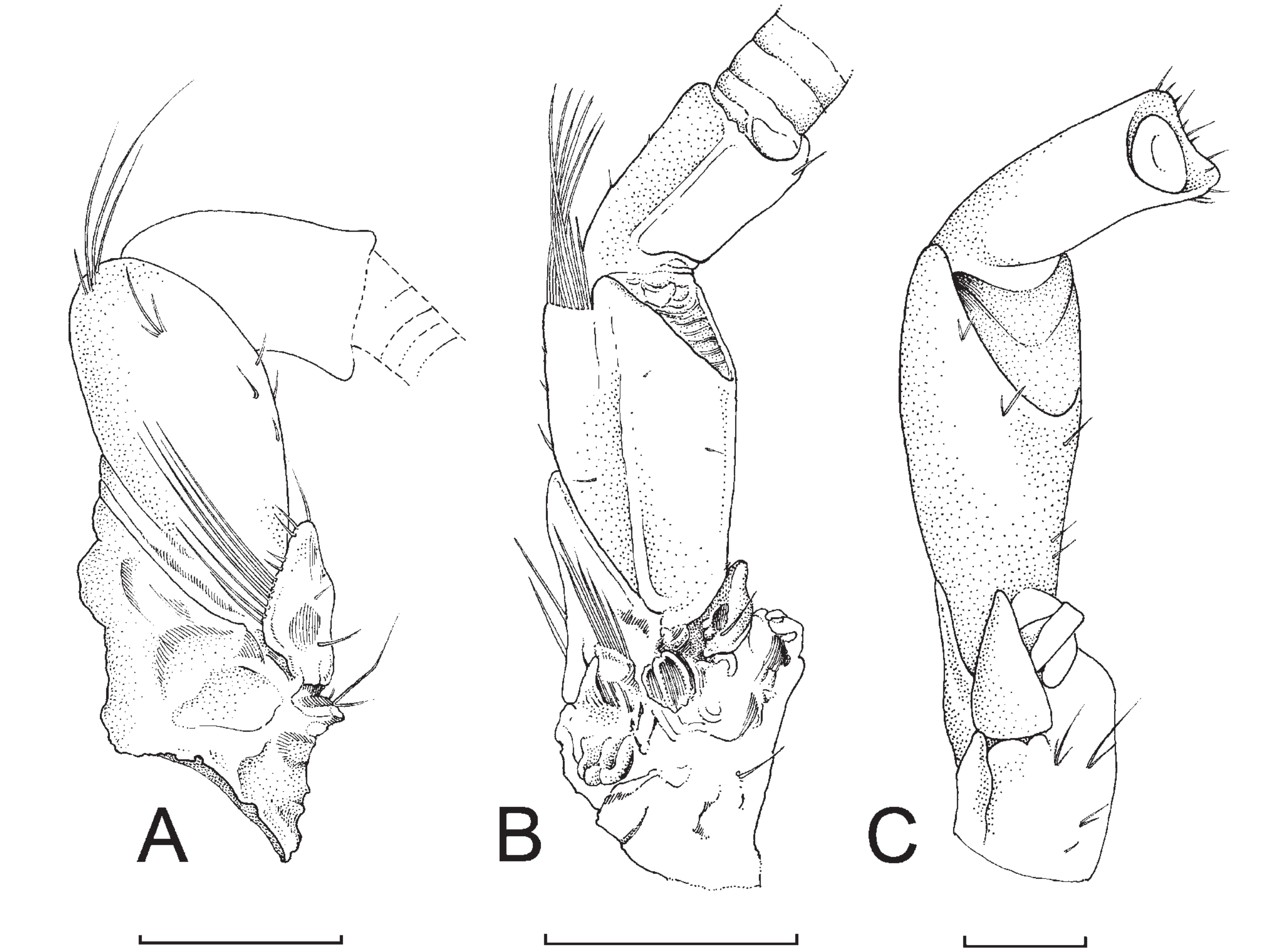

Fig. 4. Dorsal view of right antennal peduncle showing movable scaphocerite. A, *T. kelanang* (holotype, 150.0, 54.1 mm); B, *T. anomala*, (absent)-Male (151.4, 51.1 mm); C, *T. squamifera*-Male (132.5, 47.8 mm). Scale bars: a–b = 20 mm; c = 10 mm.

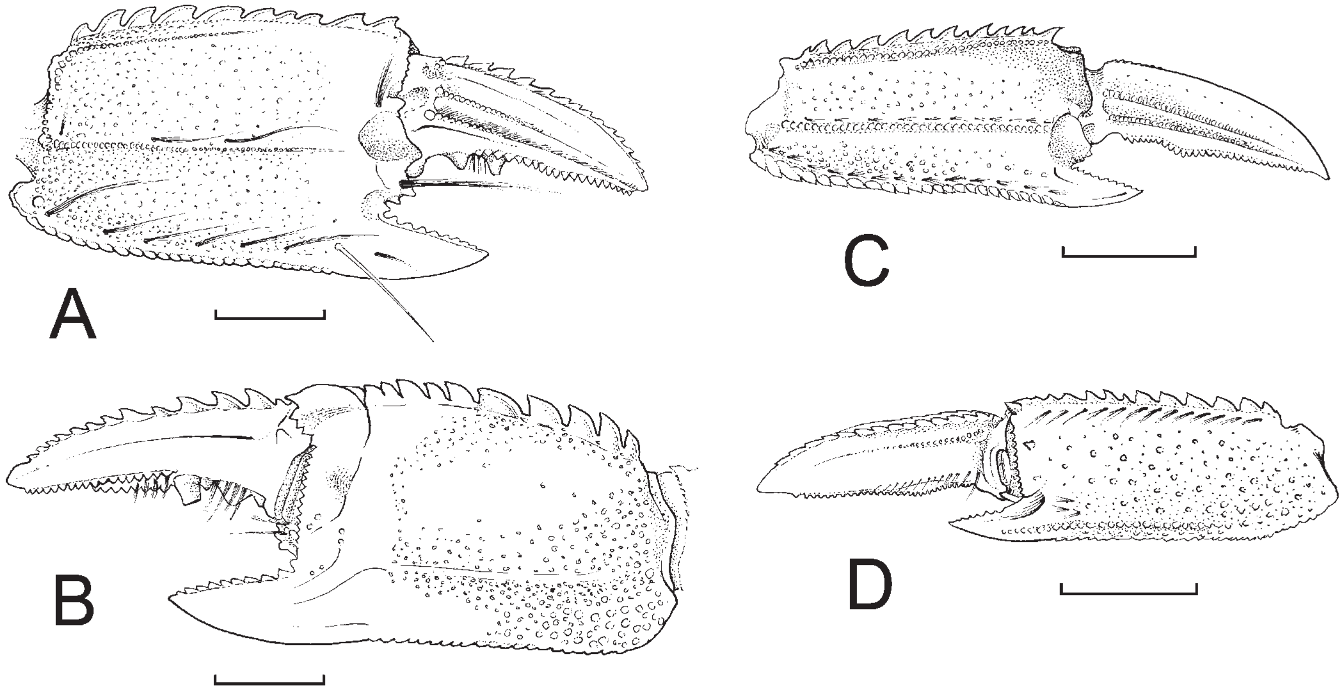

Fig. 5. Right chela of pereopod 1. A–B, outer and inner aspects, *T. kelanang* (holotype, 150.0, 54.1 mm); C–D, outer and inner aspects, *T. anomala*-Male (151.4, 51.1 mm). Scale bar = 10 mm.

Etymology. **–** The species is named after its type locality, Kelanang, in the district of Kuala Langat of the state of Selangor, Malaysia. The name is used as a noun.

Colour. **–** Carapace orange to brown on dorsal aspect, becoming grey ventrolaterally. Abdomen red to orange on dorsal aspect, pleura grey. Dorsal aspect of pereopods brownish orange, ventral aspect grey.

Biological notes. **–** *Thalassina kelanang* construct sandy mud mounds of generally less than 0.5 m in height. At Kelanang Beach, while the animal inhabits the fringing *Rhizophora* forest, there were more mounds on open sandy mud substrate without vegetation. In contrast, *T. anomala* were found in muddy substrate particularly in Carey Island, although few *T. kelanang* were found on the island. Thus, the two species appear to occupy their own microhabitats in the same general area. Male *T. kelanang*, unlike *T. anomala*, are very aggressive inflicting painful pinches on handlers; males often ended up with broken legs if placed together in an aquarium.

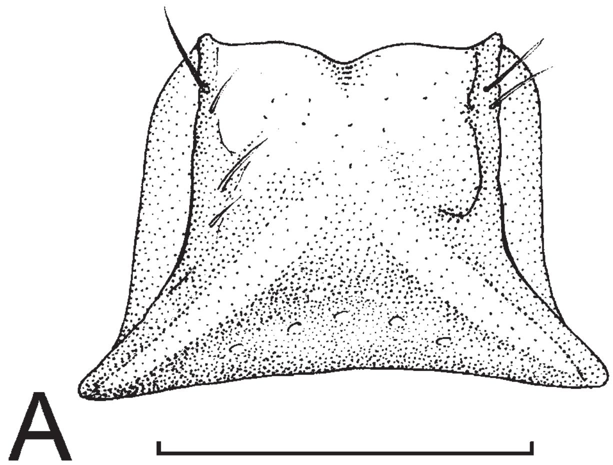

Fig. 6. Dorsal view of first abdominal somite. A, *T. kelanang* (holotype, 150.0, 54.1 mm); B, *T. anomala*-Male (151.4, 51.1 mm). Scale bar = 10 mm.

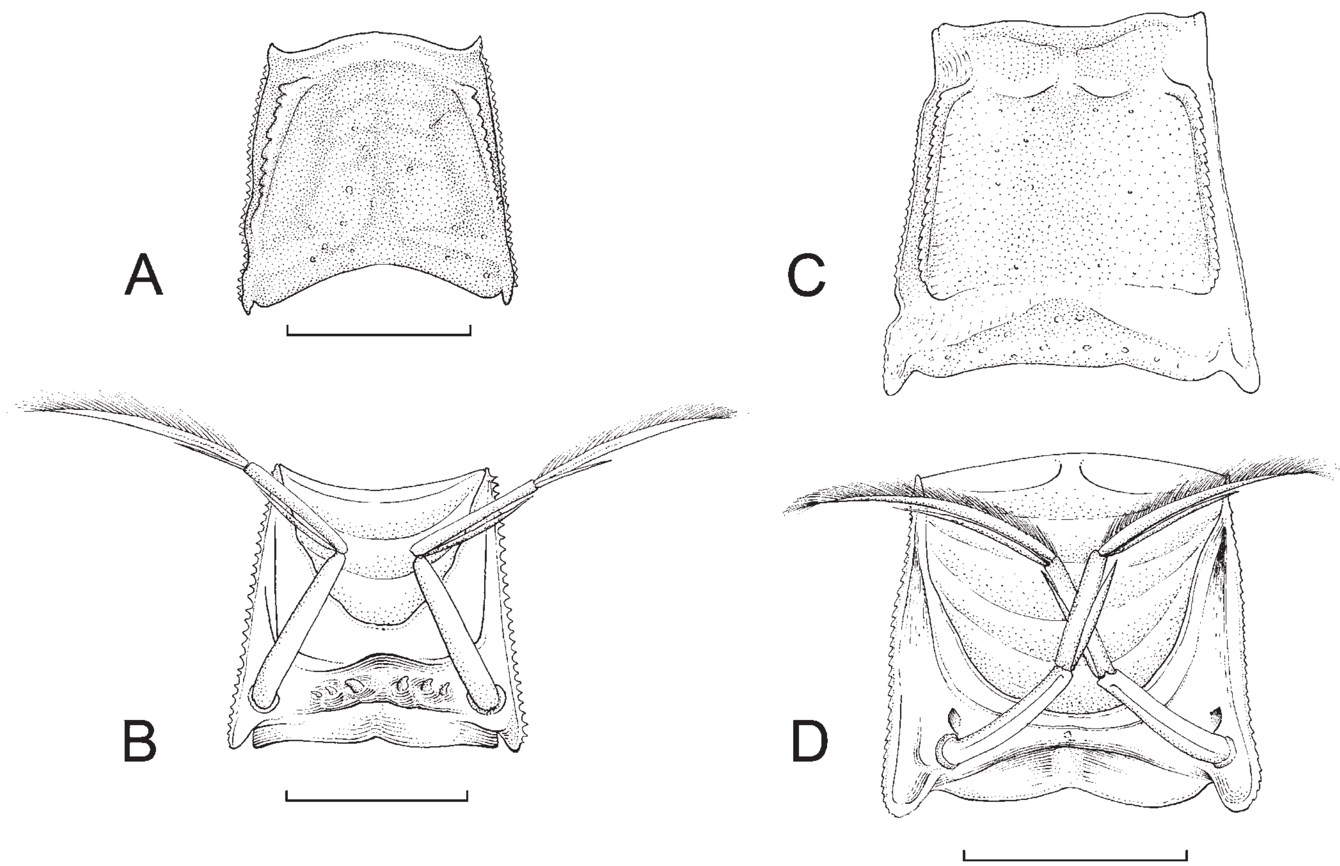

Fig. 7. Second abdominal somite. A–B, dorsal and ventral aspects, *T. kelanang* (holotype, 150.0, 54.1 mm); C–D, dorsal and ventral aspects, *T. anomala*-Male (151.4, 51.1 mm). Scale bar = 10 mm.

Remarks. – *Thalassina kelanang* shows similarities with the sympatric species, *T. anomala* in terms of size, coloration and general morphology. However, their morphological differences warrant the separation of the two species. In all our 65 *T. anomala* specimens, the posterior median spine of the carapace, often decurved, always overhangs the articulation with the first abdominal tergite (Fig. 2B). In contrast, the median spine of *T. kelanang* is short, blunt and never overhangs the first abdominal tergite. However, this character is similar to that of *Thalassina squamifera* De Man. The oblique groove of the carapace of *T. anomala* is covered with a thick row of setae, whereas in *T. kelanang* and *T. squamifera* it is sparsely covered by setae. The rostrum of *Thalassina kelanang* has an acute tip, proximal waist and a deep median sulcus (groove) that extends up to the posterior pair of dorsal punctae behind the posterior end of the adrostrals; the latter reaches only the anterior half of the gastro-orbital carina (see Fig. 3A). In contrast, both *T. anomala* and *T. squamifera* have a triangular rostrum with a shallow median sulcus that does not reach beyond the adrostrals; the latter extends to three-quarters or full length of the gastro-orbital carina (Fig. 3B, 3C). In addition, both species have rather smooth or at the most three tubercles on their adrostral and gastro-orbital carinae, posterior to the orbital margin. These features of the rostrum appear to be important in separating the different species of *Thalassina*. In fact, the examined *T. gracilis* specimens show a distinctive depressed and more acute rostrum unlike that of *T. kelanang* and others (Fig. 3D).

De Man (1928) pointed out the differences between *T. anomala* and *T. squamifera* (as a variety of *T. anomala*), in that only the latter has a scaphocerite on the antennal peduncle as well as a tuberculate ridge on the abdominal sternites (see below). Sankolli (1970) reported that *T. anomala* specimens in India, except for one female, generally did not have the scaphocerite. From a total of 65 specimens of *T. anomala* examined in this study, 29 of them have much reduced scaphocerites, while 36 specimens do not have scaphocerites (Fig. 4B). In contrast, all specimens of *T. kelanang* have distinctly large, triangular scaphocerites with a row of long setae on their inner margin (see Fig. 4A). The five specimens of *T. squamifera* also have scaphocerites but only one specimen has a row of marginal setae on the right scaphocerite (Fig. 4C). *Thalassina kelanang* has a long antennal flagellum that when stretched backwards reached more than half the length of the first abdominal somite; the flagellum of *T. anomala* is much shorter, reaching less than three quarters of the carapace length. While the examined males of *T. squamifera* all had broken antennae, both females bore antennal flagella that reached the posterior margins of the carapace.

The merus of the cheliped in *T. kelanang* has a row of 3–5 strong spines on its dorsal margin, whereas in *T. anomala* there are only two strong spines. There are also two or three strong spines in *T. squamifera*. Three other distinguishing features of *T. kelanang* are (i) the fixed finger of its chela is half the length of the movable finger, whereas in *T. anomala* the fixed finger is a quarter to a third the length of the movable finger (Fig. 5C, D), (ii) 8–12 strong dorsal spines on the inner dorsal ridge of the palm, whereas *T. anomala* has 14–20 blunt spines or tubercles, and (iii) lateral dorsal ridge of outer surface of palm extends to three-quarters distance but not to distal end, whereas in *T. anomala*, the ridge extends right up to the distal end (Fig. 5C). The same characters for *T. squamifera* are respectively fixed finger half the length of movable finger, 9–11 inner dorsal spines and a lateral dorsal ridge that extends between half to three quarters of distance to distal end.

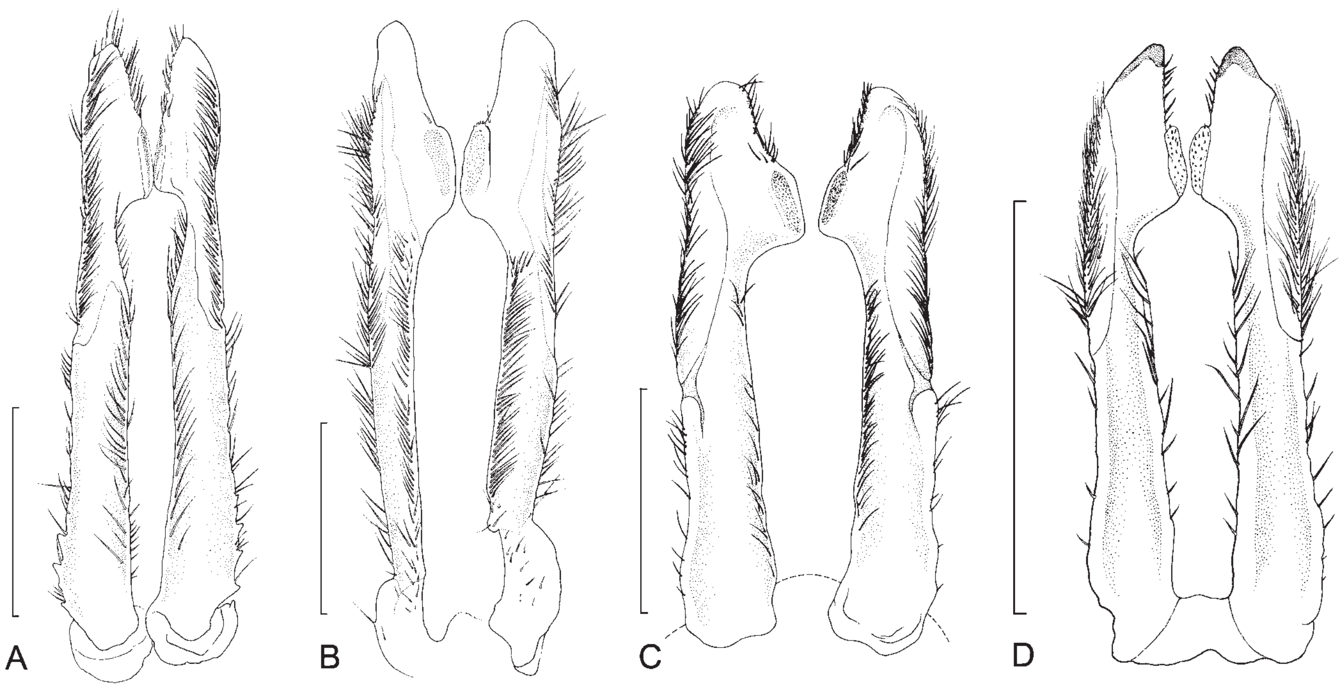

Fig. 8. Ventral view of petasma. A, *T. kelanang* (holotype, 150.0, 54.1 mm); B, *T. anomala*-Male (193, 61.4 mm); C, *T. squamifera*-Male (132.5, 47.8 mm); D, *T. gracilis*-Male (69.8, 25.8 mm). Scale bar = 5 mm.

Table 1: Comparative morphology of *Thalassina anomala*, *T. squamifera* and *T. kelanang* (new species).

T. anomala **(Herbst, 1804)**	***T. squamifera*** **De Man, 1915**	***T. kelanang*, new species**
Dorsal median margin of carapace projected as long, hooked spine resting on first abdominal tergite.	Dorsal median margin of carapace projected as short spine not resting on the first abdominal tergite.	Similar to *T. squamifera*
Rostrum triangular. Adrostral carina of carapace extending three quarters or entire distance of gastro-orbital carina, both carinae smooth or bearing maximum of three blunt tubercles postorbitally. Median sulcus of rostrum shallow, not extending to behind adrostrals.	Generally similar to *T. anomala* except rostrum more acute.	Rostrum waisted. Adrostral carina extending to about half the distance of gastro-orbital carina, both carinae with 3–11 blunt tuber cles postorbitally. Median sulcus of rostrum deep, extending behind adrostrals.
Scaphocerite absent or if present, very small.	Scaphocerite present, with or without marginal setae.	Scaphocerite distinctly large, with marginal row of long setae.
Oblique tuberculate ridge present on inner surface of first cheliped propodus, starting near the base of the fixed finger and running posteriorly.	Oblique tuberculate ridge on first cheliped propodus absent.	Oblique tuberculate ridge on first cheliped propodus absent.
Pereopod 1 with a row of 13–20 blunt spines or tubercles on the inner propodal ridge. Lateral dorsal ridge extends the entire length of propodus.	Pereopod 1 with a row of 9–11 blunt spines or tubercles on the inner propodal ridge. Lateral dorsal ridge extends to more than half but never three quarters of the propodal length.	Pereopod 1 with a row of 8–12 strong dorsal spines on the inner propodal ridge. Lateral dorsal ridge extends to three quarters or more of the propodal length.
Merus of pereopod 1 with 2 strong dorsal spines.	Merus of pereopod 1 with 2–3 large dorsal spines.	Merus of pereopod 1 with 3–5 large dorsal spines.
Tergite of first abdominal somite has two petaloid depressions in the form of an inverted V.	Tergite of first abdominal somite raised up as a distinct rectangular piece, with inverted Y groove.	Similar to *T. squamifera*.
Pleura of second to sixth abdominal somites with single longitudinal carina occupying entire length of somite.	Pleura of second and third abdominal somites with two longitudinal, serrated carinae occupying anterior three quarters of somite length.	Similar to *T. squamifera*
Abdominal sternites of second to fifth somites with only one median tubercle.	Abdominal sternites of second to fifth somites with distinct bicuspid sternal ridge, each cusp bearing 3–5 teeth for male while adult female without any.	Abdominal sternites of second to fifth somites with distinct bicuspid sternal ridge, each cusp bearing 3–6 teeth in both male and female.
Petasma without proximal spines, tip broadly rounded without setae.	Petasma without proximal spines; outer and inner marginal setal rows extending almost to pointed tip. "Neck" behind keel broad, width half the length of inner keel surface.	Petasma with 3–4 strong proximal spines on outer margins; outer and inner marginal setal rows extending to pointed tip. "Neck" behind keel slender, width one quarter the length of inner keel surface.

Several distinctive differences between the three species are also observed in the abdomen and its appendages. *Thalassina kelanang* and *T. squamifera* have an inverted Y-groove on the dorsal tergite of the first abdominal somite (see Fig. 6A), whereas *T. anomala* has two petaloid depressions in the form of an inverted V (Fig. 6B). In *T. kelanang* and *T. squamifera*, the longitudinal 'three-quarters long' carina runs across the base of the pleuron of the second and third abdominal somites only, whereas in *T. anomala* the carina runs the entire somite length and is present on the second to sixth abdominal somites (Fig. 7C). A sternal ridge (second to fifth somites) bearing two cusps each with 3–6 teeth/ tubercles is present in *T. kelanang* as well as in *T. squamifera*, whereas in *T. anomala*, only one median tubercle is present (Fig. 7D). This is the other feature distinguishing the two varieties of mud lobster (*sensu* de Man, 1928).

Male holotype and paratypes of *T. kelanang* (see Fig. 8A) have a petasma or intromittent organ that is quite different from that of *T. anomala* in that both outer and inner marginal setal rows of *T. kelanang* are reaching its distal tip, whereas the latter's petasmal tip is broadly rounded without setae (Fig. 8B). In *T. squamifera*, inner marginal setae but no terminal setae are present on the petasmal tip (Fig. 8C). Another important difference between the petasma of the three species is the presence of 3–4 proximal spines in *T. kelanang* but which are absent in both *T. anomala* and *T. squamifera*. All our nine male specimens of *T. kelanang* have these proximal spines. The petasma of *T. squamifera* is stout compared to that of its congeners. We also examined the petasma of *T. gracilis* and this is distinctly different from the rest and also without proximal spines (Fig. 8D). Therefore, despite the close similarities between *T. kelanang* and *T. squamifera* (Table 1), based on mainly differences of their petasma and the rostrum, we conclude that they are two different species.

The new species of *T. kelanang* is more similar to *T. squamifera* than to *T. anomala* in general morphology, but can be distinguished from *T. squamifera* based on the morphology of the petasma and rostrum. Thus, the characteristics of both rostrum and petasma are very useful in distinguishing the species of *Thalassina*.

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