

ZOOLOGISCHE MEDEDELINGEN

UITGEGEVEN DOOR HET

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE TE LEIDEN
(MINISTERIE VAN WELZIJN, VOLKSGEZONDHEID EN CULTUUR)

Deel 59 no. 14

30 augustus 1985

ISSN 0024-0672

FRESHWATER DECAPOD CRUSTACEANS FROM PULAU TIOMAN, WEST MALAYSIA

by

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Ng, P. K. L.,: Freshwater Decapod Crustaceans from Pulau Tioman, West Malaysia. Zool. Med. Leiden 59 (14), 30-viii-1985: 149-162. figs. 1-6. — ISSN 0024-0672.

Key Words: Decapod Crustacea; Brachyura; Potamidae; *Stoliczia (Johora)*; Natantia; *Macrobrachium*; *Caridina*; descriptions; new species; new records; Pulau Tioman.

Two new freshwater crabs, *Stoliczia (Johora) punicea* spec. nov. and *S. (J.) tiomanensis counsilmani* subsp. nov., are described from streams in Pulau Tioman, West Malaysia. Taxonomic notes are added of *S. (J.) tiomanensis tiomanensis* Ng & Tan, 1984. New records of the carideans *Macrobrachium pilimanus* (De Man, 1879) and *Caridina typus* H. Milne Edwards, 1834, are presented for the island.

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INTRODUCTION

Pulau Tioman (fig. 1) is a large island about 45 km east of the Malayan peninsula belonging to the state of Pahang. The flora and vertebrate fauna of the island are especially well known as a result of several detailed studies that have been carried out over the years (Ridley, 1893; Henderson, 1930; Medway, 1966a, b). Knowledge about the invertebrate fauna, however, especially regarding freshwater life, is very poor.

In a recent account of the freshwater biology of the island (Ratnasabapathy, 1977: 27), no mention was made of any crustaceans other than an unidentified prawn. Johnson (1968: 220) had earlier recorded the prawns *Macrobrachium lar* (Fabricius, 1798) and *M. latidactylus* (Thallwitz, 1891) from the island. As to the crabs, which are so prominent in freshwaters on the Malayan peninsula, only very recently was the first record made, viz., of a new species, *Stoliczia (Johora) tiomanensis* Ng & Tan, 1984.

In June 1984, when participating in a field trip to Pulau Tioman organised by the Department of Zoology, National University of Singapore, I had the

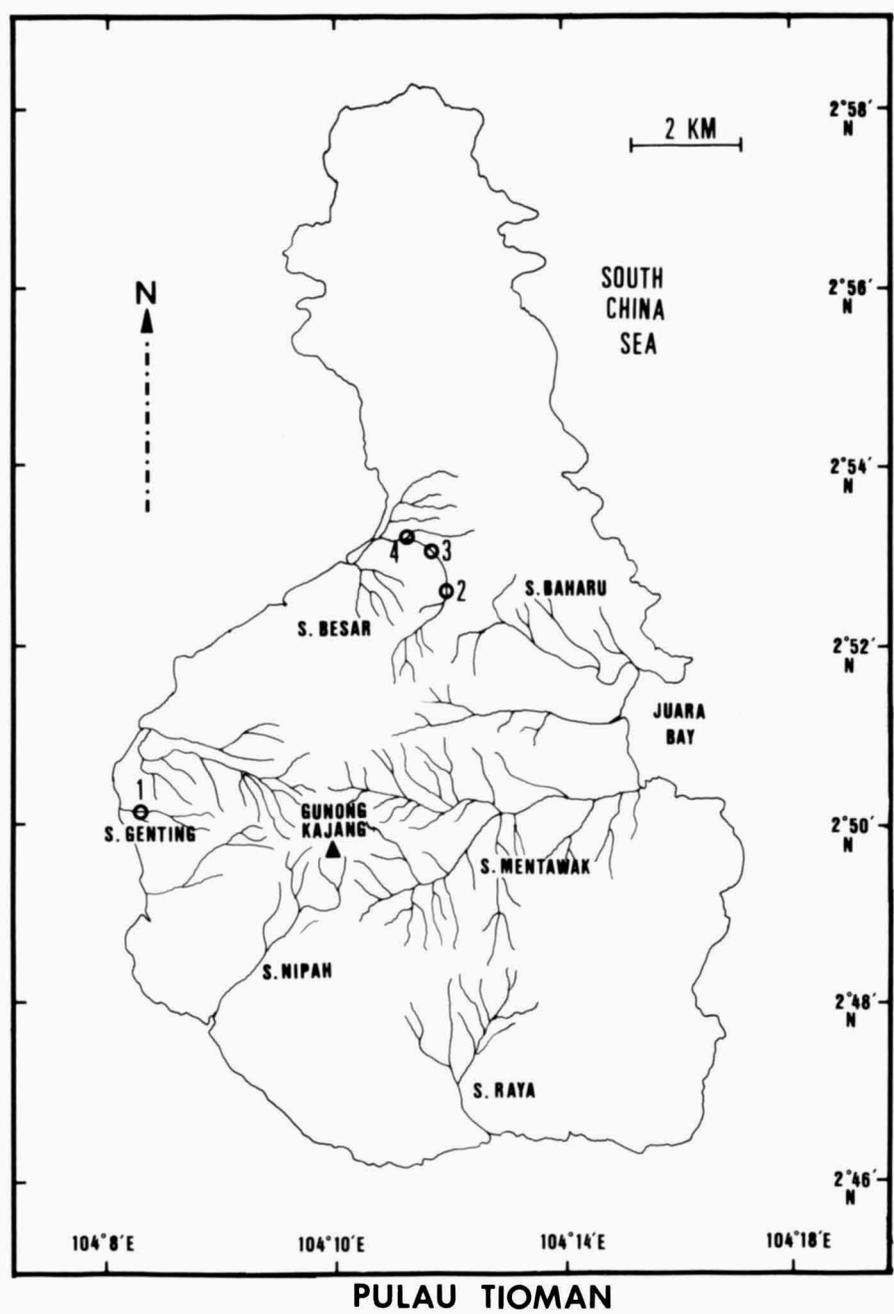


Fig. 1. Pulau Tioman, showing main streams and sites of collection. S = Sungai (river or stream); G = Gunung (hill or mountain). Numbers refer to the various field stations.

opportunity to do some collecting in and around Sungei Besar, one of the largest streams on the mid-western side of the island.

Four species of decapod crustaceans were collected: two caridean prawns and two crabs. Of the carideans obtained, one was a palaemonid, *Macrobrachium pilimanus* (De Man, 1879), the other an atyid, *Caridina typus* H. Milne Edwards, 1834. Both are new records for the island, and the record of *Caridina typus* is also the first for West Malaysia. Of the two crabs, one is a previously undescribed species belonging to the genus *Stoliczia* Bott, 1966, subgenus *Johora* Bott, 1966. The other turned out to be a new subspecies of *Stoliczia (Johora) tiomanensis*.

Notes on the taxonomy, distribution and ecology of these four decapods, and descriptions of the new crabs form the subject of the present paper. Some taxonomic notes are also included for *Stoliczia (Johora) triomanensis tiomanensis* Ng & Tan, 1984, a species originally described on the basis of several males and females collected during an earlier trip to the island (Ng & Tan, 1984).

The waters where these decapods are found have a slightly acidic pH of between 5.2. to 5.8, which is typical of hill streams, with the temperature ranging from 25.5 to 26.5°C (Ratnasabapathy, 1977: 27).

All specimens are deposited in the Zoological Reference Collection (ZRC), Department of Zoology, National University of Singapore, and the Rijksmuseum van Natuurlijke Historie (RMNH), Leiden.

SYSTEMATIC ACCOUNT

BRACHYURA
(Crabs)

POTAMIDAE

***Stoliczia (Johora) tiomanensis tiomanensis* Ng & Tan, 1984** (fig. 2).

Stoliczia (Johora) tiomanensis Ng & Tan, 1984: 167.

Holotype. — 1 ♂, 39.0 by 32.0 mm (ZRC nr. 1983.7.19.1), Sungei Genting, western Pulau Tioman, Pahang, West Malaysia, c.120 m (fig. 1 stn. 1), iv-1983, leg. P. K. L. Ng.

Paratypes. — 1 ♂, 2 ♀ (ZRC nrs. 1983.7.19.2-4), 1 ♂, 1 ♀, (RMNH nr. D. 36089), same data as holotype; largest male (ZRC nr. 1983.7.19.3) 47.0 by 37.0 mm; largest female (ZRC nr. 1983.7.19.2) 37.0 by 29.0 mm.

Remarks. — Ng & Tan (1984) established this taxon on the basis of three males and three females from Sungei Genting, a stream on the western part of Pulau Tioman. The first gonopods of the holotype male and the largest paratype male are depicted in fig. 2 to show the variation in the ventral fold of the terminal segment.

Bott (1970), in revising the subfamily Potamiscinae Bott, 1970, had regarded the expansion of the ventral fold of the terminal segment as a major diagnostic character in distinguishing the genus *Ranguna* Bott, 1966 from the other genera — *Potamiscus* Alcock, 1910 *sensu* Bott, 1966, *Stoliczia* Bott, 1966 and *Larnaudia* Bott, 1966 — and had originally established *Ranguna* as a subgenus of *Potamiscus* mainly on account of this character (1966: 481). The variation of the ventral fold of the terminal segment presently observed in *S. (J.) tiomanensis tiomanensis* thus casts doubt on the use of the expansion of the ventral fold as a generic character. According to Bott's classification of 1970, the structure of the first gonopod of the holotype male of *S. (J.) tiomanensis tiomanensis* clearly indicates that it belongs in the genus *Stoliczia*, subgenus *Johora*. The paratype male, however, would have to be referred to *Ranguna* (*Ranguna*) instead! There is thus a need to revise and redefine Bott's genera so as to reflect this variation. For the present study, Bott's classification is followed for want of anything better and to avoid further confusion.

As observed by Ng & Tan (1984: 167), *S. (J.) tiomanensis tiomanensis* is a nocturnal taxon found in fast flowing streams which are strewn with boulders. In life, the colour of the carapace is brown, with yellow patches.

***Stoliczia (Johora) tiomanensis counsilmani* subspec. nov.**
(figs. 3, 4).

Holotype. — 1 ♂, 43.0 by 31.9 mm (ZRC nr. 1984.6798), Sungei Besar, western Pulau Tioman, Pahang, West Malaysia, c. 300 m (fig. 1 stn. 2), 20-vi-1984, leg. P. K. L. Ng.

Paratypes. — 2 ♂, 2 ♀ (ZRC nrs. 1984. 6799-6802), 1 ♂, 1 ♀ (RMNH nr. D 36163), same data as holotype; largest female (ZRC nr. 1984. 6800) 28.1 by 23.7 mm.

Remarks. — The external morphology of this new subspecies is to a large extent identical to that described for the nominate subspecies, but the first gonopod differs in several respects, viz.: 1. the rectangular cleft on the distal portion of the penultimate segment is much broader, 2. the sickle-shaped terminal segment is less developed, relatively short, and not tapering, but with the distal portion gently bending upwards (not sideways), and 3. the ventral fold of the terminal segment is much broader and expanded on the distal portion to form a distinct flap-like structure.

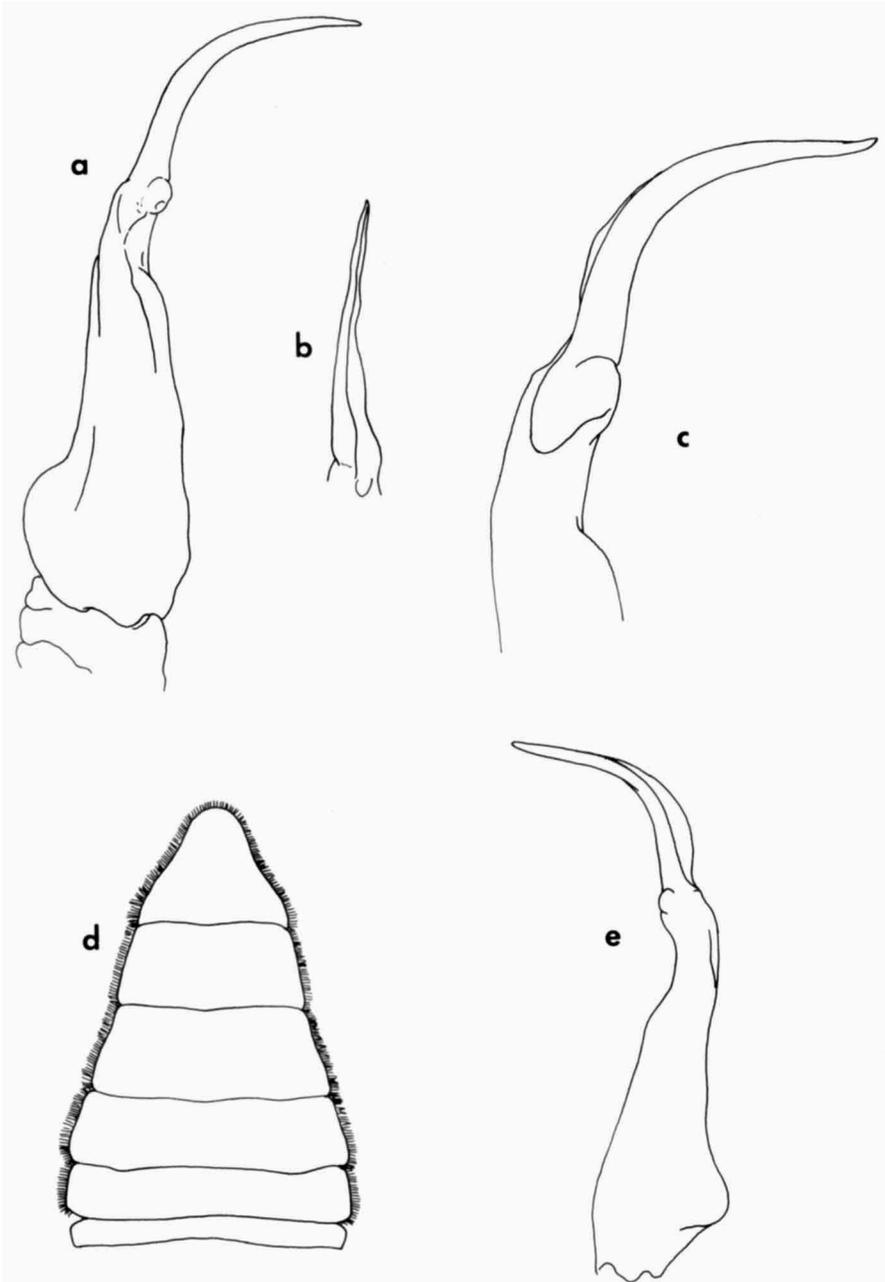


Fig. 2. *Stoliczia (Johora) tiomanensis tiomanensis* Ng & Tan, 1984. a-c, male holotype; d-e, paratype male; a, dorsal view of right first gonopod; b, dorso-lateral view of terminal segment of right first gonopod; d, abdomen; e, dorsal view of left first gonopod; a, b, $\times 11.5$; c, $\times 15.5$; d $\times 3.5$; e, $\times 9$.

The consistent character of the structure of the terminal segment of the first gonopod is shown in fig. 4 for three specimens of *S. (J.) t. counsilmani*. Although the relative length of the terminal segment gradually increases in relation to the increasing body size, the main features of the structure do not change significantly.

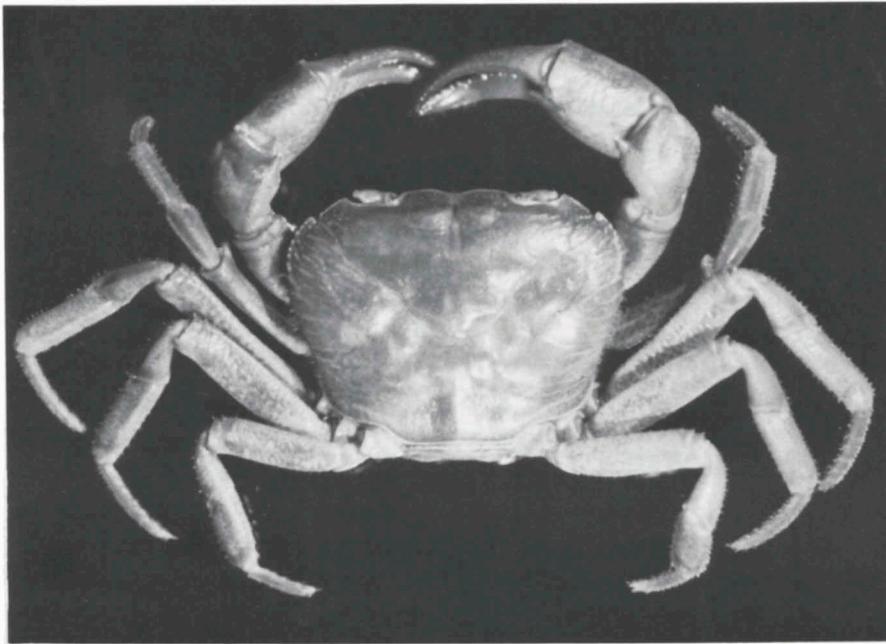


Fig. 3. *Stoliczia (Johora) tiomanensis counsilmani* subsp. nov. Male holotype, 43.0 by 31.9 mm, dorsal view.

Male *S. (J.) t. counsilmani* probably attain full maturity when they reach about 35 mm or so in carapace breadth, since a specimen at 28.7 mm is still immature, and since all males with a carapace breadth exceeding 39 mm are mature. The carapace of the smallest female measures 22.8 by 17.9 mm: this individual clearly is a juvenile since its abdomen is triangular in shape and not covering most of the sternum. The carapace of the largest mature female (ie. with the abdomen rounded and covering most of the sternum) measures 28.1 by 23.7 mm.

Another size-associated variation is in the length of the fingers relative to the palms of the male chelae. There appears to be a gradual, but distinct lengthening of the fingers as the animals increase in size.

S. (J.) t. counsilmani, like the nominate subspecies, inhabits fast flowing

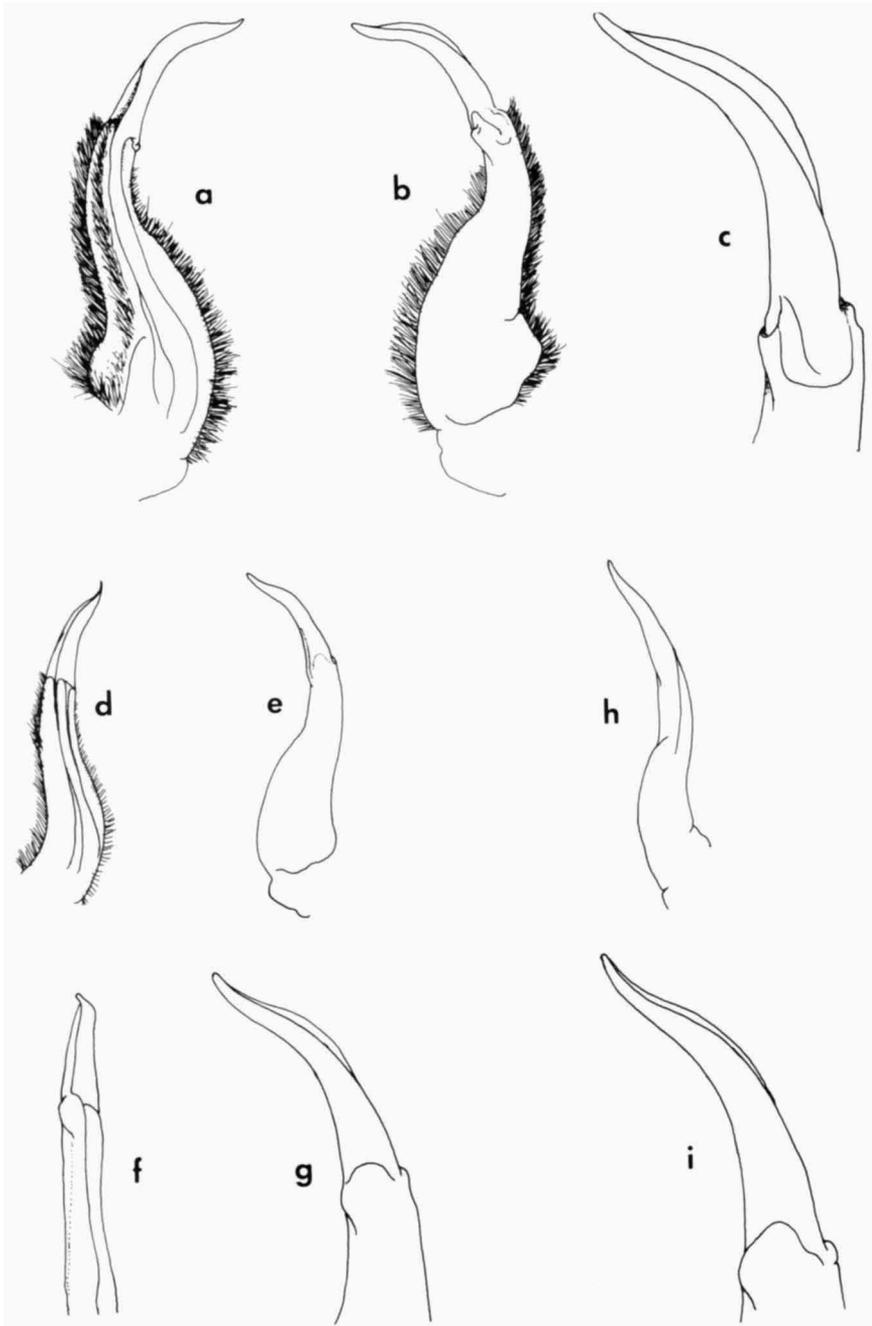


Fig. 4. *Stoliczia (Johora) tiomanensis counsilmani* subspec. nov. Right first gonopods; a-c, male holotype, 43.0 by 31.9 mm; d-g, male paratype, 28.1 by 21.8 mm; h-i, male paratype, 21.1 by 17.0 mm; a, d, ventral view; b, e, h, dorsalview; f, dorso-lateral view; c, g, i, enlarged terminal segment; a, b, $\times 7$, c, $\times 15$, d-f, $\times 7$, g, $\times 15$, h, $\times 10$; i, $\times 20$

streams, being found in the river, under rocks. Its colour is a mottled brown and yellow when alive. In some specimens, the inner surfaces of the chelal meri are purplish-red.

Etymology. — This new subspecies is named after Dr. James J. Counsilman of the Department of Zoology, National University of Singapore, who helped me with my collections at Pulau Tioman.

***Stoliczia (Johora) punicea* spec. nov.**
(figs. 5, 6)

Holotype. — 1 ♂, 19.7 by 15.5 mm (ZRC nr. 1984.6803), under rocks on slope adjacent to Sungei Besar, western Pulau Tioman, West Malaysia, c. 300 m (fig. 1 stn. 2), 20-vi-1984, leg. P. K. L. Ng.

Paratypes. — 2 ♂, 2 ♀ (ZRC nrs. 1984.6804-6808), 1 ♂, 1 ♀ (RMNH nr. D.36142), same locality as holotype except for one female (ZRC nr. 1984.6808) found under rocks in shallow water instead; largest male (ZRC nr. 1984.6804) 20.6 by 15.2 mm.

Description. — Carapace quadrilateral, almost glabrous, smooth, regions not well demarcated. Region immediately behind post-orbital cristae and gastric regions slightly convex. Transversely, carapace rather flat. Areas adjacent to the margins of the carapace and intestinal regions pale purplish-red, other regions much darker. Front slightly deflexed, margins sinuous, divided into two convex lobes by a narrow, shallow median cleft. Front margin of each lobe slightly concave, sloping very gently towards median cleft. External orbital angle obtuse-triangular, with outer margin longer than inner. Antero-lateral margin convex, smooth, with only a small but distinct epibranchial tooth, slightly crested at short distance behind the epibranchial tooth. Postero-lateral margins straight, slightly converging. Meso- and meta-branchial regions transversed by low, indistinct, striae. Epibranchial region completely smooth, slightly swollen. Post-orbital and epigastric cristae low, but distinct. Post-orbital and epigastric lobes distinct. Epigastric lobes separated by a short, narrow, median furrow that extends posteriorly to a shallow V-shaped groove. Epigastric and post-orbital cristae not separated by a notch, the latter not distinctly confluent with the antero-lateral margin. Cervical groove deep; proximal portion broad, with region around it appearing depressed, joining deep, H-shaped central depression. Intestinal regions flat, covered with scattered, short hairs. Supra-orbital margin smooth, slightly sinuous; infra-orbital margin nearly smooth, lined with very low, rounded granules. Basal segment of the antennae just touches front and base of the eye peduncle. Sub-hepatic and pterygostomial regions smooth; sub-branchial and sub-orbital regions slightly rugulose, with sub-branchial more so. Outer surfaces of third

maxillipeds smooth, with scattered, very short hairs. Ischia with a shallow, broad, median, longitudinal groove; inner margin smooth. Exopods with a long flagellum. Terminal segment of mandibular palps simple, with single segment.

Chelae unequal; right chela twice the size of the left. All surfaces smooth, but outer surfaces of palm of right chela slightly rugulose. Inner angle of carpus with short, sharp spine; base with a small tubercle. Inner margin of merus with row of four sharp, forwardly pointing tubercles. Tip of fingers of chelae curved, beige-coloured. Cutting edges of fingers with variably sized denticles, closing without any distinct gap. Fingers of right chela shorter the palm, slightly longer in left chela. Dactyli purple, except for beige-coloured tip. Rest of chela purplish-red, becoming paler towards merus.

Ambulatory legs long, second pair longest. All joints unarmed, covered with scattered, short, stiff hairs, especially on the margins. Dorsal margins of meri slightly serrated forwardly. Legs purplish-red, with last pair and the ventral surfaces paler.

Sternum smooth, glabrous, pinkish-white. Abdomen triangular, seven-segmented. First two segments slender, but laterally broad, rectangular in shape. Third to sixth segment progressively broader, more trapezoidal in shape. Last segment triangular, tip rounded, lateral margins concave.

First gonopod sickle-shaped, terminal segment slender, long, tapered, curving outwards. Distal portion of penultimate segment slender, neck-like, without cleft or notch. Second gonopod with long flagellum, approximately equal in length to first gonopod.

The female paratypes agree with the holotype male in most non-sexual characters, except that their chelae are equally developed. Their abdomens are seven-segmented, broad and rounded, covering most of the sternum. In some of the males, the sub-branchial and sub-orbital regions are more strongly rugulose compared to the holotype.

Remarks. — *Stoliczia (Johora) punicea* appears to be closely related to *S. (J.) tiomanensis* Ng & Tan, 1984, especially with regards to its sickle-shaped first gonopod. *S. (J.) punicea* is however, clearly a distinct species, and can be separated on the basis of the following characters: 1. the distal portion of the penultimate segment of the first gonopod is slender, neck-like, and not broad with a wide cleft, 2. the terminal segment of the first gonopod is long, slender, cylindrical, without any trace of folds or flaps, 3. the carapace is smooth, almost glabrous, without any trace of hairs on the branchial regions (the surfaces of *S. (J.) tiomanensis* are much rougher and more hairy), 4. the region between the front and the post-orbital and epigastric cristae is completely smooth, and not covered with small, low granules, 5. the anterior part of the

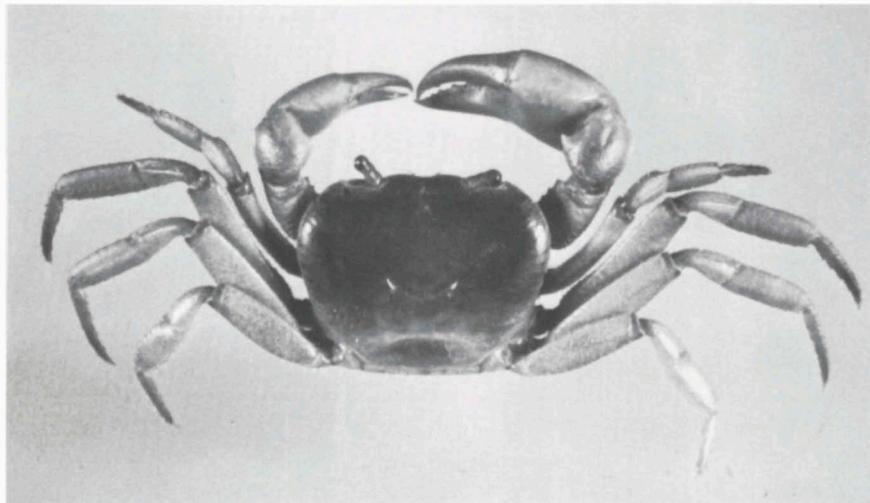


Fig. 5. *Stoliczia (Johora) punicea* spec. nov. Male holotype, 19.7 by 15.5 mm, dorsal view.

epigastric lobes is triangular, relatively smooth, projecting forwardly, without any distinct transverse striae, 6. the epibranchial regions are more swollen, 7. the antero-lateral margin is smooth, not slightly serrated, 8. the meso- and meta-branchial regions bear very low, oblique, transverse striae, with the epibranchial regions completely smooth (in *S. (J.) tiomanensis*, all three regions are covered with distinct striae), 9. the ambulatory dactyli and propodi are much less pubescent, 10. the larger male chela is distinctly inflated, with the fingers slightly longer than the palm (in *S. (J.) tiomanensis*, the larger chela is less distinctly inflated, with the fingers distinctly longer than the palm), 11. the inner margins of the meri of the chelae have a row of four tubercles, not six or more as in *S. (J.) tiomanensis*, 12. the dorsal margins of the meri of the ambulatory legs are slightly serrated, unlike in mature specimens of *S. (J.) tiomanensis* (the smallest male of *S. (J.) t. counsilmani* however, also has these margins slightly serrated), 13. the colour is purplish-red, and not mottled brown and yellow as in *S. (J.) tiomanensis*, 14. it is almost exclusively found under rocks on moist parts adjacent to the stream, and hardly ever in the fast flowing water itself, and, 15. its smaller size; the carapace breadth of adult *S. (J.) tiomanensis* varies between 35 to 50 mm, whereas that of the largest *S. (J.) punicea* obtained (a female) measured only 20.6 mm.

The sickle-shaped first gonopod is also characteristic of *Ranguna (Ranguna) luangprabangensis phuluangensis* Bott, 1970, and *Stoliczia (Johora) johorensis gapensis* (Bott, 1966). *S. (J.) punicea* can be differentiated from *R. (R.) l.*

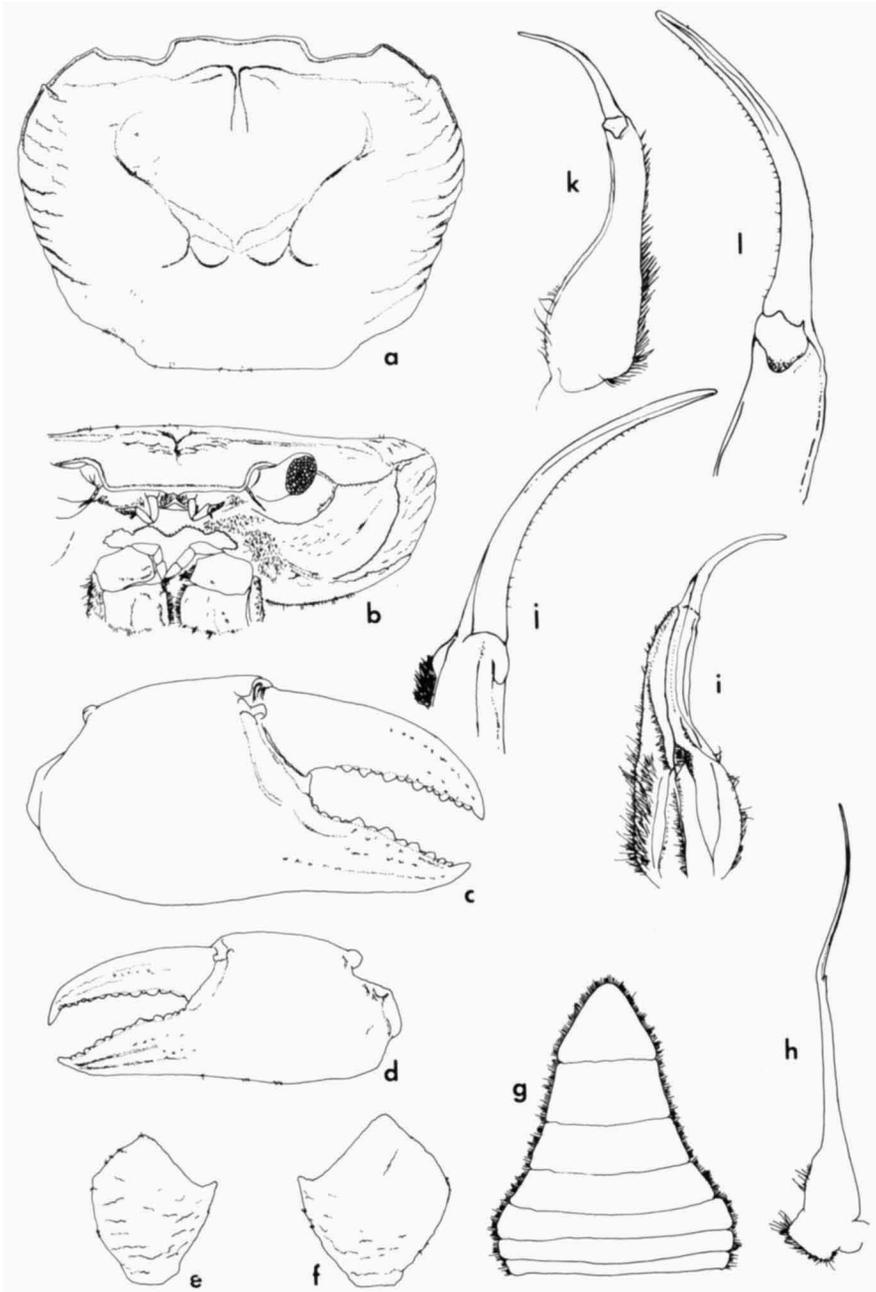


Fig. 6. *Stoliczia (Johora) punicea* spec. nov. Male holotype; a, dorsal view of carapace; b, frontal view of carapace; c, right chela; d, left chela; e, left chelal carpus; f, right chelal carpus; g, abdomen; h, second gonopod; i, ventral view of first gonopod; j, enlarged tip; k, dorsal view of first gonopod; l, enlarged tip; a, $\times 5$; b-g, $\times 4.5$; h, i, k, $\times 6$; j, l, $\times 15$.

phuluangensis in having the distal portion of the penultimate segment straight and not twisted outwards, and being slender and neck-like, not broad. It can be separated from *S. (J.) j. gapensis* by its larger size (about 20 mm carapace breadth in adult *S. (J.) punicea* compared to about 15 mm for *S. (J.) j. gapensis*), and its almost glabrous (not pubescent) carapace.

The presence of two closely related taxa, viz., *S. (J.) punicea* and *S. (J.) tiomanensis counsilmani* in the same locality can easily be explained by their different habitats. *S. (J.) t. counsilmani* (and *S. (J.) t. tiomanensis*) is only found in the fast flowing water of the stream itself, usually under rocks, whereas *S. (J.) punicea* prefers the rocks on the moist ground adjacent to the river (one specimen was even caught over a hundred metres from the stream). Only one specimen (ZRC nr. 1984.6802) was collected in the water.

Both sexes of *S. (J.) punicea* mature at a much smaller size as compared to *S. (J.) tiomanensis*. Males of *S. (J.) t. counsilmani* of similar size as the holotype male of *S. (J.) punicea* are still immature, with their first gonopods still relatively straight, the terminal segment indistinctly separated from the penultimate, and the hairs lining the groove of the second gonopod still undeveloped. The structure of the first gonopod of *S. (J.) punicea* suggests that this subspecies may have evolved from *S. (J.) t. tiomanensis*, *S. (J.) t. counsilmani*, or some other closely related taxon through the process of "Progenesis", ie. the accelerated attainment of sexual maturity while maintaining juvenile features (Gould, 1977), and by colonising the hitherto unoccupied semi-terrestrial niche.

Etymology. — *S. (J.) punicea* is named for its purplish-red colour.

MACRURA NATANTIA

(Prawns)

PALAEMONIDAE

Macrobrachium pilimanus (De Man, 1879)

Palaemon (Macrobrachium) pilimanus De Man, 1879: 181

Material. — 2 ♀ (1 ovigerous) (RMNH nr. D. 36210), side stream of Sungei Besar, Pahang, West Malaysia, c. 100 m (fig. 1 stn. 4), 19-vi-1984, leg. P. K. L. Ng.

Remarks. — The present specimens represent the first records of this species from Pulau Tioman. It has previously been reported from the Malayan peninsula, Java, Sumatra and Borneo. The specimens were collected in rela-

tively fast flowing water. One of the females is ovigerous, with the eggs large, suggesting that the larval development is of the "completely suppressed (abbreviated) type" (Shokitai, 1973: 122-124). The present specimens agree very well with *M. pilimanus sensu* Johnson (1958: 265), with the merus of the second pereopod swollen and the carpus cup-shaped. The status of the other two species that Johnson (1958: 265, 1964: 10-15) regarded as distinct but belonging to the same complex as *M. pilimanus* — *M. leptodactylus* (De Man, 1892) and *M. malayanus* (Roux, 1934), has already been discussed by Holthuis (1979: 10). I agree with Prof. Dr. Holthuis in regarding these synonymus with *M. pilimanus*, pending a better understanding of variation within the species.

In life, both specimens were mottled dirty green and light brown, the hair on the palm of the second pereopod was light brown, the eggs light green.

ATYIDAE

Caridina typus H. Milne Edwards, 1834

Caridina typus H. Milne Edwards, 1834: 363 (not *Caridina typus* Spence Bate, 1888: 704).

Material. — 1 ♀ (RMNH nr. D. 36209), side stream of Sungei Besar, Pahang, West Malaysia, 200 m (fig. 1 stn. 3), 20-vi-1984, leg. P. K. L. Ng.

Remarks. — The present specimen is the first record of this species from the Malay peninsula. Johnson (1961a, 1961b) had previously recognised eight species of *Caridina* from West Malaysia and Singapore. *C. typus* appears to have a wide range, being recorded from east Africa to the island of Sulawesi in Indonesia. The rostrum of the present specimen is shorter than figured by De Man (1892: 367, pl. 21 fig. 22), although the general structure is similar.

As pointed out by Prof. Dr. L. B. Holthuis (personal communication), the length of the rostrum is a variable character; which is not unexpected, considering the wide range of the species.

The specimen was collected on rocks in a well shaded side stream with shallow and relatively slow moving water. The substrate was fine sand and plant detritus. The animal was pale yellowish brown when alive.

ACKNOWLEDGEMENTS

The author wishes to thank the organiser of the field trip, Dr. Jon B. Sigurdsson for inviting him to participate, and Dr. James J. Counsilman for his help in the field collections. He is also indebted to Prof. Dr. L. B. Holthuis (RMNH, Leiden) for checking and confirming the identities of the two carideans. The kind assistance of Mrs. C. M. Yang, curator of the Zoological Reference

Collection, National University of Singapore during the course of this study is also gratefully acknowledged. Ms. Shirley S. L. Lim drew text-figure 6, and Mr. H. K. Yip took the photograph for fig. 5. This study has been supported by a 1984 research grant to the author from the Singapore Institute of Biology.

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