Malaysian J. Sci. **14**: 1-25 (1992)

MALAYSIAN
JOURNAL OF SCIENCE

Crabs of the *Stoliczia stoliczkana* (Wood Mason, 1871) species complex (Crustacea : Decapoda : Brachyura : Potamidae)

Peter K. L. Ng
Department of Zoology, National University of Singapore, Kent Ridge, Singapore 0511, Republic of Singapore

Abstract. The taxonomy of the Malayan freshwater potamid crab Stoliczia stoliczkana (Wood Mason, 1871) and its allied taxa is revised. The four previously recognised subspecies are here regarded as distinct species. The identity of *Potamiscus (Stoliczia) stoliczkana perlensis* Bott, 1966, is clarified and a new species, *S. kedahensis*, is described from Kedah, Peninsular Malaysia.

IKHTISAR. *Taksonomi mengenai* Stoliczia stoliczkana *(Wood Mason, 1871), ketam potamid air tawar di Semenanjung Malaysia, dan takson-takson berhubungkait dengannya adalah dikaji semula. Empat takson yang dikenali dahulu sebagai subspesies adalah kini dianggap sebagai spesies berlainan. Identiti* Potamiscus (Stoliczia) stoliczkana perlensis *Bott, 1966 adalah dijelaskan dan satu spesies baru,* S. kedahensis, *didapati dari Kedah, Semenanjung Malaysia.*

INTRODUCTION

The freshwater crab genus *Stoliczia* Bott 1966, with 13 known species and subspecies from Peninsular Malaysia and southernmost Thailand, was last reviewed by Ng (1988). For the type species, *S. stoliczkana* (Wood Mason 1871), Ng (1988) recognised four subspecies, viz. *S. s. stoliczkana, S. s. perlensis* (Bott 1966), *S. s panhai* Ng & Naiyanetr 1986, and *S. s. ekavibhathai* Ng & Naiyanetr 1986.

Stoliczia stoliczkana perlensis was orginally described from only one large male from Perlis, and has not been reported since. Ng (1988) regarded specimens from Kedah as conspecific as their external features and male first pleopod structures agreed quite well with Bott's (1966, 1970) descriptions and figures. Ng (1988) however, did not manage to examine the type specimen of *S. s. perlensis*. Recently, Dr. Michael Türkay of the Senckenberg Museum was kind enough to send the holotype male of *S. s. perlensis* to the author. Direct comparisons showed that the Kedah specimens differed from *S. s. perlensis* s. str. in several aspects. These observations require a reappraisal of the taxonomic positions of the Kedah and southern Thailand specimens.

The four known subspecies of *S. stoliczkana* are here regarded as separate species. The Kedah specimens are referred to a new species, *S. kedahensis*. The detailed taxonomy of these five species, here referred to as the *S. stoliczkana* species complex, forms the text of the present paper.

MATERIAL AND METHODS

As some of the differences between taxa are quantitative, the measurements and ratios have been tabulated (Tables 1 and 2). Qualitative differences are listed in Table 1. Comparisons in the text are thus kept brief.

The abbreviations G1 and G2 are used for the male first and second pleopods respectively. Terms used essentially follow those used by Ng (1988). All measurements (in millimetres) provided of the material examined are of the carapace widths and lengths respectively. The carapace height is measured from the base of the second sternal segment (where there is a clear suture line) to the highest part of the gastric region. The posterior margin of the carapace is the distance between the coxae of the last pair of ambulatory legs. The distance between the bases of the chelipeds is measured between the bases of their coxae. All measurements are made with vernier callipers. All measurements and ratios are to two decimal places. Specimens of comparable sizes have been selected for measurements as far as possible. When larger or smaller specimens of the same species have different ratios, these are discussed in the text.

The carapace length and posterior margin of the carapace have been chosen as standards for proportion as these are not known to show significant allometric growth as the animals increase in size. In many crabs, the carapace is known to widen disproportionately as the animals grow. The following abbreviations have been used: WD = carapace width; LH = carapace length; HT = carapace height; PC = posterior margin of carapace; BC = distance between base of chelipeds; M, C, D and P refer to the merus, carpus, dactylus and propodus of the ambulatory legs respectively. The numerals in front of M, C, D and P indicate the position of the leg. Thus 4M = merus of fourth ambulatory leg.

The lengths of the GI and its terminal segment are measured along the longitudinal axis. All measurements of the GI terminal segment are made from ventral view. This segment is asymmetrical and is longer when measured from the dorsal face. The total length of the GI is determined from the tip of the terminal segment to the base of the inner margin just as it makes a sharp curve inwards.

Specimens examined are deposited in the Zoological Reference Collection (ZRC), Department of Zoology, National University of Singapore; Senckenbergischen Naturischforschenden (SMF), Frankfurt, Federal Republic of Germany; Cambridge University Zoology Museum (CMZ), United Kingdom; Zoological Survey of India (ZSI), Calcutta, India; Chulalongkorn University Natural History Museum (CNHM), Bangkok, Thailand and the Reference Collection of the Department of Biology, Universiti Sains Malaysia (USM), Penang, Malaysia.

TAXONOMY

FAMILY POTAMIDAE ORTMANN 1896
GENUS *STOLICZIA* BOTT 1966 SENSU NG 1988

Stoliczia stoliczkana (Wood Mason 1871)
(Pl. 1, Figs. 1, 2, 9A, B)

Telphusa stoliczkana Wood Mason 1871: 199, Pl. 12 fig. 8-12
Potamon (Potamonautes) stoliczkanum - Ortmann 1897: 304, 307 (part)
Potamon (Potamonautes) stoliczkana - Rathbun 1905: 187, Pl. 15 fig. 7
Potamon (Potamon) stoliczkanum - Alcock 1910: 53
Potamiscus (Stoliczia) stoliczkanus - Bott 1966: 491, Fig. 27, Pl. 20 fig. 9
Stoliczia (Stoliczia) stoliczkana stoliczkana - Bott 1970: 177, Pl. 39 fig. 52, Pl. 50 fig. 48
Stoliczia stoliczkana stoliczkana - Ng 1988: 56, fig. 24

Diagnosis. Branchial regions distinct, cervical groove shallow, upper surfaces covered with scattered, very short, stiff hairs. Exopod of third maxilliped with short, flap-like flagellum, longer than distal width of exopod. Ambulatory legs relatively long, lined with short hairs, more dense in smaller specimens. G1 terminal segment 0.31 times total length of G1, gently sinuous, strongly tapering.

Material examined. 7 males, 15 females (ZRC 1984. 6824-6842), 1 male, 1 female (CNHM), 1 male, 1 female (MZB 1138), Botanic Gardens, leg. M. W. F. Tweedie, iv. 1935. — 1 male, 1 female (ZRC 1984. 6843-6844), 8 males, 17 juvs. (ZRC 1984. 6845-6849), 4 males, 3 females, 6 juvs. (ZRC 1984.6870-6882), Penang Hill, leg. M. W. F. Tweedie, iv.1935. —1 male, 2 females, 1 juv. (ZRC), 1 male, 1 juv. (USNM), in pool adjacent to main stream, rocky substrate, dripping water from overhanging rocks, below dam of reservoir, Botanic Gardens, leg. P.K. L. Ng, 13.vi. 1987.— 1 male (42.0 by 31.5 mm) (ZRC 1989. 2013), in wedge of rock, with dripping water, side stream, about 300 m from Titikarawang Waterfalls, leg. P. K. L. Ng, 13.vi.1987. All localities in Penang Island.

Remarks. This is a common taxon, apparently endemic to the highlands of Penang Island. First described by Wood Mason in 1871 on the basis of specimens collected by Dr. Stoliczka from Penang (= Pulau Pinang), the taxonomy of this species has been quite stable. The taxon appears to be the only potamid in Penang, extending throughout the Penang Hills, which occupies a continuous stretch along the centre of the island.

The large number of specimens available are quite consistent in their presently recognised generic and specific characters. There is slight variation in the form of the frontal margin, being usually straighter in smaller specimens but more sinuous in larger ones. The G1 of adult males also shows slight variation. The terminal segment of most individuals is straight and in line with the subterminal segment, but in several, especially larger specimens, the terminal segment is slightly sinuous. The flagellum on the exopod of the third maxillipeds is vestigial, being short, resembling a small flap, throughout all the various size and age-groups for both sexes. There is some slight variation in the shape and degree of bending of the G1 terminal segment. The form of the postorbital cristae changes as the animals increase in size. In smaller specimens (less than 30 mm carapace width), the crista appears almost straight, except for a gentle curve (towards the posterior margin) as it meets the epibranchial tooth. In large specimens, this curve is more pronounced, the postorbital crista appearing sinuous.

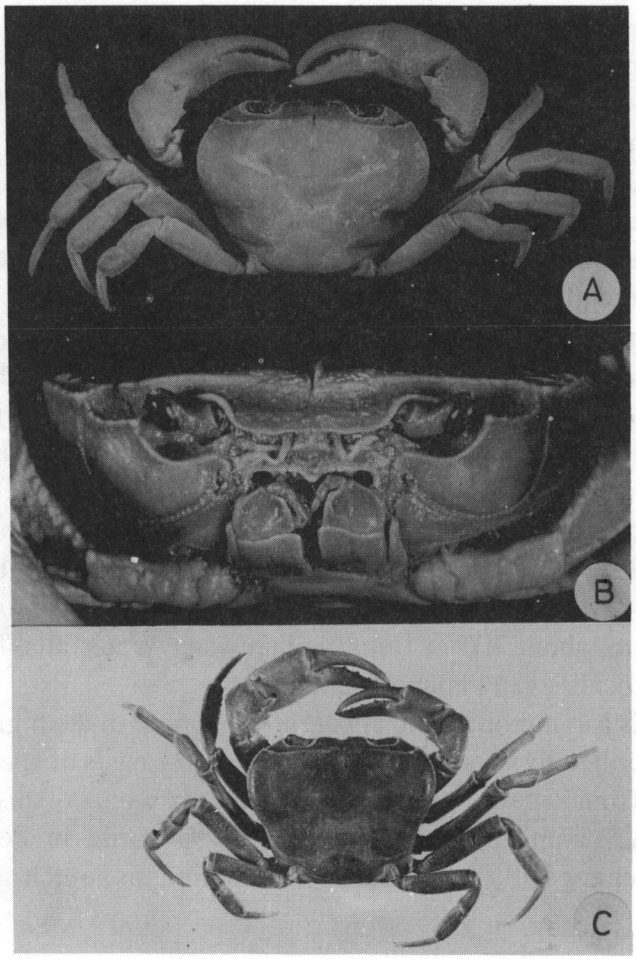

Plate 1. *Stoliczia stoliczkana*. A, B, male, 38.5 by 28.9 mm (ZRC 1984. 6809) (Penang Hills, Penang); C,male, 42.2 by 32.2 mm (ZRC 1989. 2013) (Titikarawang Hills, Penang).

Wood Mason (1871) had based his description of the taxon on one male and one female specimen. The male, measuring 48.0 by 36.0 mm, was designated the lectotype by Ng (1988), and is deposited in the ZSI. Alcock (1910) describes the third maxilliped exopod of the types as having a "strong" flagellum, which is in complete contradiction to what is known for all the other specimens known thus far from Penang. Dr. Maya Deb of the ZSI has examined the type specimens at the author's request, and commented (*in litt.* 28 June 1988) that the flagella on the exopods of the third maxilliped exopods are very short, only about 2.0 mm in length, which corresponds very well with those on the present specimens. Alcock thus seems to have been mistaken in his observations.

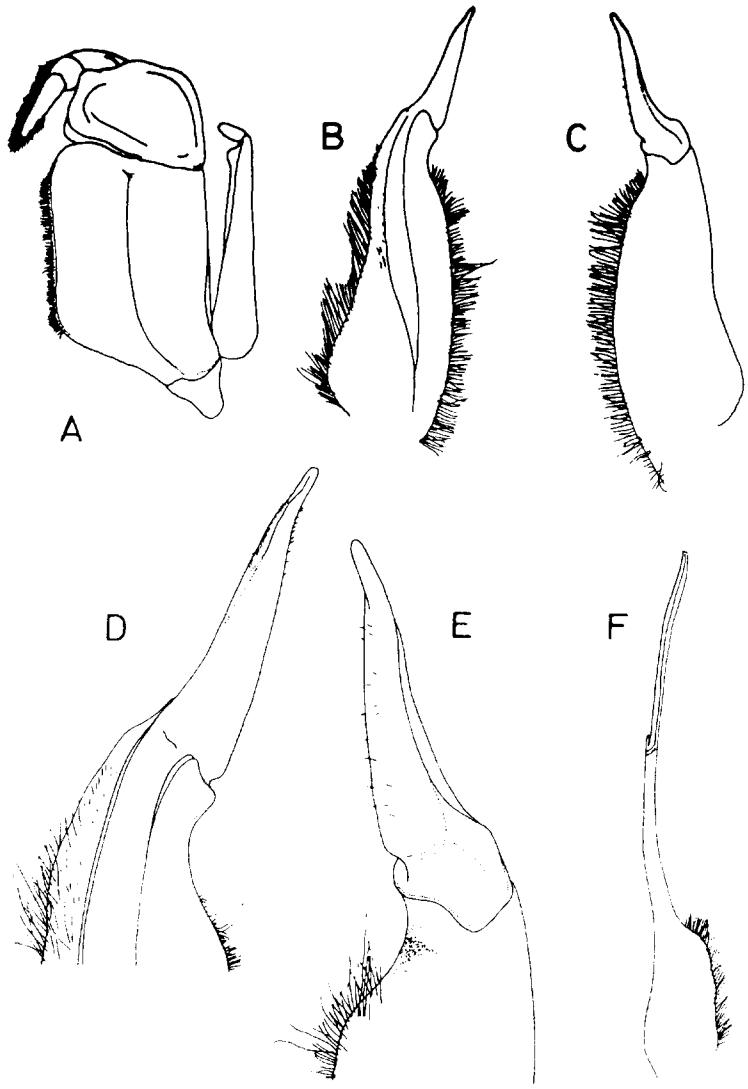

Figure 1. *Stoliczia stoliczkana*. Male, 42.2 by 32.2 mm (ZRC 1989. 2013) (Titikarawang Hills, Penang). A, Left third maxilliped; B, D, Ventral view of left GI; C, E, Dorsal view of left G1; F, Left G2.

A large male collected from the western part of the island (at Titikarawang) for the first time is identical to the other specimens. The carapace colour of the live male was yellowish-orangish brown, the orbital margins pale cream, the pterygostomial regions pale orange, and the third maxillipeds bluish-grey. The ambulatory legs were purplish. The outer surfaces of the palm were orangish-brown, the tips of the fingers and the cutting teeth bright orange. The first segment of the sternum was pale orange,

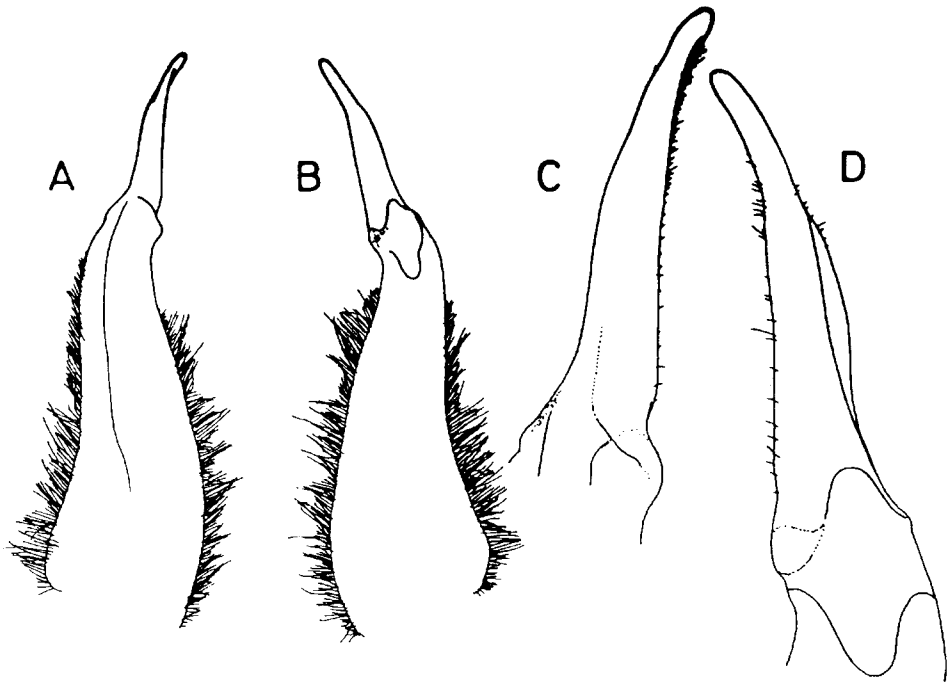

Figure 2. *Stoliczia stoliczkana*. Male, 31.0 by 23.2 mm (ZRC 1984. 6870) (Penang Hill, Penang). A, C, Ventral biew of left G1; B, D, Dorsal view of left GL.

the other parts being dirty white. The G1 terminal segment was bright orange, the other parts being dirty white. The smaller specimens from the Botanic Gardens, when alive, closely resembled the Titikarawang male in colouration, although there was some slight variation between individuals. In general, their carapaces were purplish-grey, the supra- and infraorbital margins with a cream margin (broader in the latter), pterygostomial region, abdomen and sternum white, and ambulatory legs brownish.

The lower two thirds of the palms of the chelipeds was deep orange, gradually becoming brown in the upper third, most of the dactylus being brown, with bright orange tips. The carapace of most of these specimens, including the largest male and female, from the Botanic Gardens appeared more brownish, the legs paler brown, the cream border on the orbital margins were indistinct, and the surfaces of the palm purplish. The ambulatory legs of the smallest specimen (a juvenile) however, were very pale brown in colour and appeared to be more mottled. The pale colouration of juvenile crabs is usual for most taxa of freshwater crabs. All specimens from the Botanic Gardens were completely glabrous.

Stoliczia stoliczkana seems to prefer clean flowing mountain and hill streams, usually hiding under rocks, and apparently having essentially the same ecological requirements as the genus *Johora* Bott 1966 (see Ng 1987). Younger specimens were collected from calm rock pools adjacent to the main stream. They are relatively hardy, able to survive out of water for several hours provided the temperature is cool.

Table 1. Similarities and differences in six characters among the various species of the genus *Stoliczia* from the Malay peninsula.

Character	*S. stoliczkana*	*S. perlensis*	*S. kedahensis*	*S. panhai*	*S. ekavibhathai*
Carapace shape	distinctly transvese	distinctly transverse	distinctly transverse	distinctly transverse	slightly broader than long
Ratio of carapace width to length	1.31	1.33	1.30	1.31	1. 28
Carapace height	flat	flat	flat	flat	swollen
Carapace hair	slightly hirsute	almost glabrous	hirsute	hirsute	almost glabrous
Third maxilliped flagellum	flap-like, longer than distal width of exopod	elongate, about twice distal width of exopod	absent	flap-like, shorter than distal width of exopod	flap-like, shorter than distal width of exopod
Hair on ambulatory leg	short hairs	short hairs	short hairs, stiff bristles	short hairs, stiff bristles	short hairs
Ratio of G1 terminal segment to subterminal segment	0.31	0.27	0.22	0.28	0.30

Table 2. Carapace and ambulatory leg measurements, and ratios among the various species of the genus *Stoliczia* from the Malay peninsula.

	WD	LH	HT	PC	BC	4M	3M	2M	1M	4C	3C	2C	1C
S. stoliczkana (a)	28.2	21.7	10.0	10.0	8.4	12.9	15.7	17.0	12.6	7.8	7.8	7.9	6.1
S. stoliczkana (b)	42.0	31.5	15.0	12.5	12.0	17.4	21.6	23.3	19.9	10.6	11.0	11.3	9.5
S. perlensis	31.5	23.6	12.8	10.9	13.4	13.8	17.0	18.6	14.5	8.4	8.2	9.0	7.4
S. kedahensis	39.0	30.1	15.7	11.0	15.4	15.0	17.2	20.3	16.8	9.0	9.8	10.6	9.0
S. panhai	30.3	23.4	13.0	9.8	8.3	10.8	14.6	16.2	12.9	7.0	7.9	7.2	6.5
S. ekavibhathai	31.3	24.4	13.0	10.8	13.3	13.0	18.5	14.6	15.0	7.8	8.7	8.6	7.3

	4P	3P	2P	1P	4D	3D	2D	1D
S. stoliczkana (a)	7.9	9.0	9.6	7.3	8.6	10.3	11.1	8.5
S. stoliczkana (b)	11.1	12.8	13.6	9.8	11.9	14.6	15.4	12.6
S. perlensis	8.8	10.1	11.1	7.8	10.0	12.0	12.6	9.9
S. kedahensis	9.9	11.5	12.8	10.2	11.1	13.1	14.4	12.3
S. panhai	7.6	9.0	9.0	7.5	7.7	10.5	10.8	9.1
S. ekavibhathai	7.9	9.2	10.0	7.9	9.3	11.9	12.4	9.8

	WD/LH	PC/WD	PC/LH	4M/PC	4M/LH	3M/PC	3M/LH	2M/PC	2M/LH	1M/PC	1MLH
S. stoliczkana (a)	1.30	0.35	0.46	1.29	0.59	1.57	0.72	1.70	0.78	1.26	0.58
S. stoliczkana (b)	1.33	0.30	0.40	1.39	0.55	1.73	0.69	1.86	0.74	1.59	0.63
S. perlensis	1.33	0.35	0.46	1.27	0.58	1.56	0.72	1.71	0.79	1.33	0.61
S. kedahensis	1.30	0.28	0.37	1.36	0.50	1.56	0.57	1.83	0.67	1.53	0.56
S. panhai	1.29	0.32	0.42	1.10	0.46	1.49	0.62	1.65	0.69	1.32	0.55
S. ekavibhathai	1.28	0.35	0.44	1.20	0.53	1.49	0.66	1.69	0.75	1.39	0.61

	4C/PC	4C/LH	3C/PC	3C/LH	2CPC	2/PC	1C/PC	1C/LH	4P/PC	4P/PC	3P/PC	3P/LH
S. stoliczkana (a)	0.78	0.36	0.78	0.36	0.79	0.36	0.61	0.28	0.79	0.36	0.90	0.41
S. stoliczkana (b)	0.85	0.34	0.88	0.35	0.90	0.36	0.76	0.30	0.89	0.35	1.02	0.41
S. perlensis	0.77	0.36	0.75	0.35	0.83	0.38	0.68	0.31	0.81	0.37	0.93	0.43
S. kedahensis	0.82	0.30	0.89	0.33	0.96	0.35	0.82	0.30	0.90	0.33	1.05	0.38
S. panhai	0.71	0.30	0.81	0.34	0.73	0.31	0.66	0.28	0.78	0.32	0.92	0.38
S. ekavibhathai	0.72	0.32	0.81	0.36	0.80	0.35	0.68	0 .30	0.73	0.32	0.85	0.38

	2P/PC	2P/LH	1P/PC	1P/LH	4D/LH	4D/LH	3D/PC	3D/LH	2D/PC	2D/LH	1D/PC	1D/lh
S. stoliczkana (a)	0.96	0.44	0.73	0.34	0.86	0.40	1.03	0.47	1.11	0.51	0.85	0.39
S. stoliczkana (b)	1.09	0.43	0.78	0.31	0.95	0.38	1.17	0.46	1.23	0.49	1.01	0.40
S. perlensis	1.02	0.47	0.72	0.33	0.92	0.42	1.10	0.51	1.16	0.53	0.91	0.42
S. kedahensis	1.16	0.43	0.93	0.34	1.01	0.37	1.19	0.44	1.31	0.48	1.12	0.41
S. panhai	0.92	0.38	0.77	0.32	0.79	0.33	1.07	0.45	1.10	0.46	0.93	0.39
S. ekavibhathai	0.93	0.41	0.73	0.32	0.86	0.38	1.10	0.49	1.15	0.51	0.91	0.40

For abbreviations, refer to material and methods. Specimens used: *S.stoliczkana* (a) - male, ZRC 1984. 6843, Penang Hills; *S.stoliczkana* (b) - male, ZRC 1989. 2013, Titikarawang, Penang; *S. perlensis* - holotype male; *S. kedahensis* - holotype male; *S. panhai* - paratype male, ZRC, Ton Nga Chang Waterfall; *S. ekavibhathai* - holotype male.

Stoliczia perlensis (Bott 1966)
(Pl. 2, Figs. 3, 9C)

Potamiscus (Stoliczia) stoliczkana perlensis Bott 1966: 492, Fig. 28, Pl. 20 fig. 10
Stoliczia (Stoliczia) stoliczkana perlensis - Bott 1970: 178, Pl. 39 fig. 53, Pl. 50 fig. 49

Diagnosis. Epigastric and postorbital cristae very close to frontal and supraorbital margins, epigastric cristae distinctly forward of postorbital. Surfaces of carapace and chelipeds almost glabrous, ambulatory legs covered with scattered very short hairs. Exopod of third maxilliped with short flagellum, about twice width of distal part of exopod. GI gently sinuous, distal part of terminal segment strongly tapering, 0.27 times total length of GI.

Material examined. Holotype–1 male (32.0 by 25.0 mm) (SMF 2781), Kaki Bukit, Perlis, Peninsular Malaysia, 6° 6'59"N, 100°2'44"E, leg. Raffles Museum collector, 1938 (don. Raffles Museum).

Remarks. Described on the basis of a single male (as a subspecies) measuring 32.0 by 25.0 mm collected from or near Kaki Bukit in Perlis, the identity of this taxon was uncertain as it was only briefly described and figured by Bott (1966, 1970). Other than the holotype male, no other specimens of this species are known.

The holotype of *S. perlensis* has an exopod flagellum only on the right third maxilliped, the left maxilliped exopod was without any trace of one. Bott (1966, 1970) however, had recorded that this species has no flagellum. The exopod of the types of *S. kedahensis*, new species, however, all lack a flagellum, and possess instead, a tuft of very short hairs at the distal end, which are absent on specimens of *S. perlensis*. This suggests that the absence of a flagellum on the left third maxilliped of the holotype male is due to loss by breakage.

The subdistal inner tooth of the right exopod of the third maxilliped of *S. perlensis* is rather sharper and more produced than that in the other species. The subdistal tooth of the left exopod however, is lower and resembles those of the other species.

Stoliczia kedahensis, new species
(Pl. 3, Figs. 4, 9D)

Stoliczia stoliczkana perlensis – Ng 1988: 58, Fig. 25
(not *Potamiscus (Stoliczia) stoliczkana perlensis* Bott 1966: 492, Fig. 28, Pl. 20 fig. 10)

Diagnosis. Branchial regions distinct, cervical region depressed, without prominent cervical grooves, epigastric cristae distinctly forward of postorbital cristae. Surfaces

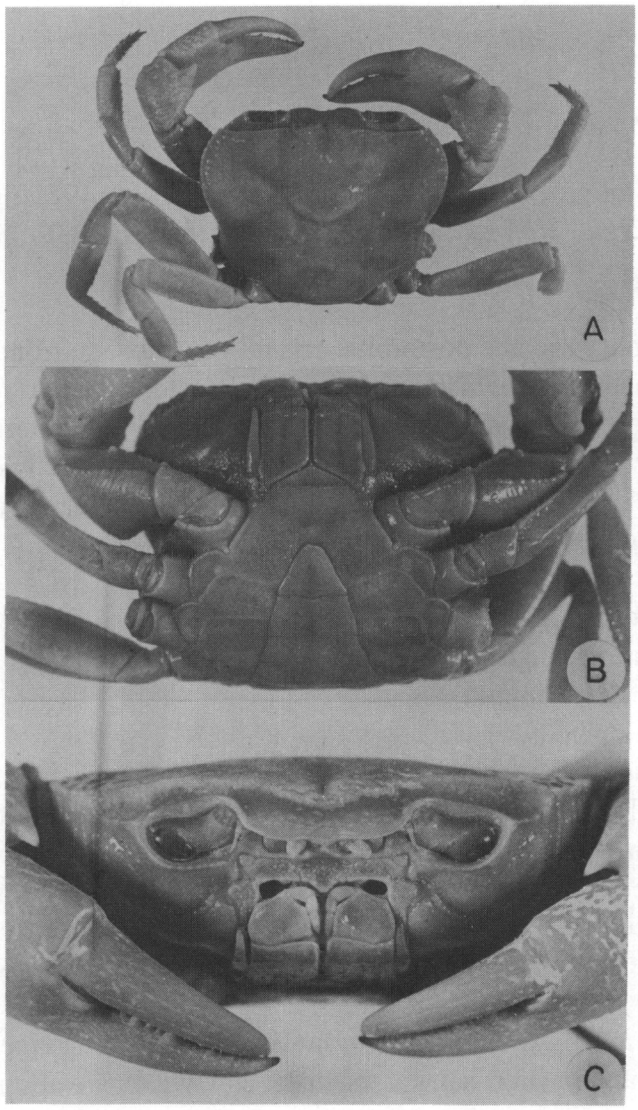

Plate 2. *Stoliczia perlensis*. A-C, holotype male, 32.0 by 25.0 mm (SMF 2781) (Kaki Bukit, Perlis).

at and adjacent to intestinal, frontal, anterolateral and posterolateral regions covered with numerous short stiff hairs. Posterior margin of carapace in larger specimens proportionately shorter compared to other species. Ambulatory legs and parts of the chelipeds covered with numerous short hairs, ambulatory propodi and dactyli lined with numerous stiff bristle-like hairs. G1 terminal segment 0.22 times total length of G1, distal part sharply tapering.

Material examined. Holotype–1 male (39.0 by 29.0 mm) (ZRC 1989. 3261), Sungai Tekai, ca. 30 milestone, on Naka to Nami road, Padang, Terap district, Kedah, leg. J. I. Furtado & M. N. A., 1. iv. 1967. Paratype –1 male (25.2 by 19.8 mm) (ZRC 1989. 3262), same data as holotype.

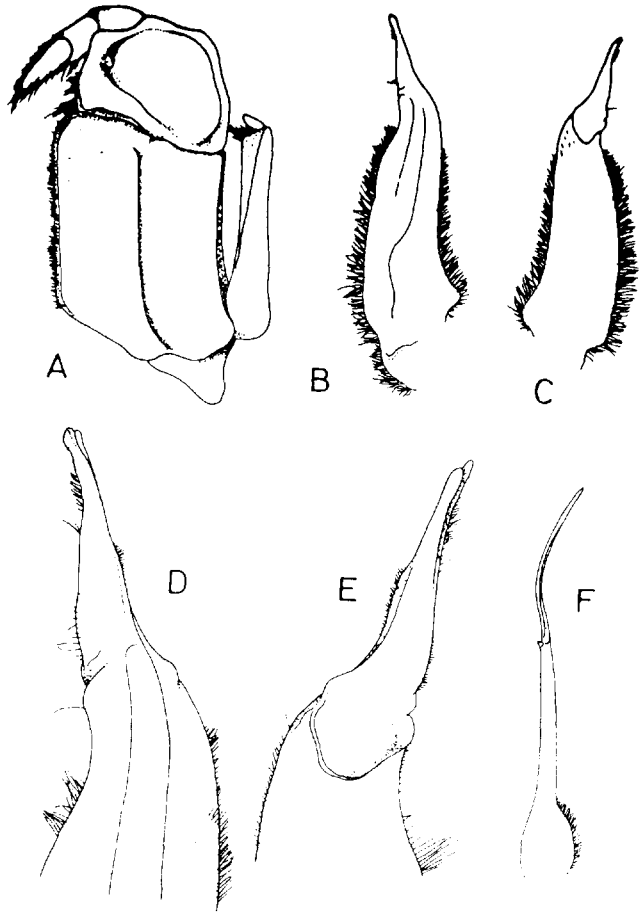

Figure 3. *Stoliczia perlensis*. Holotype male, 32.0 by 25.0 mm (SMF 2781) (Kaki Bukit, Perlis). A, Exopod of left third maxilliped; B, D, Ventral view of left G1; C, E; Dorsal view G1; Left G2.

Remarks. Ng (1988) referred specimens from Kedah to *S. s. perlensis* on the basis of the descriptions and figures by Bott (1966, 1970). Bott (1966, 1970) stated that his subspecies lacked a flagellum on the third maxilliped exopod, and his rather diagrammatic figure of the G1 closely resembled that on the Kedah specimens.

A direct comparison between the holotype male of *S. perlensis* (here regarded as a species) and the Kedah specimens show that they are not conspecific as presumed by Ng (1988). The Kedah specimens are here described as a new species, *S. kedahensis*. *Stoliczia kedahensis* differs from *S. perlensis* in having the epigastric and postorbital cristae distinctly further behind the frontal and supraorbital margins, the epigastric cristae being more distinctly forward of the postorbital cristae, the exopod of the third maxilliped exopod completely lacking a flagellum, possessing instead a tuft of short hairs, and the GI terminal segment being less sinuous and proportionately shorter.

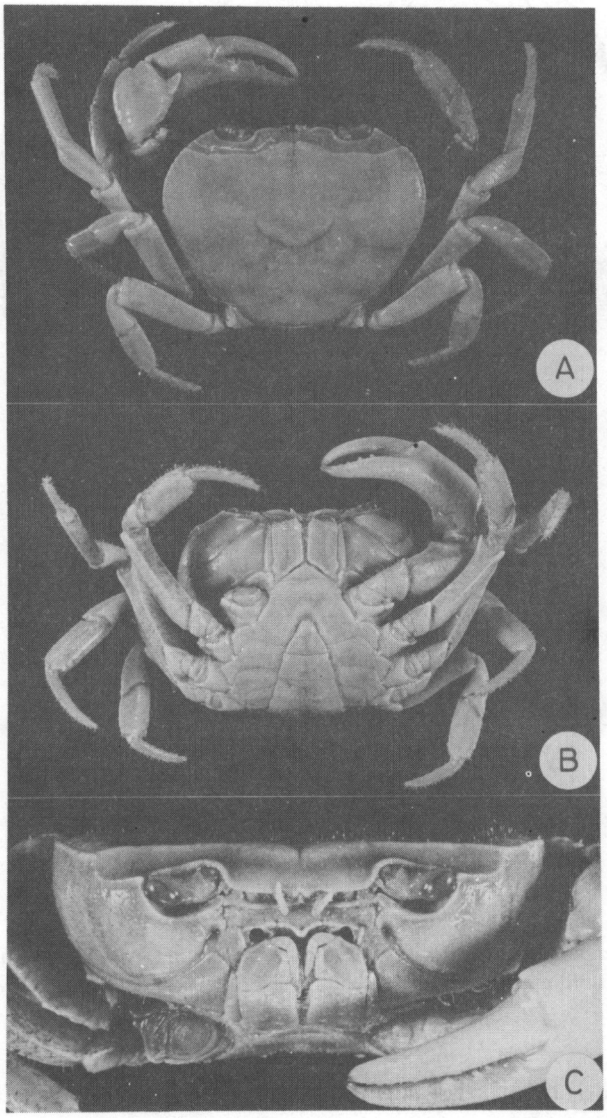

Plate 3. *Stoliczia kedahensis*. A-C, holotype male, 39.0 by 29.0 mm (ZRC 1989. 3261) (Sungai Tekai, Kedah).

In the holotype male, the posterior margin of the carapace is distinctly shorter proportionately than any of the other species (Table 2). The smaller paratype male of this species however, has ratios comparable to those of the other species (PC/WD 0.33 and PC/LH 0.43). It is not true however that the ratio decreases as the animals increase in size. Large specimens of *S. stoliczkana* do not have such small ratios. A 42.2 by 32.2 mm male of *S. stoliczkana* has a PC/WD and PC/LH ratios of 0.31 and 0.41 respectively.

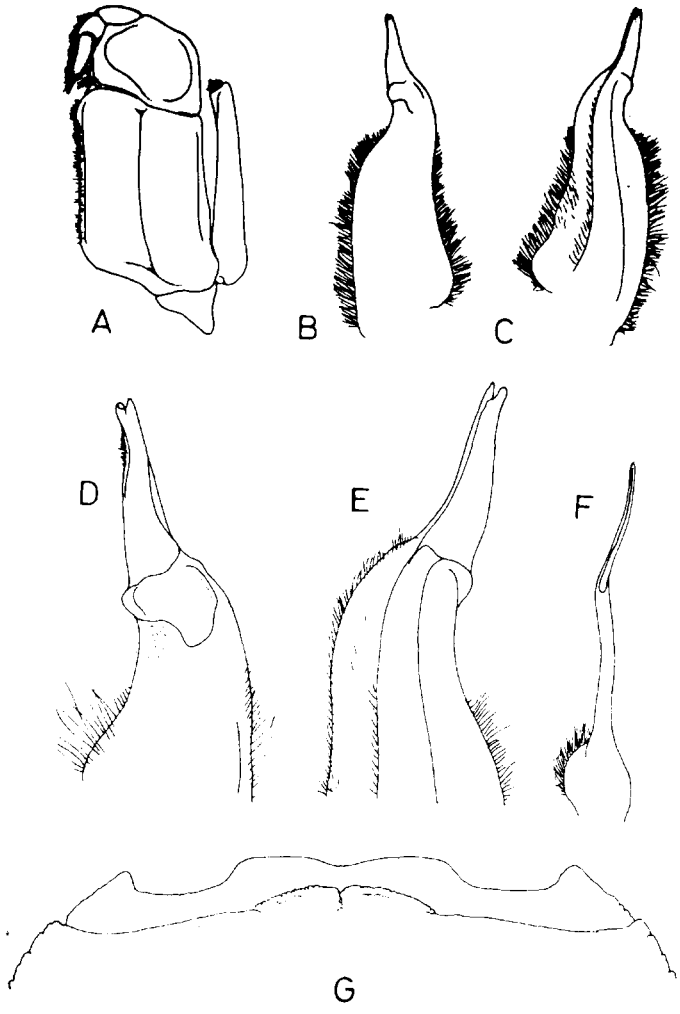

Figure 4. *Stoliczia kedahensis*. A-F, Holotype male, 39.0 by 29.0 mm (ZRC 1989. 3261) (Sungai Tekai, Kedah). A, Left third maxilliped; B, D, Ventral view of left GI; C, E, Dorsal view of left G1; F, Left G2. G, Frontal region of paratype male, 25.2 by 19.8 mm, (ZRC 1989. 3262), same data as holotype.

Stoliczia panhai Ng & Naiyanetr 1986
(Pl. 4, Figs. 5, 9E)

Stoliczia tweedei --Naiyanetr 1978: 34 (part); Naiyanetr 1980a: 31 (part); Naiyanetr 1980b: 51 (part); Naiyanetr 1983: 43 (part); Naiyanetr 1988: 9 (part), Pl. 7 (part)
Stoliczia stoliczkana panhai Ng & Naiyanetr, in Ng 1986: 41, Fig. 15; Ng, 1988: 60, Fig. 26
(not *Potamon* (*Potamiscus*) *tweedei* Roux 1934: 31, Fig. 2, Pl. 4 fig. 3)

Diagnosis. Epigastric and postorbital cristae very close to frontal and supraorbital margins, epigastric cristae distinctly forward of postorbital. Surfaces of carapace,

chelipeds and ambulatory legs covered with numerous short hairs, ambulatory propodi and dactyli lined with numerous stiff bristle-like hairs. Exopod of third maxilliped with short flagellum. G1 terminal segment 0.28 times total length of G1, distal part sharply tapering.

Material examined. Holotype--1 male (28.9 by 22.2 mm) (ZRC), Ton Nga Chang waterfall, Amphoe Hat Yai, Songkhla Province, southwestern Thailand, leg. P. Naiyanetr.

Paratypes—1 male (ZRC), 1 female (CNHM), same data as holotype.—3 females (NHM), Bo Ri Phat waterfall, Amphoe, Rataphum, Songkhla Province, southwestern Thailand, leg. P. Naiyanetr. — 1 female (CNHM), Pa Num waterfall, Amphoe Khuan Ka Long, Satun Province, southwestern Thailand, leg. P. Naiyanetr.— 22 males, 2 females (CNHM), Ya Roy waterfall, King Amphoe Khuan Don, Satun Province, southwestern Thailand, leg. P. Naiyanetr.

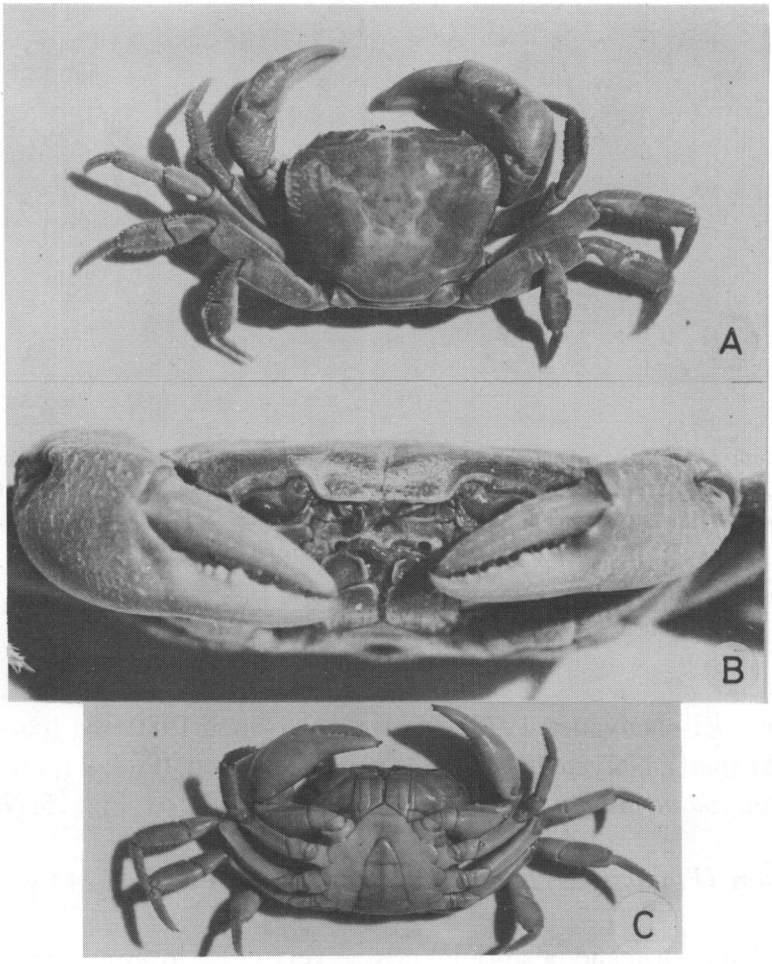

Plate 4. *Stoliczia panhai*. A-C, holotype male, 28.9 by 22.2 mm (ZRC) (Songkhla Province, Thailand).

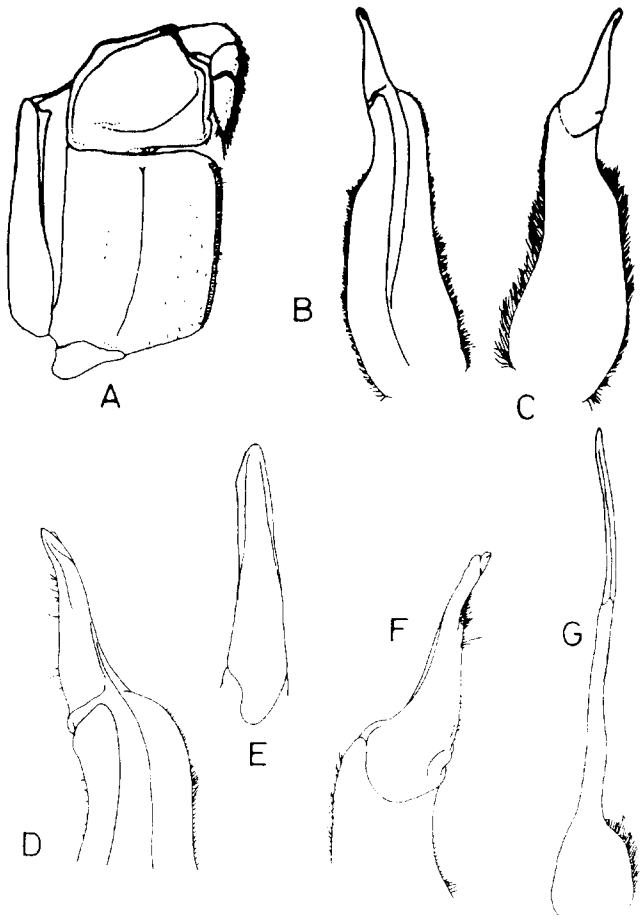

Figure 5. *Stoliczia panhai*. Holotype male, 28.9 by 22.2 mm (ZRC) (Songkhla Province, Thailand). A, Left third maxilliped; B,D, Ventral view of left G1; C, E, E, Dorsal view of left G1; F, Left G2.

Remarks. This species is easily differentiated from the other species in the *S. stoliczkana* complex by its distinctly shorter ambulatory legs (Table 2) which are covered with numerous stiff bristle-like hairs. Although *S. kedahensis* also has such hairs on its legs, they are not as dense. The ambulatory legs of *S. kedahensis* are also proportionately longer.

From *S. cognata* (Roux 1936), *S. panhai* can be separated by its flatter, more rectangular and hirsute carapace, generally larger size, and more strongly bent G1. From *S. tweediei* (Roux 1934), *S. panhai* can be separated by its hirsute, slightly more convex and less squarish carapace, and more strongly bent GL. The live colour of *S. panhai* is not known.

This species can be found under rocks in the shallow waters of relatively fast flowing strems.

Stoliczia cf. *panhai* Ng & Naiyanetr 1986
(Pl. 5, Fig. 6)

Patamon (Patamon) pealianum --Lanchester 1906: 128 (part)
(not *Telphusa pealiana* Wood Mason 1871: 204, Pl. 14 fig. 7-11)

Material examined. 1 young male (14.1 by 11.8 mm) (CMZ 30.XI. 1899b), Bukit Besar, northern Peninsular Malaysia.

Remarks.. Lanchester (1906) identified 11 specimens collected from "Bukit Besar" at an altitude of 2500 feet as "*Potamon pealianum*", but this is extremely unlikely, since the type of *P. pealianum* (transferred by Bott (1966) to the genus *Potamiscus*) was from Assam. The exact locality of "Bukit Besar" is difficult to determine, and there are several highlands in Peninsular Malaysia named "besar", which is simply Malay for "big". None of these highlands are near the area where Lanchester's specimens are known to be collected, i.e. the Isthmus of Kra, around the border between southern Thailand and northern Malaysia. Lanchester's "Bukit Besar", being a Malay name, is probably located in Malaysia itself, or the southernmost tip of Thailand, where the population is predominantly Malay.

Lanchester however, noted that the short hairs on the carapace are densest in young specimens, and this is reminiscent of the condition in *S. kedahensis* and *S. panhai*, which are the most hirsute of the *Stoliczia* taxa so far recognised. In the CMZ, there are five females and a male labelled as "*Telphusa stolickana*" (C.B. Goodhart, *in litt.* 18 September 1985), a pair of which were kindly sent to the author for detailed study.

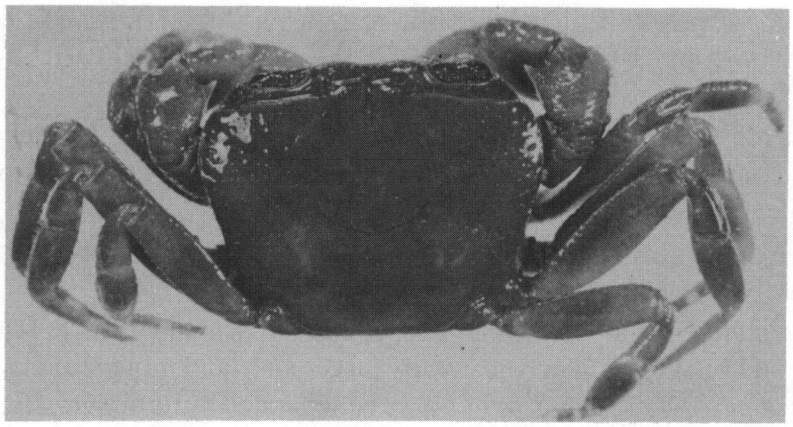

Plate 5. *Stoliczia* cf. *panhai.* Young male, 14.1 by 11.8 mm (CMZ 30. XI. 1899b) (Bukit Besar, northern Peninsular Malaysia).

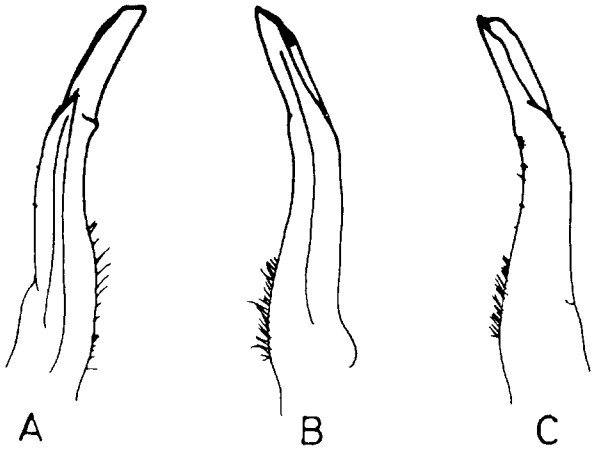

Figure 6. *Stoliczia* cf. *panhai*. Right G1, young male, 14.1 by 11.8 mm (CMZ 30.XI. 1899b) (Bukit Besar, northern Peninsular Malaysia). A, Ventral view; B, Dorso-marginal view; C, Dorsal view.

The single male specimen was contained in a separate vial from the others, with a label on which "Bukit Besar" was written. In all probability, this male belongs to the same series as the specimens identified by Lanchester (1906) as *Potamon pealianum*. Some of Lanchester's specimens are kept in the CMZ, including most of his specimens from the 1899 "Skeat" Expedition. This also agrees with the knowledge that some of Lanchester's specimens are deposited in the CMZ (Ng 1989: Ng & Tan 1988). The male specimens from "Bukit Besar" is clearly a *Stoliczia*, the exopod of its third maxilliped without a discernible flagellum, and its G1, although still poorly developed, closely resembles *Stoticzia stoliczkana*.. The presence of a very short flagellum cannot be ruled out as the specimens are very small and not well preserved. Its carapace and legs are very tomentose, agreeing well with Lanchester's description. This combination of characters suggests that Lanchester"s specimens might well be *S. panhai* and is here identified close to that species. The absence of adult males and more precise collection data precludes any certainty for the time being.

The other specimens contained in the same bottle are all rather small but are glabrous, with their carapaces slightly more convex. They are tentatively referred to *S.* cf. *ekavibhathai* instead.

Stoliczia ekavibhathai Ng & Naiyanetr 1986

(Pl. 6, Figs. 7, 9F)

Stoliczia tweedei - Naiyanetr 1978: 34 (part); Naiyanetr 1980a: 31 (part) ; Naiyanetr 1980b: 51 (part) ; Naiyanetr 1983: 43 (part); Naiyanetr 1988: 9 (part)

Stoliczia stoliczkana ekavibhathai Ng & Naiyanetr, in Ng 1986: 41, Fig. 16; Ng 1988: 62, Fig. 27

(not *Potamon (Potamiscus) tweedei* Roux 1934: 31, Fig. 2, Pl. 4 fig. 3)

Diagnosis.. Carapace appears rounded due to smooth surfaces and more convex branchial regions; cervical regions depressed without deep cervical groove, surface of and adjacent to anterolateral and posterolateral margins slightly rugose, with very few scattered and very short hairs, intestinal regions glabrous. Exopod of third maxilliped with very short flap-like flagellum. Ambulatory legs lined with scattered short hairs. GI terminal segment 0.30 total length of GI, distal part gradually tapering or slightly flared.

Material examined. Holotype—1 male, 30.8 by 23.5 mm (ZRC), Sai Khao waterfall, Amphoe Khok Pho, Pattani Province, southeastern Thailand, leg. P. Naiyanetr.

Paratypes—1 male, 1 female (CNHM), 1 male (ZRC), same data as holotype. — 9 males, 5 females (1 gravid) (CNHM), Suk Tha Lai, Amphoe, Banang Sata, Yala Province, southeastern Thailand, leg. P. Naiyanetr. — 2 females (CNHM), Than To waterfall, King Amphoe Than To, Yala Province, southeastern Thailand, leg. P. Naiyanetr. — 1 male, 1 female (CNHM), Chat Wa Rin waterfall, Amphoe Sungai Padi, Narathiwat Province, southeastern Thailand, leg. P. Naiyanetr. — 22 females (CNHM), Ba Cho waterfall, Amphoe Bacho, Narathiwat Province, southeastern Thailand, leg. P. Naiyanetr.

Remarks. This species was briefly characterised (as a subspecies) by Naiyanetr & Ng (in Ng 1986) and Ng (1988). There is some variation in the specimens collected from the various localities, but these are all minor. In the smaller male from Chat Wa Rin waterfall (CNHM no. 757a) (29.7 by 23.0 mm), the postorbital crest continues almost all the way to the epibranchial tooth without any sharp bend. In the larger male from this same locality as well as others, the junction between the epibranchial tooth and the postorbital crista is much more angular. An aberrant male from Sai Khao waterfall (ZRC) has the carapace more distinctly inflated, with the dactyli of the legs appearing longer than other comparatively sized males. Other specimens collected from the same locality are however, identical with the holotype. It is possible that this aberrancy may have developed during the post-moult period, when the carapace is still soft, and factors like habitat choice etc. would be important in determining the final shape of the animal. The G1 terminal segments show some variation, but they are not significantly different from each other. It must be emphasised that the configuration and structure of the terminal segment, so important in freshwater crab taxonomy, may be affected by not only age, but also by moulting and mating processes. It is thus important to determine whether the differences observed are of the qualitative or quantitative kind, and if they could be possibly accounted for by other factors.

Ng (1988) figured the transposed right G1 as the left G1; but subtle differences in the general form and tip of the G1 necessitate that both be figured here (Figs. 7B-E, 8A, B, E-H). In the actual left G1, the tip is more flared and slightly flattened, whereas

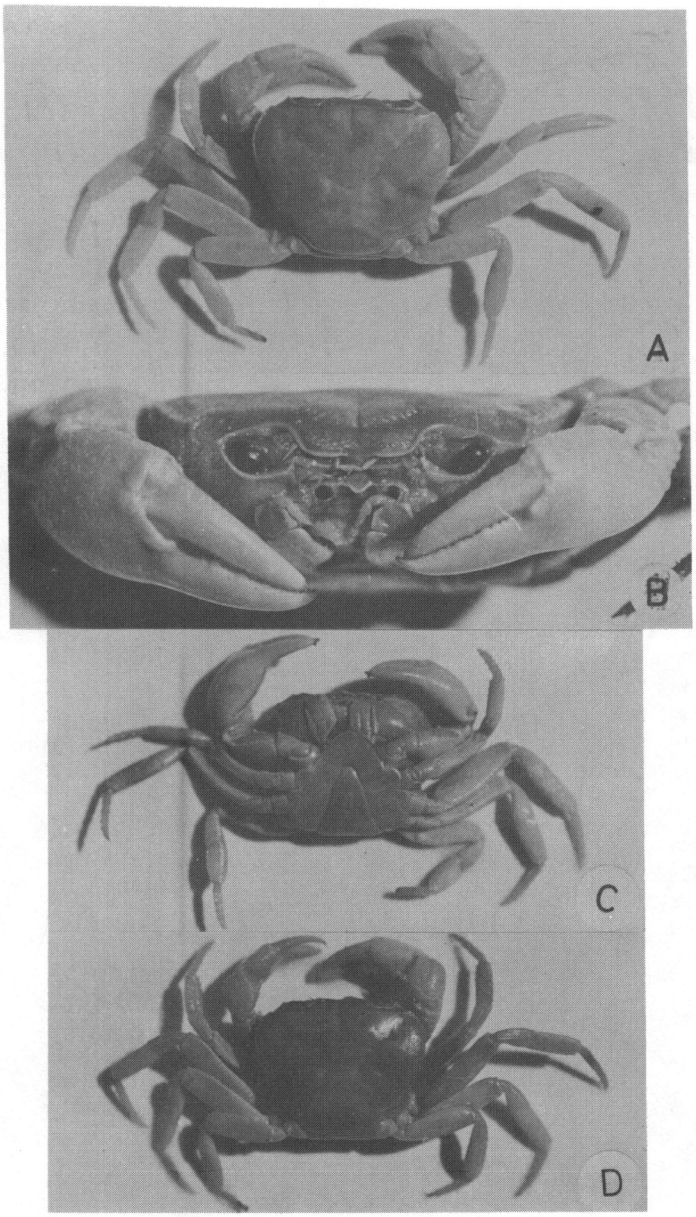

Plate 6. *Stoliczia ekavibhathai*. A-C, holotype male, 30.8 by 33.5 mm (ZRC) (Pattani Province, Thailand); D, Aberrant paratype male (ZRC) (Pattani Province, Thailand).

it appears slightly flared in the right. The angle from which the G1s are drawn can significantly affect the apparent shape (Figs. 7B, C vs. 8C, D). When the G1 is lying more on its dorsomarginal edge, the outer margin appears much straighter. When lying completely horizontal, the outer margin appears gently sinuous instead.

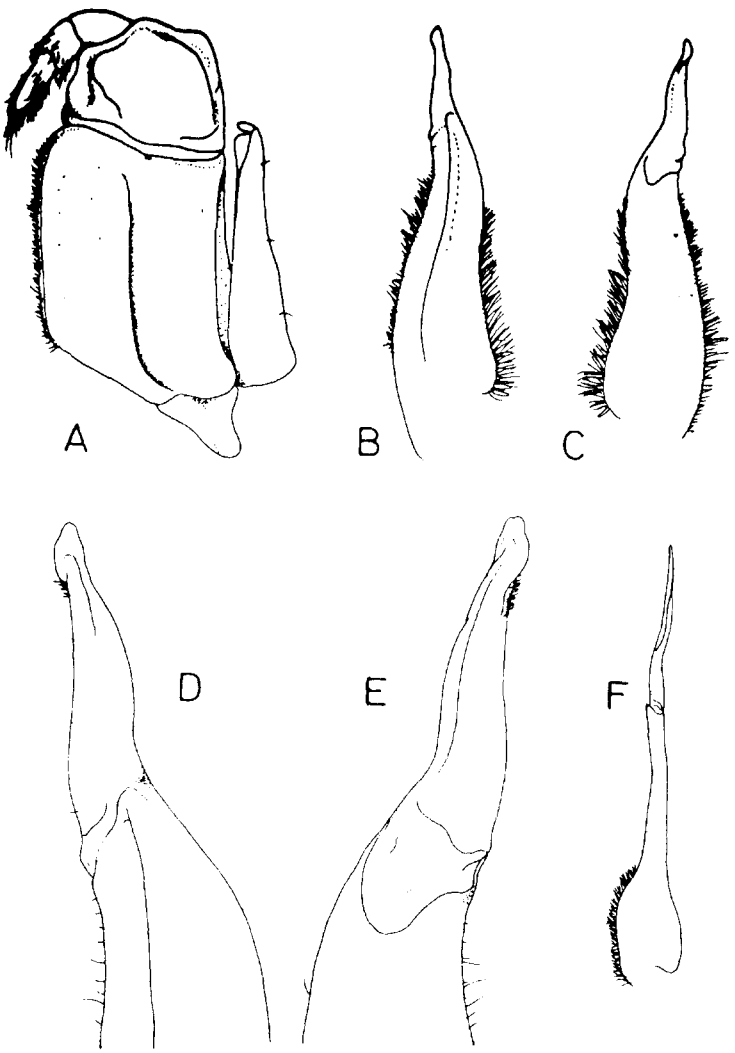

Figure 7. *Stoliczia ekavibhathai.* Holotype male, 30.8 by 33.5 mm (ZRC) (Pattani Province, Thailand). A, Exopod of left third maxilliped; B, D, Ventral view of left GI; C, E, Dorsol view of right G1; F, Right G2.

Stoliczia ekavibhathai can be separated form *S. tweediei* s. str. by its more inflated carapace (that of *S. tweediei* is flat), absence of a deep cervical groove, blunt lower epistomal median triangle (that on *S. tweediei* is sharp), shorter flagellum on the third maxilliped exopod, and the more sinuous G1.

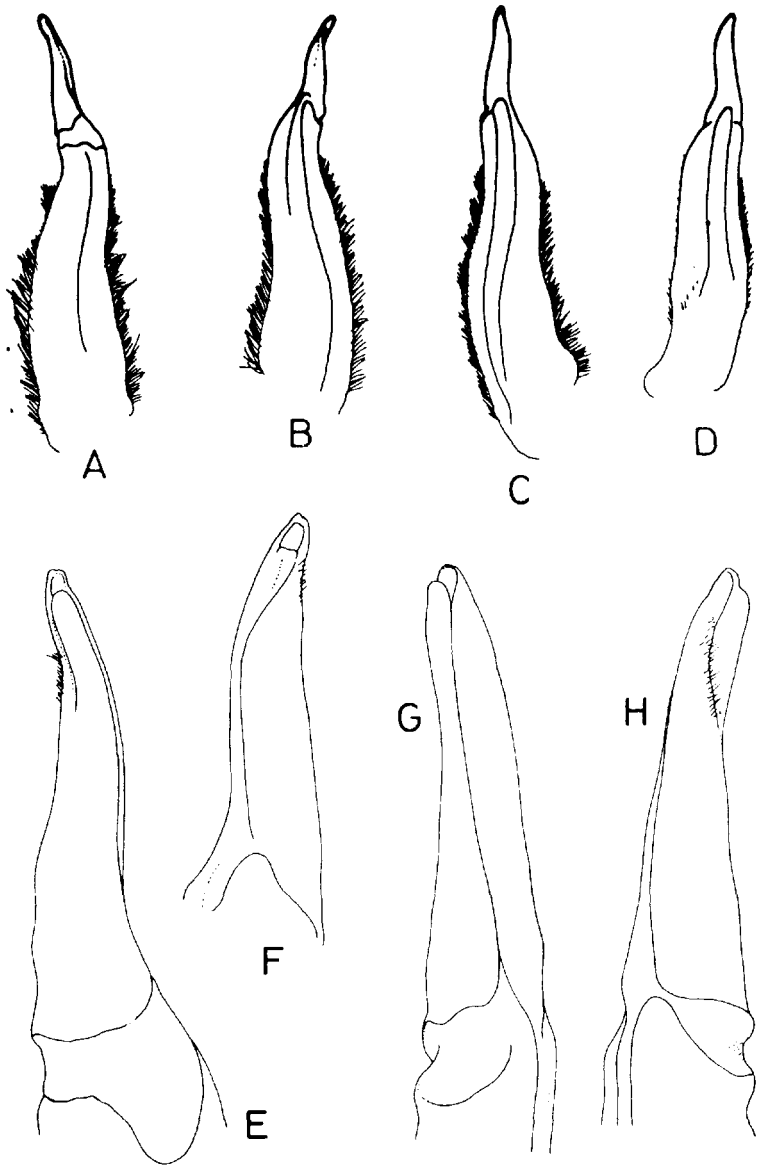

Figure 8. *Stoliczia ekavibhathai.* Holotype male, 30.8 by 33.5 mm (ZRC) (Pattani Province, Thailand). A, B, E-H, Left G1; C, D, Right G1(drawn at a different angle from Fig. 7B, D).

This species can be found under rocks in shallow, fast flowing streams. Naiyanetr (1983) provides some information on its biology (as *S. tweedei*). The colour is a dirty olive green on all dorsal aspects (see Naiyanetr 1988).

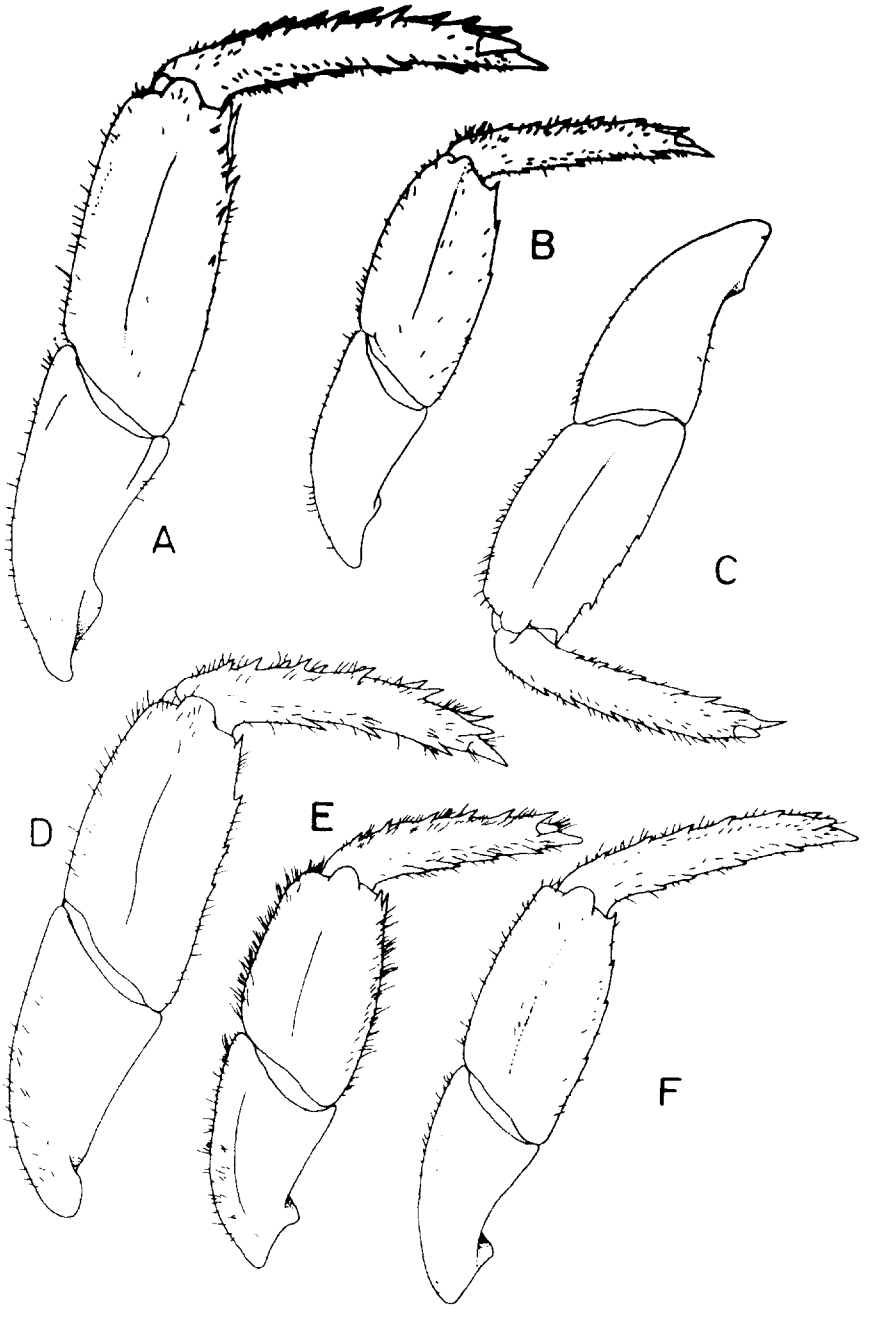

Figure 9. Last ambulatory legs. A, B, D-F, right leg; C, left leg (right dactylus damaged). A, *S. stoliczkana*, 42.0 by 31.5 mm (ZRC 1989. 2013) (Titikarawang, Penang); B, *S. stoliczkana*, male, 28.2 by 21.7 mm (ZRC 1984. 6843) (Penang Hill, Penang); C, *S. perlensis*, holotype male, 32.0 by 25.0 mm (SMF 2781) (Kaki Bukit, Perlis); D, *S. kedahensis*, holotype male, 39.0 by 29.0 mm (ZRC 1989. 3261) (Sungai Tekai, Kedah); E, *S. panhai*, holotype male, 28.9 by 22.2 mm (ZRC) (Songkhla Province, Thailand); F, *S. ekavibhathai*, holotype male, 30.8 by 33.5 mm (ZRC) (Pattani Province, Thailand).

Stoliczia cf. *ekavibhathai* Ng & Naiyanetr 1986
(Pl. 7)

Potamon (Potamon) pealianum --Lanchester 1906: 128 (part)
(not *Telphusa pealiana* Wood Mason 1871: 204, Pl. 14 fig. 7-11)

Material examined. 5 females (largest 30.2 by 23.0 mm) (CMZ 30. XI. 1899a), State of Lacom, Southern Thailand, "Skeat" Expedition, leg. 1899.

Remarks. The female specimens collected by Lanchester from "Lacom" and deposited in the CMZ are likely to belong to this species, their carapaces being relatively smooth, glabrous and convex. As all the specimens are relatively young, no males are available, and the exact collection locality uncertain, the present author prefers to place the specimens close to *S. ekavibhathai* until more specimens can be obtained. Tweedie (1936) indicated that "Lacom" might be in Nakon Sri Tammarat province, but this locality is much further north of the area where *S. stolickana* is known to occur. In that area, *Potamon manii* Rathbun 1904, is common instead. In any event, these specimens are clearly *Stoliczia*, with the third maxilliped exopod not possessing a discernible flagellum (see Remarks for *S.* cf. *panhai).*

GENERAL DISCUSSION

The highland along the southeastern part of Thailand where *S. ekavibhathai* occurs is relatively far from those inhabited by *S. stoliczkana* and *S. perlensis*, being separated by several patches of low lying ground. *Stoliczia stoliczkana* is found on the highlands on Penang island, *S. perlensis* on Kaki Bukit in the state of Perlis, *S.*

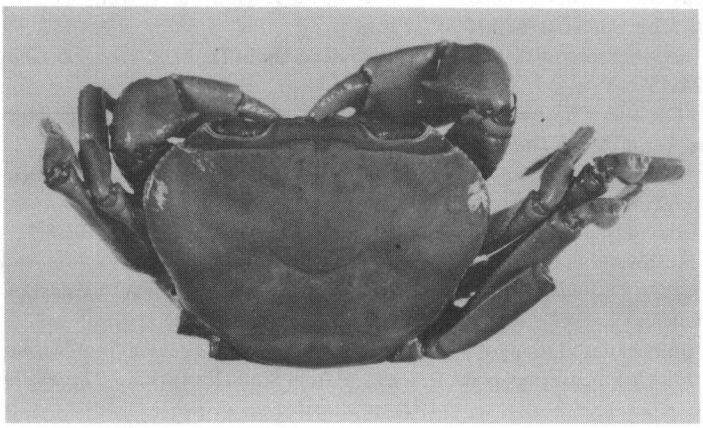

Plate 7. *Stoliczia* cf. *ekavibhathai*. Female, 30.2 by 23.0 mm (CMZ 30. XI. 1899a) (Lacom, southern Thailand).

kedahensis in Kedah and *S. panhai* in southeastern Thailand; all localities being on the Malay Peninsula. Despite the close proximity of all these localities, the difference indicate that some degree of isolation has occurred in the past.

The highlands of Satun, where *S. panhai* occurs, are separated from the Tenasserim range of mountains, while the highlands where *S. ekavibhathai* is found, runs down the eastern side of southern Thailand, continuing into the Main Mange of mountains in Peninsular Malaysia. These highlands appear to be the northenmost border of the genus *Stoliczia*, which they are replaced by *Potamon manii*.

Acknowledgements. Thanks are due to Dr. Michael Türkay (SMF), Dr. R. U. Gooding (CMZ), Prof. Phaibul Naiyanetr (CNHM), Dr. Maya Deb (ZSI), Mrs. C. M. Yang (ZRC), Dr. A. Sasekumar (University of Malaya, Kuala Lumpur), Dr. R.P. Lim (formerly University of Malaya, Kuala Lumpur) and Dr. Wong Tat Meng (USM) for their kind help during this study. Prof. Dr. L.B. Holthuis and Dr. Zdravko Stevcic kindly read an early draft of the manuscript. Most of the photographs were taken by Mr. H.K. Yip (National University of Singapore).

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