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THE IDENTITY OF THE CAVERNICOLOUS FRESHWATER CRAB *POTAMON (THELPHUSA) BIDIENSE* LANCHESTER, 1900 (CRUSTACEA: DECAPODA: BRACHYURA: GECARCINUCIDAE) FROM SARAWAK, BORNEO, WITH DESCRIPTION OF A NEW GENUS

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ABSTRACT. - A new genus of cave-dwelling freshwater crab, *Stygothelphusa*, is described from Sarawak, Borneo, with *Potamon (Thelphusa) bidiense* Lanchester, 1900 as type species. This species was synonymised with *Thelphusula melanippe* by Bott (1970) and regarded as a separate species of *Thelphusula* by Holthuis (1986). Its distinctive carapace, leg and gonopod features however, warrant the establishment of a separate genus for it. A neotype for the type species is also designated.

INTRODUCTION

Potamon (Thelphusa) bidiense was described by Lanchester (1900) from the Bau Caves in Sarawak, Borneo. Bott (1970), in his revision of the Asian freshwater crabs synonymised the species with *Thelphusula melanippe melanippe* (De Man, 1899) without much comment. Holthuis (1986) and Guinot (1988) subsequently reported the species from caves as *Thelphusula bidiensis* (Lanchester, 1900). All known records of this species have been from caves, and it appears to be a troglobitic species.

Ng & Goh (1987) commented that the genus *Thelphusula* Bott, 1969 was probably heterogeneous in composition, and *Potamon (Thelphusa) bidiense* should be placed in a group by itself. They commented that this group could be characterised by its ".... squarish carapace, convex surfaces, broad external orbital angles, indistinct epibranchial tooth, elongated meri of the chelipeds, extremely long legs ..... which have the dorsal margins of the meri gently serrated, a stout G1 [male first pleopod] which has a short, stout and cone-shaped terminal segment, and a G2 [male second pleopod] with a long flagellum [distal segment]" (Ng & Goh, 1987: 326). They however, did not formally name the group.

Although the carapace of this species resembles the genus *Thelphusula* s. str., the above mentioned characters strongly suggest against including it in that genus. The male first pleopod of *Thelphusula* s. str., in contrast to that of *Potamon bidiense* is slender and strongly sinuous, the terminal segment being long and cylindrical, with the subterminal segment slender and sinuous. The distal segment of the male second pleopod of *Thelphusula* s. str. is also very short, the lateral margins of the sixth male abdominal segment

being slightly concave, and the ambulatory legs are much shorter. These characters strongly suggest the establishment of a separate genus to accomodate the species.

The present paper serves to formally describe this new genus, here named *Stygothelphusa*, new genus. The type species is redescribed and its taxonomy clarified. Notes of its colour and ecology are also presented, and its troglobitic habits discussed.

The abbreviations G1 and G2 are used for the male first and second pleopod respectively. Measurements, in millimetres, are of the carapace width and length respectively. Terminology follows that used by Ng (1988). Specimens are deposited in the Rijksmuseum van Natuurlijke Historie (RMNH), Leiden, Netherlands; Sarawak Museum (SM), Kuching, Sarawak, East Malaysia; and the Zoological Reference Collection (ZRC), Department of Zoology, National University of Singapore.

TAXONOMY

SUPERFAMILY GECARCINUCOIDEA RATHBUN, 1904

FAMILY GECARCINUCIDAE RATHBUN, 1904

GENUS *STYGOTHELPHUSA*, NEW GENUS

Type species. - *Potamon (Thelphusa) bidiense* Lanchester, 1900

Thelphusula - Bott, 1970: 58 (part)

Diagnosis. - Carapace squarish, surfaces distinctly convex, external orbital angle sometimes extends slightly beyond frontal margin, epibranchial tooth very low, sometimes appearing confluent with external orbital angle. Chelipeds in adult males unequal, merus long, almost length of palm. Ambulatory legs very long, dorsal margin of merus gently but distinctly serrate. G1 stout, terminal segment less than quarter total length of G1, cone-shaped, short, tapered at tip, G2 distal segment long, subequal or slightly shorter than basal segment.

Etymology. - The genus name is derived from the Latin "Stygian", meaning "of the underworld", together with the generic name "Thelphusa"; alluding to the cavernicolous habits of its single species. The gender is feminine.

Remarks. - The status of the genus *Thelphusula* sensu Bott, 1970, remains uncertain. Ng & Goh (1987) had suggested that the genus as defined by Bott (1970) can easily be divided into three groups, of which the presently described *Stygothelphusa* is one. Other than *Thelphusula* s. str., the third group (comprising *T. melanippe* (De Man, 1899), *T. kadamaiana* (Borradaile, 1900) and *T. rhadamanthysi* Ng & Goh, 1987) resembles *Stygothelphusa* with regards to its long ambulatory legs. This unnamed group however, has shorter legs, the carapace is more ovate and not squarish, and the G1 and G2 structures are very different, being more like those of *Thelphusula* s. str. Although the length of the ambulatory merus of the *"T. melanippe"* group approaches that of *Stygothelphusa*, the lengths of the propodus and dactylus (especially the former) of *Stygothelphusa* are distinctly longer. The overall length of the ambulatory legs of *Stygothelphusa* are thus much longer than those of the *"T. melanippe"* group (see De Man, 1899; Bott, 1970). In *T. melanippe*, the ratio of the overall length of the second leg to the width of the posterior carapace margin is only 4.4 whereas for *Stygothelphusa*, it is 5.1. A revision of the yet unnamed *"T. melanippe"* group is being prepared at present.

The structures of the G1 and G2 of *Stygothelphusa* affiliate it most closely with *Adeleana* Bott, 1969, a Sumatran and Bornean genus. Of the four known species of *Adeleana*, only the recently described *Adeleana chapmani* Holthuis, 1979 from Sarawak, Borneo, has legs approaching (but still distinctly shorter than) the length of that of *Stygothelphusa*.

Lanchester (1900) had compared the "fifth" male abdominal segment of *S. bidiensis* with that of *A. melanippe*, noting that the sides of this segment in *A. melanippe* are more tapered but more parallel in *S. bidiensis*. These differences are not presently observed for their fifth segments, but agree almost perfectly with their seventh segments instead.

The genus *Stygothelphusa* is monotypic. The family classification proposed by Bott (1969, 1970) for *Thelphusula* and allied genera is followed here for convenience. The characters used however to differentiate the three Sundanian families of the Gecarcinucoidea Gecarcinucidae Rathbun, 1904, Parathelphusidae Alcock, 1910 and Sundathelphusidae Bott, 1970, are not very reliable (see Ng, 1988) and a revision is clearly necessary.

Stygothelphusa bidiensis (Lanchester, 1900)

(Pls. 1, 2; Fig. 1)

Potamon (Thelphusa) bidiense Lanchester, 1900: 256, Pl. 12 fig. 3
Potamon (Geothelphusa) bidiensis - Rathbun, 1905: 214
Thelphusula melanippe melanippe - Bott, 1970: 60 (part)
Thelphusula bidiensis – Holthuis, 1986: 613; Guinot, 1988: 15

Material. - Neotype - 1♂ (16.4 by 14.5 mm) (SM Cru 1986.17), Bidi Caves, Bau district, Sarawak, Borneo, leg. C. J. Brooks, vi.1903.

Others - 2♂, 4♀(largest 16.9 by 14.8 mm), 2 juvs. (SM Cru 1986.18-25), Bidi Caves, Bau district, Sarawak, Borneo, leg. C. J. Brooks, vi.1903; 3♂, 2♀(largest 17.1 by 14.9 mm) (RMNH Nr. 33952), Jambusan Cave, Gunong Jambusan, Bau district, Sarawak, Borneo, ca. 1° 25′ N, 110° 9′ E, on guano and mud, leg. P. Chapman, 22.xi.1980; 2♂, 1♀(RMNH Nr. 33949), Fairy Cave, Gunong Kapor, Bau district, Sarawak, Borneo, ca. 1° 25′ N, 110° 9′ E, in twilight zone on damp mud floor covered with blue green algae and moss, leg. P. Chapman, 26.xi.1980; 1♂, 1♀ (RMNH Nr. 33951), Posih Cave, Gunong Jambusan, Bau district, Sarawak, Borneo, ca.1° 25′ N, 110° 9′ E, leg. P. Chapman, 1.xii.1980; 1♀ (15.6 by 14.2 mm) (RMNH Nr. 33950), Posih Cave, Gunong Jambusan, Bau district, Sarawak, Borneo, ca. 1° 25′ N, 110° 9′ E, in water-filled joint near stream,leg. P. Chapman, 25.xi.1980; 2♂ (largest 15.0 by 13.0 mm), 2♀ (largest 17.0 by 14.9 mm) (ZRC 1984.7543-7546), 'Borneo', no other data; 1♀ (ZRC), on wet ground near cave entrance, Gua Pitas, Bau Caves, Sarawak, Borneo, leg. S. Yussof, 1987.

Description. - Carapace appears squarish, width 1.2 times that of length, dorsal surfaces distinctly convex, glabrous, devoid of hair, relatively smooth except for strongly rugose lateral regions, gastric and branchial regions evenly inflated, cervical grooves broad, shallow, not distinctly merging with deep H-shaped central gastric depression; epigastric and postorbital cristae confluent, parallel to frontal and supraorbital margins, postorbital cristae very low, indistinct, epigastric cristae rounded, not sharp, separated by small but deep notch which reaches backwards to mesogastric region as a groove; epibranchial tooth very low but discernible in most specimens; tip of external orbital angle level with or extending slightly beyond frontal margin, outer margin entire, smooth, almost straight or slightly concave, about 2.7 times length of inner margin; anterolateral margin convex, appears gently serrated due to strong oblique striae on lateral regions, not dis-

tinctly crested, clearly separated from converging, convex posterolateral margins; posterior margin straight, 0.5 times width of carapace; frontal margin prominently deflexed, distinctly sinuous, lateral lobes narrow, small but visible, closely appressed to frontal margin. Pterygostomial, sub-orbital and sub-branchial regions rugose; carapace appears oval-shaped from frontal view, dorsal surfaces, sub-branchial regions and branchiostegites not separated by distinct cristae or ridges, appearing smoothly confluent. Orbit about 0.64 times length of frontal margin, about 0.2 times length of carapace width; eyes well developed, filling orbital hiatus entirely, cornea with distinct pigmentation. Posterior margin of epistome distinctly cut into three lobes; triangular median lobe well developed, sides of median lobe distinctly convex, tip rounded, separated from broad lateral lobes by deep V-shaped notches. Third maxillipeds quadrate, ischial sulcus distinct, obliquely median, exopod 1.3 times length of outer margin of ischium, distal part of inner margin without distinct tooth, flagellum long, well developed, exceeding width of merus.

Chelipeds in adult males unequal, surfaces rugose, especially on outer parts; merus long, about 1.3 times length of posterior margin of carapace; carpus with sharp spine and basal tubercle on inner angle; palm of one cheliped enlarged in males, reaching three times size of smaller one; fingers of smaller chela as long as palm, those of larger chelae shorter; cutting edges of fingers with numerous denticles and blunt teeth.

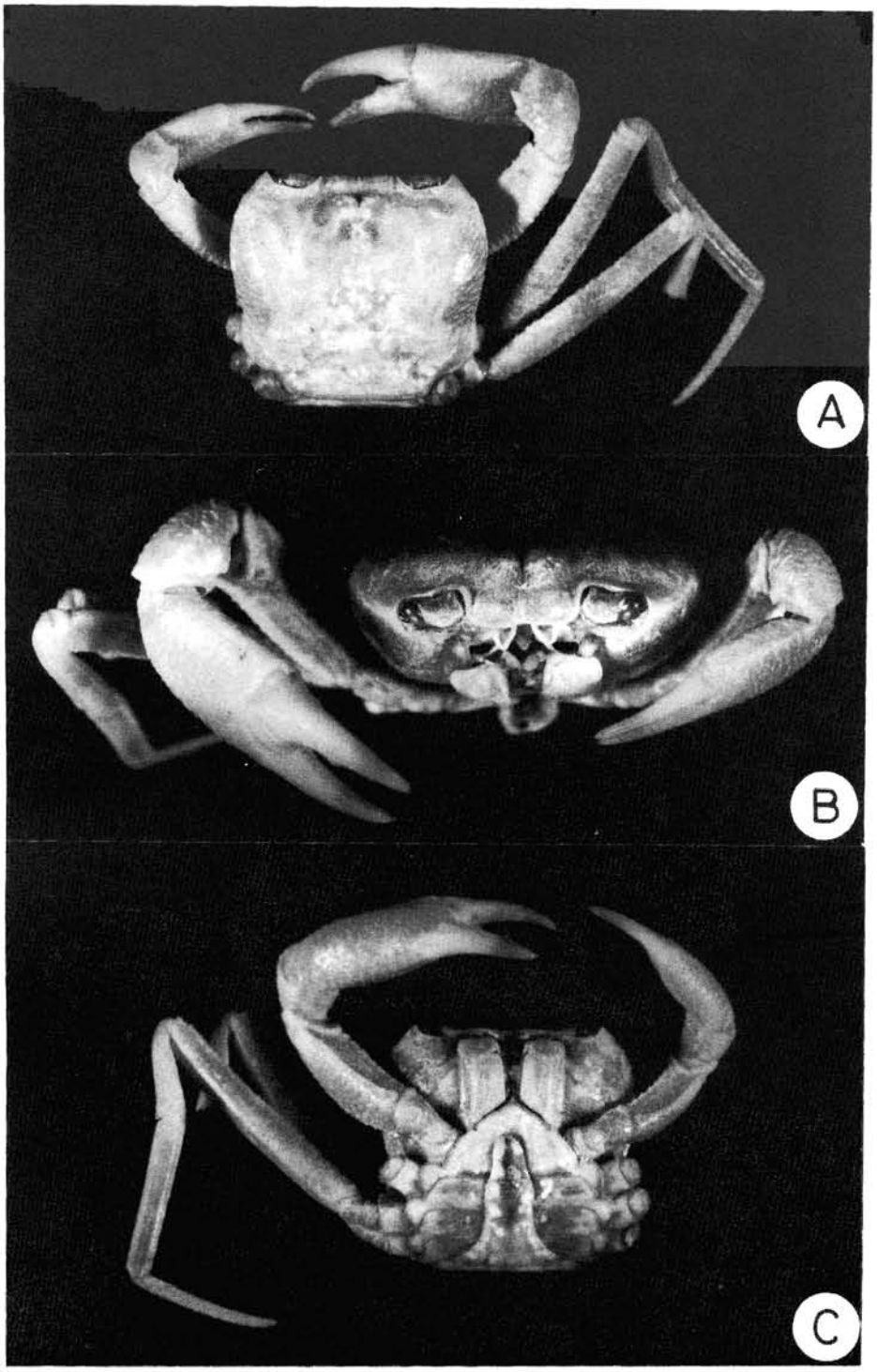
Ambulatory legs very long, second pair longest, meri, propodi and dactyli of second and third legs about 1.9, 1.0 and 1.2 times length of posterior margin of carapace respectively; surfaces of meri, carpi, propodi slightly rugose; dorsal margin of merus gently but distinctly serrated, serrations directed obliquely forwards, dorsal subterminal area with very low, often rounded tubercle, without sharp spine; dactylus gently curved, proximal part almost straight.

Sternum smooth, almost glabrous. Male abdomen distinctly T-shaped, first segment reaching bases of coxa of last pair of ambulatory legs, segments three to five progressively more trapezoidal, sixth segment rectangular, longer than broad, lateral margins almost parallel, seventh segment triangular, tip rounded, lateral margins distinctly concave.

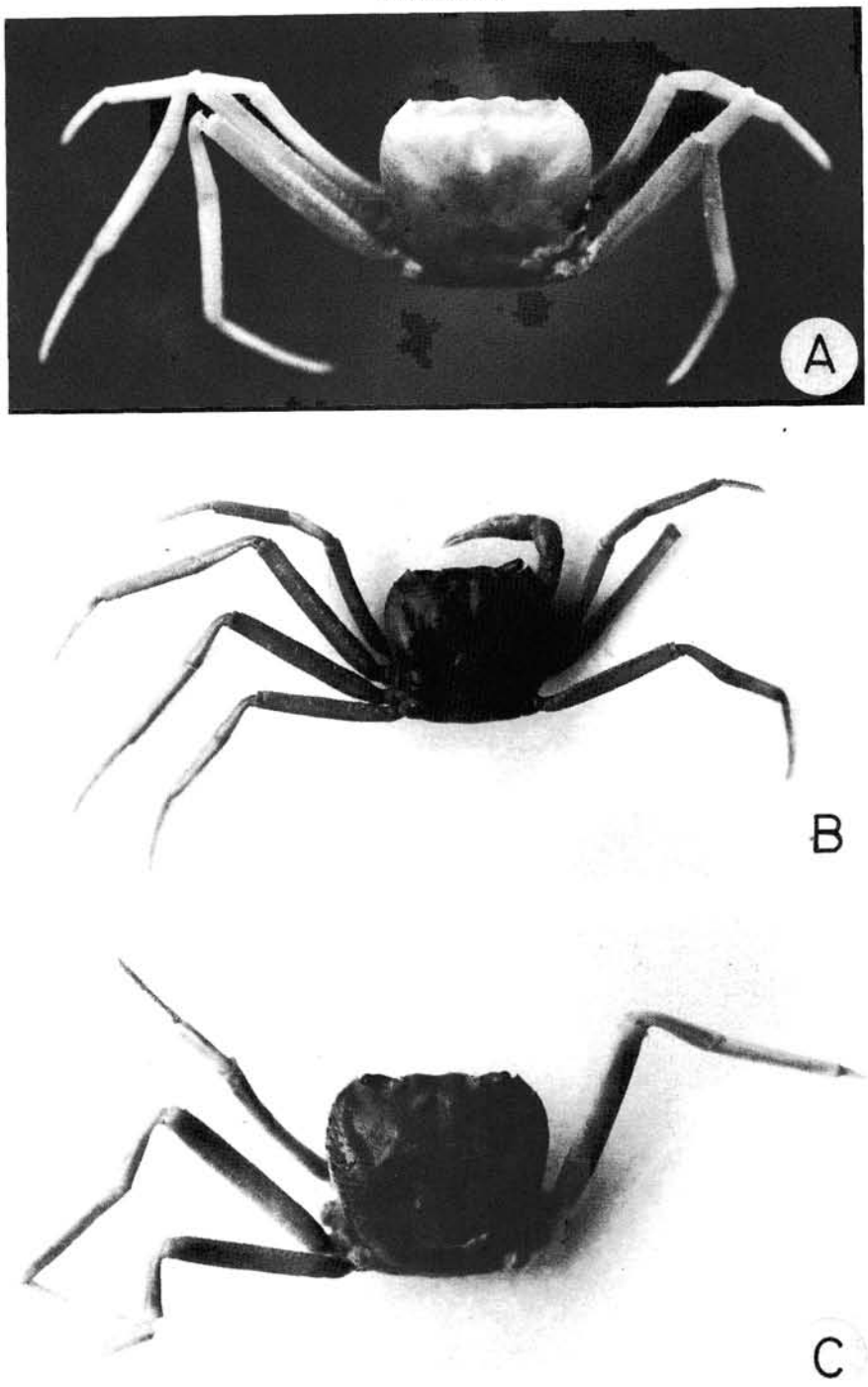
Male gonopores coxal, female gonopores sternal. G1 stout, appears straight, not sinuous, terminal segment bent outwards, subequal or less than one quarter length of subterminal segment, short, generally cone-shaped, basal part appearing cylindrical but distal part tapered, outer margin with scattered long hairs; outer margin of subterminal segment gently sinuous. G2 distal segment long, whip-like, subequal or slightly shorter than length of basal segment.

Remarks. - *Potamon (Thelphusa) bidiensis* was described by Lanchester (1900) from a single male collected in the Bidi Caves in Sarawak, Borneo, by C. J. Brooks in 1899. Rathbun (1905) adopted Lanchester's identification, but transferred the species to the subgenus *Geothelphusa* Stimpson, 1858, probably because of its smooth and rounded carapace, indistinct epibranchial teeth, and low postorbital cristae. Bott (1970) however, synonymised *Potamon bidiensis* with *Potamon (Potamon) melanippe* De Man, 1899, and transferred it to the genus *Thelphusula*. No specimens of *Potamon bidiensis* however, were examined by either Rathbun or Bott.

Lanchester (1900: 249) noted that R. Shelford of the Sarawak Museum had sent him specimens for identication while he was in Singapore in 1899. He also recorded that Shelford had "..... been kind enough to let me retain all but two of the specimens, and



Pl. 1. *Stygothelphusa bidiensis* (Lanchester, 1900). male, 15.0 by 13.0 mm (ZRC 1984.7543), "Borneo". A, dorsal view; B, frontal view; C, ventral view.



Pl. 2. *Stygothelphusa bidiensis* (Lanchester, 1900). A, Neotype male, 16.4 by 14.5 mm ((SM Cru 1986.17), Bidi Caves, Bau district, Sarawak, Borneo; B, 17.1 by 14.9 mm (RMNH Nr. 33952), Jambusan Cave, Gunong Jambusan, Bau district, Sarawak, Borneo; C, 15.6 by 14.2 mm (RMNH Nr. 33950), Posih Cave, Gunong Jambusan, Bau district, Sarawak, Borneo.

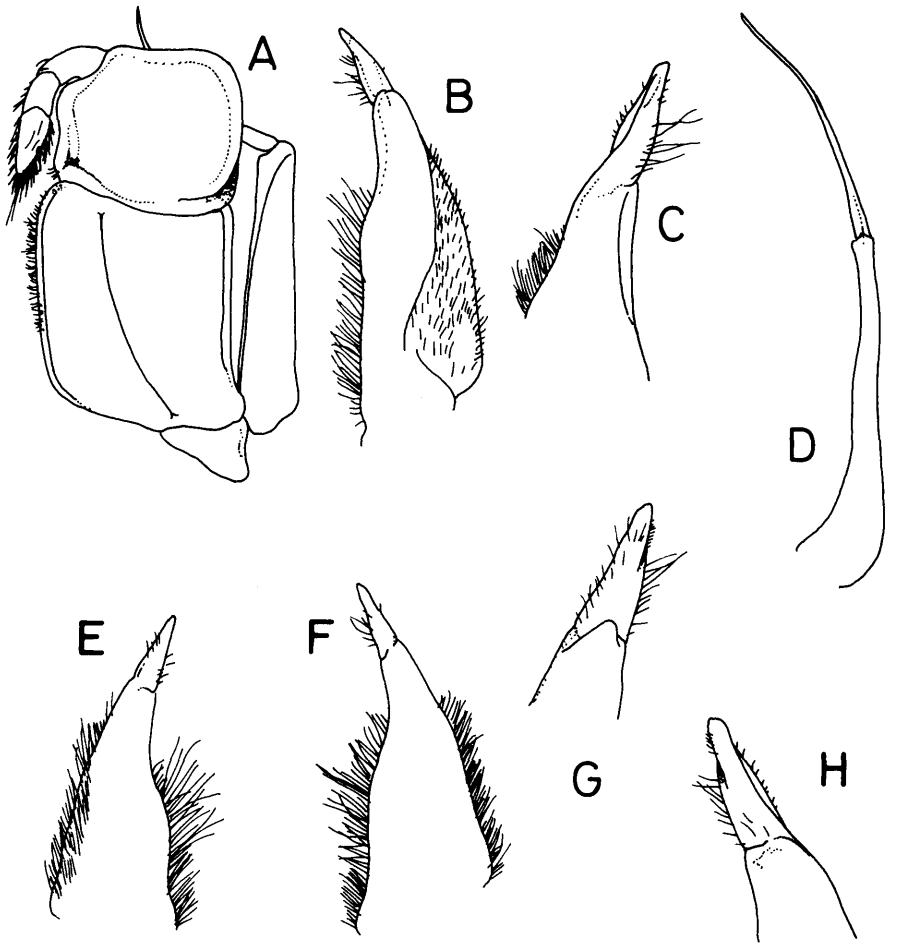


Fig. 1. *Stygothelphusa bidiensis* (Lanchester, 1900). A, female, 15.9 by 13.6mm (ZRC), Gua Pitas, Bau, Sarawak, Borneo; B-D, male, 15.0 by 13.0mm (ZRC 1984.7543), "Borneo"; E-H, Neotype male, 16.4 by 14.5mm (SM Cru 1986.17), Bidi, Bau, Sarawak, Borneo. A, left third maxillipeds; B, C, right G1; E-H, left G1s; D, right G2. B, E, G, ventral views; C, F, H, dorsal views; C, G, H, G1 terminal segments.

those that may be desiderata to the Natural History Museum at South Kensington will be deposited there" (p. 249). He did not however, indicate the destiny of the various specimens treated in the paper. Hanitsch (1900) however, listed four of the five species of the freshwater crabs reported by Lanchester (1900), in his catalogue of the crabs in the Raffles Museum. The missing species is *Potamon (Geothelphusa) bidiense*. Lanchester (1900) indicated that Shelford had duplicate specimens of at least some of the species he examined in the SM (p. 250), and cited the numbers of the specimens given to him by Shelford. I have searched through the SM shelves, and no such duplicates exist for *Potamon bidiense*. Shelford also sent many of his Sarawak specimens to G. Nobili of Turin for study (see Nobili, 1901, 1903), but *Potamon bidiense* was not among the species reported on by him. Zdravko Ševcić (Rovinj) was kind enough to make a copy of the unpublished catalogue of the freshwater crabs contained in the Museuo Istituto di Zoologie Sistematica deli Universita di Torino (Italy) for me, where Nobili deposited Shelford's material. *Potamon bidiense* is not on the list.

As Lanchester's affiliations were with the King's College, Cambridge, and he had stated that he would deposit some of his material in the South Kensington Museum, efforts were made to locate the type male of *Potamon bidiense* in the British Museum (Natural History) and the Cambridge Museum of Zoology, University of Cambridge. The specimen is neither in the British Museum (fide Paul Clark, *in litt.* 14 May 1985) or the Cambridge Museum (Richard Preece, *in litt.* 18 April 1989). Some of Lanchester's other material is known to be deposited in these collections (see Johnson, 1958, 1961; Ng & Tan, 1988). The type specimen is also not in the SM.

The ZRC has four specimens of *S. bidiensis*, including two males which have no data. They were contained in a very old jar, which had apparently not been opened for many decades. An unidentified potamid *(Isolapotamon* sp.) specimen was also in the jar. One of these males (ZRC 1984.7543) measures 15.0 by 13.0 mm, a measurement very close to that of the type male which measured 14.0 by 12.25 mm. It is very possible that this male was the one examined by Lanchester, and the type of *Potamon bidiense* was one of the two specimens retained by Shelford. Some of Shelford's material is deposited in the ZRC, and there was a mutual exchange program between the SM and the Raffles Museum (present ZRC) in the early 1900s (Charles Leh, personal communication; Hanitsch, 1900). No mention of this species however, was made by Hanitsch (1900) in his report on the crabs in the Raffles Museum, or in subsequent reports. Although the largest male in the ZRC may well have been the one utilised by Lanchester in his description of the species, it is not advisable to recognise this specimen as the type male without more proof, especially since this specimen has no precise data. The type male must thus be regarded as lost and untraceable. In the interests of stabilising the taxonomy of the species, a neotype should be designated instead. Examination of numerous specimens in the SM, which had also been collected by C. J. Brooks from the type locality, Bidi, showed them to be identical with Lanchester's descriptions and excellent figure in almost all respects. These specimens however, are not cotypes since they had been collected several years later in 1903. The largest male in the SM is hereby made the neotype of *Potamon (Thelphusa) bidiense* Lanchester, 1900.

The SM specimens are identical with others in the RMNH and ZRC which had been recently collected from the Bau Caves and other caves nearby. Those in the RMNH had been identified by Holthuis (1986) to this species. Holthuis however, transferred the species to the genus *Thelphusula*.

Slides of living animals taken by Shaharin Yussof and forwarded to me show this species to be greyish-white in colour with dirty-white legs. The eyes are fully pigmented.

As to its cavernicolous habits, Lanchester (1900) commented that "..... there is no evidence to show that this species is essentially a cave-dwelling one; although its occurence in a dark cave is very interesting, and shows the possibility of such being the case" (p. 257). The note supplied to him by Shelford about the conditions under which the specimen was collected stated that it was from "Caves at Bidi in pools; the caves were absolutely dark. Body colour brown, legs white" (Lanchester, 1900: 256).

Stygothelphusa does not appear to be a complete troglobite. (sensu Barr, 1968). It does not appear to be entirely confined to the twilight zones of caves, although this appears to be its preferred habitat. The few specimens that have been collected outside caves have always been very close to cave entrances. The species is certainly not blind since the eyes still contain considerable pigmentation. In some troglobites, the eyes are frequently devoid of pigment. The general coloration, a pale grey, and the long legs are however, characteristic of many troglobitic crabs, and *Stygothelphusa* bears a striking resemblance to troglobitic potamids of the genus *Cerberusa* Holthuis, 1979, especially *C. tipula* Holthuis, 1979 (see Holthuis, 1979; Guinot, 1988).

From the ecological data and slides provided of the species by Philip Chapman and Shaharin Yussof (personal communication), both who have observed the species alive, *S. bidiensis* appears to be an amphibious species. As to its diet, it is probably a scavenger. It has been collected on cave floors covered with guano and mud, searching for food. On such soft substrates, the long legs probably give the crab an advantage over other less specialised cave animals. When cornered by man, *S. bidiensis* adopts a threatening posture, brandishing its small and delicate pincers. Given the opportunity however, it prefers to quickly dash for cover. (See Ng & Yussof, in press)

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