

*Thelphusula dicerophilus* sp. nov., a new species of freshwater crab (Crustacea: Decapoda: Brachyura: Gecarcinucidae) found in mud wallows of the Sumatran rhinoceros from Sabah, Borneo

Peter K.L. Ng

Department of Zoology, National University of Singapore, Kent Ridge Campus, Singapore 0511, Republic of Singapore.

Robert Stuebing

Universiti Kebangsaan Malaysia (Sabah Campus), Beg Berkunci No. 62, 88996 Kota Kinabalu, Sabah, East Malaysia

**ABSTRACT:** A new species of semiterrestrial gecarcinucid freshwater crab, *Thelphusula dicerophilus* sp. nov. is described from mud wallows used by the Sumatran Rhinoceros, *Dicerorhinus sumatrensis* in eastern Sabah, Borneo. The species is closest to *Thelphusula granosa* Holthuis, 1979 from Gunong Mulu in Sarawak but can easily be distinguished by differences in their carapace sculpture, frontal margin, male first and second pleopod structures.

## 1 INTRODUCTION

While studying the habits and biology of the Sumatran Rhinoceros, *Dicerorhinus sumatrensis* (Fisher, 1814) in the East Malaysian state of Sabah, Borneo, the second author obtained numerous specimens of a semiterrestrial freshwater crab. These specimens proved to represent an undescribed species of the gecarcinucid genus *Thelphusula* Bott, 1969. A description of this new species with notes about its biology forms the text of the present paper.

All measurements are in millimetres, and are of the carapace width and length respectively. The abbreviations G1 and G2 are used for the male first and second pleopods respectively. All specimens are deposited in the Universiti Kebangsaan Malaysia (Kampus Sabah) Museum of Zoology (UKMS), Sabah Campus; Zoological Reference Collection (ZRC), Department of Zoology, National University of Singapore; and the Rijksmuseum van Natuurlijke Historie (RMNH), Leiden, The Netherlands.

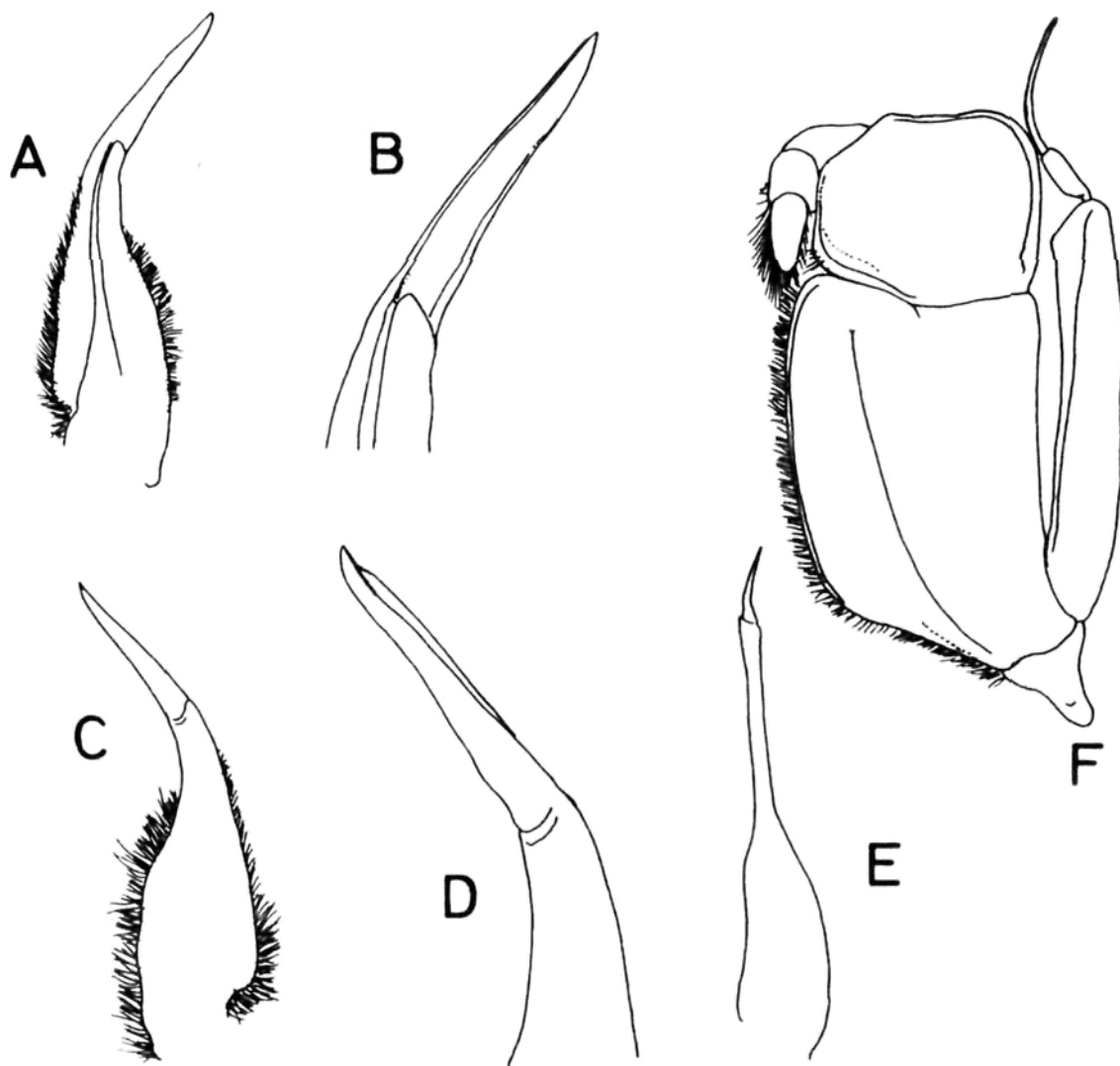


Figure 1. *Thelphusula dicerophilus* sp. nov. Holotype male (14.0 × 12.0 mm). A, B. Left G1 (ventral view); C, D. Left G1 (dorsal view); E. Left G2; F. Left third maxilliped.

## 2 TAXONOMIC ACCOUNT

### FAMILY GECARCINUCIDAE RATHBUN, 1904

#### *Genus Thelphusula* Bott, 1969

#### ***Thelphusula dicerophilus* sp. nov. (Pl. 1, Fig. 1)**

#### *Diagnosis*

Carapace squarish, very high, appearing inflated, surfaces rough, lateral margins covered with rugose striae. Lateral margin gradually convex, anterolateral margin not distinctly demarcated from posterolateral, epibranchial tooth not discernible. Ischium of third maxilliped with shallow sulcus, exopod with well

developed flagellum which transverses width of merus. Surfaces of the meri of ambulatory legs very rugose and rough, covered with numerous flattened granules. Male abdomen T-shaped, G1 slender, terminal segment clearly demarcated from and longer than half length of subterminal, rod-like, tapered at tip which is slightly upcurved; distal part of subterminal segment narrower than basal, appearing neck-like. G2 long, flagellum short, distal half of basal segment very slender, neck-like.

*Material examined*

Holotype: 1 male, 14.0 by 12.0 mm, ZRC 1989. 3588, (Field Cat. No. E1S 55), in pitfall trap, adjacent to pool of rhinoceros mud wallow, Danum Valley, Sabah, Borneo, ca. 4°55'N, 117°46', leg. R. Stuebing, 4.iii.1988.

Paratypes: 1 large female, 18.3 by 15.0 mm, ZRC 1989. 3593, (Field Cat. No. E1S 002), in pitfall trap, adjacent to pool of rhinoceros mud wallow, leg. 1.iii.1988–1 small female, 1 large female, 19.6 by 16.6 mm, UKMS, (Field Cat. No. E1S 003), in pitfall trap, adjacent to pool of rhinoceros mud wallow, leg. 1.iii.1988–1 juv., ZRC 1989. 3594, (Field Cat. No. E1S 006), in rhinoceros mud wallow pool, leg. 1.iii.1988–1 juv., ZRC 1989. 3592, (Field Cat. No. E2N 019), in rhinoceros mud wallow pool, leg. 1.iii.1988–2 females, UKMS, (Field Cat. No. S1E 35), in rhinoceros mud wallow pool surroundings, leg. 2.iii.1988–1 large male, 18.5 by 15.4 mm, ZRC 1989. 3591, (Field Cat. No. E1N 36), in mist net in rhinoceros mud wallow pool, leg. 2.iii.1988–1 male, 2 females, RMNH, (Field Cat. No. W1N 37), in rhinoceros mud wallow pool surroundings, leg. 2.iii.1988–1 small male, 1 small female, ZRC 1989. 3589-3590, (Field Cat. No. W1N 53), in rhinoceros mud wallow pool, leg. 2.iii.1988; all localities in Danum Valley, Sabah, Borneo, ca. 4°55'N, 117°46'E, leg. R. Stuebing.

*Male holotype description*

Carapace slightly broader than long, appearing squarish, very high, carapace height to width ratio 0.63. Surfaces of carapace gently convex, appears rugose and rough, especially margins which are covered with well defined oblique striae and flattened granules. Branchial regions swollen, carapace appears inflated, other regions poorly demarcated, cervical groves shallow but distinct, extending from postorbital cristae to deep and very pronounced H-shaped central depression. Epigastric regions low but distinct, very rugose, separated by a narrow cleft, epigastric cristae not prominent. Postorbital cristae low, strongly rugose, confluent with and not clearly demarcated from epigastric cristae, gradually merging with anterolateral margin. Frontal margin slightly deflexed, very slightly sinuous, about one third total width of carapace, the two frontal lobes not clearly separated. 'Pseudo-frontal median triangle' wide, extending throughout most of frontal margin, very narrow, but upper border not completely confluent with lateral borders. Anterolateral and posterolateral margins not very distinctly separated. Anterolateral margins gradually convex, lined with a finely granulated cristae, epigastric teeth not discernible, area where epigastric teeth

normally is visible with only very shallow cleft. Posterolateral margins straight, approximately parallel. Posterior margin straight, only slightly shorter than total width of frontal, orbital and anterolateral margins. Median triangle of posterior margin of epistome broadly triangular, tip rounded, lateral margins broadly concave. Orbits large, eyes occupying entire width, orbital margins crested. Eyes well developed, cornea of eyes distinct, well-pigmented. Suborbital, sub-branchial and subhepatic regions rugose, pterygostomial region appears pubescent, covered with numerous short soft hairs. Ischium of third maxillipeds with shallow oblique groove which is closer to inner margin; merus squarish, margins with cristae; exopod with triangular projection at distal part, flagellum as long as width of merus. Terminal segment of mandibular palp with two lobes.

Chelipeds slightly unequal, left larger. Surfaces of carpus and merus strongly rugose, covered with numerous flattened, scale-like granules. Lower margins of merus distinctly serrated. Carpus with distinct inner spine and tubercle at its base. Surfaces of palm and fingers covered with numerous granules and tubercles, especially along margins. Fingers as long as or slightly longer than palm, cutting edges with several large obliquely forward-pointing teeth and numerous blunt denticles.

Ambulatory legs normal length, third pair longest. Margins of meri distinctly serrated, but without distinct subterminal spine. Surfaces of meri, carpus and propodus appears strongly rugose, covered with numerous striae and flattened granules.

Male abdomen distinctly T-shaped, first segment very narrow, triangular, extending throughout width of posterior margin, reaching bases of last pair of ambulatory legs, second segment broader, approximately rectangular, segments three to five progressively more trapezoidal, lateral margins strongly converging, sixth segment longer than broad, rectangular, lateral margins almost straight, seventh segment triangular, sides slightly concave, converging, tip rounded. G1 slender, terminal segment clearly demarcated from and longer than half length of subterminal, rod-like, gradually tapering, tip slightly upcurved, groove for G2 dorsal, dorsal and ventral folds meeting at dorsal surface of segment; distal quarter of subterminal segment much narrower than basal, subterminal segment appearing neck-like, both inner and outer margins lined with numerous short hairs. G2 long, flagellum short, distal half of basal segment very slender, structure appearing neck-like.

#### *Paratypes*

A larger male paratype (18.5 by 15.4 mm) (ZRC) differs from holotype male in having its two chelipeds more distinctly unequal. The larger cheliped is distinctly inflated, the palm appearing swollen. The female paratypes agree very well with the holotype male in almost all non-sexual aspects. Their chelipeds however, are always almost equal in size, and the palms never appear inflated

even in large specimens. The carapace of young and juvenile specimens appear to be less strongly inflated than the adults. The G1 structure of smaller male specimens however, agree almost completely with that of the holotype.

#### Remarks

Ng & Goh (1987) commented that the genus *Thelphusula* Bott, 1969, as conceived by Bott (1969, 1970) is rather heterogeneous, and three distinct groups can be recognized. Of the eight species previously recognized as belonging to this genus, Ng & Goh (1987) noted that only five - *T. hendersoniana* (De Man, 1899), *T. luidana* (Chace, 1938), *T. buergeri* (De Man, 1899), *T. baramensis* (De Man, 1902), and *T. granosa* Holthuis, 1979, could be satisfactorily classified in *Thelphusula* s. str., which they defined as having a rather squarish carapace, almost undiscernible epibranchial tooth, straight and almost parallel posterolateral margins, ambulatory legs of normal length, a slender and sinuous G1 with a relatively long and cylindrical terminal segment, and a G2 which has a short flagellum. The characters of *T. dicerophilus* thus clearly place it in *Thelphusula* s. str., making it the sixth species in this group, and only the second to be reported from the state of Sabah, the first being *T. luidana* from the area of Mount Kinabalu.

The presence of a 'pseudo-frontal median triangle' affiliates *T. dicerophilus* with *T. granosa* and *buergeri*. The other species of *Thelphusula* s. str. do have distinct frontal median triangles, 'pseudo-' or otherwise. *Thelphusula dicerophilus* is perhaps closest to *T. granosa* described from Gunong Mulu National Park in Sarawak, especially with regards to the high carapace, rugose carapace and legs. *Thelphusula dicerophilus* however, is clearly distinct from *T. granosa*, with the carapace appearing more squarish, carapace surfaces having less granules but more striae, the 'pseudo-frontal median triangle' wider, the G1 subterminal segment having the distal part narrow and neck-like, the G1 terminal segment longer, straighter, and the tip slightly upcurved, and the G2 is elongate, the neck-like distal part of the basal segment been distinctly longer. *Thelphusula dicerophilus* is also affiliated to *T. buergeri* from Mount Liang Koebeng in Central Borneo but can easily be distinguished by its more rugose carapace, cheliped and ambulatory leg surfaces, much broader 'pseudo-frontal median triangle', more distinct cervical grooves, and the G1 subterminal segment being less distinctly sinuous, the terminal segment being longer and less cylindrical in shape.

Holthuis (1979) has noted that the classification of the genus *Thelphusula* in the family Gecarcinucidae poses some problems. The structure of the 'pseudo-frontal median triangle' in the three species of *Thelphusula* is reminiscent of that in members of the Sundathelphusidae Bott, 1969, a family Bott (1969) characterized mainly by the upper border of the frontal median triangle being distinctly separate and not confluent with the lateral borders. The classification of the above mentioned three *Thelphusula* species in the Sundathelphusidae while

retaining the remaining species in the Gecarcinucidae is far from satisfactory since all the species in *Thelphusula* s. str. clearly represent one homogeneous grouping. The separation of *T. buergeri*, *T. granosa* and *T. dicerophilus* from *T. hendersoniana*, *T. luidana* and *T. baramensis* solely on the basis of the presence or absence of the 'pseudo-frontal median triangle' is unsatisfactory since this character is obviously a quantitative one and likely to be quite variable between taxa. Ng (1986) has also commented that the presence or absence of a frontal median triangle, or possessing a 'pseudo-frontal median triangle', is an unreliable character since some species of the gecarcinucid genus *Phricotelphusa* Alcock, 1909 also have discernable 'pseudo-frontal median triangles'. If this character is of dubious value, a reappraisal of the classification of the three families of the Gecarcinucoidea is clearly necessary. This paper however, is not the place to elaborate on this.

*Thelphusula dicerophilus* is a semiterrestrial species, and its habits parallel those of *T. granosa* in most aspects. The high carapace and inflated branchial regions is clearly reflection of its adaptations to this lifestyle. Of the 14 specimens obtained, nine were caught in areas surrounding the rhinoceros mud wallow pools, in pitfall traps or by hand; testimony to their amphibious habits. The water conditions in the mud pools were as follows - pH 5.5 to 6.3, temperature 24.9 to 25.7°C, conductivity 0.4 to 0.6 ms., turbidity 144 to 810, and dissolved oxygen 0.1 to 1.3 ppm. In habitat as unusual (and unpredictable) as a mud pool, and where dissolved oxygen levels can drop to extremely low levels, the ability to move freely on dry land is clearly an advantage.

A variety of organisms were collected with *T. dicerophilus* - three frogs of the family Ranidae; *Occidozyga laevis* (Günther), *Rana kuhli* Dumeril & Bibron, and *Rana finchi* Inger, coleopteran beetles and their larvae, dipteran fly larvae, culicine mosquito larvae, mayfly (Ephemeroptera) nymphs, dragonfly (Odonata) nymphs, hemipteran water bugs, various water skaters of the family Gerridae, leeches (Hirudinea), turbellarian flatworms, acarine mites, and unidentified gastropod molluscs.

#### *Etymology*

The specific name is derived from the generic name of the Sumatran Rhinoceros, *Dicerorhinus*, since all the types have been collected in or near the mud wallows favoured by this rhinoceros, alluding to the preference of this species for such habitats.

#### ACKNOWLEDGEMENTS

The authors wish to thank Dr. Mazlin Mochtar and Mr. Lee Yook Heng of UKMS for supplying the physical data about the rhinoceros mud wallow pools.

Thanks are also due to Dr. N.A. Johnston and Katherine Johnston for their help in the field and laboratory. They are also grateful to Dr. Harold Voris for his kind help.

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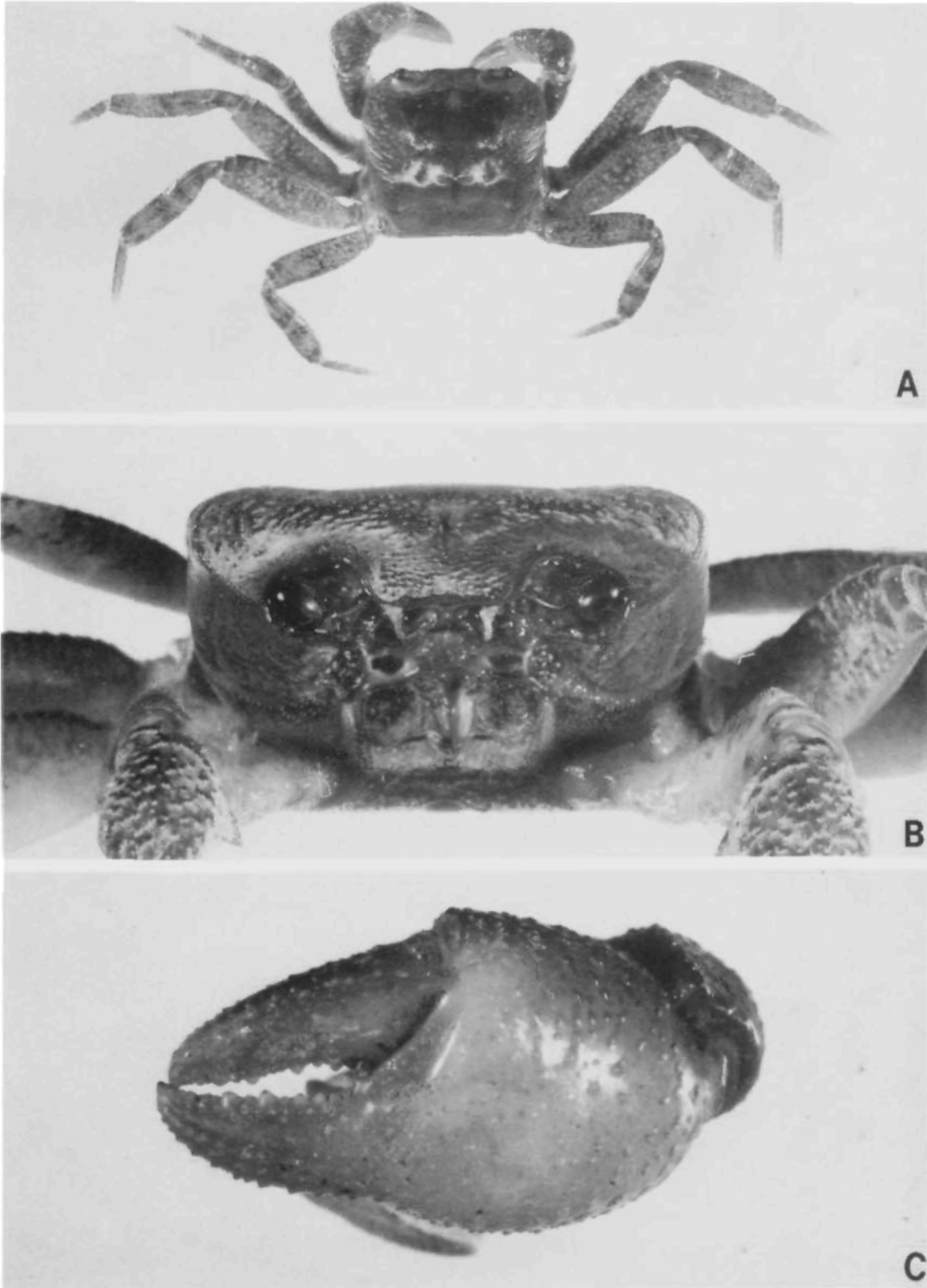


Plate 1. *Thelphusula dicerophilus* sp. nov. A, B, Holotype male (14.0 × 12.0 mm); C, Paratype male (18.5 × 15.4 mm). A. Dorsal view; B. Frontal view; C. Left cheliped.