

TWO NEW SPECIES OF *PARATHELPHUSA* H. MILNE EDWARDS, 1853, FROM THE PHILIPPINES (CRUSTACEA: DECAPODA: BRACHYURA: PARATHELPHUSIDAE)

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ABSTRACT. – Two new species of freshwater crabs in the genus *Parathelphusa* H. Milne Edwards, 1853, are described from Palawan Island in the Philippines. The new species are each easily distinguished from their closest congeners by characters of the male first pleopod, in conjunction with a unique combination of other morphological characters. A key to the *Parathelphusa* species of the Philippines is provided.

KEY WORDS. – Freshwater crab, Crustacea, Parathelphusidae, *Parathelphusa*, Palawan, Philippines, taxonomy, new species.

INTRODUCTION

The present study arises out of an extensive ecological survey of the river systems of St. Paul's Subterranean River National Park in Palawan, Philippines, conducted by the first author during 2000-2001. Of these river systems, the freshwater brachyuran fauna of the Cabayugan / Underground River was found to be dominated by an undescribed species of *Parathelphusa*, which comprised 73 out of 82 freshwater crab specimens collected; the remaining nine specimens belonging to the potamid genus *Insulamom*. A second new species of *Parathelphusa*, from Lake Manguao near Taytay, northern Palawan, was found in the collection of the State Polytechnic College of Palawan (FI21.11.2001). The present paper describes these two new species of *Parathelphusa*, which are distinguished from their congeners by a combination of diagnostic morphological characters. In addition, a key to all the species of *Parathelphusa* in the Philippines is provided.

Three genera of freshwater crabs (*Parathelphusa* H. Milne Edwards, 1853, *Insulamom* Ng & Takeda, 1992, and *Carpomon* Tan & Ng, 1998) are currently recognised from Palawan, Philippines. *Parathelphusa* currently includes eight Philippine species and is assigned to the family Parathelphusidae, while the other two genera are each monotypic, and both in the family Potamidae (see Ng & Takeda, 1992, 1993; Tan & Ng, 1998). The two new species

described in the present study are immediately identifiable as members of the genus *Parathelphusa* by their bilobed mandibular palp, T-shaped male abdomen, well-developed epibranchial teeth (two on each anterolateral margin), and relatively simple, undifferentiated male first pleopod (sensu Ng, 1988).

The early records of the genus *Parathelphusa* H. Milne Edwards, 1853, from Palawan, Philippines, and northern Borneo were originally described as *Palawanthelphusa* Bott, 1969 (see Bott, 1969, 1970), but the latter genus was later synonymised with *Parathelphusa* (see Ng & Goh, 1987). All *Parathelphusa* species are characterised by having three teeth on the anterolateral margin [i.e. one external orbital angle and two epibranchial teeth] (see Ng & Takeda, 1993). Eight species of *Parathelphusa* are currently known from the Philippines, viz., *P. palawanensis* (Bott, 1969); *P. obtusa* (Bott, 1969); *P. saginata* Ng & Takeda, 1993; *P. rasilis* Ng & Takeda, 1993; *P. nana* Ng & Takeda, 1993; *P. balabac* Ng & Takeda, 1993; *P. parma* Ng & Takeda, 1993; and *P. mindoro* Ng & Takeda, 1993 (see Ng & Takeda, 1993).

The abbreviation G1 is used for the male first pleopod. Measurements are of carapace width and length respectively. Terminology used essentially follows Ng (1988). Specimens examined are deposited in the National Museum of the Philippines Manila (PNM); the Aquatic Science &

Technology Department Puerto Princesa of the State Polytechnic College of Palawan, Philippines (SPCP-ASTD); the Zoological Reference Collection of the Raffles Museum of Biodiversity Research, National University of Singapore (ZRC); and the Zoological Collection of the Martin-Luther-University Halle, Germany (ZIH). Some of the specimens now in the SPCP-ASTD may be used for destructive testing and other ecologically-related experiments later on and as such, these are not listed here as paratypes.

KEY TO THE PARATHELPHUSA SPECIES OF THE PHILIPPINES

1. Both first and second epibranchial teeth well-developed, sharp 2
 - First epibranchial tooth poorly-developed or low, blunt; second epibranchial tooth poorly developed or small, blunt (except in *P. rasilis* - second tooth well developed, sharp) 5
2. Cervical grooves deep. Ambulatory leg merus always with sharp subdistal spine on dorsal margin. Sixth male abdominal segment elongated, ca. 1.30 times longer than broad. Tip of G1 with distinct subdistal notch on outer margin (Figs. 1A, C, D, 1F, 2, 3A, 3C, 4A) (Palawan) *P. cabayugan*
 - Cervical grooves shallow. Ambulatory leg merus with or without subdistal spine on dorsal margin. Sixth male abdominal segment stout, ca. 1.05 to 1.21 times longer than broad. Tip of G1 without distinct subdistal notch on outer margin 3
3. Postorbital cristae with lateral part strongly arched in adults. Ambulatory leg merus with sharp subdistal spine on dorsal margin. G1 distinctly bent outwards, very slender, upper half of proximal part subequal in width to distal part; tip of G1 truncate, directed upwards (Figs. 5A, C, D, 6, 7A, 8A) (Palawan) *P. manguao*
 - Postorbital cristae with lateral part not arched or very gently arched. Ambulatory leg merus usually without subdistal spine on dorsal margin. G1 sinuous or gently curved outwards, relatively broad, proximal part distinctly broader than distal part; tip of G1 sharp 4
4. Carapace dorsal surface flat, with gastric and branchial regions flat. Sixth male abdominal segment relatively slenderer, ca. 1.21 times longer than broad. G1 gently sinuous; tip of G1 gently curved upwards (Ng & Takeda, 1993: Figs. 1B, F-J, 2D, I-M, 3) (Palawan) *P. palawanensis*
 - Carapace dorsal surface convex, with gastric and branchial regions swollen. Sixth male abdominal segment relatively stouter, ca. 1.05 times longer than broad. G1 gently curved outwards; tip of G1 directed upwards (Ng & Takeda, 1993: Figs. 4B, E-J) (Palawan) *P. saginata*
5. Ambulatory leg merus with sharp subdistal spine on dorsal margin. Tip of G1 with shallow subdistal notch on outer margin (Ng & Takeda, 1993: Figs. 8C, D, G-J) (Palawan) *P. nana*
 - Ambulatory leg merus without subdistal spine, or with subdistal knob or blunt tooth on dorsal margin. Tip of G1 without subdistal notch on outer margin 6
6. First epibranchial tooth lobiform. Sixth male abdominal segment appearing relatively stouter, ca. 1.07-1.09 times longer than broad 7
 - First epibranchial tooth small, low, but not lobiform. Sixth male abdominal segment appearing relatively slenderer, ca. 1.10-1.19 times longer than broad 8
7. Carapace appearing more squarish, with very gently convex anterolateral margins. G1 proximal part with distinct knob on outer margin; tip of G1 directed upwards (Ng & Takeda, 1993: Figs. 9A, G-L) (Balabac) *P. balabac*

- Carapace appearing more transverse, with more distinctly convex anterolateral margins. G1 proximal part without distinct knob on outer margin; tip of G1 gently curved upwards (Ng & Takeda, 1993: Figs. 10A, B, I-L) (Balabac) *P. parma*
- 8. Ambulatory leg merus with subdistal knob or blunt tooth on dorsal margin. Tip of G1 sharp, gently curved upwards (Ng & Takeda, 1993: 11C, D, G-J) (Mindoro) *P. mindoro*
 - Ambulatory leg merus without subdistal knob or blunt tooth on dorsal margin. Tip of G1 not sharp, directed upwards 9
- 9. Second epibranchial tooth indiscernible. Sixth male abdominal segment appearing relatively stouter, ca. 1.10 times longer than broad. Tip of G1 sub-truncate (Ng & Takeda, 1993: Figs. 8A, F-J) (Palawan) *P. obtusa*
 - Second epibranchial tooth well-developed, sharp. Sixth male abdominal segment appearing relatively slenderer, ca. 1.16 times longer than broad. Tip of G1 truncate (Ng & Takeda, 1993: Figs. 6A, B, G-I, 7A-H) (Palawan) *P. rasilis*

TAXONOMY

FAMILY PARATHELPHUSIDAE ALCOCK, 1910

***Parathelphusa cabayugan*, new species (Figs. 1-4)**

Material examined. - Holotype - male (32 by 25.3 mm) (PNM 17259), Cabayugan River, Puerto Princesa, Palawan, coll. H. Freitag, 5 Jun.2001.

Paratypes - 2 males (larger 19.3 by 16.4 mm), 1 female (21.6 by 17.8 mm) (ZRC2004.0622), 2 males (larger 20.7 by 17.2 mm) (ZIH), 2 males (largest 17.2 by 14.7 mm) (SPCP-ASTD), Cabayugan River, Puerto Princesa, Palawan, coll. H. Freitag, 2001.

Others (designated for ecological studies) - 38 males (largest 14.6 by 12.4 mm), 28 females (largest 26.4 by 21.6 mm), >100 juveniles (smallest 5.0 by 4.5 mm) (SPCP-ASTD), same data as paratypes.

Diagnosis. - Carapace low, dorsal surface flat; cervical grooves distinct, deep, broad; epibranchial teeth well developed, sharp, directed forwards. Merus of ambulatory legs with well developed subdistal spine on dorsal margin. Male sixth abdominal segment elongated, relatively slender, longer than telson (segment 7). G1 gently sinuous, proximal part broader than distal part; tip truncate, gently curved outwards, with distinct subdistal notch on outer margin.

Etymology. - The species is named for the type locality, Cabayugan River and Barangay Cabayugan of Puerto Princesa City. The name is a noun in apposition.

Colour. - In life, dorsal carapace and walking legs dirty greyish brown, the latter with a slight cross-stripe pattern. Ventral parts (sternum and abdomen) a dirty-white colour. Eleven out of 71 specimens with blackened fingers of the chelipeds, while the rest with greyish brown fingers. In alcohol, all brown parts become a light orange-brown.

Remarks. - *Parathelphusa cabayugan*, new species, superficially resembles several known species of Philippine *Parathelphusa*. For example, the sharp, well-developed

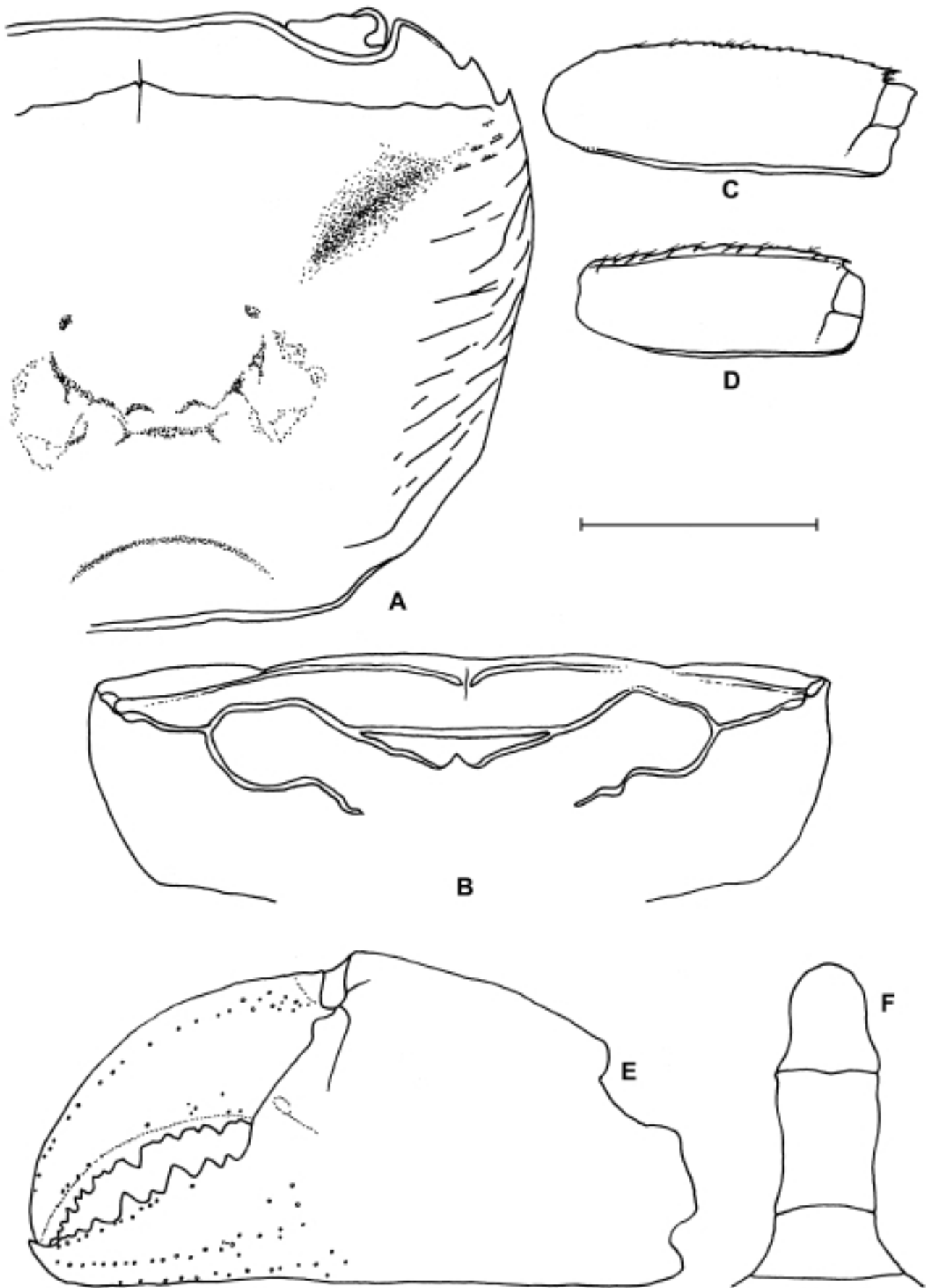


Fig. 1. *Parathelphusa cabayugan*, new species, holotype male (32 by 25.3 mm) (PNM 17259). A, dorsal view of carapace; B, frontal view of carapace; C, right third ambulatory merus; D, right fourth ambulatory merus; E, left chela; F, abdominal segments 5-7. Scales = 10.0 mm.

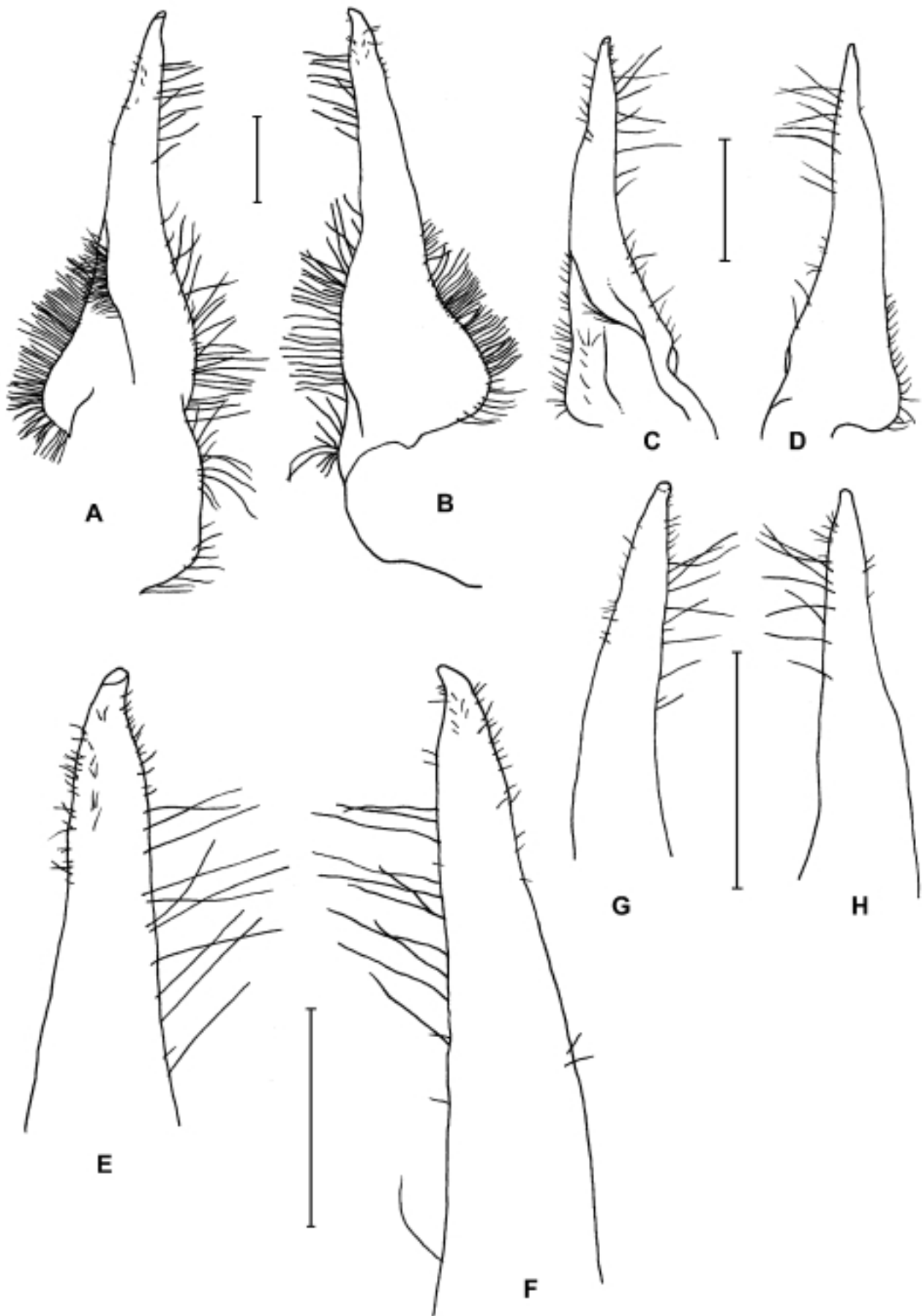


Fig. 2. *Parathelphusa cabayugan*, new species, left G1. A, B, E, F, holotype male (32 by 25.3 mm) (PNM 17259); C, D, G, H, paratype juvenile male (15.2 by 13.1 mm) (SCCP-ASTD). A, C, ventral view; B, D, dorsal view; E, G, ventral view of distal part; F, H, dorsal view of distal part. Scales = 1.0 mm.

epibranchial teeth of *P. cabayugan* resemble those of *P. palawanensis* (Bott, 1969), *P. saginata* Ng & Takeda, 1993, *P. mindoro* Ng & Takeda, 1993, and *P. manguao*, new species (present study). In addition, the truncate tip of the G1 of *P. cabayugan* resembles that seen in *P. obtusa* (Bott, 1969) and *P. rasilis* Ng & Takeda, 1993; and the overall form of its G1 is similar to that of *P. nana* Ng & Takeda, 1993. *Parathelphusa ovum* Ng, 1994, from Sabah, Borneo, also possesses a G1 with a truncate tip that is similar to that of *P. cabayugan*.

Parathelphusa cabayugan, however, can be immediately separated from these and all other *Parathelphusa* species by the presence of a distinct subdistal notch on the outer margin of the tip of its G1, in addition to a unique combination of external and other G1 characters (see Tables 1A, B).

The diagnostic subdistal notch on the outer margin of the tip of the G1 and the sharp, well-developed epibranchial teeth

are also present in juvenile specimens of *P. cabayugan* (Figs. 2C, D, G, H).

Ecological notes. – The habitats where *P. cabayugan* occur are in the Cabayugan River catchment (10°09'N, 118°51'E), which has an area of approximately 3,683 ha (PAMB of Puerto Princesa City, 1998, unpublished). The catchment is surrounded by mountains up to 1028 m high, but all permanent tributaries and sites sampled are lowland waters. The soils drained are yellowish to deep red clays on ultrabasic subsoils at the peripheral headwaters; alluvial soils on shale and sandstone at the upper to middle river course; and karst soils on limestone at the lower and subterranean course of Cabayugan/Underground River. This results in the pH being generally basic, ranging from 7.1 to 8.7, and the conductivity being relatively high, ranging from 140 to 740 µS/cm.

Highest abundance of *P. cabayugan* was found in undisturbed first to third order headwaters with moderate to low turbidity (> 120 cm light penetration). The specimens were collected from the river bed and in colonization baskets situated between stony and coarse organic substrates. Within such river sections, the crabs were found in different micro-habitats such as under small falls, in riffles, and in pools. Applying drift nets at all sites, several specimens were caught only at a spring brook running out off limestone rocks. Dissolved oxygen was occasionally found decreasing to 60% saturation in this site. All other sites sampled had generally higher values.

Lower abundance of *P. cabayugan* was found in the middle river course that is influenced by anthropogenic activities (paddy fields, settlements). Those result in higher temperature fluctuations ($26^{\circ}\text{C} \pm 3^{\circ}\text{C}$), raised turbidity and slightly increased BOD₂₊₅ (max: 2.6 mg/l, n=5). In paddy fields and their draining channels, no individuals of the species were found. This is in contrast to other parathelphusid crabs such as members of *Sayamia*, *Esanthelephusa* and *Somanniathelphusa* that occur in rice fields in many parts of Indochina and China (see Ng & Naiyanetr, 1993; Naiyanetr, 1994; Ng, 1995; Dai, 1999; Yeo & Nguyen, 1999). It is possible that the absence or low abundance of *P. cabayugan* in the middle parts of the river may be due to natural physical/

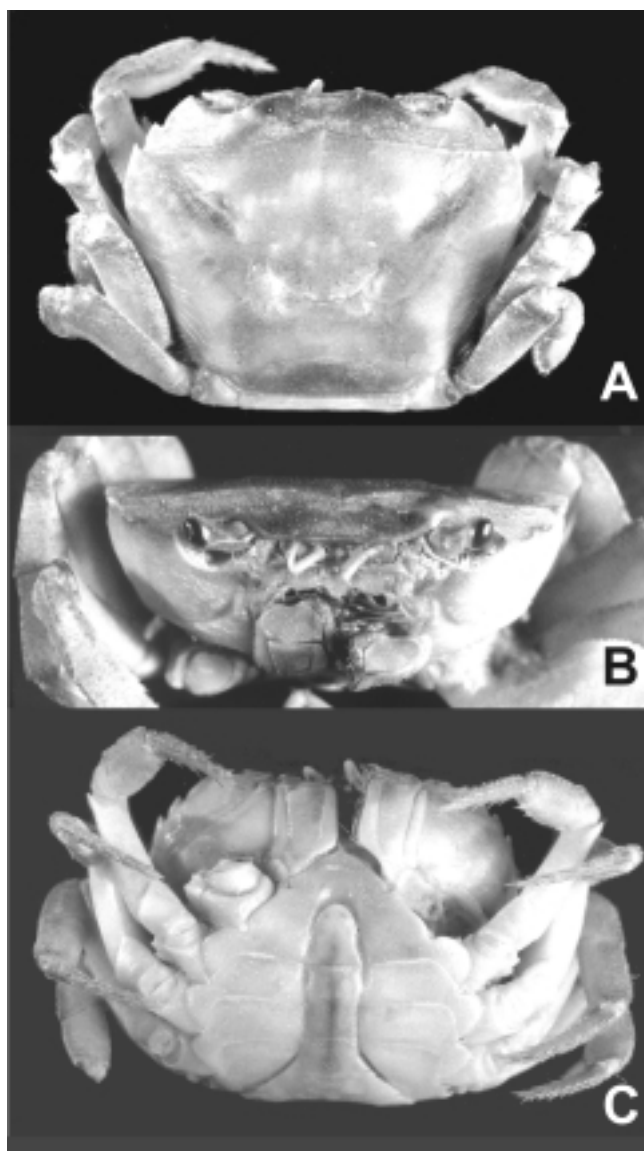


Fig. 3. *Parathelphusa cabayugan*, new species, holotype male (32 by 25.3 mm) (PNM 17259). A, dorsal view; B frontal view; C, ventral view.



Fig. 4. *Parathelphusa cabayugan*, new species, paratype female (26.4 by 21.6 mm) (ZIH).

Table 1A. Differences between *Parathelphusa cabayugan*, new species, *P. manguao*, new species, and *P. palawanensis* (Bott, 1969), *P. saginata* Ng & Takeda, 1993, *P. mindoro* Ng & Takeda, 1993, *P. obtusa* (Bott, 1969), *P. rasilis* Ng & Takeda, 1993, and *P. ovum* Ng, 1994.

	Carapace dorsal surface	Postorbital cristae	Cervical grooves	Epibranchial teeth	Dorsal margin of ambulatory leg merus
<i>P. cabayugan</i> (see Figs. 1A-D, 3A, B, 4)	Flat, with gastric and branchial regions flat	Gently sinuous, with lateral part not arched	Deep	Well-developed, sharp	Subdistal spine present
<i>P. manguao</i> (see Figs. 5A-D, 7A, B, 8)	Convex, with gastric and branchial regions gently swollen	Sinuous, with lateral part strongly arched in adults	Shallow	Well-developed, sharp	Subdistal spine present
<i>P. palawanensis</i> (present study; after Ng & Takeda, 1993: 2, Figs. 1-3)	Flat, with gastric and branchial regions flat	Sinuous, with lateral part not arched or very gently arched	Shallow	Well-developed, sharp	Subdistal spine usually absent
<i>P. saginata</i> (after Ng & Takeda, 1993: 6, Fig. 4)	Convex, with gastric and branchial regions swollen	Gently sinuous, with lateral part not arched	Shallow	Well-developed, sharp	Subdistal spine absent
<i>P. mindoro</i> (present study; after Ng & Takeda, 1993: 18, Fig. 11)	Convex, with gastric and branchial regions swollen	Almost straight, with lateral part not arched	Shallow	Low, blunt	Subdistal spine absent, knob or blunt tooth present
<i>P. obtusa</i> (after Ng & Takeda, 1993: 7, Fig. 5)	Convex, with gastric and branchial regions gently swollen	Almost straight, with lateral part not arched	Shallow	First tooth barely discernible, blunt; second tooth indiscernible	Subdistal spine absent
<i>P. rasilis</i> (present study; after Ng & Takeda, 1993: 9, Figs. 6, 7)	Convex, with gastric and branchial regions swollen	Almost straight to gently sinuous, with lateral part not arched or very gently arched	Shallow	First tooth low, blunt; blunt; second tooth well-developed, sharp	Subdistal spine usually absent
<i>P. nana</i> (present study; after Ng & Takeda, 1993: 12, Fig. 8)	Convex, with gastric and branchial regions swollen	Gently sinuous, with lateral part not arched	Shallow	First tooth small, blunt; second tooth very small, blunt	Subdistal spine present
<i>P. ovum</i> (present study; after Ng, 1994, Fig. 11)	Convex, with gastric and branchial regions distinctly swollen	Almost straight, with lateral part not arched	Shallow	Low, sharp	Subdistal spine present

environmental variables. However, the use of pesticides and fertilizers in the nearby paddy fields may also have played a part.

The species was not detected in the other stretches of the river, viz., the subterranean course and the estuary.

The species appears to be primarily aquatic in habits, as majority of the specimens were collected from within the river. However, a single specimen caught on the river bank about 1 metre above the water surface, in an emergence trap for eclosing aquatic insects, suggests that the members of the species actively leave the water body for short times at least.

Juvenile stages (< 5 by 4.5 mm) assigned to this species were found several times throughout the year at the same stream

courses as the adults. One female (26.4 by 21.6 mm) was found carrying 54 juveniles of 2.0 by 1.9 mm size. Juveniles of the same size were detected as smallest among the released free living ones.

The data from this semi-quantitative collection seems to indicate that *P. cabayugan* has an affinity for small and undisturbed headwater streams, with clear and unpolluted water. The preferred habitats overlap in parts with those of the potamid genus *Insulamon* Ng & Takeda, 1992.

***Parathelphusa manguao*, new species**
(Figs. 5-8)

Material examined. – Holotype – male (21.9 by 18.2 mm) (PNM 17283), Lake Manguao, Municipality of Taytay, coll. S. Schoppe (SPCP-ASTD), 21 Nov.2001.

Table 1B. Differences between *Parathelphusa cabayugan*, new species, *P. manguao*, new species, and *P. palawanensis* (Bott, 1969), *P. saginata* Ng & Takeda, 1993, *P. mindoro* Ng & Takeda, 1993, *P. obtusa* (Bott, 1969), *P. rasilis* Ng & Takeda, 1993, and *P. ovum* Ng, 1994.

	Male abdominal segment 6	G1 overall shape	Tip of G1	Proximal part of G1
<i>P. cabayugan</i> (see Figs. 1F, 2, 3C)	Elongated, ca. 1.30 times longer than broad	Gently sinuous, proximal part distinctly broader than distal part	Truncate, gently curved outwards, with distinct subdistal notch on outer margin	Inner margin gently concave
<i>P. manguao</i> (see Figs. 5F, 6, 7C)	Relatively stout, ca. 1.08 times longer than broad	Distinctly bent outwards, very slender, upper half of proximal part subequal in width to distal part	Truncate, directed upwards, lacking subdistal notch on outer margin	Inner margin gently concave
<i>P. palawanensis</i> (present study; after Ng & Takeda, 1993: 2, Figs. 1-3)	Relatively stout, ca. 1.21 times longer than broad	Gently sinuous, proximal part distinctly broader than distal part	Sharp, gently curved upwards, lacking subdistal notch on outer margin	Inner margin gently concave to almost straight
<i>P. saginata</i> (after Ng & Takeda, 1993: 6, Fig. 4)	Relatively stout, ca. 1.05 times longer than broad	Gently curved outwards, proximal part broader than distal part	Sharp, directed upwards, lacking subdistal notch on outer margin	Inner margin almost straight
<i>P. mindoro</i> (present study; after Ng & Takeda, 1993: 18, Fig. 11)	Relatively stout, ca. 1.19 times longer than broad	Gently curved outwards, proximal part broader than distal part	Sharp, gently curved upwards, lacking subdistal notch on outer margin	Inner margin almost straight
<i>P. obtusa</i> (after Ng & Takeda, 1993: 7, Fig. 5)	Relatively stout, ca. 1.10 times longer than broad	Gently curved outwards, proximal part distinctly broader than distal part	Sub-truncate, directed upwards, lacking subdistal notch on outer margin	Inner margin almost straight
<i>P. rasilis</i> (present study; after Ng & Takeda, 1993: 9, Figs. 6, 7)	Relatively stout, ca. 1.16 times longer than broad	Gently curved outwards, proximal part broader than distal part	Truncate, directed upwards, lacking subdistal notch on outer margin	Inner margin almost straight
<i>P. nana</i> (present study; after Ng & Takeda, 1993: 12, Fig. 8)	Relatively stout, ca. 1.06 times longer than broad	Gently curved outwards, proximal part broader than distal part	Sharp, gently curved outwards, with shallow subdistal notch on outer margin	Inner margin gently concave
<i>P. ovum</i> (present study; after Ng, 1994, Fig. 11)	Relatively stout, ca. 1.20 times longer than broad	Distinctly bent outwards, proximal part broader than distal part	Truncate, directed upwards, lacking subdistal notch on outer margin	Inner margin gently convex

Paratypes – 1 female (26.6 by 22.3 mm) (SPCP-ASTD), 1 male (16.6 by 14.3 mm) (SPCP-ASTD), 1 female (16.4 by 14.2 mm) (ZIH), 1 juvenile male (13.8 by 12.3 mm) (ZIH), 1 juvenile female (15.6 by 13.5 mm), 1 juvenile male (13.2 by 11.4 mm) (ZRC2004.0623), 1 juvenile female (15.3 by 13.1 mm) (PNM 17283), same data as holotype.

Others (designated for ecological studies) – 4 juvenile females (largest 14.3 by 12.5 mm) (SPCP-ASTD), same data as holotype.

Diagnosis. – Carapace low, dorsal surface gently convex; postorbital cristae strongly developed, sinuous, with lateral part strongly arched in adults; cervical grooves shallow but distinct; epibranchial teeth well developed, sharp, directed forwards. Merus of ambulatory legs with well developed subdistal spine on dorsal margin. Male sixth abdominal

segment relatively stout, longer than telson (segment 7). G1 gently but distinctly bent outwards at the middle, slender, with upper half of proximal part subequal in width to distal part; tip truncate, broad, with slight subdistal swelling.

Etymology. – The species is named for the type locality, Lake Manguao, (Municipality of Taytay, northern Palawan). The name is used as a name in apposition.

Colour. – In life, dorsal carapace dark brown, and slightly spotted; legs dark brown with a cross pattern of lighter brown; ventral parts (sternum and abdomen) dirty-white colour; fingers of the chelipeds dark reddish brown, except for the lighter coloured fingertips (S. Schoppe, pers. comm). All preserved type specimens in alcohol with similar coloration, probably due to initial preservation in formalin.

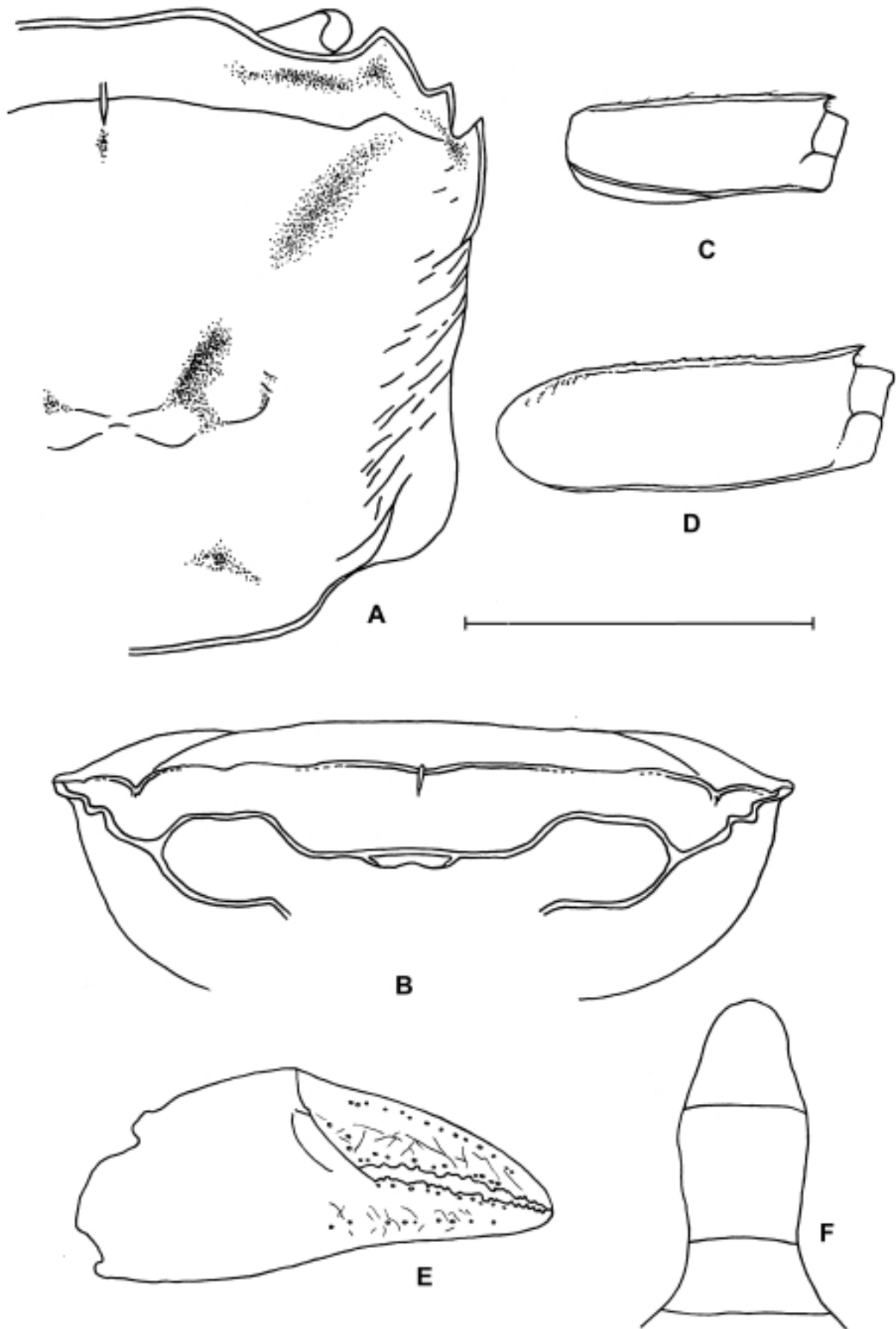


Fig. 5. *Parathelphusa manguao*, new species. Holotype male (21.9 by 18.2 mm) (PNM 17283). A, dorsal view of carapace; B, frontal view of carapace; C, right fourth ambulatory merus; D, right third ambulatory merus; E, right chela; F, abdominal segments 5-7. Scales = 10.0 mm.

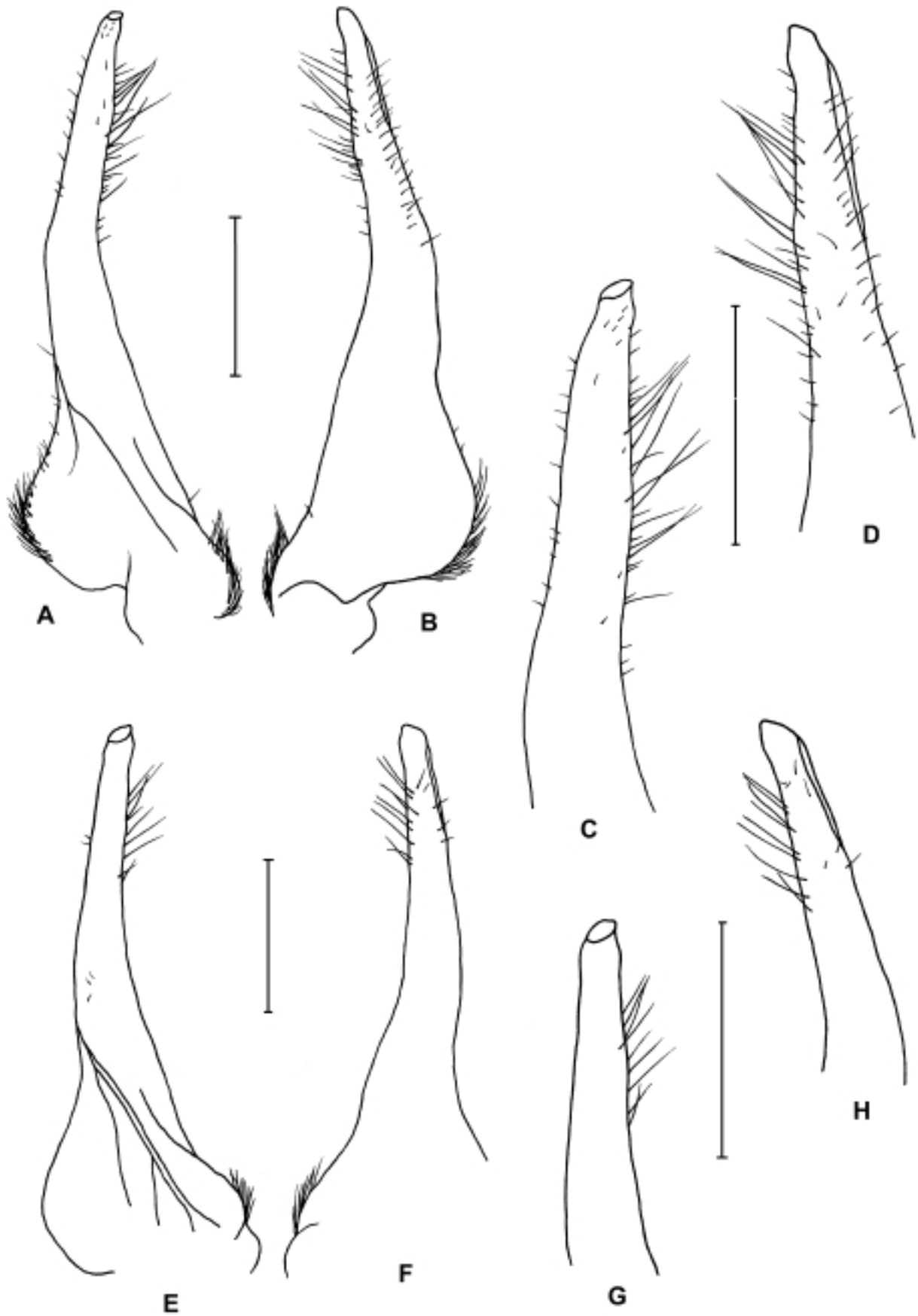


Fig. 6. *Parathelphusa manguao*, new species, left G1. A-D, holotype male (21.9 by 18.2 mm) (PNM 17283); E-H, paratype juvenile male (13.8 by 12.3 mm) (ZIH). A, E, ventral view; B, F, dorsal view; C, G, ventral view of distal part; D, H, dorsal view of distal part. Scales = 1.0 mm.

Remarks. – Among the Philippine freshwater crab fauna, *P. manguao* may be confused with *P. palawanensis* (Bott, 1969), *P. saginata* Ng & Takeda, 1993, *P. mindoro* Ng & Takeda, 1993, or *P. cabayugan*, new species, by virtue of its sharp and well-developed epibranchial teeth. The form of the G1 of *P. manguao* also superficially resembles that of *P. rasilis* Ng & Takeda, 1993, and *P. ovum* Ng, 1994 [Sabah, Borneo]. However, the very slender overall form of the G1 immediately distinguishes *P. manguao* from all the above species. While the G1 of *P. saginata* is also relatively slender in appearance when compared with its other congeners, that of *P. manguao* is still more slender, more strongly bent, and has a truncate tip (versus sharp tip)(Fig. 6; cf. Ng & Takeda, 1993: Fig. 4). Furthermore, the ambulatory legs of *P. manguao* possess a well developed subdistal spine on the dorsal margin (versus subdistal spine absent in *P. saginata*) (Figs. 5C, D, 8A, B; cf. Ng & Takeda, 1993: Fig. 4). In addition to these, other small specific differences in the G1 as well as differences in external characters such as the strongly arched lateral part of the postorbital cristae combine to give a diagnostic suite of characters for the species (see Tables 1A, B).

While juvenile specimens also have sharp, well-developed epibranchial teeth (Fig. 8A), the condition of the postorbital cristae mentioned above is seen only in adults of *P. manguao*.

Ecological notes. – The type specimens of *P. manguao* were caught at the northern littoral of Lake Manguao (10°45'27"N, 119° 33'30" E) among stony substrate. *Parathelphusa* species have also been observed from many other parts of the lake (S. Schoppe, pers. comm.). The authors have not had the opportunity to examine these other specimens; however, bearing in mind the highly restricted distributions of most Philippine *Parathelphusa* species (present study; Ng & Takeda, 1993), it is likely that they are also *P. manguao*.

The banks of Lake Manguao are dominated by rock, rarely grit and sand. Physico-chemical data for April 1989 are provided by Davies & Green (1990), and for 21-22 November 2001 from a survey conducted by the SPCP Aquatic Science & Technology Department. Water temperature ranged from 26.4 °C to 30.5°C in 1989, and around 26.8°C in 2001. The water was slightly alkaline, with the pH varying from 8.1 to 8.86 (Davies & Green, 1990), and 7.44 to 7.77 at the surface slightly decreasing towards bottom to a minimum of 6.79 (SPCP-ASTD). Dissolved oxygen (DO) was found between 9.5 mg/l^a 127% saturation (morning, water surface) and 6.3 mg/l^a 79% saturation (early night, water surface) in the Davies & Green (1990) study. Values of the second study were 5.2 mg/l - to 8.7 mg/l. From both studies, no substantial variations in DO were reported between surface and bottom layers indicating good vertical circulation. Conductivity was

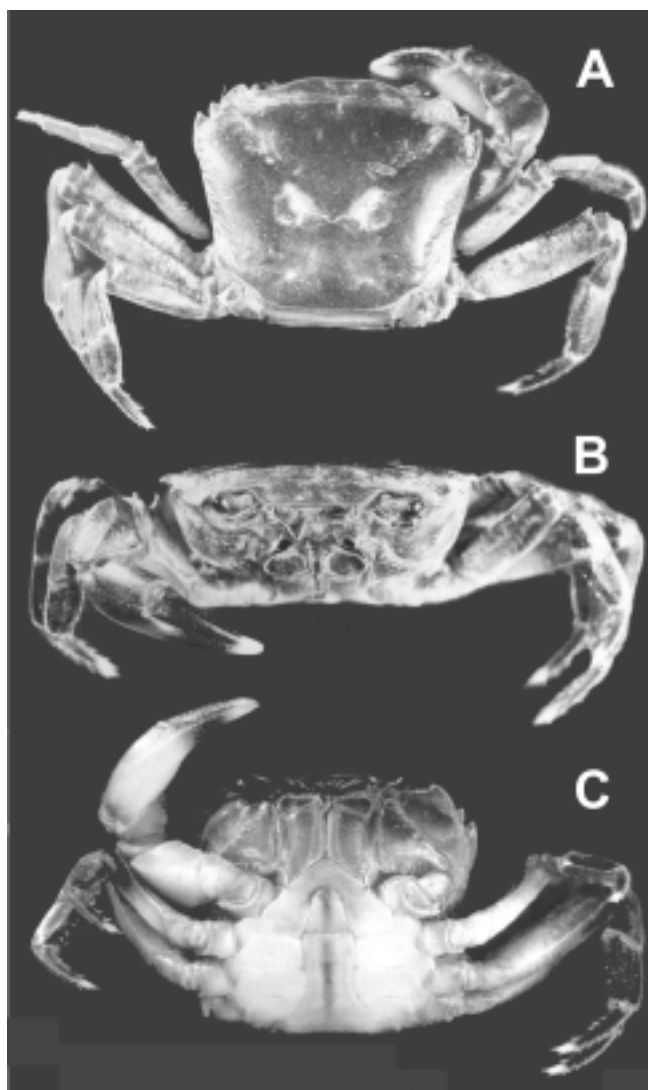


Fig. 7. *Parathelphusa manguao*, new species. Holotype male (21.9 by 18.2 mm) (PNM 17283). A, dorsal view; B frontal view; C, ventral view.

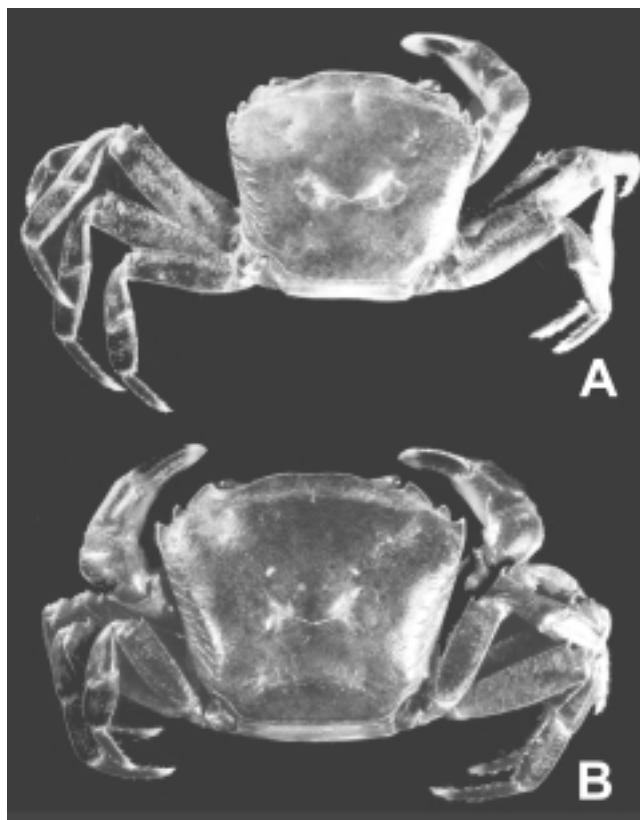


Fig. 8. *Parathelphusa manguao*, new species. A, paratype juvenile male (13.8 by 12.3 mm) (ZIH); B, paratype female (26.6 by 22.3 mm) (SPCP-ASTD).

reported to be 43 $\mu\text{S}/\text{cm}$ (Davies & Green, 1990) and 55 $\mu\text{S}/\text{cm}$ to 79 $\mu\text{S}/\text{cm}$ (SPCP-ASTD).

COMPARATIVE MATERIAL

Parathelphusa palawanensis (Bott, 1969) – 1 male (21.6 by 17.4 mm), 1 female (23.9 by 18.4 mm) (ZRC 1992.8366-8367), Iraan River, Palawan Island, Philippines, coll. M. Takeda, S. Shokita & N. Gapas, 5 Aug.1985. *Parathelphusa mindoro* Ng & Takeda, 1993 – PARATYPES – 1 male (24.8 by 19.6 mm), 1 female (32.8 by 25.0 mm) (ZRC 1992.8364-8365), Agan River, Oriental Mindoro Island, Philippines, coll. M. Takeda, 14 Aug.1985. *Parathelphusa rasilis* Ng & Takeda, 1993 – PARATYPES – 1 male (18.0 by 14.5 mm), 1 female (16.0 by 13.0 mm) (ZRC 1992.8372-8373), Panibacan River, Palawan Island, Philippines, coll. M. Takeda, 5 Aug.1985. *Parathelphusa ovum* Ng, 1994 – PARATYPES – 1 male (18.8 by 15.3 mm), 1 female (30.1 by 23.6 mm) (ZRC 1994.4204), Kinabatangan basin, Sabah, Borneo, coll. K. Lim et al., 12 Apr.1994; 2 males (larger 23.1 by 18.5 mm), 2 females (larger 23.0 by 18.8 mm) (ZRC 1994.4206), Kinabatangan basin, Sabah, Borneo, coll. K. Lim et al., 9-13 Apr.1994. *Parathelphusa nana* Ng & Takeda, 1993 – 1 male (14.0 by 11.8 mm), 1 female (14.8 by 12.7 mm) (ZRC 1992.8370-8371), Nagasaguipi River, Palawan Island, Philippines, coll. M. Takeda, 9 Aug.1985. *Parathelphusa parma* Ng & Takeda, 1993 – PARATYPES – 1 male (30.0 by 22.9 mm), 1 female (30.6 by 23.8 mm) (ZRC 1992.8368-8369), Negros Island, Philippines, coll. unknown, Feb.1988.

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